Pitt Mc... Ph

ANNUAL REPORT

OF THE

DEPARTMENT OF AGRICULTURE

FOR THE

YEAR 1893-94.

REPORT OF THE UNDER SECRETARY FOR AGRICULTURE.

BRISBANE:

BY AUTHORITY: EDMUND GREGORY, GOVERNMENT PRINTER, WILLIAM STREET.

1894.

TABLE OF CONTENTS.

ANNUAL REPORT OF THE DEPARTMENT OF AGRICULTURE FOR THE YEAR 1893-94.

TO THE HONOURABLE THE SECRETARY FOR PUBLIC LANDS AND AGRICULTURE.

Department of Agriculture,
Brisbane, 1st June, 1894.

SIR,—When submitting my last Annual Report I was compelled to give prominence to the disastrous results to agriculture arising from the floods in the early part of 1893. It now gives me much pleasure to be able to report that during the past year the seasons have been most favourable. The harvest has been plentiful; but, on the other hand, prices have ruled low in consequence. In a country like Queensland, where the seasons are not defined as in Europe, where planting and harvesting operations are proceeding at nearly the same time, it is not to be wondered at that the maize farmers grumble because the weather is dry when the reaper and binder are at work, and that the wheat farmers complain if the season be suitable for maize planting at the time they wish to harvest their crops. That favourable seasons for growth and harvesting are essential to the prosperity of Queensland and of its farmers can be easily understood when it is remembered that nearly all the labour bestowed upon the land after the February floods last year, and that nearly all the seed planted at that time, were lost and destroyed in June. This last flood entailed a charge upon the Flood Relief Fund of £4,000 for seed alone, which was all distributed through the agency of this Department to about 1,200 farmers, roughly speaking, the same number as those who received seed after the February floods. Though these floods cause direct and considerable loss, they are not in all cases unmitigated evils to the farmers. Nearly all the crops in places affected by flood waters are lost, but often the land, which by constant cropping has become exhausted or nearly so, receives indirectly a great benefit from the sediment left by the floods, which restores vitality to a greater degree than any manurial agent could supply.

SHIPMENT OF FRUIT TO CANADA.—Mention was made last year of the experiment in this direction, since when a report has been received from the Department of Agriculture in Ottawa. The report, which was made by Mr. W. Borthwick to the Acting Director of the Experimental Farm at Ottawa (Mr. J. Fletcher), is dated 3rd July, and is as follows:—

Acting on your instructions of the 20th June, I took from the Department of Agriculture the five cases of fruit (four of oranges, and one of pineapples) sent by the Department of Agriculture, Queensland, Australia. I examined the fruit carefully myself, and gave samples to several parties in Ottawa and Montreal, and I have the honour to make the following report:—Condition: The oranges were all in good condition when received, except one case which contained two rotten oranges; but these, in my opinion, had been damaged before being packed. These were in No. 2 package. The fruit was very irregular in size, reducing the value when sold by the dozen; but this could easily be overcome by properly assorting when packing, for it is necessary that the fruit should be of even size in each package. Packing: Though the fruit was in good condition when it arrived, I am of opinion that wrapping each orange in good tissue paper and packing them tight in boxes containing 150 to 300 oranges, according to size of fruit, is the best way, as I found that those wrapped in paper kept the best when exposed to the air. Quality: With regard to quality, the oranges in appearance resembled those grown in Jamaica and in Florida, but the quality is better than the fruit we get from either of those places, being sweet, juicy, and free from pulp. I cannot say that I recognise much difference in any of the packages. Pineapples: The pineapples were all rotten, and a total loss. I enclose a letter from Messrs. Hart and Tuckwell. I sent them another sample from each package, and they said they had nothing further to say, and when speaking to other dealers in Montreal they expressed themselves as being of the same opinion.

The letter from Messrs. Hart and Tuckwell, of Montreal, is dated 24th June, and states:—

Taking special interest in the Australian fruits for export, I was pleased to get the oranges you sent me; but at the same time I would prefer to have seen more to pass a fair judgment on the quality. In appearance they resemble the Brazilian orange, and are a good deal like the Florida in quality, being very juicy and sweet, but very little flavour as compared with the best grades of Sicily fruit. No doubt in time they will improve very much. The expense of sending them so far would not as yet make it a very profitable venture to ship to Canada, but if size is improved they should find a good market in England if it could be arranged to have them landed in sound condition. If you could arrange to send a case to Montreal I should be better able to judge of the parcel in a general way, which I shall be glad to do.

Accompanying Mr. Borthwick's letter to Mr. Fletcher was a cheque for 3·96 dollars, being account of net proceeds as follows:— Sold five dozen oranges at 40 cents, 2 dollars; eight dozen at 30 cents, 2·40 dollars=4·40 dollars, from which was deducted 44 cents for commission, at the rate of 10 per cent.

The consignment was in two lots, one lot being sent to the Ministers for Agriculture in Vancouver and Ottawa as a present from this Department, and the other shipments on commercial principles. The prices realised for the latter were certainly not such as would be remunerative, but, as pointed out in the report, the quality was superior to that of the orange imported into Canada from Jamaica and Florida. A point in the report upon which I would comment is the unevenness in size which commercially militated against the success of the shipment. Our producers, whether fruit-growers, market gardeners, or farmers, have much to learn in this direction. If high prices are desired, grading of all produce must be done, whether of fruit, vegetables, maize, wheat, hay, chaff, &c., &c. Uniformity is a word that must be in every farmer's mouth when preparing his produce for market, and a reputation for his goods must be secured and maintained.

New Potato Disease.—During the last potato-growing season the attention of the Department was called to a peculiar disease attacking the growing crops at Ravensbourne, and also at the same time at Corinda. A proper investigation from the specimens of potatoes and haulms sent in not being possible, Mr. H. Tryon was despatched to make inquiry on the spot. From his report, which is as follows:—

It is found to be a new disease, no record of its occurrence having been met with either in popular or scientific literature. The plant at any period in its growth, and however vigorous, suddenly and without premonitory symptoms commences to droop, as if lacking moisture, and fades within a few hours, and never recovers. The tubers, when this change first takes place, though even thus early an indistinct translucent line running parallel to the outer margin may be distinguished on cutting them across, are apparently sound. They soon, however, commence to rot, decay starting in the more superficial portions of the tissue, and the potato substance is eventually converted into an offensive, odorous, tenacious, whitish slime. Should the tuber when once affected be removed from the influences of warmth and moisture, or from the coil, these destructive changes are temporarily suspended.

The disease is uniformly distributed throughout a cultivation, or it may show itself in patches of potato plants here and there within its area. It injures five different varieties of potatoes, and probably none will prove proof against its attacks. It occurs in soils with different aspect and surface contour, of varying physical and chemical constitution, whether absorbent of water or not, on those naturally well drained as well as on those which are not, and is as commonly found on the virgin ones as on soils which have been long under crop. It is also found that, without special intervention, potatoes raised from seed in which there is no history of disease, upon land on which it has appeared during the previous season, and often even on that which is contiguous to it, will almost invariably contract the disease, and that every fresh outbreak occurring under these circumstances is more virulent and extensive than the one which preceded it. Again, seed potatoes derived from a crop in which the malady has shown itself will generally give rise to a diseased crop when grown upon land where it has not previously manifested its presence. Owing to its attacks, the yield may be reduced even 90 per cent. At Ravensbourne it was first noticed in 1891, on three or four selections only. Mr. Tryon now finds that it has extended to thirteen, and probably affects others unvisited by him. In addition, too, to this outbreak at Ravensbourne and one at Corinda, evidence is forthcoming to show that the disease has also visited Gowrie, Little Gowrie Plains, the Laidley district, and even that of Parramatta, in New South Wales.

The same disease is also met with on seedling tomato plants grown amongst potatoes in which it already occurs. It is occasioned by a small living microbe having an average length of less than one ten thousandths of an inch, resembling in appearance the bacillus of chicken cholera and other organisms. This potato bacillus may always be found in the tissues of affected plants at the commencement of the disease, and before any destructive changes have taken place, but it is absent in those of healthy ones. It at first exclusively occurs and multiplies within the vessels traversing the roots, tubers, and stem; but it is afterwards met with within those parts of the tuber which undergo the decay which it originates. A potato apparently sound even on section, if derived from a diseased plant, may harbour the still living microbes in its vessels, though circumstances uncongenial to its multiplication and the development of its pernicious activity may temporarily suspend the commencement of decay entered upon when a warm, damp atmosphere affords the conditions requisite for the happening of this event. The bacillus is capable also of living apart from the potato, and may thus be artificially propagated. The same bacillus also occurs under identical circumstances in the tomato plants when similarly diseased. The spread and continuance of the disease directly by the seed of the potato, and indirectly through the agency of the soil in which diseased plants have grown, and other phenomena regarding it, are then shown to be accounted for by the presence of these bacilli in the tissues of the diseased plants, and their persistence and capacity for multiplication when separated from them; whilst they justify the correctness of the inference as to the origin of the disease drawn from the occurrence of the bacilli under the circumstances mentioned.

The following recommendations are made with regard to the measures to be adopted to secure crops from the disease, and to stamp it out:—

1. Only such seed to be employed for planting generally as has no ancestral history of disease, or has been derived from a locality concerning which it has been positively ascertained that this potato disease does not already exist there.

[NOTE.—In this connection, it may be urged that countries in which the *Peronospora infestans* of the potato plant is already found occurring be discarded as sources for new seed, since there is no authentic instance on record of the formidable potato disease to which this parasitic fungus gives rise having been hitherto met with in the Australian colonies, and it is submitted that it is undesirable to incur the risk of its introduction.]

2. As soon as the disease has manifested itself, if this be in a district not previously visited by it, the whole crop to be destroyed; but if not a novel occurrence, the plants affected to be daily removed from the ground in as intact a state as possible, and destroyed by fire. In both these cases also, the land not to be replanted with potatoes for at least two seasons.

The report concludes with a recommendation for further investigations.

It may be permitted to me to suggest (Mr. Tryon writes) that the proportions and virulence which this new potato disease has already assumed might be considered a sufficient plea for further prosecuting this inquiry, so that if possible even better methods for contending with it and staying its spread than those dictated by the present imperfect state of our knowledge concerning it, may be devised. Of the genesis of the disease—how it originated, nothing whatever is known. Much has also to be learnt regarding the biological history of the microbe that occasions it, not only in relation to the plants that it so injuriously affects, but also as concerns its capacity for propagation on other media than the tissues of its host. How it re-acts when subject to the influence of various physical conditions and different chemical substances, is again an important consideration. It is also of the utmost economic importance that the localities in which the disease has already occurred be defined, and the history of the different outbreaks made the object of careful inquiry.

The deadly character of the disease and the only preventive that could be suggested can be easily understood. This instance is only one among many that can be used as a powerful argument in favour of the establishment of an experiment farm in connection with an Agricultural College where such diseases could be studied in all their stages, and remedies in all likelihood provided, and provides evidence of the necessity here for an entomologist in connection with this Department.

WHEAT.—A more favourable season than the last could not have been experienced. No previous year has produced a better grain; the weather during harvesting was perfect, and the crop was successfully reaped and stacked. The average return was between 15 and 16 bushels; but, unfortunately for the farmers, the prices obtained have been low, giving but a poor return for the labour bestowed, especially with small areas. Wheat-growing here, to be financially successful, must be on a large scale, and must cover larger areas than is the case in Queensland, where, in the majority of cases, the wheat farmer sums up his acres under crop by five. In South Australia the farmer counts his acres by hundreds, hence the farmer there manages to exist with an average return of from 7 to 10 bushels; here, it is complained that with a return of from 15 to 16 bushels, wheat-growing will not pay. It is also argued that with an increased area, an increased cost of production is to be met; but lately machinery has advanced greatly, and though adopted largely by the Downs farmers, it is not yet adopted to the extent it should be, probably owing to the heavy outlay necessary to the purchase of harvesting machines. A first-class machine, which in America costs about £25, here costs about £63, which heavily handicaps the small man. Co-operation in the purchase of these machines can hardly be thought of, because as a rule the crops ripen nearly at the same time; thus it is necessary that the farmer must have a harvester for his own use. It has been stated that wheat-growing in Queensland has not yet passed the experiment stage, owing to the damage from red rust, and owing to the quality of the wheat being so far below that grown in South Australia and other places whence our flour supplies are drawn.

A statement was also made in the *Brisbane Courier*, of the 14th December last, that flour from wheat grown on the Darling Downs will not keep, that it makes 10 per cent. less bread than a like quantity of Adelaide flour, and that it will not sell. This statement may or may not be pure assumption, but, admitting for the moment that there is some truth in it, can no cause or remedy be found? As a rule, a great deal of our wheat has been harvested in wet weather, put into stacks that have not been made waterproof, and so a considerable bulk of the grain has been damaged from carelessness or a want of knowledge of the amount of damage caused by dampness to a crop that may have been successfully reaped but badly stacked. Experiment has proved that wheat absorbs a large quantity of water; so, therefore, a large quantity of our wheat has passed to the miller as full of moisture as it would hold, from wet weather during harvest or from absorption of water caused by defective stacking. With grain in the condition referred to, it is natural that inferior flour should be produced, which will not make such good bread as that produced in South Australia, where the average rainfall is small and the dry atmosphere is favourable to the keeping qualities of wheat, grain, and flour. But, taking the conditions as they exist here, are there no means by which our wheat can be made equal in value to that produced elsewhere? If the moisture in Queensland is the cause of the non-keeping quality of our grain and flour, would it not be possible for our millers to kiln-dry the grain before milling, and so improve the flour produced? Until within the last two years wheat-growing was principally confined to the Darling Downs; but during the last season, 1,100 acres of wheat were grown in the Roma district, and in the Mitchell district 232 acres. This area will be largely increased for the coming season. Amby Downs Station alone, as I learn, intend to put down 500 acres, and other growers will, no doubt, follow suit. The large influx of settlers that have of late come into the district has had a most beneficial effect upon the town of Roma, which three years ago was nearly deserted, half the shops and houses being empty. To-day not a single shop can be rented, all the houses are occupied, and building is going on. This is the result of the land in the district being settled by farmers; and wherever in Queensland a like movement can be induced, a similar effect will be produced.

The increase in the settlement of this district has been to a great extent brought about by the action of this Department. The area reaped for grain in Queensland in 1893 was about 24,214 acres, producing 364,978 bushels of grain. The totals were supplied by the Registrar-General, but the returns being incomplete, are liable to slight alteration.

Rust in Wheat Conference.—By invitation from the Government, the fourth conference on this subject met in Brisbane on the 20th March last, representatives being present from New South Wales, Victoria, and South Australia. The result of the experiments carried out by the colonies represented since the last conference were submitted, and gave clear evidence of the advances towards the solution of the problem that has claimed the attention of practical and scientific men for many years. The importance attached to these conferences must be great, and the appreciation in which they are held is shown when we know that the recommendations arrived at have been adopted by the United States, Canada, England, Germany, France, &c., and that the lines of action have been and are being carried out in these countries. Sir J. B. Lawes, the greatest authority in England upon all matters pertaining to agriculture, has marked his approval of these conferences by stating that he believes the colonies are on the right track in dealing with the rust plague, and urges continuance of the same course of action. In the report of the Instructor in Agriculture will be found the particulars of the work done in Queensland during the past year, and of the course proposed to be followed during the present.

Wheat Trophy.—The work done at the wheat stations during the year, though of interest to the farmers in the neighbourhood, and of ultimate gain to the industry generally, is to a great extent hidden from the public. To remedy this, and to bring before the public, as an object lesson, the results of last year's experiments, and to show what can be accomplished here in wheat production, advantage was taken of the Summer Show of the National Agricultural and Industrial Association to erect a trophy of wheat grown by the Department, which was exhibited with the grain in bottles ranged 'round the base. The trophy was much admired, and was the feature of the show, there being upwards of 200 different kinds of wheat thereon. Though much interest was taken in Brisbane, a still greater was taken at Toowoomba, Warwick, and Allora, where the trophy was also exhibited. No such exhibit had ever been made here, and it created much comment among the farmers in these wheat-growing centres.

Sugar.—This industry has been very active during the past year, and many inquiries have been made at this office for land suitable for the purpose, and of the scope and intentions of the Sugar Works Guarantee Act. The increased production of 20,626 tons over the previous year is very gratifying, and should this season have proved to have been a fair one, an increase of 20 per cent. over 1893 will not be an unfair estimate for the production of 1894. Some of the old plantations have recommenced work, and large areas of cane land have been put under cane. In some districts, however, deterioration of cane, with a consequent short yield, has been reported, but this can probably be traced to constant cropping for many years with the same variety. The new kinds brought from New Guinea, and propagated at the State Nurseries at Mackay and Kamerunga, promise well so far, and will probably prove of timely assistance in such cases. Some few plants of these and of those raised from the seedlings received from Kew have been distributed, and by next planting there will be a goodly number available for this purpose. Hitherto, excepting the Rosewood district and a small area in the Fassifern district, sugar cultivation has been confined to the coast; but there is a prospect of its being further extended, for at the beginning of last planting a supply of cane was obtained by this Department at the request of the Hon. G. Thorn, and distributed by him through the Fassifern district. This has been propagated, and steps are being taken to increase the area this year; efforts are also being made to induce the erection of a central mill.

Maize.—Upwards of 25 tons weight of seed maize were received here in November last for distribution to farmers who required a change of seed and had requisitioned for it. The weather at the time of arrival and planting was very dry in some places, and because the seed did not germinate at once some of the recipients were not slow in condemning it as worthless. This was not the case, however, in all instances, for many letters have been received praising the seed, and some apologising for having formed hasty conclusions respecting it. Presuming that some of the seed did fail, it is, I think, not surprising, for the firm from which it was ordered had only a limited time wherein to collect and ship; the order reached America late in the season, and it is probable that the seven different kinds, totalling 1,014 bushels, had to be gathered in from many places. Upon the whole I think the consignment has given satisfaction, and that the second crop will give better results.

Rice.—Many varieties have found their way here, and have been successfully cultivated, but when placed on the market it was found that none of them were of the kind that found favour with buyers in Queensland. To rectify this the Department imported paddy of the approved kind, which is disposed of to farmers at actual cost price, so that in a short time our local wants should be supplied with a first-class product of the kind that is saleable in the local market. Sir T. McIlwraith, when lately in India, obtained seed of many kinds of rice and of other seeds, which were distributed to private individuals in different districts, and were cultivated at St. Helena and the State Nurseries, so that they have been thoroughly tested with regard to our climate.

Travelling Dairy.—This has been working throughout the year principally in the Toowoomba district, during which time 276 pupils have passed through a course of instruction. At the inception of the dairies two objects were in contemplation—(1) the education of those engaged in dairying in the latest methods; and (2) the establishment of co-operative factories for the manipulation of milk in large quantities with a view to the possibilities of an export trade. That these objects have been to a great extent accomplished there can be no doubt. The butter and cheese locally prepared show great improvement upon that produced by the old methods. A number of butter and cheese factories have been established which before were non-existent, and concerning which, before the dairies started, there was no prospect of their establishment. These factories, however, are not carried out on co-operative lines, but for the most part are owned by companies, who purchase the milk outright. An export trade has, however, not yet been realised, and it is remarkable that, although there were fourteen factories established and in full operation during 1893, the butter imports for that year exceeded that of 1892 by 146,767 lb. The only cause that can be assigned for this increase is that the floods of February and June of last year had a most injurious effect upon all kinds of grass and herbage, with a corresponding reduction in the supply of milk. Cheese, however, shows a satisfactory return for 1893 over 1892, the decrease in imports for the year representing 339,552 lb. weight. For the first five months of the present year, while butter imports show an increase of 100 per cent. over the corresponding period of 1893, the imports of cheese have declined 400 per cent. for the same time. The establishment of butter and cheese factories is evidence of the near approach of the time when a market outside our borders will be wanted, when, as it will be necessary to provide facilities for storing and exporting of these perishable commodities, the question of the erection of refrigerating chambers should not be lost sight of. Moreover, if a successful export trade be established, it will be absolutely necessary that a certain control be exercised to provide against inferior articles being shipped away, to the detriment of the trade, and also to preserve a good reputation for our productions. The following table, compiled from the statistics published by the Registrar-General, gives the rise and fall of the imports of butter and cheese since 1889:—

—	QUANTITIES.				
	1889.	1890.	1891.	1892.	1893.
	lb.	lb.	lb.	lb.	lb.
Butter	781,442	366,317	313,419	131,895	271,106
Cheese	1,274,310	1,106,762	971,869	709,309	366,031

—	VALUES.				
	1889.	1890.	1891.	1892.	1893.
	£	£	£	£	£
Butter	35,041	13,436	14,182	7,338	11,456
Cheese	31,853	23,192	20,174	15,727	8,069

Imperial Institute.—To bring the resources of Queensland under the notice of visitors to that institution, a large number of exhibits have been forwarded to England during the past year, which have, I understand, been placed in position. Further collections are being made, so that in a short time the Queensland Court should favourably compare with the courts of the other colonies.

Special Agent for Queensland.—The services of Mr. M. H. Black have on several occasions been requisitioned by the Department in connection with the raw products forwarded to London for the opinion of experts as to their commercial value. The information obtained has been of great value, and will in some cases probably result in the opening up of trade with England, with the consequent profitable employment of people here.

Instructor in Meat Preserving.—The services of Mr. Allcutt have been in much demand during the year, the instruction required necessitating travelling over 9,000 miles in visiting the different works. A notable experiment which should be of much service to those engaged in the meat trade was successfully carried out by Mr. Allcutt during the year. Through the kindness of Messrs. J. C. Hutton and Co., facilities were given at their factory at Zillmere for the preparation of beef, which was cured and shipped as ordinary cargo in two lots—one to Hamburg and one to Antwerp. Both consignments arrived in good order and condition, and were pronounced to be equal to the best American. The result convinces Mr. Allcutt that with the use of refrigerating machinery in the chilling and curing rooms, there is no country where Queensland meat cannot be delivered in good condition. The prominence given to the demonstration at the last Exhibition in the manufacture of oleo has resulted in that branch of the meat trade being established here, to the profit of those engaged in it. Mr. Allcutt attended meetings for the establishment of meat works at St. Lawrence, Cooktown, Taroom, Charleville, and Eidsvold.

Persons in Receipt of Relief.—The suggestion made by this Department that the services of those in receipt of relief might be utilised in return for the rations given, received the approval of the Hon. the Colonial Secretary, and the men have been successfully employed in repairing the damage caused by the floods last year in the Government Domain and in the Botanic Gardens.

Agricultural College.—Each succeeding year proves more conclusively than its predecessor the necessity for a college, and never before in the history of Queensland has that necessity been greater than at present. The depression that has lately existed in all classes of industrial occupations in the towns has caused many parents to try and find some other means of livelihood than is to be found in the towns; and many inquiries have been made at this office as to the probabilities of an early establishment of an Agricultural College, with the object of giving their children proper training before entering upon agricultural pursuits. The inquiries have been sufficiently numerous to prove to me that a college would be successful from its inception. Several Queensland lads have during the year been successful in gaining admission to the colleges in New South Wales and Victoria, and there are others who tried, but were not fortunate in gaining admission. At present there are not many openings in other walks of life, and many of our young people are growing up with no immediate prospects of employment. In these days of keen competition in all branches of trade, when to be successful one must acquire the highest development of mind and body, the necessity for a college is clear, and needs no close argument to prove the benefits to be derived therefrom.

Tobacco.—The area under this crop was largely increased during the past year, and large quantities have been absorbed by the local manufactories at fair average prices. The season was favourable to the production of good leaf, and this taken with the low prices ruling for maize, wheat, and other products, has induced many to try their hands at cultivating this crop. The demand for seed has been very great, and I am of opinion that the area for 1894 will largely exceed that of 1893, which, according to the returns furnished by the Registrar-General, was 475 acres.

Raisin and Currant Grapes.—The demand for these grapes is still great, and shows a desire for entering upon other than the one or two special kinds of production that have for so many years found favour with farmers. During 1893 and 1892, about 40,000 cuttings were in each year imported and distributed, after undergoing fumigation, and for this year many orders have been received. Those previously introduced have been reported as doing well, and it should therefore not be long before raisins and currants of local manufacture are for sale. The Western country is known to be specially adapted to this kind of cultivation.

Cocoanuts.—The following report upon a visit made in July last to inspect the cocoanut plantations in the North, will be of interest in showing the progress here made:—

During the month of July last year I visited several of the islands in the neighbourhood of Mackay, where cocoanut planting has been carried on for the last two years. While my report bears specially on those islands visited by me, these do not embrace the whole field of operations, as there are now nuts planted, and from latest reports flourishing, on forty-nine islands between Prudhoe Island, south of Flat-top, and Sir Charles Hardy Island, north of Cooktown.

Accompanied by Captain Griffith, of the cutter "Lizzie Jardine," I left Mackay in the Customs launch, which had been courteously placed at my disposal by the Portmaster, and at 5 p.m. arrived one mile off the shore of Keswick Island. The water here being shallow for a long way out, and rocks abundant, making a near approach to the shore by boats of any draught dangerous, we had some little difficulty in finding a suitable landing. I may here state that this is one of the difficulties and dangers in carrying out planting operations, at times it being impossible to land on some of the islands, they being exposed on all sides during tempestuous weather. Having effected a landing on Keswick Island, we had about half a mile to walk to reach the plantation. This is situated at the mouth of a gully with steep ridges on three sides, and exposed to the sea on the fourth. The plants are well above tidal reach, although considerable inroads have been made by the sea since planting operations commenced. The soil is a dark sandy loam, well adapted to the growth of the palm, as is evidenced by the height of some of them. Although not more than two years old, some are fully 6 feet high, and correspondingly strong and healthy. When planting operations were first commenced on this island, the nuts were planted in a nursery, and after germination were planted out. The wisdom of this course is manifest when the number of nuts that fail to germinate is seen. I fear that in many instances the nuts purchased have been pulled before they were fully ripe, hence the large number of failures. On this island there are 157 palms. Owing to the rank and rapid growth of grass, constant vigilance and attention is required to save the plants from destruction by fires, which are of very frequent occurrence. On many of these islands fresh water is found, and passing vessels often replenish their supplies from the springs and catchments on them, when from carelessness in making fires to cook meals, or by dropping matches about, often these islands are completely swept by bush fires. To prevent destruction to the young palms, a considerable area round each has to be kept clear of grass, by which means a certain amount of protection is afforded. If the plantations continue to flourish as they are doing at present, in a short time the foliage will be thick enough to shade a large area around the plants, and so keep the ground round them bare, and further lessen danger from fires.

On the adjacent island, St. Bees, eighty nuts were planted before the captain of the cutter was aware that some cattle were roaming at large on the island. It would appear that some few years ago an individual squatted on this island, taking a number of cattle over with him. After remaining a short time, he abandoned the place, leaving a few head of cattle behind. As soon as the palms made any growth, these cattle destroyed a great number of them with their horns. When this was observed, the uninjured ones, numbering some forty, were removed and replanted on Keswick Island, the balance being left to the cattle. These may possibly survive the rough treatment from the cattle, and in time come into bearing.

The largest plantation is located on M Island, practically two islands—viz., Brampton and Carlisle, the two being separated by a narrow channel only; they are generally known, however, as M Island. On Brampton, where 353 nuts were planted, an experiment was tried that appears so far to have been successful. On the most suitable portion of this island, a bit of flat land, just above sea level, covered with a thin growth of stunted trees fairly wide apart, was found. Among these trees the nuts were planted. The shelter thus afforded to the young palms has been most beneficial, as at this spot we have the most healthy looking and vigorous palms of the lot. When these palms have developed sufficiently, the trees will be cleared away, and the young palms will shoot out strong enough to resist any tempest that may blow.

The largest plantation exists on Carlisle Island, consisting of an area of about 4 acres. These, while making good growth since being planted out, are far too close, and will require thinning out. There being a bit of land adjacent of about the same area, and suitable to the growth of the palm, I have instructed Captain Griffith to replant every second plant in the first lot on this piece. This, when finished, will give an area of from 7 to 8 acres under the cocoanut palm on this island, which I have no doubt can be leased at a very fair rental within the next seven years.

It was on the east side of this island that the ss. "Geelong" was wrecked some years ago, and, had a plantation of cocoanuts existed then, would have been of infinite service to the shipwrecked crew. Where the plantation exists a good landing can be effected nearly all the year round.

I next visited Newry Island. On this there are 300 palms looking fairly well, although they had been attacked by a caterpillar, which at the time of my visit had ceased, and the young palms were rapidly recovering.

Rabbit Island was next visited. There are some 405 young palms planted on two different portions of the island, and a nursery containing 1,200 nuts. Although only ten months old, the 405 planted were doing well, and had made good growth. Those in the nursery will be removed in due course to a low flat island lying between M and the Barrier.

In addition to cocoanuts, mangoes, peaches, and other fruit trees, also pumpkins and melons have been planted. But none of these can be said to have done well. The soil is not suitable, and the exposure is fatal to such tender plants.

As I have already stated, the planting has been carried out on the islands from Prudhoe Island in the South to Sir Charles Hardy Island in the North. The islands from Prudhoe to Dent in Whitsunday Passage have been planted by the men in the employment of this Department, and those on the islands opposite Townsville, Cairns, and Cooktown by the men in the employment of the Harbour Masters of those ports.

I think it most fortunate that I inspected the plantations off Mackay, as I have now seen what has been done, and am in a better position to advise as to proper methods, and also on what islands future operations are to be carried on.

The following list gives the names of the islands planted and the number growing on each:—

Islands.	Number of Growing Plants.
L1, Keswick	117
Plantation No. 2, Keswick	52
In Passage	4
Seawfell	82
Brampton	371
" in Nursery	37
Carlisle	1,407
Goldsmith	150
Newry	77
Rabbit Island	164
" in Nursery	113
Kennedy Sound	183
Neck Bay	44
Seaforth	10
No name	3
Dent Island	10
Long Island	24
Repulse Island	59
Lindeman	7
Calder	6
Wigton	12
Cockermouth	59
Fern Reef	10
	3,001

Fraser's Island.—The inspection made by me of the forestry operations on this island where efforts have been made to re-afforest some of the denuded scrub with kauri pine was not so satisfactory as I could have wished, and I propose shortly to experiment on other lines than those hitherto followed. Re-afforestation cannot be settled in one year or two, as different systems must necessarily be experimented with before the right one can be found. The operations as now carried out are not of a costly nature, and the same economy will be the best to follow until the right method is found.

Agave Sisalana.—A plantation was made on the island because it was stated that this plant was admirably adapted to poor land; but experience has proved that in Queensland at least this is not the case, very little progress having been made. I therefore considered it necessary to remove them to more fertile soil; and space having been set apart at St. Helena, the whole lot were lifted, a small number being sent to the State Nursery, Mackay, and the remainder to St. Helena.

State Nurseries.—The advantages of these nurseries for propagation and distribution of seeds and plants that cannot be obtained from seedsmen have been much in evidence during the past year, the local farmers having taken much more interest in the operations, especially with regard to sugar-cane, the demand during the planting having exceeded the supply, which was not a small one, the applications for the New Guinea cane being the greater number.

Disease in Sugar-cane in New South Wales.—A fatal disease having attacked the canefields in New South Wales, a thorough investigation into the cause and effect was made by Dr. Cobb, the

Pathologist of the Department of Agriculture in that colony, the result of the investigations being published. This subject being of great interest to Queensland, 1,000 copies of the pamphlet were purchased and distributed through the sugar districts.

CO-OPERATIVE GROUPS.—Under the Act of 1893, eleven groups have been allotted areas of land, but unfortunately they were formed at the wrong period of the year, and therefore arrived at their settlements too late in the season to secure immediate results from their labours. Consequently it is impossible at present to forecast what will be the result of the experiment, for although it is now nearly six months since the first group (the Mizpah) went out, not a single group has, excepting vegetables, secured a crop. Excepting the Mizpah, Obertown Model, and Reliance, the groups did not go upon the land as a body, but in detachments; consequently there has been more time spent over the necessary preliminary work of housing so many families than would have been the case had the groups gone out with their whole strength and roughed it, as many men have had to do before them, instead of going upon the land a few at a time, and the remainder staying behind comfortably housed in Brisbane. The grant of £12 per member was soon expended, and a further advance has become necessary to save them from starving. The following table gives information concerning the expenditure, &c., up to the 31st May, which may be of interest:—

CO-OPERATIVE COMMUNITIES—BALANCES to 31ST MAY, 1894.

Group.	No. of Adults.	No. of Railway Passes Issued.	Amount Voted.	Amount Expended.	Balance to Credit.
			£	£ s. d.	£ s. d.
Mizpah	35	151	620	540 11 1	79 8 11
Nil Desperandum	35	104	420	407 16 2	12 3 10
Obertown Model	45	151	740	661 0 11	78 19 1
Excel Pioneers	45	118	740	535 17 1	204 2 11
Reliance	41	129	617	534 15 1	82 4 11
Monmouth	35	104	420	413 2 2	6 17 10
Woolloongabba Exemplars ...	59	116	708	540 19 10	167 0 2
Resolute	40	150	480	409 15 1	70 4 11
Bon Accord	43	131	516	508 2 8	7 17 4
Byrnestown	34	104	408	387 5 5	20 14 7
Industrial	38	55	456	362 10 0	93 10 0
TOTAL	450	1,313	6,125	5,301 15 6	823 4 6

DISTRIBUTIONS AND PUBLICATIONS.—The distributions of seed of plants of economic value that are either new to the colony or not obtainable from seedsmen, numbered 1,705 during the year, of fifty different kinds of plants, some of them of several varieties; for instance, there were twenty-one kinds of wheat distributed, three varieties of broom corn, and so forth. The necessity for limiting my Report to as small dimensions as possible does not permit me to enter into details of the result of these experiments, which were, on the whole, fairly successful, and would have been more so but for the earlier experiments being heavily discounted by the floods. The publications have been very limited, so far as new publications are concerned, those issued having been underway previous to the commencement of the present financial year. The demand for those available has been equal to that of previous years.

Departmental.—The work during the past year has been especially heavy and continuous, the more so in connection with work done for other institutions and departments. No sooner was the work finished for the Central Flood Relief Committee with reference to the February floods of 1893, when it had to be all done over again in connection with the June floods. The request of the Department of Public Works for the services of my officers in connection with the Sugar Works Guarantee Act, just at the time when that part of the Co-operative Communities Land Settlement Act allotted to this Department commenced to operate freely, was also a strain on the limited staff. Notwithstanding these and other demands upon the officers of the Department outside of what I may term their regular work, and which demanded much night duty, the work has been faithfully and satisfactorily performed without extra remuneration or outside help.

The inquiries made from outside countries for information as to the facilities for settlement here—inquiries in many cases brought about by the efforts of the Agent-General and Mr. Black—have been on the increase during the year, which have, in some instances to my knowledge, resulted in settlement here, and there may be of course some to whom I have supplied information, and who have settled here without my knowledge.

Appended to my Report will be found reports from the Instructor in Agriculture, the Colonial Botanist, the Curator of the Botanic Gardens, the Manager of the Dairy, and the Overseers of the State Nurseries at Mackay and Kamerunga.

PETER McLEAN.

REPORT OF THE INSTRUCTOR IN AGRICULTURE.

Sir,—I have the honour to present the following report of work done by me, as Instructor in Agriculture, during the year ending 31st May, 1894:—

Instruction Proper.—The prosecution of this branch of work has led me, in response to numerous invitations, much about the colony. These visits have embraced nearly every section in which agriculture has obtained a foothold. Without going into details concerning this work of instruction in the different districts, it may be said, in a general way, that it has involved an inspection of each section visited, and personal counsel with the farmers. The visit has generally ended with a gathering of farmers and their families at some central point, where a lecture, an hour or more in length, has been followed by answers to questions and a discussion of points raised in the lecture. In the case of nearly every district visited, the farming community has shown the utmost interest in the work attempted. The meetings have generally embraced the entire male population of the districts visited, and the questions discussed have included most subjects of local practical interest. I have not nearly been able to meet the calls that have been made upon me for services in this connection. One realises, in attempting to carry out a work of this kind, how great a colony Queensland is. Inasmuch as some discrimination as to localities had to be made, efforts in the last year had been largely directed towards the newer portions of the colony, and especially those districts not hitherto visited by me. Larger efforts in the shape of conferences, carried out on lines laid down in previous reports, have been attempted at Toowoomba and Bowen. The Toowoomba conference was, in point of attendance, a failure, but the Bowen meetings were largely attended and the interest well sustained throughout. A striking feature of the Bowen meeting was the large attendance of ladies, farmers' wives and daughters making fully one-half of the audience of each session. I am persuaded that these meetings are useful and often very directly helpful to the people of the districts in which they are held. The papers that are presented at the conferences, and the discussion that takes place at all the meetings, bring to light a class of information of the greatest interest that cannot be elsewhere obtained—namely, the local experience of practical farmers. As a rule, the men who are now taking up the new lands of the colony for cultivation have not been bred to the soil. Quite generally farming is adopted as the last resort of those who have failed to obtain remunerative employment in customary callings. It is needless to say that errors of practice are common, even in the most elementary operations of the farm, among a class so inexperienced. It has been my pleasant duty, in hundreds of instances, to help these, for the most part, most teachable people to the solution of perplexing problems.

In connection with this work of instruction, the need of an agricultural school or college, properly equipped, has been constantly felt. There is undoubtedly a very strong demand for the kind of instruction that only an institution of this kind can give. In every part of the colony parents have come to me with the question: "Where shall we send our sons that they may receive the education and training necessary to the successful prosecution of farming?" As things now are, the influences drawing the young men towards the soil are few and feeble. They naturally hesitate to invest labour and money in a comparatively intricate business such as agriculture is, without an acquaintance with even the elements of the art. The bent of the youth, therefore, is towards those callings which can be easily picked up or which involve no capital in money or special knowledge. On the other hand, this tendency might, I am persuaded, be largely arrested if one, for the present, central institution, having a good farm and necessary tools, with a teaching force sufficient to give the rudiments of agricultural science, could place its privileges within easy reach of the class of young men needing them. From such a school there would annually go forth to all the agricultural sections of Queensland young men, full of zeal for agriculture, backed by accurate knowledge, who, wherever they located, would be centres of advanced thought and practice in agriculture. It is often objected that one school of agriculture cannot meet all of the requirements in this regard of a country varying in climate and soil productions, as is the case in Queensland. To this I reply the principles of agriculture are the same the world over. The man who understands the fundamental practices of farming, and knows, besides, something of the nature of soils, their needs, and the means by which their requirements are met, will not be at a loss to apply this knowledge in the cultivation of special crops, however unfamiliar. If monetary stringency is urged as an excuse for failure to inaugurate a work which nearly every civilised people have found it necessary and profitable to carry out, often on a large scale, I can only ask how can our means be better employed than in equipping the youth of the colony with the knowledge and skill which will enable them to successfully occupy the country?

Special Reports.—In September, at the request of residents of Bowen, a visit was made to the valley of the Proserpine River, located nearly midway between Mackay and Bowen, for the purpose of inquiring into the suitableness of the country for the growth of sugar-cane. A report on this beautiful district, made in October, has been given wide publicity by the Press of the colony. For a like purpose the coastal country about Rockhampton, as far North as Yeppoon, and South to Raglan, was carefully examined and reported upon. It may be said that, in a sense, every district visited by me during the year has been made the subject of a special report. It has been my practice almost from the first to give an opinion of the agricultural capacity of each district visited, either through the public Press or at meetings held in the district itself.

Agricultural Progress.—An intimate acquaintance with the agriculture and agriculturists of the colony leads irresistibly to the conclusion that in all sections, North and South, agriculture is making steady growth in the number of farmers, as well as in methods and results, and that too despite the prevailing low prices of many of the staple products of farming. This progress is seen most markedly in that branch of farming associated with sugar production, but a less ostentatious, although none the less real, advance has been made in dairying and improvements in dairy stock, in wheat-growing, and in the use of improved machinery in all branches of farm labour. There are, undoubtedly, obstacles of a serious character to the rapid extension of farming in Queensland, not the least of which is the prevailing prejudice against farming that exists in the minds of so many colonists. The people who so constantly assert that "farming don't pay," never ask themselves what trade or calling in which the same capital or intelligence are embarked, pays as well as farming. The farmers of Queensland, with few exceptions, make a living; some do a good deal more, and nearly all add to their capital year by year either in the shape of cash or its equivalent in improvements. Queensland offers certain material advantages to the farmer which I believe have never been appreciated at their true worth. So far as mere existence is concerned, it is difficult to conceive of a more perfect climate than that of Queensland, taken as a whole. I am satisfied that over most of the colony farm work is done, even in the summer season, as easily and with as little hardship to the labourer as in the American States. Here the peculiar equableness of the seasons favours the farmer in a double sense, by reducing his wants and increasing his capacity for production. The elaborate farm buildings, clothing, winter provisions for the family, and fodder for every class of stock may in good part be dispensed with in a country where occasional light frosts mark the severity of winter, and where grass and vegetables grow all the year round. One has but to run over, in mind, the list of productions of Queensland farms, to understand how nearly it is possible for the farmer to meet all the requirements of the home, even where a comparatively high standard of living is maintained, with the products of his own acres. A country that can produce either five or six cuttings of lucerne, two crops of potatoes, two of maize, or a crop of wheat and another of maize upon the same land during one season, has advantages in the race of competition that are sure to tell early in its favour. While it is a matter that is incapable of proof, I am confident of keeping quite within the limits of strict accuracy in saying that eight hours of labour on Queensland farms and stations will produce more than ten hours of work applied in like manner in the Northern States of America.

Perhaps the greatest annual loss comes to the agricultural community through the practice of that haphazard system, or rather lack of system, which may be called farming for prices rather than profits. The past year has witnessed in Queensland a pretty general and aggravated outbreak of this speculative farming. About one year ago, maize, by reason of the short supply, commanded very high prices in all the markets of the colony. The big prices acted as a powerful inducement to the cultivation of the corn crop. There was a general rush to the growth of the promising staple in all the farming sections of the colony. Farmers who had "gone out of maize" two years before on account of prevailing low prices, now came back to the old crop with increased ardour. The result of this boom in maize-growing is seen in the great crop of the present year, with the inevitable accompaniments, glutted markets and prices probably below the cost of production, as things now are in farming. In like manner tobacco has during the year, for various reasons, sold at very high prices. The men who have grown this crop year after year, thus accumulating knowledge and experience of it, have certainly profited very handsomely by their patient continuance with a familiar crop. But now the bucolic mind has become seized with the idea that there is a "big thing" in tobacco-growing. The present run on tobacco promises to more than outdo the corn boom of one year ago. Speaking roughly, nearly or quite one-half of my present correspondence with farmers relates to tobacco culture. In the case of tobacco a craze of this sort is particularly to be deprecated. Tobacco, of all crops, demands a peculiar soil, and special, minute, and very careful attention in cultivation and subsequent handling. To fail to give this crop the careful treatment which it demands is to produce, not merchantable tobacco, but weeds and utter rubbish. It is not difficult to foresee the outcome of this mania for tobacco-growing. As in the case of overproduction in maize, glutted markets will be followed by prices that leave no margin of profit to the grower. Our farmers need to remember that farming is a business in which knowledge and experience count for much. The farmer who changes his system constantly in order to catch the expected variations in market prices is losing the use of that knowledge which has come to him through experience with familiar crops. Moreover, the speculative farmer, in the great majority of cases, fails to receive the great prices on which his hopes have been centred. By the time he has become a producer, prices have reached the normal level; the temporary vacuum has been filled by the inrush of the needed product from all directions. The farmer who grows crops according to some system based on the nature of his soil, the general needs of the market, and his own tastes and means, has all the chances in his favour. By long continued practice he learns the "short cuts" to successful production, and among the various crops and products of his farm there is always something that can be marketed at a profit.

Experiments.—The Agricultural Department has neither land nor other equipment for extended experimental undertaking in the Southern part of Queensland. Nevertheless, it has been felt that the Department clearly had a duty to perform in adding to the stock of new facts bearing on the agricultural industry. In 1891, experiments to test the efficacy of certain fungicides in checking the spread of wheat rust were undertaken on the Darling Downs. The Rust in Wheat Conference held in Adelaide in 1892 imposed additional responsibilities, in this direction, on all the colonies there represented. To carry out the recommendations of this conference a considerable experiment with varieties of wheat was undertaken last year in the neighbourhood of Warwick and Roma. The general plan of these experiments was given in my last Annual Report, with a complete list of all the varieties sown. A full report of the Warwick and Roma experiments was presented by me to the Rust in Wheat Conference held in Brisbane in March last. In a general way, it may be said that the Warwick experiment was not a conspicuous success, while that conducted at Roma gave most satisfactory results. At Warwick, while rust was generally present upon most of the varieties, the attack was feeble and wanting in customary virulence. Again, certain accidents overtook the Warwick plantings—among others, a violent hailstorm which laid the crop nearly level with the ground, just as it was coming in ear—which made it impossible to draw conclusions from the experiment. At Roma, on the other hand, the season and other conditions were almost perfect for the work in hand. The wheat plants made a steady unchecked growth from seeding, and late in the season were attacked by a very active form of rust, which put to a severe test the rust-resisting qualities of all the sorts there grown. Of the ninety-seven distinct varieties in cultivation fewer than twenty passed through the rust ordeal uninjured, or with such slight injury as to show unaffected grain. Between occasional feeble rust colonies, located upon the foliage of the plants, every degree of rustiness, to complete rottenness with the disease, might be seen in the Roma experiment. The following are the varieties least affected, naming them approximately in the order of their immunity from rust attacks:—Sicilian Baart, Marshall's No. 3, Marshall's No. 8, Allora Spring, Ward's White, Victorian Defiance, Gore's Indian, Belotourka, Fluorspar, King's Jubilee, Square-headed Sicilian, Early Para, Australian Wonder, Indian Pearl. Arrangements have been made to continue this experimental work upon a somewhat enlarged scale near Roma, upon the farm of Patrick Smith as before, and near Allora at Andrew Rickert's farm. At Allora 266 varieties, and at Roma 209 varieties, excepting a few possible duplicates, have been planted. Appended hereto is a complete list of the names of all the different sorts planted.

Partly with the purpose of learning the capacity of different sections of the colony for wheat growing in general, and in part with the object of testing and disseminating improved varieties, a considerable extension of the wheat-growing experiments of the Department has been undertaken during the year. At each of the following places, Herberton, Hughenden, Clermont, and Springsure, a sub-station has been established for the growth of experimental varieties of wheat. At each of these stations about thirty approved varieties have been sown. These varieties have been selected with especial reference to the needs of each district, so far as those wants could be gauged from present knowledge.

Our plantings of the present year have been made with the view of introducing sorts possessing not merely rust-resisting character, but also those qualities which make wheat attractive to the Australian miller. The experiences had in the different colonies with rust-resistant wheats have, to my mind, amply demonstrated that there are already available to growers a considerable number of wheats which may be relied upon, under nearly every circumstance of soil, climate, and culture, to escape all harm from rust contagion. Unfortunately, nearly every one of these rust-resistant sorts is, in its grain, of such a peculiar horny or flinty texture that the millers, with machinery now in use, find it difficult to work it into flour of satisfactory quality. The trade, therefore, refuses them, or takes them only at a great reduction in price. Inasmuch as the miller declines to come to the farmer in this matter, it seems worth while for the farmer to go to the miller, and produce sorts that add to powers of rust resistance, good milling qualities, according to the Australian standard. At all events the experiment seems worth trying. The next step in the progress of this work is clearly to bring the better class of rust-resistant wheats, as shown by experiment, into general use by the farmers of the colony. To a certain and very considerable extent improved sorts have obtained a foothold in the colony. A very large proportion of those now grown possess rust-resistant qualities in a greater or less degree, and nearly all are of very recent introduction. To further this work, and make it practically valuable to wheat-growers, seed wheat farms, under private management, are needed to popularise the sorts introduced and thoroughly tested by the Department. To bring into general use these approved sorts of wheat is a work that may well engage the attention of the Department in the immediate future and for years to come.

Wheat-growing in the colony seems likely for some time to share the general depression in this branch of farming, due to the prevailing low prices. A committee of the United States Senate appointed to investigate this question of low prices has reported, according to the newspapers, that wheat can be grown in India at 6½d., in Argentina at 1s. 1d., and on the large American wheat farms at 1s. 4½d. per bushel. If these figures represent the actual facts in regard to the wheat-growing of these countries, then the day of the cheap loaf—which to the wheat farmer often means "no bread"—seems to be a long one. It may be doubted if wheat can be grown at a less price than 2s. 6d. per bushel on the hard-working, black soils of the colony, and where expensive clearing of the land is necessary. Especially this is true of the small areas which are the rule in Queensland. Where wheat is grown extensively, in blocks of hundreds of acres, wheat can, with modern machinery, be grown as cheaply here as in the United States of America. Existing conditions, however, tend to drive the wheat-grower in Queensland, as in America, to the West, where cheap, easily cleared, and easily worked lands await occupation, and where the natural protection of expensive carriage from the coast secures to him the increasing Western market. Present indications point to a considerable and early expansion of wheat-growing in the interior of both the Central and Southern portions of the colony.

An interesting experiment in lemon-curing has been tried in a room specially fitted up for the purpose, in the basement of the Department's building in William street. In California it has long been the practice to put lemons through a process known technically as "curing," by which the fruit is actually improved by the slow process of ripening which it undergoes, and is made even more marketable than the fresh or uncured article. The conditions necessary for the successful curing of lemons are that they shall be gathered before they are fully ripe, and stored away on shelves in a building that ensures for them darkness, absence of drafts of air, and a uniform and low temperature—preferably 60 degrees Fah. A small darkened room, with fairly insulated walls and good ventilation, without drafts, containing a box, also well ventilated and fitted with shelves, was the apparatus of this experiment. The fruit was gathered 15th to 17th August, and shortly afterwards placed in the curing-room, a single layer of fruit occupying each shelf. Without further care, except to remove the decayed fruit—amounting to under 9 per cent.—as it appeared, the lemons kept perfectly for nearly or quite five months. By this method of curing, Queensland lemons undoubtedly may be put in shape such that they will bear transportation, and that as ordinary cargo, to the most remote markets.

MINOR DUTIES.—I have prepared plans and superintended the erection of a fruit and vegetable evaporator of considerable capacity, which may now be seen in the basement of the Department building. This evaporator has certain new and useful features which it is believed will commend it to those cultivators who are interested in preserving products by drying. Plans and estimates of cost for the use of anyone wishing to construct one of these machines are now in course of preparation. At the Rust in Wheat Conference, held in Brisbane in March last, I was one of the Queensland delegates, and as such presented a report on the experiments with varieties of wheat referred to above. As secretary I had, besides general duties, much of the work of preparing the final report of the conference.

Varieties of Wheat grown near Herberton, at the farm of John Newell—

Gore's Indian, No. 1	Fluorspar	African
,, ,, No. 2	Bellevue Talavera	Allora Spring
Early Para	Lazistan	Canning Downs Rust-resistant
Marshall's White	Improved Fife	Ward's Prolific
Leaks	Tourmaline	Blount's Fife
Jacinth	Indian Early	Sicilian Baart
Australian Wonder	King's Jubilee	Indian Club, No. 2
Indian Pearl	White Cytherè	,, ,, No. 1
Manitoba	Belotourka	
Medeah	Mummy	

Varieties of Wheat grown near Clermont, at the farm of A. Madge—

Gore's Indian, No. 1	Fluorspar	Allora Spring
,, ,, No. 2	Bellevue Talavera	Canning Downs Rust-resistant
Early Para	Lazistan	Victorian Defiance
Marshall's White	Improved Fife	Blount's Fife
Leaks	Tourmaline	Sicilian Baart
Jacinth	Indian Early	Indian Club, No. 1
Australian Wonder	King's Jubilee	,, ,, No. 2
Indian Pearl	Belotourka	
Manitoba	Mummy	
Medeah	African	

Varieties of Wheat grown near Springsure, at the farm of Alexander McLaughlin—

Gore's Indian, No. 1
,, ,, No. 2
Early Para
Marshall's White
Leaks
Jacinth
Australian Wonder
Indian Pearl
Manitoba
Medeah
Fluorspar
Bellevue Talavera
Lazistan
Improved Fife
Tourmaline
Indian Early
King's Jubilee
White Cytherè
Belotourka
Mummy
African
Allora Spring
Canning Downs Rust-resistant
Victorian Defiance
Blount's Fife
Sicilian Baart

Varieties of Wheat grown near Hughenden, at the farm of Thos. Cox—

Gore's Indian, No. 1
,, ,, No. 2
Early Para
Marshall's White
Leaks
Jacinth
Australian Wonder
Indian Pearl
Manitoba
Medeah
Fluorspar
Bellevue Talavera
Lazistan
Improved Fife
Tourmaline
Indian Early
King's Jubilee
White Cytherè
Belotourka
Mummy
African
Allora Spring
Canning Downs Rust-resistant
Ward's Prolific
Blount's Fife
Sicilian Baart
Indian Club, No. 1
,, ,, No. 2

List of Wheats grown upon the farm of A. Rickert, near Allora, sown 22nd to 24th May, 1894. When two or more names, separated by an ×, are given as the name, a hybrid of these sorts is indicated—

Plat 1, 4 rows—Ambrose's Standup
,, 2, 4 ,, American Pearl
,, 3, 2 ,, Marshall's No. 3
,, 4, 4 ,, ,, No. 31
,, 5, 4 ,, ,, No. 8
,, 6, 4 ,, Inglis' Rust-proof
,, 7, 2 ,, Venning's
,, 8, 3 ,, Marshall's No. 3 White (probably identical with No. 3)
,, 9, 2 ,, Inglis' Success No. 10
,, 10, 2 ,, Battlefield No. 3
,, 11, 2 ,, Marshall's No. 36
,, 12, 2 ,, Marshall's No. 8 (probably identical with No. 5)
,, 13, 2 ,, Marshall's No. 10
,, 14, 2 ,, Buckley's Rust-proof
,, 15, 2 ,, Marshall's No. 3 Purple
,, 16, 2 ,, Marshall's No. 9
,, 17, 4 ,, Hercules
,, 18, 4 ,, Marshall's No. 4
,, 19, 4 ,, Marshall's No. 7
,, 20, 4 ,, Marshall's No. 11
,, 21, 2 ,, Ward's White
,, 22, 6 ,, Marshall's No. 6
,, 23, 8 ,, Leak's Rust-proof
,, 24, 2 ,, King's Purple Straw
,, 25, 1 ,, Old Red Straw
,, 26, 1 ,, Unknown
,, 27, 1 ,, King's Bearded No. 3
,, 28, 1 ,, No. 1 Bearded
,, 29, 1 ,, King's Pearl
,, 30, 1 ,, White Essex
,, 31, 1 ,, White Tuscan (Dr. Cobb)
,, 32, 1 ,, White Tuscan (Mr. Inglis)
,, 33, 2 ,, Blount's Lambrigg
,, 34, 1 ,, Belotourka
,, 35, 1 ,, Imported Baart
,, 36, 1 ,, Excelsior
,, 37, 2 ,, Wheaton's Rust-proof
,, 38, 1 ,, Galland's Hybrid
,, 39, 1 ,, King's Beauty
,, 40, 1 ,, Talavera
,, 41, 1 ,, Algerian
,, 42, 1 ,, King's Jubilee × Indian A.

List of Wheats—*continued.*

Plat 43, 1 row—Jacinth × Ward's White
,, 44, 1 ,, Ward's White × Tourmaline
,, 45, 1 ,, Steinwedel × King's Jubilee
,, 46, 1 ,, Steinwedel × Early Japanese
,, 47, 1 ,, King's Jubilee × Indian A.
,, 48, 1 ,, Jacinth × Ward's Prolific
,, 49, 1 ,, Horneblende × Early Baart
,, 50, 1 ,, Blount's Fife × Ward's Prolific × Ward's White
,, 51, 1 ,, King's Jubilee × Tourmaline
,, 52, 1 ,, Vermont × Leak s
,, 53, 1 ,, King's Jubilee × Zimmerman
,, 54, 1 ,, Horneblende × Leak's
,, 55, 1 ,, Quartz × Ward's White
,, 56, 1 ,, Horneblende × Indian A.
,, 57, 1 ,, Amethyst × Indian B.
,, 58, 1 ,, Jock × Blount's Lambrigg × Horneblende
,, 59, 1 ,, Standup × Ward's Prolific
,, 60, 1 ,, Farmer's Club × Horneblende
,, 61, 1 ,, Jacinth × Ladoga
,, 62, 1 ,, Amethyst × Indian D.
,, 63, 1 ,, Horneblende × Blount's Lambrigg × Horneblende
,, 64, 1 ,, 58A × Ward's Prolific
,, 65, 1 ,, Horneblende × Indian B.
,, 66, 1 ,, Steinwedel × Early Baart
,, 67, 1 ,, King's Jubilee × Amethyst × Horneblende
,, 68, 1 ,, Anglo-Canadian × Horneblende
,, 69, 1 ,, Quartz × Vermont
,, 70, 1 ,, Jock × Ward's Prolific
,, 71, 1 ,, Chatsbury × Horneblende
,, 72, 1 ,, Leak's × Horneblende
,, 73, 1 ,, Horneblende × Summer Club
,, 74, 1 ,, Fultz × Blount's Lambrigg × Horneblende
,, 75, 1 ,, Blount's Fife × Ward's White
,, 76, 1 ,, Imperial Fife × Blount's Lambrigg
,, 77, 1 ,, Sardonyx × Ward's Prolific
,, 78, 1 ,, Blount's Lambrigg × Ward's White
,, 79, 1 ,, Fultz × Blount's Lambrigg
,, 80, 1 ,, King's Jubilee × Early Japanese
,, 81, 1 ,, Horneblende × Blount's Lambrigg
,, 82, 1 ,, King's Jubilee × Improved Fife
,, 83, 1 ,, King's × Ward's White
,, 84, 1 ,, Indian B. × Indian D.
,, 85, 1 ,, Ward's White × Horneblende
, 86, 1 ,, Quartz × Zimmerman
,, 87, 1 ,, Quartz × Zimmerman
,, 88, 1 ,, Bega × Horneblende
,, 89, 1 ,, Jacinth × Early Baart
,, 90, 1 ,, Quartz × Leak's
,, 91, 1 ,, Vermont × Blount's Lambrigg
,, 92, 1 ,, Horneblende × Indian A.
,, 93, 1 ,, Horneblende × Moscow
,, 94, 1 ,, Vermont × Ward's White
,, 95, 1 ,, Quartz × Early Japanese
,, 96, 1 ,, King's Jubilee × Indian B.
,, 97, 1 ,, Horneblende × Ward's Prolific
,, 98, 1 ,, Moscow Hairy × Indian B.
,, 99, 1 ,, Blount's Fife × Ward's Prolific
,, 100, 1 ,, Early Japanese × Amethyst
,, 101, 1 ,, Quartz × King's Jubilee
,, 102, 1 ,, Blount's Fife × Horneblende
,, 103, 1 ,, Blount's Fife × Vermont
,, 104, 1 ,, Blount's Wheat × Amethyst
,, 105, 1 ,, Jock × Ward's Prolific
,, 106, 1 ,, Quartz × Amethyst
,, 107, 1 ,, Leak's × Early Japanese
,, 108, 1 ,, Improved Fife × Blount's Lambrigg
,, 109, 1 ,, Sicilian Square-headed Red × Ward's White
,, 110, 1 ,, King's Jubilee × Golden Drop
,, 111, 1 ,, Fultz × Horneblende
,, 112, 1 ,, Blount's Fife × Horneblende
,, 113, 1 ,, Horneblende × Indian D.
, 114, 1 ,, King's Jubilee × Leak's
115, 1 ,, Blount's Wheat × Early Japanese

List of Wheats—*continued.*

Plat 116, 1 row—Steinwedel × Amethyst × Horneblende
,, 117, 1 ,, King's Jubilee × Vermont
,, 118, 1 ,, Early Baart × Early Japanese
,, 119, 1 ,, King's Jubilee × Indian D.
,, 120, 1 ,, Steinwedel × Amethyst
,, 121, 1 ,, Fultz × Blount's Lambrigg
,, 122, 1 ,, Horneblende × Leak's
,, 123, 1 ,, Chatsbury × Horneblende
,, 124, 1 ,, Blount's Lambrigg × Ward's White
,, 125, 1 ,, King's Jubilee × Tourmaline
,, 126, 1 ,, Ward's White × Horneblende
,, 127, 1 ,, Horneblende × Blount's Lambrigg
,, 128, 1 ,, Horneblende × Murray River
,, 129, 1 ,, Blount's Fife × Ward's Prolific
,, 130, 1 ,, Quartz × Vermont
,, 131, 1 ,, Steinwedel × Early Baart
,, 132, 1 ,, Quartz × Leak's
,, 133, 1 ,, Blount's Wheat × Amethyst
,, 134, 1 ,, Blount's Fife × Vermont
,, 135, 1 ,, Vermont × Leak's
,, 136, 1 ,, King's Jubilee × Indian G.
,, 137, 1 ,, Jacinth × Early Baart
,, 138, 1 ,, Steinwedel × King's Jubilee
,, 139, 1 ,, Ward's White × Tourmaline
,, 140, 1 ,, Steinwedel × Amethyst × Horneblende
,, 141, 1 ,, King's Jubilee × Ladoga
,, 142, 1 ,, Vermont × Ward's White
,, 143, 1 ,, Horneblende × Indian G.
,, 144, 2 ,, Ward's Prolific
,, 145, 2 ,, Marshall's No. 3 Purple
,, 146, 2 ,, Marshall's No. 9
,, 147, 2 ,, Marshall's No. 10
,, 148, 8 ,, Marshall's No. 7
,, 149, 1 ,, Buckley's Rust-proof
,, 150, 2 ,, Hard Wheat—Indian
,, 151, 2 ,, White Ghoni—Indian
,, 152, 2 ,, Daman White—Indian
,, 153, 4 ,, Maire Wheat—Indian
,, 154, 4 ,, Lowland White—Indian
,, 155, 2 ,, White Wheat—Indian
,, 156, 4 ,, Pannuan Wheat—Indian
,, 157, 4 ,, Gore's Indian No. 1
,, 158, 2 ,, Gore's Indian No. 2
,, 159, 2 ,, Canning Downs Rust-resistant
,, 160, 2 ,, African
,, 161, 2 ,, Indian Pearl
,, 162, 2 ,, Indian Early
,, 163, 8 ,, Tardent's Blue
,, 164, 1 ,, Allora Spring
,, 165, 4 ,, Sea Foam
,, 166, 8 ,, King's Jubilee
,, 167, 4 ,, Ward's White
,, 168, 2 ,, Thomas' Rust-proof
,, 169, 6 ,, Victorian Defiance
,, 170, 6 ,, Cape Wheat
,, 171, 6 ,, Australian Wonder
,, 172, 6 ,, Australian Glory
,, 173, 2 ,, Cook's
,, 174, 4 ,, Red Californian
,, 175, 2 ,, White Cytherè
,, 176, 4 ,, Mexican Spring
,, 177, 4 ,, Jacinth
,, 178, 4 ,, Quartz
,, 179, 1 ,, Red Provence
,, 180, 2 ,, Tourmaline
,, 181, 4 ,, White Hogan
,, 182, 4 ,, Fill Bag
,, 183, 1 ,, White Lammas
,, 184, 4 ,, Blount's Fife
,, 185, 2 ,, Algerian
,, 186, 2 ,, Square-headed Sicilian
,, 187, 2 ,, Sicilian Baart
,, 188, 2 ,, Mummy

List of Wheats—*continued.*

Plat	189,	2 rows—	Polish
,,	190,	2 ,,	D'Arblay's Hungarian
,,	191,	½ ,,	Fultz × Marshall's No. 3
,,	191A,	½ ,,	Zimmerman × Ward's White × Horneblende
,,	192,	½ ,,	Amethyst × (King's Jubilee × Ward's White)
,,	192A,	½ ,,	Steinwedel × 57 × King's Jubilee × Ward's White
,,	193,	½ ,,	Red Mexican × Ward's White
,,	193A,	½ ,,	Imperial Fife × Early Japanese
,,	194,	½ ,,	Velvet Pearl × Ward's White
,,	194A,	½ ,,	(Anglo-Canadian × Improved Fife) White Naples
,,	195,	½ ,,	193 (c) × King's Jubilee
,,	195A,	½ ,,	43 (A) Ladoga
,,	196,	½ ,,	Horneblende × Marshall's No. 3
,,	196A,	½ ,,	Indian A.
,,	197,	½ ,,	Sicilian Square-headed Red × Early Japanese
,,	197A,	½ ,,	Marshall's No. 3 × Horneblende × Ward's White
,,	198	½ ,,	Bellevue Talavera × (Vermont × White Fife)
,,	198A,	½ ,,	(Jacinth × Amethyst) × (King's Jubilee × Imp. Fife.)
,,	199,	½ ,,	Early Japanese × Ward's White
,,	199A,	½ ,,	(Vermont × Leak's) × Cape
,,	200,	½ ,,	(Horneblende × Leak's) × Marshall's No. 3
,,	200A,	½ ,,	Velvet Pearl × (Ward's White × Tourmaline)
,,	201,	½ ,,	Steinwedel × Canning Downs
,,	201A,	½ ,,	(Jacinth × Ladoga) × Cape
,,	202,	½ ,,	Leak's × (Leak's × Vermont)
,,	202A,	½ ,,	(Vermont × Blount's Lambrigg) × Horneblende
,,	203,	½ ,,	Jacinth × (King's Jubilee × Leak's)
,,	203A,	½ ,,	Horneblende × Leak's × Lazistan
,,	204,	½ ,,	Horneblende × Freiling
,,	204A,	½ ,,	Bellevue Talavera × Ladoga
,,	205,	½ ,,	(Ruby × Ward's Prolific) × (Horneblende × Ward's White)
,,	205A,	½ ,,	D'Arblay's Hungarian × Improved Fife
,,	206,	½ ,,	(Quartz × Leak's) × (Horneblende × Ward's White)
,,	206A,	½ ,,	(Quartz × Ward's White) × (King's Jubilee × Tourmaline)
,,	207,	½ ,,	193 × Ward's White
,,	207A,	½ ,,	(Leak's × Horneblende) × Lazistan
,,	208,	½ ,,	Purple Straw × Leak's
,,	208A,	½ ,,	Jacinth × (Horneblende × Ward's White)
,,	209,	1 ,,	Gharaf—An African Wheat
,,	210,	½ ,,	White Fife × White Naples
,,	210A,	½ ,,	Unknown
,,	211,	½ ,,	Niagara × White Naples
,,	211A,	½ ,,	Australian Glory × (King's Jubilee × Improved Fife)
,,	212,	10 ,,	Hercules
,,	213,	6 ,,	Marshall's No. 4
,,	214,	1 ,,	Steinwedel's No. 5 Bearded
,,	215,	1 ,,	Purple Straw
,,	216,	1 ,,	Steinwedel Selected
,,	217,	1 ,,	Thomas' Rust-proof
,,	218,	1 ,,	Inglis' Inoculated Steinwedel No. 1
,,	219,	1 ,,	Murray River
,,	220,	1 ,,	Broderick
,,	221,	4 ,,	Imperial Fife
,,	222,	1 ,,	Russian
,,	223,	2 ,,	Fluorspar
,,	224,	1 ,,	Summer Club
,,	225,	2 ,,	Steer's Early Purple Straw
,,	226,	2 ,,	Hudson's Early Purple Straw
,,	227,	1 ,,	Purple Straw
,,	228,	6 ,,	Early Para
,,	229,	2 ,,	White Fife
,,	230,	2 ,,	Bellevue Talavera
,,	231,	1 ,,	Australian Club
,,	232,	1 ,,	Smith's Nonpareil
,,	233,	2 ,,	Freeling
,,	234,	1 ,,	Town and Country
,,	235,	1 ,,	Velvet Chaff
,,	236,	1 ,,	Blount's No. 10
,,	237,	1 ,,	Manitoba
,,	238,	2 ,,	Lazistan
,,	239,	2 ,,	Bega
,,	240,	1 ,,	Fultz
,,	241,	2 ,,	Jordan's

List of Wheats—*continued.*

Plat 242, 2 rows—Anglo-Australian
,, 243, 2 ,, White Naples
,, 244, 2 ,, Medeah
,, 245, 1 ,, Queensland Defiance
,, 246, 2 ,, French Rye—Arbouste
,, 247, 1 ,, Nepaul Barley
,, 248, 2 ,, Celestial Barley
,, 249, 6 ,, Brown Oats
,, 250, 6 ,, Marshall's No. 8

List of Wheats grown upon the farm of P. Smith, near Roma, and sown 16th and 17th May, 1894. Where two or more names, separated by an ×, are given as the name, a hybrid of these sorts is indicated—

No. 1, 2 rows—Unknown
,, 2, 1 ,, White Essex
,, 3, 2 ,, No. 1 Bearded
,, 4, 4 ,, Leak's
,, 5, 1 ,, Old Red Straw
,, 6, 1 ,, King's Bearded
,, 7, 2 ,, Talavera
,, 8, 2 ,, King's Purple Straw
,, 9, 2 ,, White Tuscan
,, 10, 4 ,, Blount's Lambrigg
,, 11, 4 ,, Wheeton's Rust-proof
,, 12, 5 ,, Imported Baart
,, 13, 1 ,, Galland's Hybrid
,, 14, 2 ,, King's Beauty
,, 15, 3 ,, Excelsior
,, 16, 2 ,, Inglis' Battlefield
,, 17, 4 ,, Marshall's No. 8
,, 18, 2 ,, Marshall's No. 36
,, 19, 2 ,, Ward's White
,, 20, 4 ,, Inglis' Rust-proof
,, 21, 2 ,, Hercules
,, 22, 4 ,, Marshall's No. 11
,, 23, 4 ,, Marshall's No. 7
,, 24, 4 ,, Marshall's No. 4
,, 25, 4 ,, Marshall's No. 3
,, 26, 4 ,, Marshall's No. 6
,, 27, 2 ,, Marshall s No. 8
,, 28, 2 ,, Marshall's No. 3
,, 29, 4 ,, Marshall's No. 3 White Straw
,, 30, 4 ,, Marshall's No. 9
,, 31, 2 ,, Marshall's No. 3 Purple Straw
,, 32, 2 ,, Buckley's Rust-proof
,, 33, 1 ,, Marshall's Success
,, 34, 1 ,, Galatian Summer
,, 35, 1 ,, Marshall's No. 22
,, 36, 1 ,, Marshall's No. 24
,, 37, 1 ,, Marshall's No. 21
,, 38, 1 ,, Marshall's No. 33
,, 39, 1 ,, Marshall's Prolific
,, 40, 1 ,, Marshall's No. 19
,, 41, 1 ,, Marshall's No. 17
,, 42, 1 ,, Marshall's No. 29
,, 43, 1 ,, King's Rust-proof
,, 44, 1 ,, Marshall's No. 37
,, 45, 1 ,, Brown's Rust-proof
,, 46, 1 ,, Marshall's No. 35
,, 47, 1 ,, Wheaton's Rust-proof
,, 48, 1 ,, Marshall's No. 15
,, 49, 1 ,, Battlefield
,, 50, 1 ,, Marshall's No. 27
,, 51, 2 ,, Venning's Rust-resistant
,, 52, 2 ,, American Pearl
,, 53, 2 ,, Ambrose's Standup
,, 54, 2 ,, Indian Early
,, 55, 2 ,, Indian Pearl
,, 56, 2 ,, Gore's Indian No. 1
,, 57, 2 ,, Gore's Indian No. 2
,, 58, 2 ,, Canning Downs Rust-resistant
,, 59, 2 , Ghoni Wheat

List of Wheats—*continued.*

No. 60, 4 rows—Maize Wheat
" 61, 4 " White Wheat
" 62, 4 " Pannuan Wheat
" 63, 2 " Lowland White
" 64, 2 " Daman White
" 65, 2 " Hard Wheat
" 66, 4 " Tardent's Blue
" 67, 1 " Steinwedel × Early Baart
" 68, 1 " Horneblende × Summer Club
" 69, 1 " Chatsbury × Horneblende
" 70, 1 " Jack × Ward's Prolific
" 71, 1 " Fultz × Blount's Lambrigg × Horneblende
" 72, 1 " Horneblende × Blount's Lambrigg × Horneblende
" 73, 1 " 58A × Ward's Prolific
" 74, 1 " Quartz × Vermont
" 75, 1 " Zimmerman × Early Japanese
" 76, 1 " Horneblende × Indian B.
" 77, 1 " King's Jubilee × Amethyst × Horneblende
" 78, 1 " Leak's × Horneblende
" 79, 1 " Anglo-Canadian × Horneblende
" 80, 1 " King's Jubilee × Indian H.
" 81, 1 " King's Jubilee × Ward's White
" 82, 1 " Steinwedel × King's Jubilee
" 83, 1 " Vermont × Leak's
" 84, 1 " Indian B. × Indian D.
" 85, 1 " Blount's Fife × Ward's Prolific × Ward's White
" 86, 1 " Jacinth × Early Baart
" 87, 1 " King's Jubilee × Golden Drop
" 88, 1 " Horneblende × Early Baart
" 89, 1 " Summer Club × Horneblende
" 90, 1 " Horneblende × Blount's Lambrigg
" 91, 1 " Blount's Lambrigg × Ward's White
" 92, 1 " Jacinth × Ladoga
" 93, 1 " Standup × Ward's Prolific
" 94, 1 " Vermont × Ward's White
" 95, 1 " King's Jubilee × Leak's
" 96, 1 " Amethyst × Indian D.
" 97, 1 " King's Jubilee × Tourmaline
" 98, 1 " Jack (58A) × Ward's Prolific
" 99, 1 " Jacinth × Ward's Prolific
" 100, 1 " Quartz × King's Jubilee
" 101, 1 " Blount's Fife × Horneblende
" 102, 1 " Blount's Fife × Ward's White
" 103, 1 " Horneblende × Indian D.
" 104, 1 " Horneblende × Leak's
" 105, 1 " Steinwedel × Early Japanese
" 106, 1 " Sardonyx × Ward's Prolific
" 107, 1 " Blount's Wheat × Early Japanese
" 108, 1 " Improved Fife × Blount's Lambrigg
" 109, 1 " Jack × Blount's Lambrigg × Horneblende
" 110, 1 " Fultz × Blount's Lambrigg
" 111, 1 " Early Baart × Early Japanese
" 112, 1 " King's Jubilee × Zimmerman
" 113, 1 " Ward's White × Horneblende
" 114, 2 " Quartz × Leak's
" 115, 1 " Ward's White × Tourmaline
" 116, 1 " Amethyst × Indian B.
" 117, 1 " Blount's Fife × Ward's White
" 118, 1 " Unknown
" 119, 1 " Horneblende × Indian G.
" 120, 1 " King's Jubilee × Indian B.
" 121, 1 " Horneblende × Indian A.
" 122, 1 " King's Jubilee × Improved Fife
" 123, 1 " Sicilian Square-headed Red × Improved Baart
" 124, 1 " Quartz × Ward's White
" 125, 1 " Horneblende × Ward's White
" 126, 1 " Moscow Hairy × Indian D.
" 127, 1 " King's Jubilee × Indian G.
" 128, 1 " King's Jubilee × Indian B.
" 129, 1 " Improved Fife × Blount's Lambrigg
" 130, 1 " Horneblende × Moscow
" 131, 1 " Blount's Fife × Vermont
" 132, 1 " Vermont × Blount's Lambrigg

List of Wheats—*continued.*

No.	133, 1	rows—	Quartz × Amethyst
,,	134, 1	,,	Jacinth × Ward's White
,,	135, 1	,,	Blount's Lambrigg × Horneblende × Horneblende
,,	136, 1	,,	King's Jubilee × Vermont
,,	137, 1	,,	Blount's Wheat × Amethyst
,,	138, $\frac{1}{2}$	,,	Pringle's No. 5
,,	138A, $\frac{1}{2}$	,,	French Early Bearded
,,	139, $\frac{1}{2}$	,,	Robbin's Rust-proof
,,	139A, $\frac{1}{2}$	,,	Blount's Lambrigg × Saxon Fife
,,	140, $\frac{1}{2}$	,,	Tunnack
,,	140A, $\frac{1}{2}$	,,	Ballarat Spring
,,	141, $\frac{1}{2}$	,,	Oakshott's Champion
,,	141A, $\frac{1}{2}$	,,	Amethyst
,,	142, $\frac{1}{2}$	,,	Lava
,,	142A, $\frac{1}{2}$	,,	Boutcher's Velvet
,,	143, $\frac{1}{2}$	,,	Bearded Herrison
,,	143A, $\frac{1}{2}$	,,	Blount's Lambrigg
,,	144, $\frac{1}{2}$	,,	White Champion
,,	144A, $\frac{1}{2}$	,,	Thomas' Rust-proof
,,	145, 1	,,	Ward's Prolific Red
,,	146, 1	,,	Ward's Prolific
,,	147, 4	,,	Blount's Fife
,,	148, 1	,,	Farmer's Friend
,,	149, 2	,,	Bellevue Talavera
,,	150, 2	,,	Steere's Early Purple Straw
,,	151, 2	,,	Victorian Defiance
,,	152, 2	,,	Improved Fife
,,	153, 8	,,	King's Jubilee
,,	154, 2	,,	Allora Spring
,,	155, 1	,,	Queensland Defiance
,,	156, 2	,,	Thomas' Rust-proof
,,	157, 2	,,	Lazistan
,,	158, 2	,,	Fill Bag
,,	159, 2	,,	Velvet Chaff
,,	160, 2	,,	Cape Wheat
,,	161, 2	,,	Anglo-Australian
,,	162, 2	,,	Medeah
,,	163, 2	,,	Nonpareil
,,	164, 2	,,	Square-headed Sicilian
,,	165, 2	,,	White Cytherè
,,	166, 4	,,	Australian Glory
,,	167, 2	,,	Bega
,,	168, 2	,,	Mummy
,,	169, 2	,,	Jordan's
,,	170, 2	,,	White Lammas
,,	171, 8	,,	Ward's White
,,	172, 4	,,	Red Californian
,,	173, 4	,,	Mexican Spring
,,	174, 1	,,	Early Japanese
,,	175, 6	,,	Freeling
,,	176 2	,,	Algerian
,,	177, 2	,,	Red Provence
,,	178, 6	,,	Jacinth
,,	179, 2	,,	Sicilian Baart
,,	180, 2	,,	Tourmaline
,,	181, 6	,,	Early Para
,,	182, 2	,,	White Naples
,,	183, 2	,,	Broderick
,,	184, 2	,,	Purple Straw
,,	185, 1	,,	Town and Country
,,	186, 1	,,	White Essex
,,	187, 1	,,	Brown-eared Mummy
,,	188, 1	,,	Niagara
,,	189, 1	,,	Australian Club
,,	190, 2	,,	Blount's No. 10
,,	191, 2	,,	Manitoba
,,	192, 2	,,	Sea Foam
,,	193, 2	,,	Hudson's Early Purple Straw
,,	194, 1	,,	Summer Club
,,	195, 4	,,	White Hogan
,,	196, 2	,,	African
,,	197, 1	,,	White Fife
,,	198, 6	,,	Australian Wonder

List of Wheats—*continued.*

No. 199, 2 rows—Fluorspar
,, 200, 1 ,, Steinwedel
,, 201, 2 ,, Belotourka
,, 202, 2 ,, Quartz

A considerable number of the above sorts of wheat, it is expected, will be available for distribution in small quantities during the coming year. Farmers interested in the cultivation of rust-resistant wheats may, on application, obtain small quantities so long as the supply lasts.

Yours, &c.,
E. M. SHELTON,
Instructor in Agriculture.

Department of Agriculture,
Brisbane, 31st May, 1894.

REPORT OF THE COLONIAL BOTANIST.

SIR,—For the information of the Honourable the Secretary for Lands and Agriculture, I have the honour to submit the following as my Annual Report for 1893-4, regarding the state of Queensland Herbarium, Museum of Economic Botany, and Botanic Library, and sketch of botanic work accomplished during the year.

It might be deemed sufficient for me to speak only of eight months, as four months elapsed between the abolishment of my position as Colonial Botanist and my reappointment; but, as by the Minister's permission I was allowed the use of the office, &c., I carried on the work as usual, and the people received my services as before; and I also saw through the Press one of my Botany Bulletins, which was at the time in the printer's hands. The botanist is not of service to the few only; he is called to the aid of the many; the medical profession, merchant, artizan, and tiller of the soil—all at times require his services. Thus it is most satisfactory to me to find that year after year more interest is being taken in the science. People are becoming alive to the importance of a scientific nomenclature; they find that to speak or write intelligibly of a plant—be it tree, shrub, or herb—the scientific name is of the utmost importance; that this applies particularly to the indigenous products, such as timbers, &c., and that I am being continually called upon to assist both the professional man and the artizan. In this respect the botanist is more needed in a new country like ours than in longer established places, for here local names are almost useless from the number often given to the same plant, and the restricted area to which a name is often known. Timber and other products have often been condemned because another under the same local name has been supplied. Persons in many instances are adopting what was recommended by me many years ago—namely, that with the local the scientific name should always be given in parentheses. From this it will be seen of what great practical use both a herbarium and botanic museum are to all classes of the community, and I am glad to find the advantage thus taken of my services. Knowing the great benefit that would accrue from the establishment of a museum of economic botany, I have always advocated one being established, and at last, when my office was transferred to the Department of Agriculture, the opportunity was offered me of making a commencement of such an important adjunct to the herbarium, and at the time a fair display was made from my own collections, and the duplicate specimens of timbers prepared for the exhibition of 1886, in England, and 1888 in Melbourne. Many fresh exhibits have from time to time been added, and at the present the colony possesses an instructive museum of vegetable products, of which we need not be ashamed, although far below what it might have been had it been more liberally supplied with funds. I feel sure that you will agree with me in stating that for the permanent prosperity of any colony we must look to its vegetable products, be they foreign or indigenous; and in a museum of economic botany such are brought under the notice of all, and it is satisfactory to find our museum is not visited only by sightseers who wish to while away an hour, but principally by persons with an object in view, and such, when in any doubt, slip into my office and obtain the assistance required to solve such doubts. To many a one the visit means the obtaining or the losing of a contract, for persons now are not satisfied with being put off with a local name as formerly; losses have made persons more mindful, therefore careful inquiries are being constantly made at my office upon these matters. This has been my reason for so persistently asking year after year for a vote, be it ever so small, to expend in collecting and preparing exhibits of the indigenous woods. At the present we have about 600 kinds on view, but my estimate of the number of Queensland woods is about 1,000.

The Herbarium.—This department is gradually being increased by the thousands of specimens arriving from residents in the country districts, who are anxious for special or general information regarding the indigenous plants. A large number of such specimens are of a fragmentary character, which, although sufficient probably for rendering the information required, are unfit to represent the species in the herbarium or for use of exchange with botanic departments in other parts of the world. I, however, always find my correspondents willing to send further specimens when requested to do so, and also to furnish me with seeds of the plants when such are obtainable. This mode of working out our vast flora is both tedious and laborious, but we must not forget that by it a very large number of the Queensland people are reaping more advantage from the botanic department than if all this work was done by paid collectors. Yet, at the same time, there are other parts of our vast area of country of which we know but little, and it is to such that I should like to be enabled now and again to send a collector, as well as to look for, make notes, or collect specimens of particular species of which it is desirable to have some further information.

Botanic Library.—Owing to the unfortunate lapse of the four months between the abolishment of my office and my reinstatement, I did not expend the vote for the Botanic Library until lately, so that all the books ordered have not yet arrived. I am most thankful for these annual votes, for I am thus enabled to add valuable works to the library, without which it would be difficult for a botanist to do satisfactory work.

Publications.—It is a source of great pleasure to me to find that my publications are not only appreciated by the people of the colony, but that they are sought by persons of other lands. This in part repays me for the hours I spend in their production, mostly when others are taking pleasure or rest, for it must be borne in mind that little time can be spared for such work in office hours. Thus all the time I have to devote to them is the early morn, late evening, and holidays. The issue of "A Companion for the Queensland Student of Plant Life" has been most favourably received, and is being used by teachers. I have now in the printer's hands a small pamphlet of a somewhat similar character, entitled "Botany Abridged." This, I hope, will prove equally acceptable to the public, and particularly to teachers of youth, as in it will be found recorded one or two of the most prominent features which are used by the botanist to distinguish many of our more common plants.

In all the work appertaining to the botanic department I have been readily supported by my assistant, and I feel satisfied that everything possible has been done to make the department of practical benefit to the colony.

Following the usual plan which I have adopted of recording, in these annual reports, the names and some account of the additional foreign plants which have become naturalised, as well as the additional blight fungi which have been observed infesting living vegetation, exotic or indigenous, the spread of noxious weeds, and notices of reported poisonous herbage, I have but little to record in addition to what has been already brought under notice. Some of the fungi blights already recorded have been bad in places, but the cause in very many instances may be put down to bad cultivation and an ignorance of the requirements of the plants; also climatic effect, such as a superabundance of wet, and want of sufficient drainage. Very many of the so-called diseases of plants of which we daily hear are not diseases in a true sense, but rather a poisoning by "stagnant." In this opinion I feel sure of being supported by every agriculturist and horticulturist in the colony. Although at times in a climate like ours, subject to periods of long drought or long-continued wet, it is most difficult to guard against heavy loss, yet it is not correct to say, when any fungi may be met with on the decomposing parts of these plants, that this fungi was the first cause, for in fact they in most instances are only following out one of the natural laws, and making use of the decomposing matter, and had nothing to do with the first cause of decay.

The few additional fungi which have been observed infesting living plants since my last report are:—*Sphacelotheca hydropiperis*, Schwn. This species might cause loss at some future time by attacking plants of an economic character belonging to Polygonaceæ. *Puccinia carissæ*, Cke. and Mass. This is a new species which has been found on a native Carissa. *Uredo pallidula*, Cke. and Mass. This new species was met with upon the pods and leaves of a Cassia.

Uromyces Fabæ, Pers., has been observed upon the broad beans. *Uromyces puccinioides*, Berk., on a Goodenia. *Æcidium Goodeniacearum*, Berk., *Æcidium compositarum*, Mart., has been met with upon a native Compositæ. *Asterina hoveafolia*, Cke. and Mass. This new species was found upon the foliage of *Hovea longifolia*. *Darluca filum*, Cast. This curious parasite has been observed this year for the first time in Australia. It was found at two distant localities upon the Sori of *Uredo sorghi* and *U. rumicis*. Another parasitic fungus, *Belonidium parasiticum*, has been met with. It was found upon an Asterina, infesting leaflets of one of our stavewoods. Dr. Cooke and

Mr. Massee, to whom I sent specimens, found it to be new, and have named it as above. *Melasmia tecomatis*, Cke. and Mass. A new species found upon the leaves of *Tecoma jasminoides*. *Glœosporium Alphitoniæ*, Cke. and Mass. This is a new species found upon the leaves of the Red Ash (*Alphitonia excelsa*). A more detailed account of the abovementioned fungus-blights will be found in my publications.

The following blight-fungi have been observed to have caused considerable damage:—

Macrosporium tomato was very destructive during December last to the tomato crop in some localities.

Puccinia malvacearum was extremely thick on some garden malvaceous plants about Brisbane.

Puccinia Sorghi did considerable damage to the leaves of maize.

Puccinia helianthi was very destructive to the leaves of the sunflower.

Cerebella paspali and *Ustilago Cesatii* were very bad upon indigenous species of Paspalum.

Glœosporium Lindemuthianum. Again during the past year in a few localities has this fungus done considerable damage to French beans.

Phyllosticta fragaricola was destructive to strawberry plants.

Besides the above, there were as usual more than enough rust, bunt, smut, and other common fungi pests.

I have no additional noxious weeds to report as having been introduced during the past year, but the alarming rate at which some of the worst of these pests are spreading over the country suggests the desirability of some more effectual method being adopted to exterminate or keep them in check than at present. The only plan at present being carried out is to let these pests grow at their own free will, and become laden with ripe seeds, and after a large portion of this has been by various means disseminated over the country the plants, with the seeds then remaining upon them, are cut down, and either left to rot or carted away to stock some other locality. The fearful effect of allowing these pests to first obtain a footing in the colony is exemplified in the "Noogoora Burr" (*Xanthium strumarium*). Fourteen years ago when the pest was discovered in the colony, a few pounds would have rid the country of it altogether; and now it covers hundreds, perhaps thousands, of acres of some of the best country, and is still spreading. An equally formidable pest, known as the "Chinese Burr" (*Triumfetta rhomboidea*), is now overrunning the Northern parts of the colony, and my object in alluding to the subject here is to warn Southern cultivators against allowing this pest to overrun the South as it has done the North. The Chinese Burr has not the poisonous properties ascribed to the Noogoora Burr, but its burrs would be of annoyance and loss to the sheep-farmer by the injury it would do to the wool, and as a weed in cultivation paddocks it would cause a great deal of trouble. From a letter lately received from a pastoralist it would seem that *Achyranthes aspera*, a plant to be seen in most Queensland scrubs, is spreading and becoming a great nuisance from its sharp burr-like fruits getting into the wool. In India this burr is known as "Chirchira." I know of no Queensland local name for this pest, and as a weed on cultivated scrub land it is not worse than many others. In all cases the most troublesome weeds are introductions.

During the past year the matter of collecting and cultivating our indigenous grasses has again been discussed. This is a matter in which I have always taken a deep interest, and I believe that few subjects are of greater importance, therefore I feel it my duty to refer to it in this Report. I am also of opinion that the work could not be so well done by private enterprise as by the Government. Thus I would solicit the Minister's attention to the matter. The economic and educational features of the project should be borne in mind. My proposition is to have the whole grass flora of the colony collected, and at first small patches of each grown on some suitable plot of land near town, each kind to be labelled with its various local and the botanic name. This is of importance, as out of the local names a trivial nomenclature might be adopted, and thus get rid of the present confusion, in which we find the names of blue-grass, barley-grass, and Mitchell-grass given to many distinct species in various localities. From these small patches a selection could be made, and seeds could be obtained of the superior kinds for cultivating elsewhere upon a larger scale, and thus further test their capabilities, as well as obtaining a supply of seed for persons who may require such, both within and beyond the colony. That there is a demand for our grasses is already proved by the letters I frequently receive on the subject. That our grasses are sought by persons of other countries is not to be wondered at when we remember that they possess in all probability nutritive qualities superior to the grasses of most other countries. What we want is to speak with authority as to the properties of our grasses, and this cannot be done until some experimental cultivation has been carried out. Our whole flora abounds with riches; all that is required is that it be developed.

If votes for library, museum, and collecting could be afforded, I should be glad, as such are greatly needed.

I have &c.,

F. MANSON BAILEY,

Colonial Botanist.

REPORT OF THE CURATOR, BOTANIC GARDENS.

SIR,—I have the honour to submit the following Report upon the condition and management of the Botanic Gardens and Government Domain during the past year.

At the commencement of the year under review, and in consequence of the disastrous floods of February, 1893, the very difficult task which had to be undertaken was the restoration of the Gardens, without the expenditure of any sum beyond that ordinarily devoted to keeping them in proper condition. By considerable exertion and the willing assistance of the staff, this has been practically accomplished, and the condition of the Gardens is at the present time in some respects even better than before the floods above referred to.

In consequence of the large numbers of trees which were killed by the floods, and which it was found necessary to grub out at a considerable expenditure of labour; the Gardens now present a much less crowded appearance than formerly, and young trees which have been planted have been placed in positions more suitable, both as regards their growth and the general appearance of the Gardens.

Weather.—The weather during a good portion of the year was most unfavourable to horticultural operations, and this of course increased the difficulties which we had to contend against; but notwithstanding this a good deal of ground not hitherto in cultivation was utilised, and many thousands of trees, shrubs, and herbaceous plants of all varieties were planted. The floods and the subsequent wet weather, which rendered digging so difficult, gave the great pest of these Gardens, nut-grass, such a start that it was difficult to keep it in check, but by persevering labour it has been again very greatly reduced.

Library.—I have again to express my regret at the manner in which I am handicapped by the loss of my valuable private library during the recent floods. In the course of my business, reference to books is constantly necessary; in fact, books may be regarded as my tools of trade. Several valuable standard works of reference which were destroyed (and which in consequence of other severe losses through the floods I am not now in a position to replace) are provided for, and are in daily use by the curators of all other botanic gardens of any account in the world; and the absence of these books is not only a severe deprivation, but very materially interferes with my business.

Horticultural Lectures.—During the year under review I delivered, in the Normal School, Brisbane, a series of thirteen lectures on horticulture, divided as follows:—(1) Soils, (2) laying out ground, (3) drainage, (4) plant life, (5) plants to grow, (6) cultivation, (7) planting, (8) propagating, (9) manuring, (10) watering and irrigation, (11) pruning, (12) budding and grafting, (13) classification.

The lectures were illustrated practically, and the attendance was most gratifying, the average attendance each evening being about 300. Many of these persons came every night; several took copious notes, and all expressed their gratitude to the Department for providing the instruction. It is my intention, with the approval of the Department, to extend and continue these lectures during the current year. I have also delivered two lectures at Maryborough, by instructions from you; and I am of the opinion that if my services were more largely availed of in this direction, industrial horticulture in the colony would be greatly promoted.

Asphalt Walks.—Last year I had the honour to report on the condition of the asphalt walks here. These contain an area of 10,274 square yards, most of which is in very bad condition. To do these properly would be a somewhat expensive work, but as I have just now a good deal of labour at my disposal, if the sum of £50 could be devoted to this purpose, the walks could be put in at least tolerable repair, and several hundred pounds would be saved, as when the surface becomes broken the walks very rapidly break up.

Extra Labour.—On the 9th May, 1894, the men receiving rations from the Immigration Department were sent to the Gardens to work, and each man has performed one day's work in the Gardens in each week since that date. By this means I have been enabled to get a large amount of work done, which may be briefly summarised as follows:—

Clearing the Government Domain of weeds and rubbish, similarly clearing the river frontage of the Gardens, constructing a new road along the garden frontage in lieu of the old one, which was, in wet weather, a perfect quagmire, with all the incidental work of procuring stone, gravel, &c; draining portions of the Gardens, clearing and trenching the palm avenue, painting all wood and iron work including the boundary fence, repairing greenhouses, constructing propagating pit, painting ditto, levelling, grading, digging, weeding, thinning out bamboos, and a variety of other miscellaneous work which was very urgently needed.

A very great deal of work has yet to be done, and the works now in hand will absorb all available labour for a very considerable time.

Exchange of Plants, &c.—This has been continued as usual, and a large variety of plants of economic and general horticultural interest have been introduced.

Inquiries on Horticulture.—I have received many inquiries during the year upon horticultural matters, in a very large number of cases by persons at the Gardens, and by people from all parts of the colony and from the adjoining colonies, and in several instances by persons visiting Brisbane from abroad; and these have had my best attention, and I have lost no opportunity of making the Botanic Gardens in this and other ways useful to the colony as a whole.

Bush-houses.—These have been restored and greatly improved and filled with choice collections. A new bush-house for propagating purposes has been erected.

Sheds.—Owing to the destruction caused by the floods, I require new sheds for storage, carrying on work in wet weather, &c. I have managed without additional cost to erect one small shed of considerable use to us, and I shall endeavour to erect another without extra expenditure.

Labour and Staff.—The conduct of the staff has been satisfactory, and no changes have been found necessary.

Government Domain.—The small sum at my disposal for the Government Domain Gardens (£300) has been expended with satisfactory results and some improvements effected, such as the making of a new walk, the better draining of the tennis lawn, &c.

Horticultural Classes.—The summer session of the horticultural classes was carried on during the year as usual, and the attendance of the children was satisfactory. Owing to pressure of work just now I have not yet commenced the winter session.

I have, &c.,

PHILIP MACMAHON,

Curator.

REPORT OF THE MANAGER, TRAVELLING DAIRY.

Sir,—I have the honour to submit an Annual Report of my work and teachings from 1st June, 1893, to 5th May, 1894; also other general remarks relative to the dairying industry in Queensland.

Commenced operations on 5th June, 1893, and from then to the time of my writing this report fourteen places were visited, viz.: Helidon, Tent Hill, Murphy's Creek, Southbrook, Westbrook, Pittsworth, Warwick, Dalby, Maida Hill, Toowoomba, Meringandan, Hampton, Goombungee, and Douglas.

At four of the above-mentioned places—Tent Hill, Murphy's Creek, Dalby, and Toowoomba—owing to the large number of pupils nominated, a double course of instructions was gone through for their accommodation.

The total number of gallons of milk received and manipulated was 15,545½; 7,893½ of which were converted into butter, giving a return of 2,816 lb., and from 7,652 gallons 7,881 lb. of green cheese were made. These returns are very good, although in a few places they were very low. 256 pupils were instructed at the various places, all of whom were unanimous in expressing their appreciation of the instructions imparted, and, with the exception of very few, all who attended have put the knowledge gained into practice, either at their own homes or for others.

Pupils of mine are now managing the largest and most important factories in Queensland, viz.:—Silverwood, Central Dairy Factory, Brisbane, Happy Valley, Lanefield, Grandchester, Greenmount, Pilton; and many others who received no other tuition than from me are managing large private dairies in various parts of the colony.

Many other places were visited, and lectures were given on the co-operative factory system and other information appertaining to dairying; a large amount of correspondence from all parts of the colony was also attended to, giving information and rendering what each and all considered valuable service. In fact, my mission has been crowned with the greatest success, and, with the exception of two farmers at Westbrook, I have not had a single complaint. Each of the persons mentioned happened to get a cheese which they considered not first class, a fact doubtless due to neglect on their own part in curing it.

It can, I think, be reasonably asserted that the results accruing from my teachings have done an immense amount of good towards developing the resources of the industry.

The visit of the Dairy to the various places has not only imparted a thorough knowledge in the manipulation of milk, the proper and most scientific methods of dairying, &c., but it has been the means of bringing the farmers together, and showing them what can be done in a large way, also the saving of labour and the superiority of the article. In fact, many of the factories and creameries that are now established is due to the Travelling Dairy bringing the people together and enlightening them.

There is also a vast improvement in the article now made to that manufactured even a year ago, and I have seen butter and cheese at factories and shows equal to the best in Australia.

Another matter which is noticeable, and speaks volumes for the rapid strides made in the industry during the past twelve months, is the number of factories and creameries that have sprung into existence during that period. There are now 16 cheese and butter factories and 13 creameries in full swing, which means an increase of 8 factories and 8 creameries for the time I speak of; but I am sorry to state that out of the above number only 4 factories and 1 creamery are worked on the co-operative factory system.

Now that it is found that growing farm produce is not a profitable undertaking, as a market cannot be found to leave a margin of profit to the producer, no branch of farming offers better prospects or the same remuneration as the dairy, which must consequently develop to very large proportions; but to warrant the future success of the industry a foreign market must be found, and this cannot be done successfully without the aid of better means of transit by railway in the way of refrigerating cars, as the quality of the butter would be seriously impaired before it reached the port. Cold storage would also have to be provided in Brisbane, where the article could be kept pending the arrival of the boat.

The Victorian people found that their success depended largely on the receiving depôt in Melbourne. If such arrangements were made, I feel confident that the industry would be placed on a sound footing.

There is also another serious matter which we have to dread—that is, the blending and exporting of inferior grades of butter, which is sure to be done unless some supervision is made so as to have the butter classed and branded before it leaves the port, for a quantity of inferior butter shipped in the infancy of our trade would mean ruination to the industry for a number of years.

Now that the industry has become one of the most important in the colony, and has engaged the attention of farmers and stock-owners everywhere, I fail to see why immediate steps should not be taken to encourage an export trade, for with an increasing demand at home and an unlimited market abroad it must give confidence to those about to enter the business. Although some people predict that the export trade is likely to be overdone, I feel certain that the foreign demand will more than keep pace with the increasing production. Now that we have the road paved for us at the expense of the southern colonies, I am at a loss to know why we cannot place a first-class article on the home market, especially when the lesson has been taught this season that our consumption is glutted.

During my travels I could not help noticing that the farmers rarely exert themselves in the slightest to get out of the mire, and should they fail to sell any trifle they look for the assistance of the Government. In my opinion they have been spoilt by being wet-nursed by State-aid in the beginning.

The three evils which at present threaten the dairying industry are—1st, want of co-operation; 2nd, want of attention with regard to the breed of cattle kept for dairying purposes, and the defective system of milking; and 3rd—a most important matter—want of energy in conserving fodder for a time of need.

In conclusion, I may state that during my term of office I have not spared any pains to forward the industry with which I am connected, and have done my utmost to uphold the reputation of the Department of which I am an officer.

It is admitted by the Press and all concerned in the welfare of the colony that the teachings of the Travelling Dairy are one of the most beneficial factors in bringing about a return of our former prosperity.

I must not omit to acknowledge, with thanks, the unvarying courtesy I have received at the hands of the several Pastoral and Agricultural Societies with which I have been brought in contact during my travels; also the various committees initiated for the purpose of carrying out the necessary arrangements for the working of the Dairy.

I have, &c.,

JOHN MAHON.

TRAVELLING DAIRY.

Summary of Operations in each District from 17th May, 1893, to 5th May, 1894.

Place.	Dairy Operating between the Dates.	Total Gallons of Milk Operated on.	Gallons of Milk made into Butter.	Pounds of Butter made.	Gallons of Milk made into Cheese.	Pounds of Cheese made.	Number of Pupils instructed.
	1893.						
Lanefield	17 May to 27 May	4,302½	3,876½	1,634	426	498½	20
Helidon	5 June to 21 June	509	183½	80	325½	375	13
Tent Hill	29 June to 15 July	1,192½	891	375	301½	327½	26
Murphy's Creek	25 July to 19 Aug.	979	611½	233	367½	408	16
Southbrook	8 Sept. to 20 Sept.	1,446	1,006½	350	439½	488	17
Westbrook	28 Sept. to 9 Oct.	1,463	907½	322	555½	567	13
Pittsworth	17 Oct. to 27 Oct.	815	348½	122	466½	463	24
Warwick	8 Nov. to 18 Nov.	858½	380½	110½	478	428½	21
Dalby	28 Nov. to 16 Dec.	1,593	779	252	814	808	21
	1894.						
Maida Hill	2 Jan. to 11 Jan.	1,058½	243	77	815½	749	15
Toowoomba	18 Jan. to 10 Feb.	809	593	141	216	196½	30
Meringandan	19 Feb. to 1 Mar.	1,183½	487½	160	696	743½	15
Hampton	12 Mar. to 27 Mar.	1,025	471	186½	554	592½	15
Goombungee	15 April to 16 April	1,399	595	234	804	864½	15
Douglas	25 April to 5 May	1,243½	424	173	819½	864½	15
Total	...	19,877	11,798	4,450	8,079	8,374	276

REPORT OF OVERSEER, STATE NURSERY, MACKAY.

Sir,—In presenting my Annual Report of the State Nursery here, I have the honour to state that many of the trees originally planted have made great progress, especially since the irrigating plant was got into working order. On 6th, 7th, and 8th July, 1893, we had hoar frost each morning, which did a considerable amount of damage to the vegetable marrows and pumpkins, indeed all plants of the genus were killed; sweet potatoes were also killed back to the ground. The Choco (*Sechium edule*) was also killed down. Although described as an annual in most works, it is, however, evidently perennial, as it sprang up from the root, and has now on it a heavy crop of fruit. The fruit is certainly the most delicious of all the cucurbitaceæ for all culinary purposes.

The want of shelter from the wind is still, and will be for a long time to come, a great hindrance to the growth of many plants. Trees planted for the purpose of shelter are themselves exposed to the full force of the gale that so often blows over the ground, and these being at their worst during the wet season, when the ground is really a puddle, there is great difficulty in keeping these isolated rows of trees from being blown down. The grape vines suffer much from the wind, and have frequently been stripped of their leaves.

Rubber Plants.—The *Para* (South American) and *Ceara* (East Indian) are growing in the same row, which has given me a good knowledge of their comparative hardiness. The two plants of the *Ceara* were cut down to the ground by the frost, but came up again, and have made single shoots ten feet high, which will now be, I think, safe, as after plants have got three or four feet above the ground there is no danger. If it escapes this season they will soon be large trees. The *Para* was slightly browned in the foliage, but that was the extent of damage done. The plants of both genii freely exude the milky juice on the slightest cut being made in the bark.

Coffee.—The frost destroyed a number of the plants planted out, but those that recovered have grown very well in spite of the wind and sunshine, they being without any shade whatever. The two plants sent up some time ago unnamed are very distinct from *arabica* in their foliage, and yet not like the Liberian. They are growing very well.

Ramie (*Bœhmeria Nivea*).—There being no appearance of a machine being brought out capable of working fibre, I intend to plough up the greater part of the half acre planted, leaving a row or so in case an efficient machine should be invented, in which case there will be plants sufficient to start another plantation. Although strenuous efforts are being made here just now to float a fibre company, it is not likely that the machinery available would be capable of working up the ramie.

Lemons.—The seedling lemons have grown into good-sized trees, and have just fruited in the fourth year.

Vi Apple (*Spondias dulcis*) have grown well, but have not as yet borne fruit.

Grape Vines (varieties principally of *Vitis vinifera*).—Out of the varieties sent and growing here I have selected the following as being the most suitable of those that have already fruited:—Royal Ascot, an English variety, somewhat like Black Hambro, but not so sweet, a strong grower and great bearer; Espar, another good black grape, almost identical with Royal Ascot, both coming in about Christmas; Le Noir, a strong grower, great bearer, long unshouldered bunch of small berries, *juice red*, very sweet when quite ripe, intensely black with a beautiful bloom, also ripens about Christmas; Green Dalmanes, a remarkable sweet honey-like grape, but a weak grower and shy bearer; White Solferina, a very strong grower, a great bearer, flesh crisp and sweet when quite ripe, has the fault of setting so thick in the bunch that it becomes solid, and should the wet season set in early there is a danger of the fruit rotting, a splendid grape in fine weather. Sweet Water (true); this grape with Alicante, Gros Colmar, Foster's Seedling, Black Hambro, and Muscat of Alexandria I brought from England, and know them to be all true; Sweet Water is about the earliest of grapes, very distinct in growth, leaf, and fruit, the very antithesis of White Nice, which is often called Sweet Water. White Nice bears about the largest bunch of any grape known; it has been grown to 28 lb.; a 2-lb. bunch of Sweet Water would be abnormal. Alicante, an excellent late black grape, beautiful bloom, but unless thinned in the bunch it is apt to rot in the wet season. Black Prince and White Muscadine, good growers and bearers, but have the same fault as Alicante. The coming grape for this neighbourhood, I believe, will be Snow's Muscat, strong grower, great bearer of large, black bunches, very loosely set, a great advantage here in the wet season, has a slight muscat flavour, and is an all-round excellent grape. Iona (*Vitis Labrusca*) is very like Isabella, not quite so thick set in the bunch, and about a week or ten days later, strong grower and great bearer, has the fault of Isabella of not ripening equally in the bunch. There are a number of good grapes here that have not yet borne, which may also be suitable for the district. So soon as irrigation was applied the effects were very patent in the much stronger growth, better swelling and ripening of the fruit, and the vines are now in much better condition than they have been before. Anthracnosis has not been very troublesome. It made its appearance during the heavy rains in April, but as the growth had then nearly ceased it did not do much harm.

Japanese Plums (a true *Prunus*).—Several varieties of these fruited through the season. They are really good plums, and will, I believe, be of great value to this neighbourhood.

Lechee (*Nephelium Litchi*) have grown well, produced a quantity of flower, but did not set fruit.

Tamarinds (*Tamarindus indica*) have nearly occupied the 20 feet allotted to them. They bore some fruit, and now the most of them are bearing a good crop, the pods being rounder and much more fleshy than those of some trees I have seen in the district.

Tea (*Thea Bohea*).—These plants have grown well; are now large bushes flowering very freely, but, when the fertility of the seeds depended on the rain, failed. Now irrigation can be applied, crops of fertile seed will be obtained.

Plantains (*Musa*).—These have grown and borne well, but they are not much appreciated. Cavendishii is certainly the best of the lot. The two last received specimens are not old enough to bear, but are making fine growth.

Indian Mangoes (*Mangifera indica*).—The eighteen varieties of these have shown a great difference in growth Some of them are 8 feet through, while three of them remain but small plants. Four have borne fruit—namely, Kachehaee, Chuckukeea, Madam, and Madras. The fruit of the first two is delicious, being far in advance of any of the seedlings that compose the trees of the district. The Madras is not so fine. The Madam is very fine but late, coming in nearly two months after all the crop of the neighbourhood had been gathered. It is also a great bearer. I cut three crops of flowers to prevent the tree from bearing, leaving a few of the first set for fruit. It, however, continued to produce two sets afterwards.

Oranges.—The original plants of Bahia imported grew well the first season, but have not done so well since. The plants, however, that I grafted from them on to orange stock are growing well. The originals, I believe, were grafted on to the citron, which accounts for their not thriving. The two Indian, Mozambique and Ladoo, have done well. Mozambique has now a crop of unripe fruit, so that its quality will soon be ascertained.

Agave rigida var. *Sisalana* has grown a great plant, and produced a number of large suckers. At the trial of the fibre machine a short time ago, I had a pair of leaves put through, and also a pair of the Trinadad Pineapple, the longest leaved sort I have. The fibre of both were good. The second consignment of Agave are no doubt the right kind; they are growing well, but it is the fourth year that they make their progress. The weight of leaves produced then is four times the amount of the three previous years.

The Fourcroya (*Furcræa gigantea*) is also making rapid progress. It is the plant that the promoters of the fibre company here intend to plant extensively, as it is said to have produced such good results in Mauritius.

Arrowroot (*Maranta arundinacea*) is still doing well.

Turmeric (*Curcuma longa*).—The curry powder plants also do well, and produce a large amount of rhizomes.

White Field Pea (Princess Sophy) is an excellent field pea, bears a heavy crop, and I have now about five bushels of it for distribution.

Sugar-cane (*Saccharum officinarum*).—The great demand for plants this season is a proof of the increase of cane-growers. Last season it was taken away principally by large planters, but this season the applicants are generally young men who have either taken up land or are renting it from the large plantations. Striped Bamboo was taken first, the last of it having now been given away, the total amounting to over 15 tons. Rose Bamboo goes next; the other three—namely, Louzier, Bronchen Blanc, and Bronchen Royee—are not favoured. The seedling *Kewensis* has developed into a very much better looking cane this season; and although not so long as some of the kinds in cultivation, it is thick, heavy, and stools immensely. I have not enough of it to put through a mill, but no doubt the chemist at Homebush will be able to ascertain what it is worth as a sugar-producer. A few canes have been distributed, so that it will soon be widely spread.

New Guinea Cane.—Of the eleven varieties received eight lived; but as they had all sprouted and were rooted in the cases, which arrived at the coldest time of the season, the chance for a fair start was not great, some of them remaining under the ground much longer than the others, so that a fair comparison can hardly be made of their rate of growth. Several of them, however, have made rapid growth, and are splendid canes, and stooled well. Therefore, if their sugar qualities are equal to their appearance, they will be a valuable addition to those at present in cultivation. The acre now planted will give a much better opportunity of testing what they are worth.

Irrigation.—The erection of the plant was finished by the beginning of July, but pumping was not much utilised before the beginning of September. The engine did not at first work satisfactorily; but all the difficulties being overcome, I am pleased to say that the pump is a first-class machine. With 12 lb. of steam it lifts and forces the water 38 feet, and in a much greater quantity than the 2-inch distributing pipes can take away; with 20 lb. of steam it could supply a 4-inch pipe. The donkey engine is now working well. A shed is much wanted to cover the plant, which is exposed to all weathers.

Necessary Improvements.—The necessity of a small place for an office and seed-room grows with time; papers and correspondence increase. I have just been obliged to purchase a piece of furniture to place in one of our rooms to hold the growing bulk, which adds to the £44 12s. that I have spent in horses, carts, and saddle, nine-tenths of which is spent in the service of the Nursery.

List of Fruits, Roots, Grains, and Plants of Economical Interest growing in the Nursery.

Fruits.

Bahia Oranges
Indian Oranges—2 varieties, Ladoo and Mozambique
Japanese Oranges—Citrus trifoliata
Lemons—Citrus limonum
Vi Apple—Spondias dulcis
Persimmons—Diospyros kaki, several varieties
Pineapples—Ananassa, 6 sorts
Grape—40 varieties
Japanese Plums—Prunus, 11 unnamed and several named sorts
Leechee—Nephelium Litchi, 3 sorts, No Mai Chee, Varhak Yep, Hung Lee
Chinese Plum (an Apricot)—Hung Sum Lee
Plantains—Musa, 7 unnamed sorts
Indian Mangoes—Mangifera Indica, 18 sorts, as follow:—Kistapal chotta, Khahaureeah, Kachchaee, Goa, Bangalore, Fuzree, Ferogabonnee, Bahandoorea, Kista palburra, Bengal No. 2, Arbuthnot, Gopal Bhog, Chuckukeea, Alphonsa, Madam, Dalhugny, Langera, Madras
Star Apple—Chrysophyllum Cainito
Bael-tree—Ægle marmelos
Figs—Brown Turkey, and one Indian unnamed
Passion Fruit—Passiflora edulis, Granadilla, Passiflora quadrangularis, Carica Papaya, new variety, Puneala Plum, Flacourtia Cataphracta

List of Fruits, Roots, Etc., growing in the Nursery—*continued.*

Plants of economic and commercial interest.

Para and Ceara Rubber
Arnatto—Bixa Orellana
Ramie—Bœhmeria nivea
Coffee—Arabica
Tea—Thea Bohea
Indigo—Indigofera tinctoria
Dolichos lablab
Dolichos uniflora
Pigeon Pea—Cajanus indicus
White Field Pea—Princess Sophy
Golden Amber Cane (sorghum)
Sugar-cane, 13 sorts—viz., Striped and Rose Bamboos, Louzier, Bronchen Blanc, Bronchen Royee; New Guinea varieties, Mahoaovua, Chenona, Oiva, Arobora, Batoe, Kikeria, Ooraya, Tduari; also an unnamed Fiji variety; also the seedling Kewensis
Jute—Corchorus capsularis and Olitorius
Teal Oil—Sesamum indicum
Teosinte
Flax—Linum usitatissimum
Sweet Potatoes—4 sorts
Arrowroot—Maranta arundinacea
Sisal Hemp—Agave sisalana
Sunn Hemp—Crotalaria juncea
Candle-nut—Aleurites moluccana
Yams—Dioscorea. Several sorts
Divi Divi—Cæsalpinia coriaria
Walnuts—Juglans regia
Rain-tree—Pithecolobium saman
8 different kinds of Indian seeds received with only native names. I cannot as yet say anything about them, only that they chiefly belong to Fabaceæand Compositæ.

List of Plants and Seeds for Distribution.

Bahia Oranges
Japanese Oranges
Indian Oranges
Ramie
Grape-vine Cuttings (20 sorts)
Seedling Mangoes (also Indian Mangoes when ready to go out)
Tamarinds
Seedling Oranges
Sugar-cane (5 sorts and the seedling Kewensis)
Indian Figs
Turmeric Rhizomes
Arrowroot Rhizomes

Seeds.

Cajanus Indicus
Tobacco (8 sorts)
Corchorus capsularis—Jute
Corchorus olitorius—Oil
Sesamum indicum—Teal Oil
Voandzeia subterranea—Earth-nut
Dolichos uniflora
Dolichos Lablab
Haricot Beans
Teosinte
Arnatto

The Indian seeds above will be for distribution when ripe, if found suitable.

D. BUCHANAN,
Overseer.

REPORT OF THE OVERSEER, STATE NURSERY, KAMERUNGA.

Sir,—I have the honour to submit herewith my Report upon the Nursery for the past year, and in so doing am pleased to say that, after two years of abnormal weather, the opening months of 1894 have given promise of a season of normal character. Since the first of January nearly 100 inches of rain have fallen, a total almost equalling that of the whole of the preceding twenty-four months. This heavy rainfall has done considerable damage to the Nursery roads, as also did a gale of wind on the 6th and 7th April to many of the larger trees and shrubs, uprooting and entirely destroying some, but fortunately the more valuable of the collection were not seriously injured. A great quantity of ripening seed was also destroyed.

NEW GUINEA SUGAR-CANE.

During May, 1893, I proceeded, by your direction, to New Guinea, and from Delena obtained some specimens of sugar-cane plants free from insect pests. These were brought over and distributed equally to the contracting parties, a few only being retained for observation at this Nursery. They were blown down in the recent gale, and have been cut up and used for plants, from which source an abundance of plants will be available for distribution next season. I am of opinion that at least three of the varieties collected will prove of value to the Queensland sugar-planters, and it is more than probable that some of these canes will ripen more rapidly than any cane known here. No statement can be made as to the value of these new varieties of sugar-cane until they have been tested in the sugar-mill. The following notes were made in the field :—

Arabora.—A purple cane. There is a slight contraction at the internodes. It is a hardy, rapid-growing cane, generally covered with white tomentum.

Batoe.—A purple cane, contracted at the nodes. This is a soft, rich cane that would probably be a favourite with mill-owners. In a short row the habits cannot well be observed, but it would appear to be a straggler. It has no tomentum.

Iduari.—Is a rather long-jointed, purple and yellow, or purple and green striped cane. This may be a very useful cane. Some very large canes of this variety were observed in New Guinea.

Akewa.—A dark strawberry-coloured cane, giving a large number of not very large cane to the stool. This may prove a valuable cane for some localities. I should think it would be a sweet cane. "Akewa" means knife in the dialect of the district where the cane was collected.

Chenoma.—Is a green cane, very distinct from the other varieties. It resembles the China cane both in colour, size, and contraction of the internodes.

Oraya.—A somewhat dirty purple, medium-sized, straight cane; shows no very peculiar characteristics. All these canes were planted on the 13th and 14th of June, 1893. Scarcely any rain fell until August, so they can hardly be said to have had a favourable season. Some other varieties were planted; some of these have died out, and of others only one plant grew with us, and sufficient valuable observations to report were not possible. It might be well to note here that many varieties of sugar-cane seen by me in New Guinea were so devoured by insect pests that clean specimens were not easily obtainable. I may mention that only one plant of a large yellow cane called Moo-Moo-Boku was retained at this Nursery; this plant failed. I thought at the time of collection this cane was the most valuable of them all.

Banana (*Musa*).—A large number of varieties of British New Guinea bananas were added to the Nursery, but I regret to say that a number have perished, only one plant of each variety that was brought over surviving. A Wardian case of Moku bananas from the West Indies was received in October. These plants had been too long in confinement, had become very spindly, and only two of them have survived until the present time.

Caprification Fig.—Some cuttings of this Ficus were received, of which the major portion failed. A form of *Ficus carica* received some time ago from the State Nursery, Mackay, yields a fair fig, and seems to like its present habitat.

Breadfruit (*Artocarpus incisa*).—Some few of the plants received last year from the Curator Botanic Reserve, Fiji, are doing well. The breadfruit of New Guinea is almost valueless. Missionary enterprise is securing plants from the South Sea Islands to plant in New Guinea. It is certainly pleasing and reassuring to see this vegetable fruit bearing so well in North Queensland.

Cola Nut (*Sterculia acuminata*).—At present some of the plants planted in July, 1890, have attained a height of a little over 6 feet. It is stated that this tree bears in its fourth or fifth year in its native country, but does not till the tenth year attain full bearing, so that flowers may be looked for during this and the coming year. The flowering is said to be nearly continuous after the tree reaches maturity. Great care is necessary in planting this tree in the open. Many importations from Kew have been made into North Queensland, but I cannot gather that any of these imported plants have thriven. Cuttings have been made from our own trees; the leaves of some of these are looking green and fairly well, but it is too early to interfere with the bases to ascertain whether there is any root growth; the cuttings look promising, however.

Cacao Theobroma.—The plants planted out in the open, being the few which survived from the Wardian case of seed received 31st December, 1892. They are at the present time looking well. Should a succession of favourable seasons, as the present, follow, I have great hopes that this tree will bear fruit. It would probably have a better chance on the Johnstone River, where there is a greater rainfall. As yet, I am given to understand, *Cacao Theobroma* has not succeeded in North Queensland, but with the aid of abundant moisture it may probably be induced to thrive.

Coffee.—The young coffee plants, *Maregopipe*, forwarded by yourself in July, 1893, are growing, but have not made much progress. A very considerable inquiry has been made for coffee seed, all of that supplied from seed grown in this Nursery being the Arabian variety. As much as 16 lb. of coffee in pulp has been taken from one tree. The ripening months are May and June, a little continuing into July. The mode adopted for seed has been drying the berries in the pulp, instructions being given to the recipients to soak the cherries and divide before planting. Some few hundreds of coffee plants have also been distributed. Field No. 3 of section 2: The coffee field is almost all planted. The late heavy rains have, however, washed some of the plants out of the ground. The two-year-old trees in this field show in many instances a large bearing of berries, and there will be abundance of coffee seed for distribution in two months' time. An unusual ailment has overtaken several of the older trees. One I noted carefully, which bore the heaviest yield last year, suddenly—*i.e.*, in a few days—drooped and died; examination of root gives no clue; trees in the neighbourhood are healthy. There has been no appearance of coffee-leaf disease. Unfortunately, the larger trees have been knocked about by the recent storms, which shows the necessity for proper break-winds on plantations. For small farmers with families, coffee culture should be encouraged; it were well, however, if not more than five acres were taken in hand, as, although prospects with coffee-planters are certainly favourable, too great an area is not advisable, particularly for beginners. Object lessons to those interested can now be given with the coffee at this Nursery. The Liberian variety of coffee does not seem to thrive so well as the Arabian, and has not shown signs of flowering up to date.

Elæis Guineensis.—The Oil Palm has flourished well during the past year. These palms were roughly treated by the recent wind storm, but none were destroyed, although one or two had the tender leaves of the heart considerably damaged, and several were flattened.

Citrus Family.—The last imported Jaffa oranges have shown a different fruit to the solitary tree of the first importation. Unfortunately the ravages of the fruit-fly have been so severe that none of these fruit were allowed to mature. A short time ago a parcel of three oranges were consigned by post to you, so that you will have the chance of judging for yourself of the qualities of this fruit. The fruit-fly has destroyed the whole of the orange crop in the Nursery, and I have not had an opportunity of tasting any of the varieties myself. This new, and presumably the true, Jaffa is a large orange with somewhat rough skin. The weight of the three sent was 3 lb. The Mozambique orange yielded two or three fruits, and I have secured one of these to preserve it from the insect pest, but it is hardly ripe enough to pronounce an opinion on its character at the present time. This orange is, however, much the finest shaped and healthiest looking of any growing in the Nursery, and will probably be found to be the best for this tropical district. The oranges from Malta have all, with the exception of the myrtle-leaved mandarin and Seville, suffered from some bark disease. The bark splits longitudinally first, cracks again at right angles, exuding a whitish gum; the branches so affected gradually wither and die. The "sweet orange," the "egg," false "blood egg," false "blood," have all succumbed. The Seville orange has, from the start, been afflicted with some leaf disease, but has resisted the bark disease. It should be mentioned that none of the Malta oranges except the "sweet" and "Seville" have come true to label. My absence from the Nursery has prevented any grafting being done this year. January and February are the grafting months with us.

Bell Apple.—This Passiflora received from Fiji has blossomed freely, but has not perfected its fruit. A trellis-work has been made on which to train it.

Tamarindus Indica.—This tree has fruited for the first time. The plants were raised from local seed, and planted during 1890.

Carob (*Ceratonia Siliqua*).—This tree has flowered several times, but has borne no fruit. This particular tree is a seedling. Doubtless grafting should be resorted to, taking scions from a fruit-bearing tree. There are not, I believe, any fruit-bearing carobs north of Bowen.

Divi Divi (*Cæsalpinia coriaria*).—Pods from this somewhat ungainly but pretty-leaved tree were forwarded to you for tannin experiments, resulting in a favourable report. I regret to say these trees were very seriously injured in the recent storm. Up to the present time there is but a poor show for a crop of pods this year, and many of the branches have had to be sawn off. It is reported this tree does well in salt-water marshes, of which we have none at this Nursery.

Fibre Plants (*Agave rigida* var. *Sisalana*).—These plants are doing well. It will be some years before distribution of plants can be made.

Fourcroya gigantea.—Flourishes admirably in this latitude. A considerable area has been planted. The leaves are hardly yet aged sufficiently for fibre, but during the present year an essay will be made with some of the older leaves.

Ramie (*Bœhmeria nivea*).—I am inclined to think this plant requires better soil than the Nursery affords. The plant grows fairly well, but attains nothing like the perfection read of. A patch will be tried, treated with manure. Up to the present no success has attended the several attempts made to separate the fibre.

Sunn Hemp (*Crotolaria juncea*).—This plant certainly grows and makes an effort to ripen its seed. It seldom exceeds more than 2 feet in height. The seed capsules are pierced by some insect, the seed seldom coming to maturity.

Indian Seeds.—A quantity of seeds were received from India in October, 1893, without names. They have mostly turned out to be useless. Some did not germinate; those that did proved to be *Dhall urber*, gingelly, and one or two poor kinds of gram. Seeds of these will be available for distribution shortly. Two rhizomes only of the ginger received showed signs of life. These were planted, but have since died.

Some seeds were received from the Rev. E. Gribble, Yarraburra Mission Station, who had himself received them from Baron von Müeller. Most of these failed or were inconsiderable, except perhaps "Okra," from which seeds are available for distribution.

I have, &c.,

EBENR. COWLEY,

Overseer.

SCHEDULE A.

Meteorological Report.

Month.	Temperature.	
	Extreme Max.	Extreme Min.
May	89·0	52·5
June	84·3	51·8
July	82·8	42·0
August	84·0	46·5
September	87·5	54·0
October	93·0	62·5
November	95·5	66·5
December	102·0	66·0
January	97·5	70·2
February	93·5	64·8
March	90·5	70·1
April	88·8	63·0

SCHEDULE B.

ECONOMIC PLANTS growing in the STATE NURSERY, KAMERUNGA, 1893-4.

Botanical Name.	Vernacular Name.	Use.	Botanical Name.	Vernacular Name.	Use.
Citrus limetta	Lime	Acid juice for drinks	Musa, var. Siskomu	Banana	Fruit
Sterculia acuminata	Kola	Beverage	,, Konoboro	,,	,,
Coffea arabica et liberica	Coffee	,,	,, arirabo	,,	,,
Artocarpus incisa	Breadfruit	Vegetable	,, poba	,,	,,
Theobroma cacao	Cocoa	Beverage	,, rokuta	,,	,,
Curcuma longa	Turmeric	Curry ingredient	,, moha	,,	,,
Gossypium	Cotton	Fabric manufacture	,, tewa	,,	,,
Ricinus communis	Castor oil	Medicinal	,, kai karakoo	,,	,,
Bixa orellana	Arnotto	Dye and fibre	,, Narooma	,,	,,
Diospyros kaki	Date plum	Fruit	,, inipi	,,	,,
Cæsalpinia sappan	...	Dye, &c.	,, kumiri	,,	,,
Abutilon periplocifolium	Abutilon	Fibre	,, poahai	,,	,,
Agave rigida, var. sisalana	Agave	,,	,, inea	,,	,,
Boehmeria nivea	Ramie	,,	,, cheos	,,	,,
Corchorus olitorius	Jute	,,	,, Kamaruba	,,	,,
Vigna sinensis	Cow pea	Fodder	,, akeo	,,	,,
Andropogon saccharatus	Kaffir corn	,,	,, Kiama	,,	,,
Musa, var. superba	Banana	Fruit	,, carooma	,,	,,
,, cavendishii	,,	,,	,, liruba	,,	,,
,, sugar	,,	,,	,, Ooara	,,	,,
,, Dacca	,,	,,	,, Iperi	,,	,,
,, barrego	,,	,,	Vitis Iona	Grape	,,
,, sossido	,,	,,	,, black Spanish	,,	,,
,, gidavau	,,	,,	Punica granatum	Pomegranate	,,
,, radjaserch	,,	,,	Panicum texanum	Texas millet	Fodder
,, tanvek	,,	,,	Panicum Teneriffæ, var. rosea	Natal red grass	,,
,, djawa	,,	,,	Panicum maximum	Guinea grass	,,
,, bigu	,,	,,	Physalis Peruviana	Cape gooseberry	Fruit
,, dau	,,	,,	Tornelia fragrans	Monstera deliciosa	,,
,, deriuri	,,	,,	Fourcroya gigantea	Agave	Fibre
,, aiva	,,	,,	Citrus varieties	Orange, sweet	Fruit
,, Karua	,,	,,			

SCHEDULE B—*continued.*

Economic Plants growing in the State Nursery, Kamerunga—*continued.*

Botanical Name.	Vernacular Name.	Use.	Botanical Name.	Vernacular Name.	Use.
Citrus, varieties	Orange, egg	Fruit	Dolichos uniflorus	Horse grain	Horse fodder
,,	,, Jaffa	,,	Indigofera tinctoria	Indigo	Dye
,,	,, myrtle-leaved mandarin	,,	Artocarpus integrifolia	Jack fruit	Fruit
,,	,, Mozambique	,,	Sorghum dura	Broom millet	Broom-making
,,	,, Bahia Navel	,,	Cichorium intybus	Chicory	Mixing with coffee
,,	,, Seville	,, marmalade	Sesamum indicum	Gingelly	Oil
,,	,, seedless	,,	Carthamus tinctorius	Safflower	Dye
,,	,, chrysanthemum	,,	Elæis guineensis	Oil palm	Oil
,,	,, Chinese	,,	Andropogon schænanthus	Lemon grass	Perfume
,,	,, subacia	,,	Ananas sativa	Pineapple	Fruit and fibre
,,	,, large sweet	,,	,,	Smooth-leaf pine-apple	,,
,,	,, cumquat	,, preserve	Manihot glaziovii	Rubber	Rubber
,,	,, sweet lemon	,,	Ficus elastica	,,	,,
Nephelium longanum	Longan fruit	,,	Luffa acutangula	Vegetable sponge	Sponges
Mangifera indica	Mango	,,	Cinnamomum	Cinnamon	Spice
Cocos nucifera	Cocoanuts	,,	Morus alba	White mulberry	Silkworm food
Tamarindus indica	Tamarinds	,,	Dalbergia sissoo	Sissoo	Timber
Anona cherimolia	Custard apple	,,	Cæsalpinia coriaria	Divi Divi	Tannin
,, muricata	,, ,,	,,	Hibiscus esculentus	Okra	Vegetable
Ceratonia siliqua	Carob	,, and fodder	Colocasia esculenta	Taro	,,
Garcinia mangostana	Mangosteen	,,	Dioscorea	Yam panna	,,
Spondias dulcis	Vi apple	,,	,,	,, uvi	,,
Terminalia catappa	Almond (Fiji)	,,	,,	,, fortuna	,,
Duranta	Duranta	Hedge plant	,,	,, Trobriand	,,
Citrus trifoliata	Japan orange	,,	,,	,, potato	,,
Crotalaria juncea	Sunn Hemp	Hemp fibre	,,	Corcunopea	,,
Cæsalpinia pulcherrima	Flower-fence	Flowering hedge plant	Citrus, New Guinea, var.	British N. Guinea, indigenous	Fruit

SCHEDULE C.

LIST of PLANTS, SEEDS, TUBERS, and CUTTINGS available for DISTRIBUTION.

Plants.

Name.		Uses and Description.
Cumquat Orange	...	Small orange; fruit for preserves.
Common Orange...	...	Small tree; fruit.
N.G. Bananas ...	...	Two varieties—*Barrego* and *Sossido.*
Common Banana vars.	...	Dacca, sugar, Cavendish, *superba.*
Citronella ...	...	Perfume grass.
Panicum maximum	...	Large grass for stock fodder.

Cuttings.

White Mulberry	...	Food for silkworms
Sweet Potato ...	...	From Dalrymple Island.
Frangipani ...	...	Extraction of perfume.
Erythrina, red and white		Ornamental tree.
Duranta, blue ...	...	Hedge plant.
Japan Orange ...	...	" "
Bauhinia var. ...	...	Ornamental tree.

Seeds.

Broom Millet ...	...	Broom-making.
Cow Pea	...	Fodder and green manure.
Kaffir Corn ...	...	" seed for poultry.
New Guinea Tobacco	...	Delicate-leaved tobacco.
Safflower	...	Oil seed; flowers dye.
Natal Red Grass	...	Excellent grass; stands drought.
Castor Oil ...	...	Medicinal.

To follow later in the Year.

Yams, of several varieties (tubers); Sweet Potato (Dalrymple Island); Turmeric; Cassava; *Boehmeria nivea*, root plants; Pineapple, suckers; Indigo, seed; Tobacco; Kaffir Corn, seed; Rice; Broom Millet, seed; Teosinte, seed; Bananas, plants, several varieties; Sissoo Tree, root plants; Jaffa Oranges, grafted trees; Sweet Orange, seedlings; Cumquat Oranges; Common Oranges, seedlings; White Maize, seed; White Mulberry, cuttings; Gingelly, seed; Pearl Millet, seed; *Dhall urber*, seeds.

By Authority: EDMUND GREGORY, Government Printer, William street, Brisbane.

[September, 1893.

Queensland.

DEPARTMENT OF AGRICULTURE, BRISBANE.

BULLETIN No. 1.

SECOND SERIES.

COFFEE-GROWING

AND

ITS PREPARATION FOR MARKET.

BY

R. W. McCULLOCH.

The Bulletins of this Department will be sent free to such Individuals interested as may request them. Address all applications to "The Under Secretary for Agriculture, Brisbane."

BRISBANE:

BY AUTHORITY: JAMES C. BEAL, GOVERNMENT PRINTER, WILLIAM STREET.

1893.

PREFACE.

THAT the Coffee plant has found a congenial home in Queensland has been amply demonstrated in almost all the Northern coast districts, and recently in the Buderim Mountain district, where the crops promise to be phenomenal. In the North the dryest season seemed to affect the plant but little, judging by the luxuriance of its dark green foliage when that of most other plants was yellow, and by the unusually heavy crop of berries produced.

The demand for seed and plants, as well as information, pointing to a growing interest in an industry which promises to be remunerative, and to, in the near future, assume large proportions, is sufficient inducement for the Department of Agriculture to issue this Bulletin on "Coffee-growing and its Preparation for Market," with a hope that the information contained herein, being the outcome of practical knowledge on the subject by the writer, and written to suit Queensland conditions, will be of interest to intending Coffee-growers.

CONTENTS.

COFFEE-GROWING AND ITS PREPARATION FOR MARKET.

(*The greater portion of this Paper was recently published in the "Queenslander," and is, by permission of the Proprietors of that journal, re-issued in Bulletin form by the Department of Agriculture.*)

HISTORICAL.

How long coffee was in use among Eastern nations before being introduced into Europe is not known. Aljeziri Alhambali, a noted Arabic author, states that it was first made known about 870 of the Hegira, and so quickly did coffee-houses and booths multiply throughout Arabia that the Government several times made strenuous attempts to suppress them, fearing they would lead the people into idleness. Notwithstanding these efforts, the "coffee habit" took such a firm hold on the people that the beverage was made and drunk in secret. They even went long distances into the desert and there prepared the seductive concotion without fear of molestation.

Some pious Mohammedans thought it might be included among the intoxicating beverages forbidden by the Koran, but Alhambali, in an able pamphlet entitled "The Support of Innocence," proved that it was not in the prohibitory section of that book. As a consequence, the followers of the prophet once more returned to the delights of coffee.

Among the Egyptians it was a favourite drink, but was allowed only twice a week, in gatherings especially assembled for the purpose, the greatest solemnity being observed on such occasions.

It was introduced into Constantinople in the early part of the seventeenth century, and writers of that time inform us that the inhabitants of that city drank it as hot as could be endured, the decoction being as black as soot, and, as Purchos puts it, "not much unlike it."

A Greek merchant introduced it into "Merrie England" about 1652, and thus advertised it: "The virtue of the coffee drinks, first publiquely sold by Pasqua Rosee, in St. Michael's Alley, Cornhill, at the sign of his own head." It was not long after that coffee-shops became numerous, and were extensively patronised by artists, literary men, merchants, and politicians of note.

As early as 1663 it was satirised in England, and on every hand the bitterest invectives were applied to it by the Press and Pulpit. In one instance, a preacher hurled anathemas at the heads of those who used as a beverage "a syrup of soot and essence of old shoes!" Probably he had good grounds for this statement, having sampled some boiled coffee. Another divine denominated it "a poison which God made black, that it might bear the devil's colour!" The women also took up the cudgels against it, for in 1664 a numerously signed petition presented by them set forth that "coffee made men as unfruitful as the deserts whence the unhappy berry is said to be brought; that the offspring of our mighty ancestors would dwindle into a succession of apes and pigmies, and" (most unpardonable of all sins in their eyes) "on a domestic message a husband would stop on the way to drink divers cups of coffee!"

So many coffee-houses sprang into existence during the reign of Charles II. (1675) that he, entertaining a belief that many political intrigues had their beginning in those places, issued an edict ordering them to be closed. In this proclamation the following words occurred:—"The retailing of coffe or tea might be an innocent trade; but it was said to nourish sedition, spread lies, and scandalise great men; it might also be a common nuisance."

Coffee is spoken of as being in use in France in 1640, but it was not until 1668 that the French learned to drink this "essence of old shoes," and it came about in this wise: A Turkish ambassador, on the occasion of a dinner given to some public functionaries, served the seductive drink in elegant porcelain cups, placed on highly-wrought silver salvers, and handed to the guests by richly caparisoned slaves. This turned the heads and hearts of those thus honoured, and in a surprisingly short time coffee-drinking became a craze among the elegants of Paris. Four years later that city boasted of having the most magnificently appointed coffee-houses, which were patronised by all the wits and geniuses of that period, among whom were Rosseau, Boindin, Dauchet, Saurin, and many other notables.

From there it spread to numerous other portions of the earth, until now it is considered an absolute necessity in all well-regulated households.

Coffee-drinking rapidly attained great proportions in Britain, and by 1847 it had reached its maximum, when the phenominal growth of the tea trade checked its consumption.

BOTANICAL.

Without diving too deeply into the botany of the coffee plant—on which volumes have been printed—it will be sufficient here to state that the coffee plant is indigenous to Abyssinia, Africa; that there are eight distinct species of coffee, due probably to hybridisation and climatic influences, but two only are of any special economic importance—namely, "Coffea Arabica," or Arabian coffee, and "Coffea Liberica," or Liberian coffee. The former has hitherto been the species mostly cultivated in all the coffee-producing districts of Southern India and Ceylon. The Liberian species came prominently under notice at the time the coffee leaf disease first appeared in Ceylon, and it was thought would supplant "C. Arabica," and bid fair in the not distant future to be the only species cultivated. But since the coffee-planters of Ceylon have gone in so extensively for tea, the enthusiasm for Liberian coffee has toned down considerably. "Coffea Liberica" is a taller, hardier, and stronger plant; has a bigger leaf, produces a larger berry and heavier crop, and, what is of much greater importance, enjoys almost complete immunity from disease. As both species thrive equally well in Queensland, the method of cultivation and preparation for market here described is applicable to both. Of the two, however, the preference is given to the Liberian variety. The plant is more robust, and gives a bigger crop, which, after all, is the main thing. During late years continued and greater interest is being taken in this variety; the plant thrives in lower elevations and in climates quite unsuited to tbe Arabian varieties. Java and the Straits Settlements are at present the centres of Liberian coffee production, the yield per acre averging in these places from 9 to 11 cwt. per acre. At these figures, placing Liberian Coffee as low as 85s. per cwt., the returns would be considerably greater than from Arabian.

CLIMATES AND SOILS FOR COFFEE.

The opinion has hitherto prevailed that coffee does well only at elevations ranging from 1,500 feet to 4,000 feet above the level of the sea; the sides of hills—mountains, in fact, with a temperature ranging from 55 degrees to 80 degrees Fahr. But anyone who has seen the coffee plants on the flat alluvial lands of some of our Northern rivers would speedily alter his opinion to mine—that the coffee plant will thrive anywhere in Queensland. The richer the soil the better—the flatter the land the better, provided always that the drainage is effective, for the coffee plant is a deep feeder, and stagnant water within reach of the tap-root is fatal. A requirement of paramount importance in coffee-growing is shelter from wind, and this is best attained, not by planting shade-trees, as some writers suggest, but by leaving belts of standing timber. It is a false economy to fell all the timber on a plot of land to be devoted to coffee-growing, and then to have to plant shade-trees again. Shade is certainly required during the earlier period of growth; but this is easily accomplished by a heavy mulching of hay or grass. Sunlight is as absolutely necessary for the growth of coffee as of any other plant in existence, and the planting of shade-trees for the express purpose of shutting out the sunlight is an anomaly. Prehistoric notions in agriculture are best forgotten in this new land of ours. Shade-trees would be necessary in a dry and arid climate, under which conditions coffee-growing is best left alone. Blocks of twenty acres, even less, under coffee, with a belt of timber half to one chain thick, to act as breakwinds between each, will be found all that is necessary to protect the plants during the flowering season, at which period high winds, by blowing the flowers off, would materially affect the crop. If a hillside is to be planted, preference should be given to a north-easterly aspect. If flat land is to be worked, care must be taken to have thorough and deep drainage. Steep slopes are objectionable on account of the wash occasioned by heavy rains, to avoid which expensive trenches have to be cut and terracing adopted. The richer the surface soil the better, but the subsoil should not be a stiff clay—anything but that, indeed. Our scrub lands, with their depth of decayed vegetable matter, are essentially coffee soils. There is no mystery about coffee-planting, ordinary intelligence and care being all that is wanted. The coffee-planter will soon learn from experience how to handle his trees. The best site, however, for a coffee plot is on the banks of a river or deep creek. These lands are usually high, and mostly have a fall back from the river or creek, and, if under scrub, have very rich and porous soils. Expense for drainage in such cases is considerably minimised.

In clearing land for coffee in Queensland the first expense is the last, hence the land should be thoroughly stumped and all standing timber removed. It is poor economy to plant among logs and stumps, and then have to use manual labour in weeding and after tillage. In Eastern countries, where labour is abundant and cheap, this system is adopted. A certain amount of manual labour will always require to be done, but when the land is thoroughly cleared, labour-saving appliances in the shape of ploughs and scarifiers can just as well be used among coffee plants as any other crop. The land should be thoroughly well broken up, harrowed, cross-ploughed, harrowed and rolled—in fact, highly cultivated. Slipshod methods will result in failure. There is no crop which responds so gratefully to generous treatment as coffee.

SEED.

The selection of seed is a matter of the greatest importance. If Coffea Arabica is to be grown, care must be taken that the seed is procured from healthy vigorous plants from seven to ten years old, and from those plants only which have strong and sturdy branches and on which the bud-joints are close. The object being to get heavy crops, close bud-jointed branches are essential, as such mean a larger surface on which the cherries will develop. Good seed is procurable locally, both the Arabian and Liberian species being obtainable in Queensland. The seed should be fully ripe when gathered for future stock; should be pulped by hand, unfermented, unwashed, dried in the shade, and be in the parchment. It should be perfectly fresh when planted; old seed is useless. One bushel of seed, as above described, will give about 25,000 plants, sufficient to plant about 37 acres, 8 feet by 8 feet, if the Arabian variety be planted; and about 80 acres, planted 12 feet each way, for Liberian. Mr. W. J. Thompson, of the Mulgrave road, Cairns, an experienced coffee-planter, is now engaged in forming a plantation, and seed or seedlings could be procured from him.

NURSERY.

Prior to the arrival of the seed, it being a matter of utmost importance that the seed be planted as fresh as possible, it is advisable to set about getting a nursery ready. The nursery should be on a high, moderately sloping piece of land, in close proximity to water, because the seedlings will require watering daily. The soil should be the richest procurable, and should be thoroughly ploughed and pulverised to a depth of at least 18 inches. The land should now be laid off in beds, each running down the whole length of the slope, and 3 feet broad. The beds should be thrown up, and separated from each other by a wide furrow or path. At the top of the slope a drain should be dug to divert the surface water. A bit of flat land, provided it is high, can be used equally well for a nursery, but the beds will require to be thrown up well, and drainage provided all round, the beds being separated by drains and paths. A nursery half an acre in extent, allowing for paths, &c., will provide sufficient space to rear 85,000 plants, or sufficient for three bushels of seed, enough to plant out over 100 acres.

The nursery being prepared, the seed on arrival should be immediately sown in the beds, in rows 6 inches apart and 6 inches between the rows. A round peg is pushed into the ground to a depth of 2 inches, and one seed dropped into this hole, flat side downwards, the earth pushed back, and so on till all is sown. If the nursery is in a shady situation, nothing further except the daily watering (best after sunset) and weeding will be required. If not in a shady situation, artificial shade must be provided—best accomplished by covering the beds over with a heavy coating of straw or grass, or by driving forked props into the ground along the sides of the beds, laying saplings along these, and covering the whole with branches or palm leaves. The height of this covering should be sufficient to allow of the weeding by hand being easily attended to. The watering should be done by a watering-can with a very fine rose, or by a hose from a 400-gallon tank raised above the level of the beds and kept full by means of a pump. In this nursery the plants will remain till they attain a height of 8 inches or 9 inches, or have developed one pair of primary branches.

Great care must be taken to gradually remove the shade in the nurseries as the seedlings develop. By so doing they are gradually inured to stand the weather when planted out. If young seedlings are so treated and are gradually inured to the full heat of the sun, there is no necessity for any artificial shade, except mulching with grass, when planted out in their permanent positions. In all, from the time the seed is put in the nursery till the seedlings are ready for transplanting, a period of about six months will elapse. As the transplanting should take place at the commencement of the rainy season—say, by the beginning of October or November, it is obvious that the nursery should be started about the beginning of April, or earlier.

TRANSPLANTING.

The field to be planted should be thoroughly well ploughed (the deeper the better), harrowed, cross ploughed, and harrowed again, and got ready by the beginning of the rainy season. The lining out of the land should then be done, and this is easily accomplished if the land has been thoroughly cleared of timber, stumps, &c., by running out drills with the plough, parallel to each other and 8 feet or 12 feet apart, accordingly as Arabian or Liberian coffee is the crop. Now run cross furrows parallel to each other and at right angles to the first lot. The intersections of these furrows will be the places for the plants. Holes are now dug to a depth and width dependent on the size of the seedling plants; or, if the land has not been cleared and the stumps remain, a good stout clothes-line, having bits of cloth tied on at distances of 8 feet apart, may be stretched across the plot to be planted, and pegs driven in at each mark, to indicate where the holes are to be dug. Eight feet from these pegs the line is again stretched, and so on till the field is all lined out. This system of lining out ensures regularity in the rows. In removing the plants from the nursery, a cloudy, damp day should be selected, and each plant removed with a good-sized ball of earth round its roots. If the tap-root is too long it may be severed by an oblique cut with a sharp knife. The seedling should be carefully planted in the hole prepared for it, care being taken to keep the tap-root straight, the earth well pressed down all round, a good double handful of hay or grass laid all round it, and the plant left to take its chance. The object attained by this mulching of hay or grass is not to keep the sun off the plant, but off the *earth round* the plant. If the planting out has been done in wet or showery weather, and the season does not get too dry, the future of the plants need occasion no worry.

CULTURAL OPERATIONS.

The after treatment till the plants come into bearing, which will take place about two and a-half to three years from the date of planting out, will be the rigorous exclusion of all weeds; a free use of the scarifier or horse-hoe will readily effect this. Should the wind-breaks left not be sufficient, it will be found necessary to support each plant by driving a stake into the ground alongside and fastening the stem to it. Again, if shade is absolutely necessary owing to the continued dryness of the weather, it will be advisable to plant maize or sorghum between the rows; it grows quickly, and will provide ample shade, while at the same time a partial return for the outlay is secured.

Drainage must now be attended to. Water must not be allowed to lie about in hollows or inequalities of the ground, which must all be drained to a lower level. If the coffee plot is in the slope of a steep hill, terracing will have to be resorted to to prevent the soil being washed away, and perhaps the plants with it; but steep hill sides had better be avoided. During the two years before the plant comes into bearing, the energetic planter will endeavour to attain a high degree of cultivation in his coffee plot if bumper crops are wanted.

PRUNING AND TREATMENT OF PLANTS.

In addition to the necessary draining, terracing, and weeding of the coffee plot during the period before bearing, the plants must also be handled to a certain extent. Pruning consists of various operations connected with either arresting the height of the plants to cause them to spread out laterally, or in removing the additional growth of wood to encourage the plants to push out new fruit-bearing shoots. These operations are technically known as topping, handling, and pruning.

Were the coffee plant left to itself it would grow upwards till it attained a height of 20 feet and over, and were this allowed, it is obvious that the gathering of the fruit would necessitate the use of ladders—an inconvenience, to say the least of it, apart from the damage done to the fruit-bearing branches by rubbing and breakage. It is usual, therefore, when the plants attain a height of from 4½ feet to 5 feet, to nip off the central bud with the finger and thumb, if the wood is soft enough, as it usually is, to allow of this, otherwise a knife is used. This operation is known as topping. The first result of topping is to induce the growth of suckers or shoots under the joints of the primary branches or on the stem. These are rubbed off as soon as noticed, without injury to the bark, as they are then very tender. This operation is called handling.

From the "primary" branches spring "secondary" branches in pairs at short intervals. Any appearing within 6 inches of the main stem are cut away at once, so as to leave a free passage for the admission of air and some light. The object of pruning is simply to divert the energies of the plant from forming wood, and to concentrate them upon forming fruit. The fruit is borne by young wood, and as the "secondaries" are reproduced when removed, they are cut off as soon as they have borne, and a constant succession of young wood is thus secured. If the topping and handling above described have been carefully attended to, this operation of pruning will not be found necessary before the third or fourth year from planting. That is to say, two crops will have been got off ere pruning becomes necessary, if at all.

The practical effect of pruning is to limit the height of the plant, say, to 5 feet, and force it to develop, horizontally, "primary" branches at intervals of 6 inches throughout the entire height, and to form along these branches a constant supply of secondary fruit-bearing twigs. All upward branches, or branches running crosswise, are removed. This treatment forces the bushes to grow out laterally, exposing a large surface to the sun and light, and from which the crop can be easily secured. Pruning must be done as soon as possible after the crop has been gathered. It is usual in pruning to leave the opposite lateral to that removed, so as to allow of its fruiting next year. By cutting the "secondaries" thus every other year, a continuous crop is secured. A "primary" must never be cut. Broken, diseased, or dead branches must always be removed.

The above notes on pruning will, it is hoped, be intelligible. It would be an impossibility to give a comprehensive description of the art of pruning in the limited space here allotted.

Before describing the harvesting and preparation of coffee it will be as well here to mention some difference between the Arabian and Liberian varieties, which should have been previously dealt with.

The Liberian variety soon grows up into a tree, running up to 30 feet, and, being a very deep feeder, is less liable to be injured by dry weather. The Liberian does not come into bearing till four years old, but when it does the yield is much heavier than the Arabian; 10 cwt. and over per acre have been got, and that from 700 trees to the acre. The Liberian need not be pruned—in fact, would be better left unpruned, beyond pulling off the suckers for the first year or two to prevent the tree from running up into too many stems. The cherries of the Liberian variety remain firmly fixed on the tree for many weeks after they are ripe enough to pick—a very important matter when there is a scarcity of labour. Owing to the size of the cherries, the ordinary pulping machinery is not effective. Special pulpers for Liberian coffee are procurable, however. The particulars of machinery to be given later on will then refer more particularly to the Arabian variety, although the processes of preparation for market of both varieties are identically the same.

HARVESTING THE CROP.

At about two to two and a-half years old, C. Arabica will begin to blossom. The blossom, which is not unlike that of the white jessamine, soon falls off, and the fruit begins to appear. From flowering to harvest occupies about eight months. It may be as well to mention here that during the period the plants are in bearing all work about them should be stopped, so as to prevent any injury to the blossom or fruit. It is also at this period, if high winds are prevalent and no wind-breaks or stakes are provided, that great injury is done, the flowers being shaken off or blown away, frequently causing a loss of fully 50 per cent. in the crop. In about seven months from the time the blossom appeared, a first picking of fruit can be made, which is usually a small one. Only the ripe fruit should be picked—easily discernible by their bright blood-red colour—and the green ones left to mature. In a few weeks, dependent on the weather, a second picking can be made, and so on until the whole of the fruit has been harvested from the plants; then the fallen fruit, knocked off by wind, birds, and the pickers, is carefully collected also. In Queensland it will be found that the fruit will commence to ripen in October or November, and continue on till January.

PREPARATION FOR MARKET.

Before describing the preparation the fruit goes through ere becoming commercial coffee, it is necessary, to avoid confusion, to explain the technical terms used in the trade. The ripe fruit is called the "cherry"; the succulent outer covering of the fruit, "pulp"; the inner adhesive layer, the "parchment"; the seed coat within the "parchment," and which adheres closely to the seed, is known as the "silver skin"; and the seed enclosed in the "parchment" after the "pulp" is removed is known as the "berry." Before the "cherry" can be converted into the commercial article it has to go through the following processes:—Pulping, fermenting, drying, hulling, and sizing, special machinery being required for the first, fourth, and fifth processes.

Pulping.—This operation consists in removing the pulpy outer covering surrounding the bean, which, when the ripe cherries are operated on daily as they are gathered, is easily accomplished. The simplest and cheapest machinery used in pulping is that known as the "disc pulper," of which there are two, the single and double disc pulpers, the mechanism of which is very simple. In the single machine

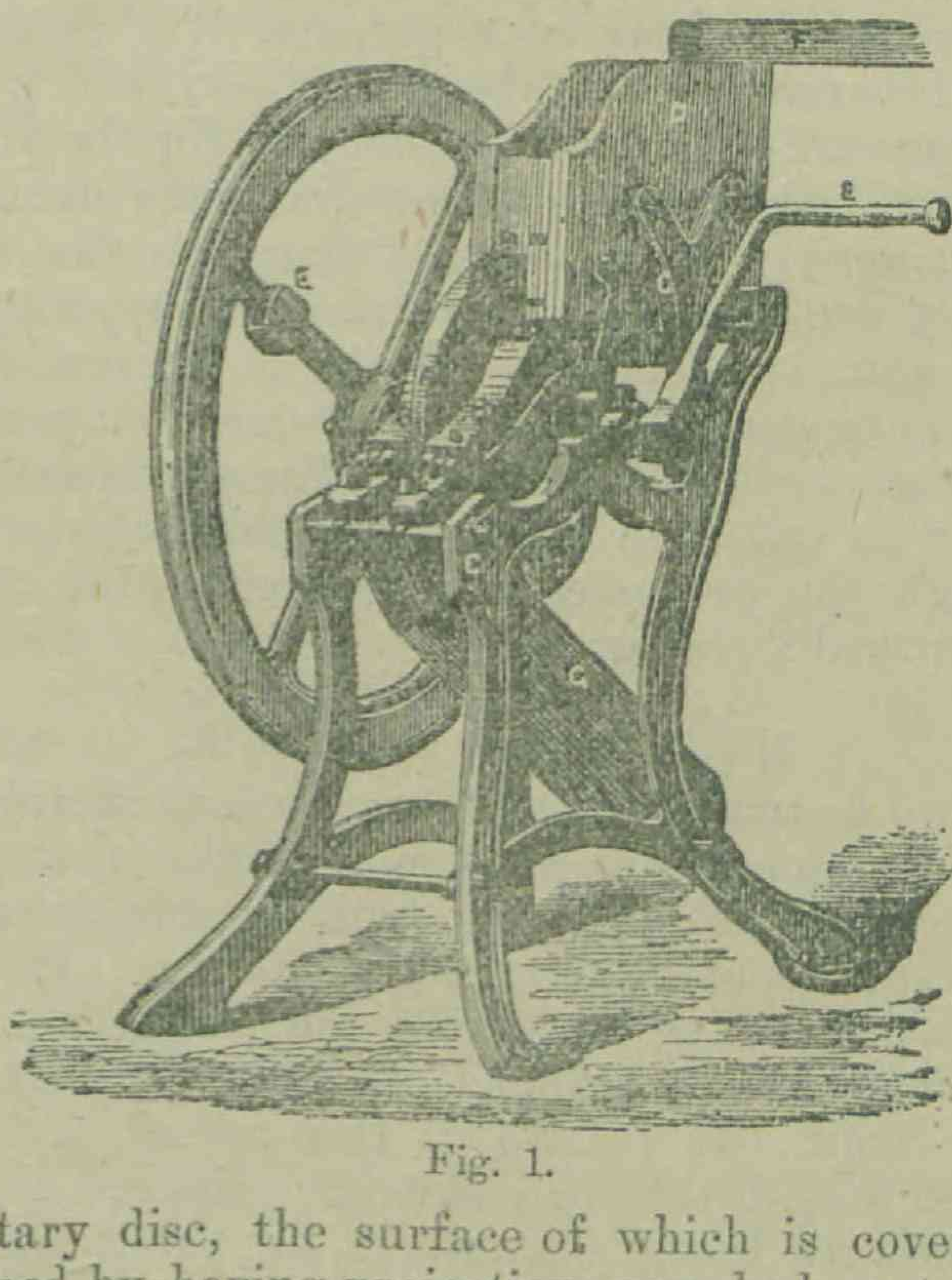


Fig. 1.

(Fig. 1) a rotary disc, the surface of which is covered with sheet copper roughened by having projections punched on to it, is made to work against smooth iron beds, so adjusted that the complete cherry cannot pass between. The cherries are pressed upwards against the beds, and the projections on the discs tear off the pulp, allowing the beans to drop into one receiver and the pulp into another. Fig. 1

represents a single disc pulper driven by hand, requiring in Ceylon three coolies, though doubtless two Europeans could well work it. It pulps from twenty to twenty-five bushels of cherry per hour. The cherry is delivered into the hopper (D) by means of a gutter or spout (F), and

ERRATUM.

After the word "January," in the 5th line, page 14, add—"in the South, and earlier in the North, about June, July."

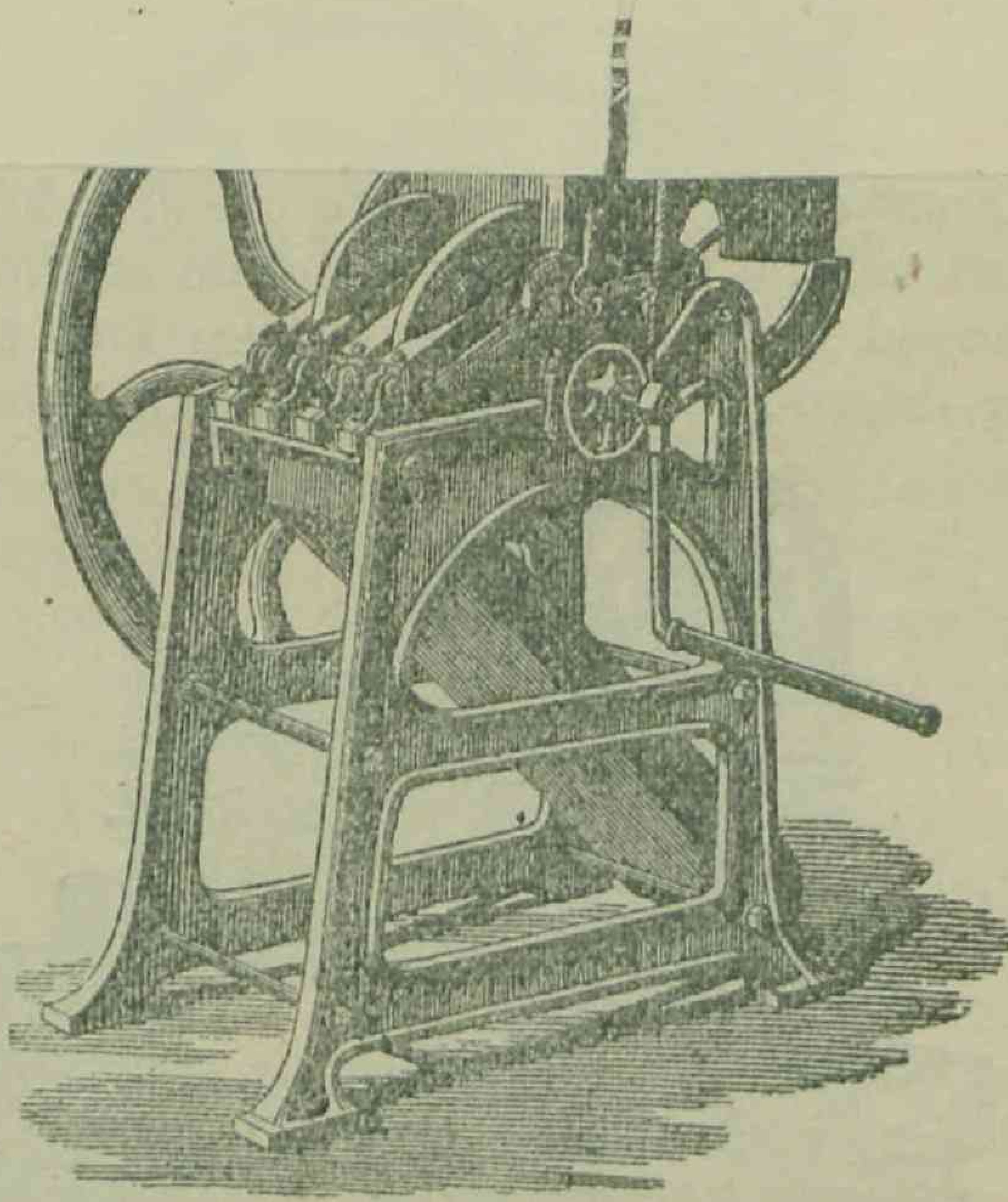


Fig. 2.

The double disc pulper (Fig. 2) is similar in construction to the other, but has two discs, and is also provided with an iron feeding roller. It can be made to be driven by hand or steam, the latter being decidedly preferable, in which case a double disc pulper would pulp from 70 to 80 bushels of cherry per hour. The price ranges from £30 to £40.

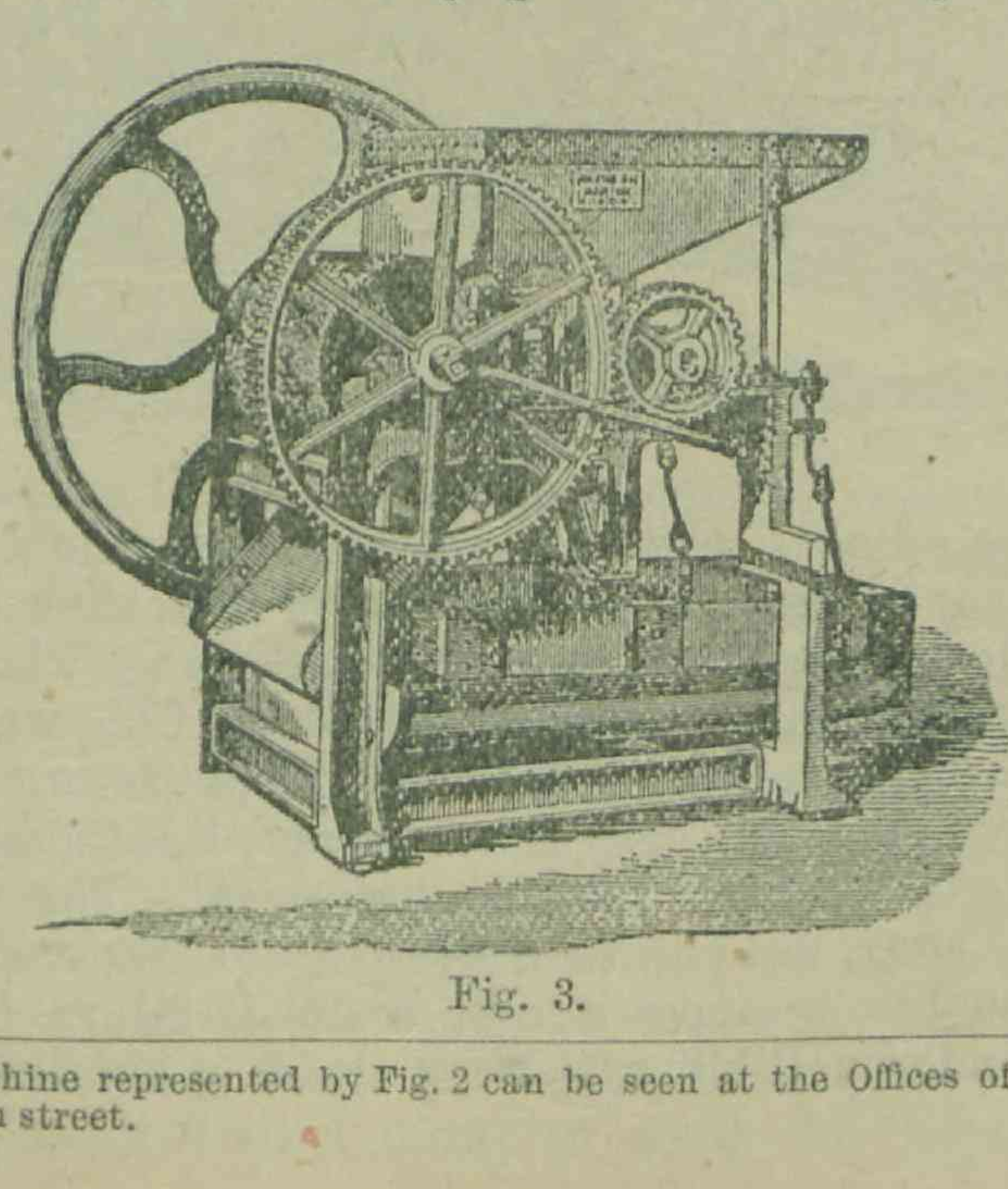


Fig. 3.

NOTE.—The machine represented by Fig. 2 can be seen at the Offices of the Department of Agriculture, William street.

represents a single disc pulper driven by hand, requiring in Ceylon three coolies, though doubtless two Europeans could well work it. It pulps from twenty to twenty-five bushels of cherry per hour. The cherry is delivered into the hopper (D) by means of a gutter or spout (F), and passes through the two conductors (BB), the pulping being done in the passage between BB and the disc A. The beans are delivered at the openings (KK), the pulp passing out through the spouting (G) at the bottom, whence it is conducted, by means of gutters, to a manure heap. The price of a single disc pulper is from £17 to £20.

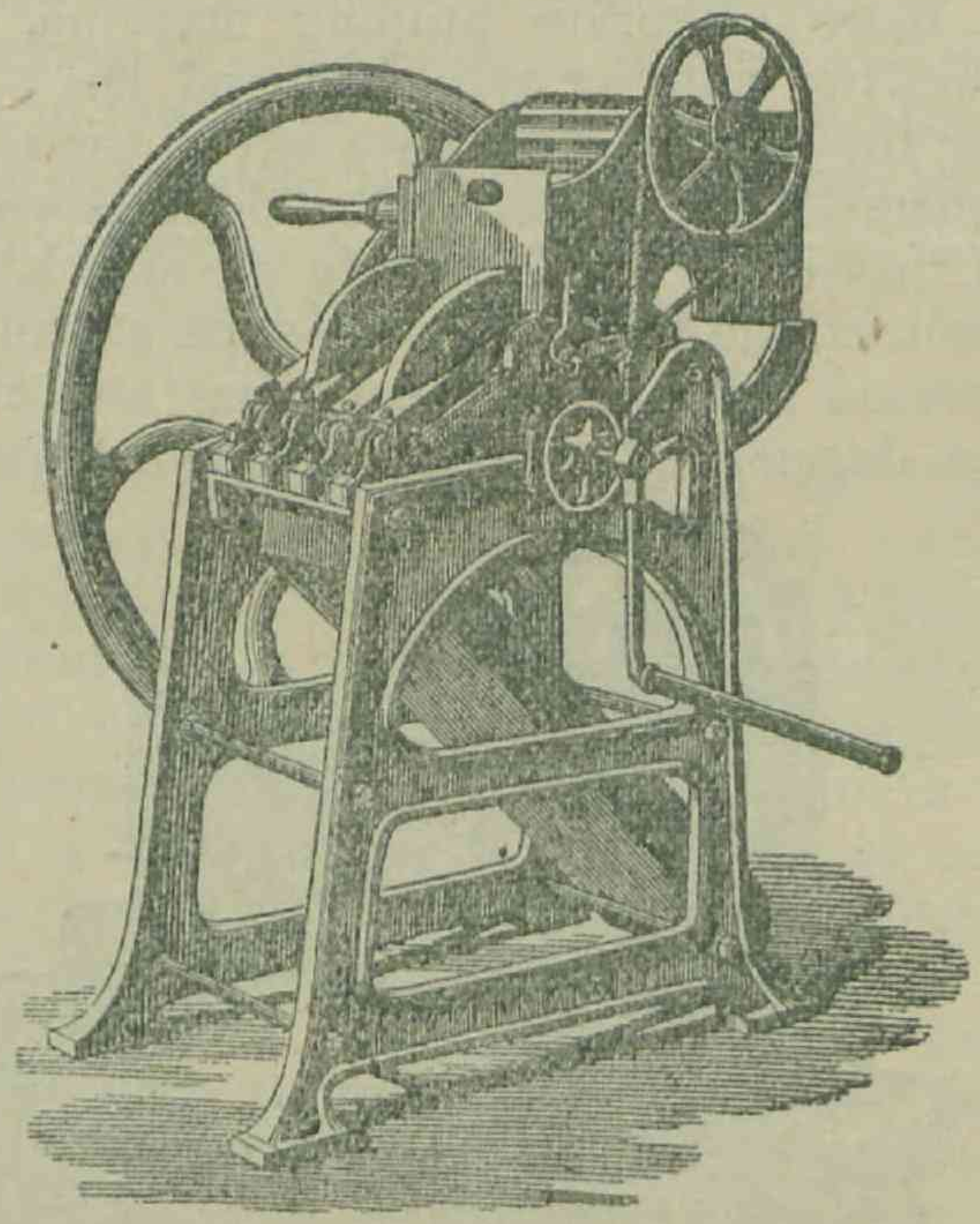


Fig. 2.

The double disc pulper (Fig. 2) is similar in construction to the other, but has two discs, and is also provided with an iron feeding roller. It can be made to be driven by hand or steam, the latter being decidedly preferable, in which case a double disc pulper would pulp from 70 to 80 bushels of cherry per hour. The price ranges from £30 to £40.

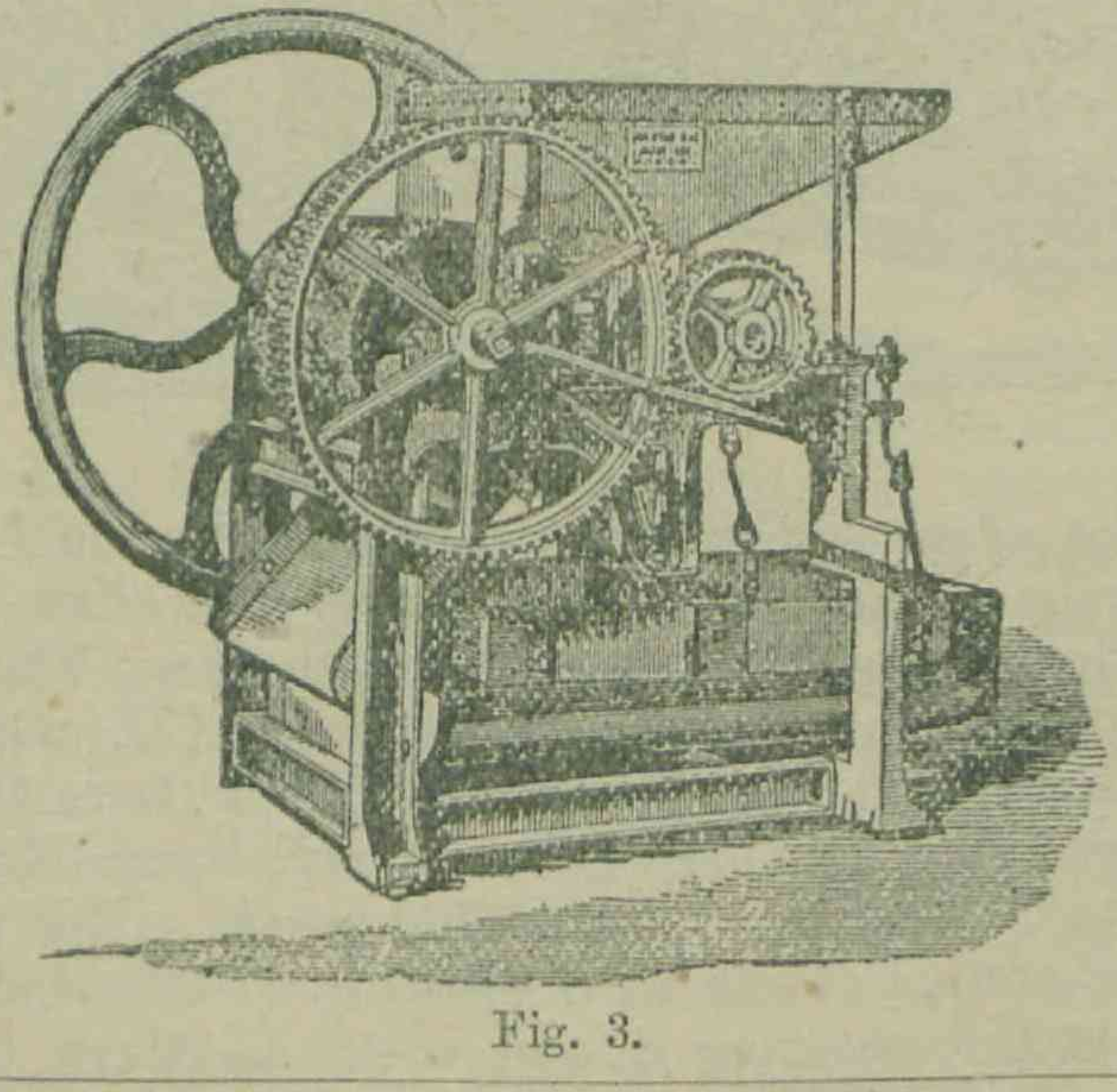


Fig. 3.

NOTE.—The machine represented by Fig. 2 can be seen at the Offices of the Department of Agriculture, William street.

Another pulper much in use, and which is more perfect than the disc machine, is known as the "Cylinder" pulper (Fig. 3), which may be described as a drum with sharp teeth working against a "breast" fixed to within a certain distance of the cylinder, or by having two sets of "chops," the bottom one having a sharp edge. The teeth fix into the pulp and drag it forward against the breast or chops while the beans fall on to a sieve, through which the pulped beans drop and allow of the unpulped being collected and returned to the pulper by an elevator attachment.

Fig. 4 is a more elaborate pulping machine, known as the "Gearless." It has two pulping cylinders, and has a set of elevator buckets for raising the unpulped cherries left on the sieves underneath and redelivering them to the hopper. The cherries are first delivered into the hopper A, passing from there into the side hoppers BB, from these into the cylinders, the pulping being done at the chops under E. The cherry is pressed between the cylinders and the upper chop, which loosens the beans. The pulp is drawn down between the

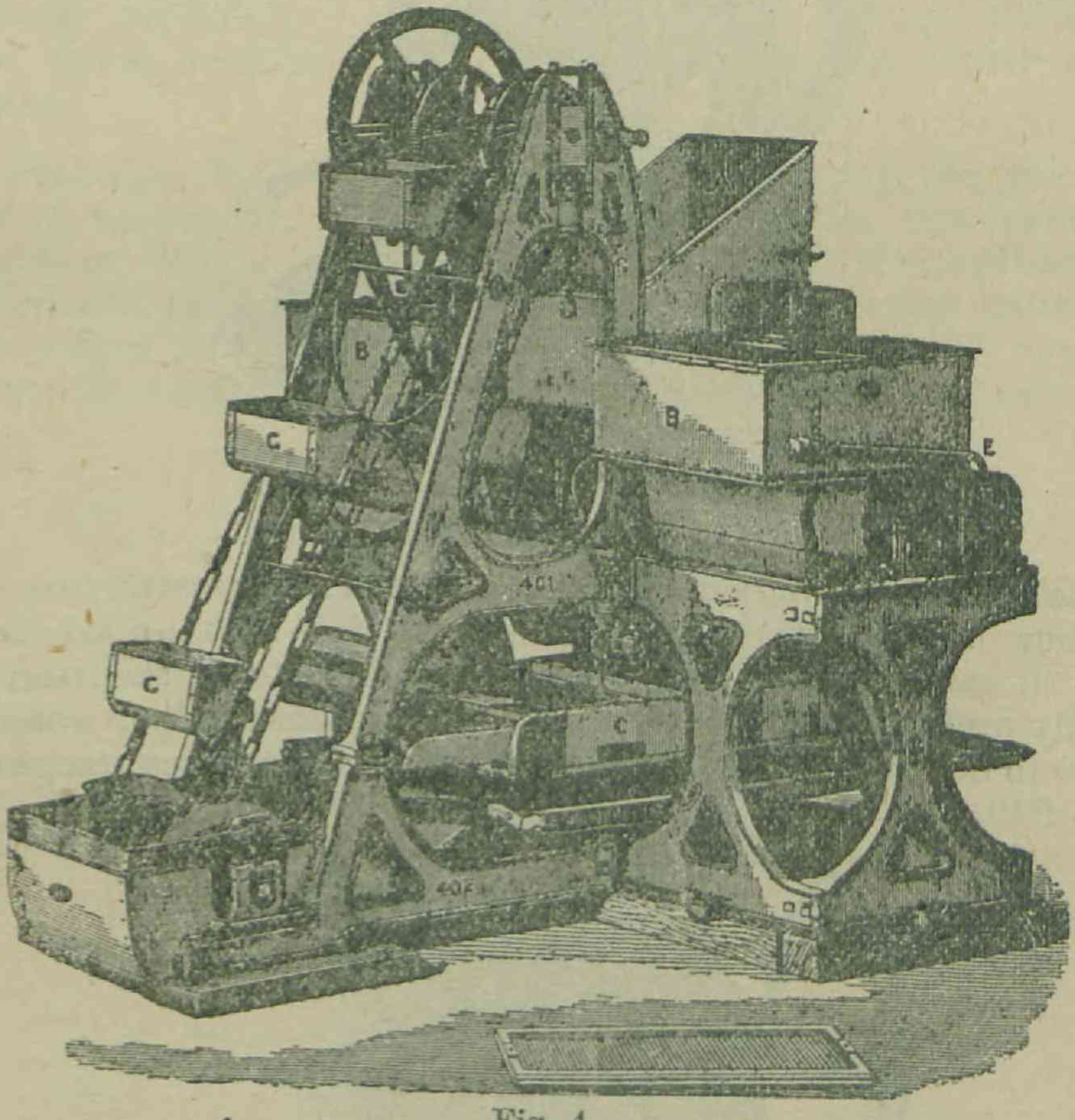


Fig. 4.

cylinder and the edge of the lower chop, while the beans pass out between the chops. The pulp and beans are thus separated, the former being floated away to the pulp pit, &c. The beans and a quantity of unpulped cherry fall into the sieve CC, which allows the beans to pass through and be carried off by spouts to the cisterns, the unpulped cherry being delivered into the well F, and by means of the elevator buckets GG returned to the hopper A. This machine pulps 100 bushels per hour, but can be worked up to 160 bushels, requires a 3-horse power engine to drive it, and costs £120 in Ceylon. These machines are made by Walker, Sons, and Co., Limited, engineers, of

Ceylon, experienced machinists in this line. The same firm also supply pulping and other machinery for operating on Liberian coffee, providing estimates and plans as well.

A modern pulping-house is usually built on a hillside, and is generally three stories high, the topmost story being a loft on which the "cherries" as they come in from the field are spread out. The next floor contains the pulper, and the lower one cisterns or tanks. By having the house on a hillside the cherries can be carried to the top loft without having to use elevators, and the cherries and water by gravitation carried to the pulper underneath. Smaller machines are procurable, and the operations all done on one floor by manual labour. An unlimited supply of clean water is necessary for this operation, as a continuous stream of water and cherries enter and leave the pulper at the same time.

Fermenting.—The "parchment" coffee or "berry" has to undergo fermentation to get rid of its saccharine matter, the removal of which facilitates drying. The beans are run by gravitation and the flow of water downwards into tanks, which are usually constructed of wood, and provided with openings for discharging the contents. In these tanks the berries remain till fermentation is set up, which usually takes place in from twelve to eighteen hours, according to the temperature at the time, after which they are discharged into another tank and thoroughly washed. Four wooden tanks are generally employed—two in which the fermentation actually takes place, and two in which the beans are washed. One of each is used for the produce of one day's pulping. The washing is accomplished mechanically or by hand.

Drying.—The beans on leaving the washing vat are run out on to the drying ground, and there exposed to the action of the sun and air. In modern plantations drying sheds are used and the beans spread out on shallow trays having perforated bottoms, the building being so arranged as to allow of these trays, in tiers, being drawn right out into the sun by means of wheels running on rails, and pushed back again at night, or in wet weather; artificial drying is also resorted to. The drying ground, if used, is usually made of concrete, somewhat arched, so as to allow any rainfall, if the berries are not covered in time, to escape. Another method is to scrape the earth and beat it down hard, then spread coir matting over it, on which the berries are spread out, the ends of the matting being brought over the top if rain falls. This ground should, of course, be directly opposite a storing shed, where the beans can be bundled in smartly if the rain is more than a slight shower. The building with tiers of shelves or trays is much the simplest plan. The trays may be as long and wide as convenient, but they should not exceed 6 inches in depth. Whatever method is adopted, the drying process requires great care; too quick drying will crack the beans. Each day's pulping will usually take quite two or three weeks to dry properly. The beans require constant turning, rakes being used; even in the turning judgment is necessary, disproportionate drying resulting from careless turning repeatedly. Too rapid drying must be avoided. A simple test for arriving at the knowledge when the beans are thoroughly dried is to remove the parchment from a dozen or so of the berries, and if the thumb nail pressed on the kernel leaves little or no mark, the berries may safely be stored away. The perfectly dry berry should now be of a slaty colour, rather light.

Hulling.—This operation requires machinery, motive power, delicate manipulation, and constant supervision, and where any of these requisites fail, the coffee suffers in appearance and consequently in value. Under these circumstances, if the grower of coffee can avoid this part of the business so much the better. Experience has proved that the coffee travels best in parchment, and the practice has now become all but universal to ship the berry to Europe in that state. Coffee reaching Europe in the parchment and there manipulated has resulted in very much better prices being realised—in some cases as much as 10s. per cwt. higher. The small increase in freight, owing to the parchment being on, is more than compensated by the enhanced price the coffee fetches in the London market. It would appear that the parchment being left for two or three months longer than usual around the berries, acts as a natural preserver, the berry having time, as it were, to mature more completely; then again, curing is done by experts and with perfect machinery. Suitable machinery is erected at some of the London wharves for this purpose, the charge being 2s. 6d. per cwt. for the operation. In most coffee-producing countries nowadays the coffee is never hulled at the plantations, but by dealers at the port of shipment. Growers in Queensland are advised to ship their coffee in the parchment; dealers in Brisbane will doubtless undertake the hulling, sizing, and winnowing. It will save expensive machinery and a lot of trouble. The operation of hulling, however, is here described, and growers may please themselves.

As a rule, the coffee in the parchment is stored till all the pulping is completed. By doing so the motive power used for the "pulper" can be utilised for the "huller." This operation consists in removing the parchment and the silver skin from the beans, and suitable machinery of all sizes is procurable. Fig. 5 represents two views of a

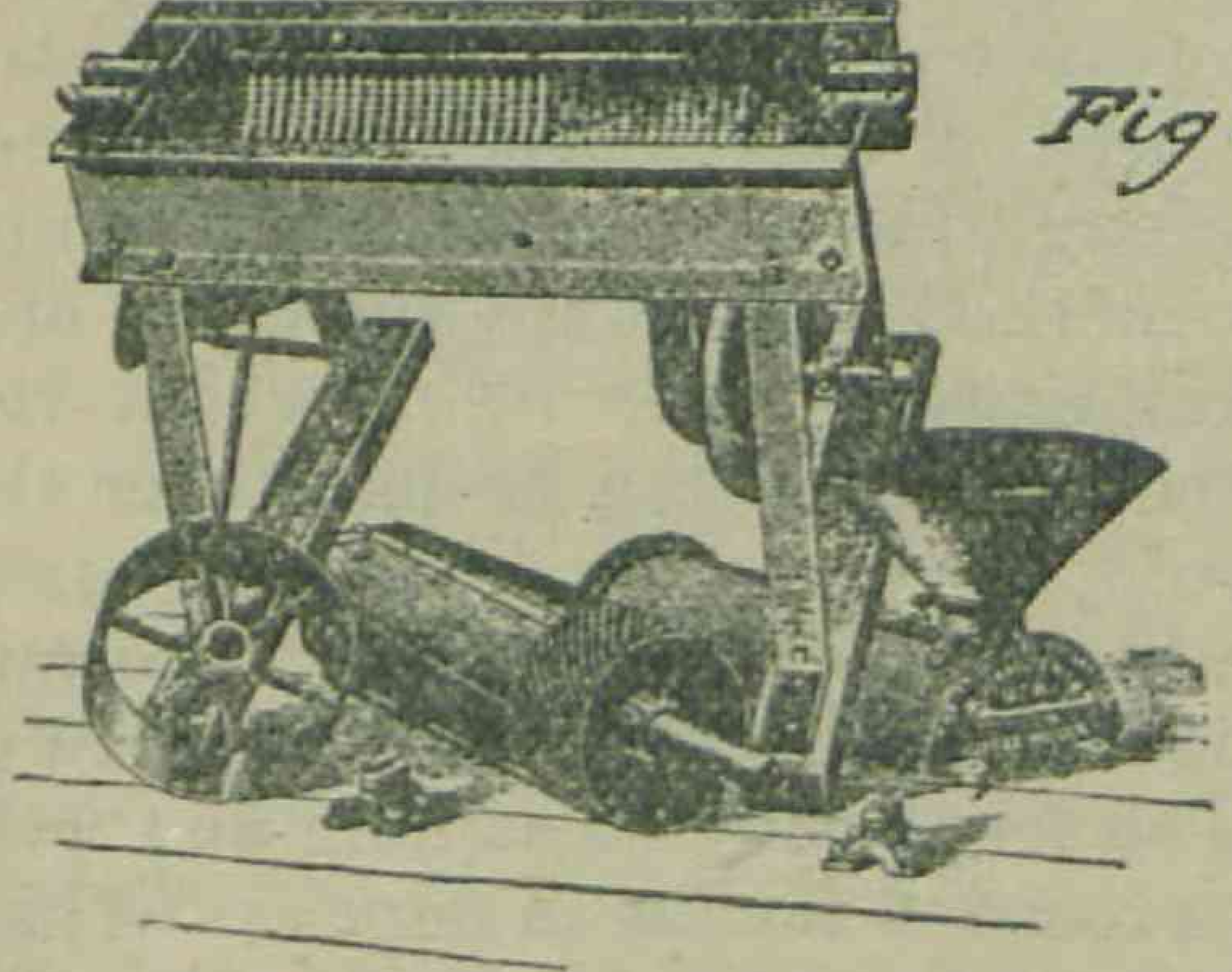
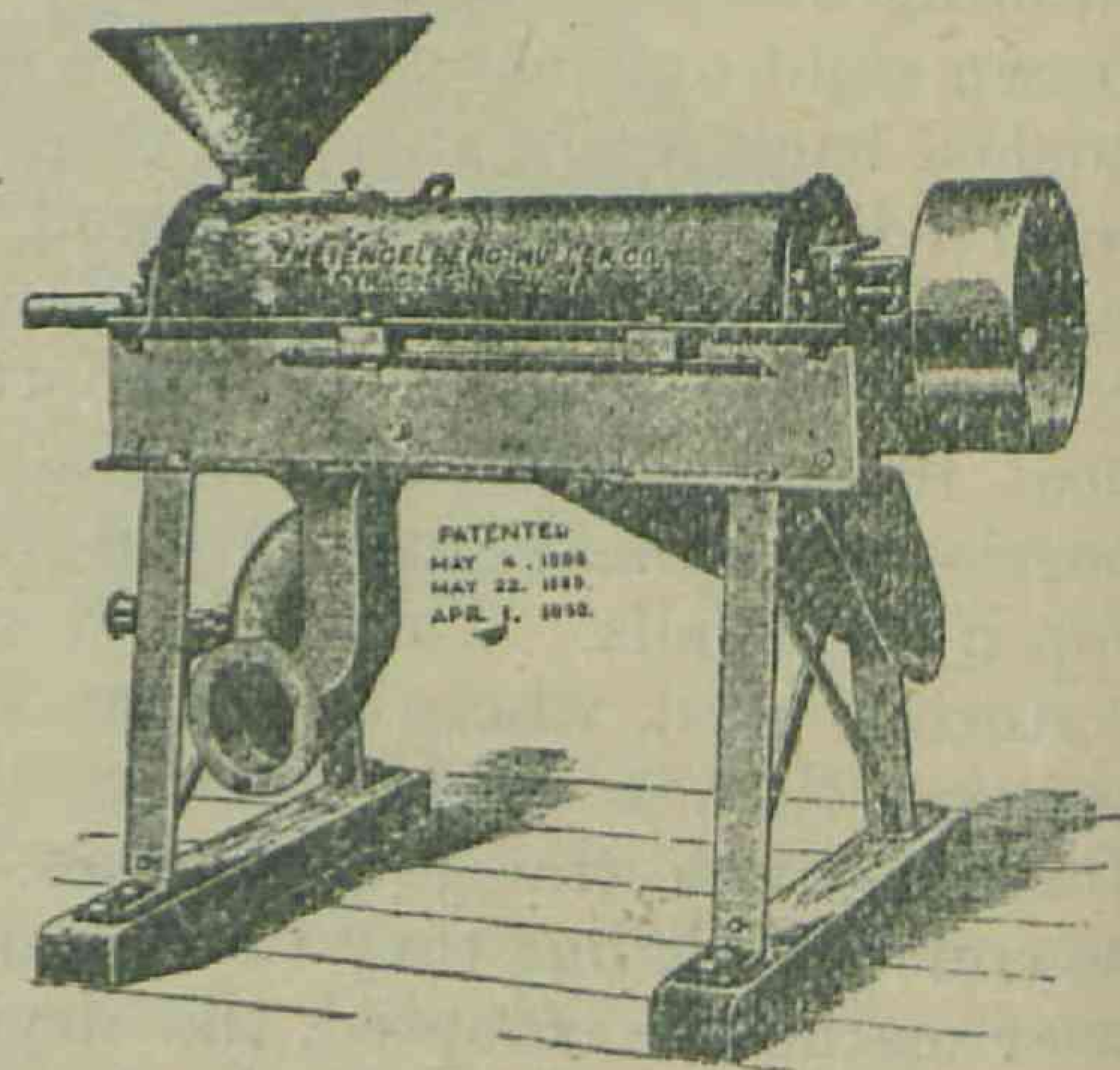


Fig 5



huller manufactured by the Engleburg Huller Company, of New York. Coffee hulled by this machine took the gold medal at the late Paris Exposition. The makers claim for this machine that it is the only one that hulls coffee rapidly without breaking the berry. The machine is 48 inches wide, 36 inches long, and 50 inches high; it will prepare 8,000 lb. of coffee in ten hours, and costs £100. Simplicity and rapidity, combined with effectiveness, have won for it a number of testimonials. This huller also separates the coffee beans from the parchment and skin in the one operation.

Sizing and Winnowing.—In most coffee mills these processes are carried out by separate machines placed below the level of the huller. The beans on leaving the huller fall on to a fan, which blows to one side the loose parchment and silver skin, the coffee beans dropping into a hopper, whence they are by means of an elevator carried into the sizing machine, having sieves so arranged that the coffee is separated into the various sizes to suit the market. This sizing of the beans has the effect of furnishing a bean of a uniform size, admitting of uniform roasting. The beans are by the sizing machine separated into what are technically known as Nos. 1, 2, and 3, and "pea berry." All these sizes have separate values, that of the pea berry being often the highest. The pea berry is in reality a malformation. Each "cherry" has usually two oval seeds, one side being convex, the other flat. If one seed is abortive, the other takes a round form, not unlike a pea; hence the name. The value attached to it is purely imaginary, probably due to the shape permitting of better roasting.

Packing.—The beans, once the parchment and silver skin are off, have to be saved from exposure to the air, and are usually packed away in casks made of selected and well-seasoned timber that is not likely to taint the coffee.

Another system of preparing coffee for market is to dispense with the pulping process entirely, and to simply sun-dry the cherries thoroughly—or employ artificial means of drying—and use a huller; or, as has been suggested, ship the dried cherries, and leaving the hulling to be done by experts. But it is very questionable whether the gain from this system would compensate for the increased freight charges and low price realised for the product. On the whole, the writer, from a lengthened experience, advises the pulping to be done ere shipment. The well-known firm of Robert Harper and Co. are purchasers of dried cherries, they undertaking the hulling.

Coffee can be treated in small quantities by thoroughly drying the cherries and pounding them gently in an ordinary mortar till the dried pulp is separated from the bean, then by letting the contents of the mortar drop from a height in a light wind the dried pulp will readily separate from the heavier bean.

COFFEE ROASTING.

This is perhaps the most important operation in connection with coffee. The whole flavour of the coffee depends on the care exercised in this operation. To be properly done the beans require to be roasted in a covered vessel, over a moderate charcoal fire, and kept in constant motion either by clockwork or a jack. The degree of roasting required for one class of coffee will not suit another. The coffee from beans of uniform size, roasted, is much superior to a mixed lot. The heat should be just sufficient to impart a light-brown colour to the bean. When the roasting process is carried too far, a disagreeable smell and a bitter taste are imparted, which lower the value of the product considerably. A capital roaster can be made out of an iron oil or nail drum by rivetting on two spindles, one at each end, cutting an opening on one side and fixing a sliding lid. One spindle bent to act as a handle, two iron uprights to support the drum, and the apparatus is finished. Coffee-roasting machines of all sizes and makes are procurable, the roasting being done by gas or fire.

YIELD PER ACRE.

Coffee at its best will be found to yield up to 10 cwt. per acre. This has been secured both in Ceylon and Java, and there is no reason why it should not be so here. But for safety an average yield of 5 cwt. per acre may fairly be expected. One-fifth of the weight of the ripe cherries is the usual return in marketable coffee, or in other words 10 bushels of ripe cherry will yield 112 lb. of coffee.

WILL IT PAY?

The only serious consideration in connection with coffee-growing is the necessary labour for picking the crop when ready, and this will have to be got over somehow. The operation is no different from the picking of hops or any other fruit. Contract work having overcome this difficulty in other places will doubtless do the same here. The following calculation may elucidate this point a little :—One acre of coffee will yield about 25 cwt. of ripe "cherries." An average European labourer ought easily to pick 200 lb. of ripe cherry per day; at this rate it will require fourteen men to pick one acre; wages, say, at 3s. 4d. per day, equal to £2 6s. 8d. The 25 cwt. of "cherry" will yield 5 cwt. of marketable coffee, valued at £2 10s. per cwt., at the very lowest, which is equal to £12 10s. per acre. Surely such a return would warrant higher wages than £1 a week being paid for coffee-picking, and so attract labour. Coffee-picking is essentially suitable work for women and children, and opens out remunerative employment for them. Payment may well be made by results, at so much per bushel. The question of suitable labour during the picking season will settle itself. Like the shearers in this colony and the hop-pickers in England, a class of coffee-pickers will spring into existence and travel about earning good wages. Coffee-growing in big areas, like our sugar plantations, is not advocated under present labour conditions, these pages being written for small growers only. Areas of from 5 to 10 acres are quite sufficient for any one grower, and, were six or twelve such growers to co-operate and procure a good pulper, would prove highly remunerative.

DISEASES.

Coffee is subject to numerous ailments, upon which a volume might be written. Some of the diseases are purely local, depending on climate, soil, and methods of cultivation, all of which can be remedied. But there are certain specific diseases to which coffee is subject, which so far have baffled all attempts to deal with them, notably the leaf disease, which is a fungoid disease. The following from the pen of Mr. William Soutter, of the Acclimatisation Society's Gardens, written for the *Queenslander*, deals specially with this disease, and, as it is a condensation of the writings of many able authors on the subject, will prove of interest to intending coffee-growers. However, in this new land of ours this disease has, so far, not been observed, and let us hope it will always remain so. And as long as we refrain from importing coffee seedlings, so long shall we be free from the disease. Intending coffee-growers should obtain their seed or plants in the colony, any quantity being procurable :—

"So far as is known the coffee plant in Queensland has escaped the attack of this leaf parasite. It is, however, well to be on guard against this and similar plant enemies that hover round our gardens and plantations. Recently I had handed to me for examination a few diseased coffee leaves, which at first sight might have readily been pronounced to be badly attacked with 'Hemileia,' but which on closer examination happily were found to be free from the parasite.

"The leaves as a whole presented a few of the characteristics of the true disease, but on making sections of them neither the mycelium nor papillate spores were detected, although a small quantity of granular matter was detectable in and around the leaf-cells in the parts affected. A microscope of higher power than mine might have revealed some further development, but from the superficial investigation made I am convinced that the leaves examined are suffering from a disease other than that which has worked such havoc in the coffee plantations of Java, Ceylon, Jamaica, &c. We have, however, every reason to look with much suspicion upon every phase of disease in plant life, and note every change, however insignificant, that may occur among the plants under our care. Taken in time a disease may be stamped out, but if allowed to develop in a neighbour's garden, orchard, or plantation it may, under favourable conditions, spread to every corner of the country. The copious moisture of the past few months has been highly conducive to the growth and development of fungoids ; and as the *Hemileia vastatrix* is of this class, its advent in Queensland would not have surprised me. A few notes on its character and habit of growth may be of some interest, as we have in the colony several fair-sized coffee patches, while nearly every garden owns its coffee plant.

"The first evidence of the presence of the 'coffee leaf disease' on a plant is heralded by the appearance of numerous small reddish-yellow spots on the leaf ; these are readily discerned when held to the light. The surface of the leaf contains no galls, or warts, consequent upon the presence of the disease, the operations of the parasite being confined to the internal organisation of the leaf only, where it lives upon the nitrogenous matters contained in the cells. In this manner the cell-contents of the leaf are completely assimilated by the parasite, thus robbing the plant of its sap-elaborating power by restricting the area of active leaf surface.

"Chemically the parasite is composed of carbonaceous and nitrogenous matters, which it absorbs from the leaf-cells. It is propagated by spores, which reach the outer world, and enter the next leaf through the stomata, or pores, which are situate on the under side of the leaves. As soon as a spore falls on a congenial place, say a speck of dew, it immediately commences to assume a mycelium form, which continues to spread until it finds an opening into the cellular tissues of the leaf, where it locates itself, to again reproduces spores, and so on.

"*Hemileia vastatrix* is a parasitic fungus, the spores of which are capable of rapid germination on the coffee leaf, especially during periods of much moisture. The growth commences in a series of short tube-like processes, which spread on the under surface of the leaves and enter the organism, where it forms a mycelium network which in four or five days, if the weather be favourably moist, produces sufficient damage to produce the yellow spots previously alluded to, and in about a fortnight later spores will be produced and ejected to act in multiplying the disease. These spores are carried by the wind and deposited on the leaves of adjoining trees, but may be carried for long distances by wind currents. Healthy as well as unhealthy plants are liable to attack, no special predisposition on the part of the coffee plant being necessary for its infection. When once inside the leaf there is no known remedy to combat the disease, but the free use of sulphur is highly advocated as a preventive; richly manured ground, to insure vigorous growth in the plants, cannot be looked upon as a prevention, though it enables the tree to produce dense foliage, and thus the sacrifice of a number of its leaves by the 'Hemileia' infection may not be so severely felt; but on such trees the fungus seems to develop more rapidly and produce spores in tenfold degree. As soon as the diseased leaves are fallen from the trees they should be carefully collected, and either burned or buried; by this method millions of spores will be destroyed. If this work were industriously carried out, it sooner or later would check the spread. The fungus attacks the leaf only. The closest investigation of the woody parts of the plant, even the young tender shoots, has never revealed the presence of the fungus there, neither are the berries attacked; but the damage to the leaves is vital, as they perform very important functions in the elaboration of the juices which go to form both flowers and fruit."

In concluding this chapter on diseases of the coffee plant, intending growers are earnestly urged to thoroughly clear and remove all old rotten stumps from their land ere planting. It is by such means, and care in keeping the plants clean, that this scourge of the coffee plant, *Hemileia vastatrix*, will be avoided. Old rotten stumps are usually the seat of fungoid growths, and healthy seedlings planted in their vicinity will be almost certain to be contaminated.

STATISTICAL.

The intending coffee planter will naturally ask where the market for his produce lies. The following table of imports during 1890 will clearly show the demand there is for the article. These figures do not limit the demand, for so surely as it is ascertained that genuine unadulterated coffee is procurable, so surely will the demand for this most popular beverage arise:—

	Coffee. lb.	Value. £
Victoria	1,288,996	58,314
New South Wales	659,241	32,294
Queensland	223,193	9,947
South Australia	397,476	19,912
Total	2,568,906	120,467

The above figures represent imports of both raw and roasted coffee. Can anyone doubt the chances of success of coffee-growing?

By Authority: JAMES C. BEAL, Government Printer, William street, Brisbane.

[March, 1894.

Queensland.

DEPARTMENT OF AGRICULTURE, BRISBANE.

BULLETIN No. 2.

SECOND SERIES.

RICE GROWING

AND

ITS PREPARATION FOR MARKET.

(2nd EDITION.)

BY

R. W. McCULLOCH.

The Bulletins of this Department will be sent free to such Individuals interested as may request them. Address all applications to "The Under Secretary for Agriculture, Brisbane."

BRISBANE:
BY AUTHORITY: EDMUND GREGORY, GOVERNMENT PRINTER, WILLIAM STREET.
1894.

CONTENTS.

RICE GROWING

AND ITS PREPARATION FOR MARKET.

INTRODUCTORY.

Rice *Oryza* (Linn.), order *Gramineæ*, is a genus of grasses. The inflorescence is in panicles. Glumes two, not exactly opposite, outer pale, ribbed. The seeds grow on separate pedicles, which spring from the main stalk, and each grain is usually terminated by an awn or beard resembling some kinds of wheat. *Oryza sativa* and its varieties yield the well-known rice of commerce. "Paddy" is the name by which it is known in its unhusked unprepared state, when it closely resembles barley in appearance. It has been said before, and will bear repeating again, that probably few people realise, if they have even given it a thought, the important part that rice plays in the economic history of the world; that probably there does not exist any other product of the soil which forms the staple food of as great a number of human beings—computed at three-fifths of the entire human race—as depend for subsistence on rice.

Rice is supposed to be of Asiatic origin, but it is found growing wild in several other parts of the world, notably in Central America, Africa, and even in our own Colony, Queensland. To India, however, belongs the honour of first utilising it as a food, and by the cultivation of centuries altering the wild product into what it now is. Wild rice is still considered a luxury in Madras and other parts of India, but it is scarcely ever cultivated owing to the smallness of the return and the difficulty of harvesting, as the grain is shed as soon as it ripens. It is a very fine white rice and sweet to the taste. In India it is known as "oori," and is treated as a weed. The rice plant is to be found growing between the 45th parallel north and the 30th south. Rice is extensively cultivated in India and the East generally, and when it is mentioned that it is also cultivated in the South of Italy, Spain, Portugal, the West Indies, Central America, United States, and Australasia, it will be readily seen that the plant thrives under varying conditions of climate and soil.

VALUE AS A FOOD.

The nutritive value of rice has hitherto been considerably underrated. An acknowledged authority once said that 1 lb. of rice cooked for the table gave up 88 per cent. of its bulk as nutriment, whereas the same quantity of beef only gave 25 per cent. Further, boiled rice was digestible in an hour, while roast beef took three hours. The former cost just one-third of the price of the latter. The natives of India perform very long journeys and undergo a great amount of exertion on a handful or two of parched or roasted rice; indeed, they subsist for days on such a diet and Nature's beverage, water. Rice analysed contains: starch, 86·9; gluten, 7·5; fatty matter, ·7; sugar and gum, ·5; epidermis, 3·5; ash, ·9; total, 100. The general composition of rice from another analysis shows: water, 13·7; flesh-forming substances, 6·5; non-nitrogenous substances, 79·4; ash, ·4; total 100.

Rice-dust, meal, or refuse, made up of the husk and external layers of rice obtained by preparing the paddy for market, has been found good feed for poultry, cows, and pigs, containing as much fatty substances, it is said, as the best oats. The composition of rice meal or dust is as follows :—Water, 12·1 ; woody fibre, 46·5 ; starch, gum, and sugar, 25·5 ; proteine compounds, 6·6 ; fatty matter, 5·6 ; soluble saline substances, 3·7 ; total, 100. Ricemeal as a flesh-forming food has only to be known to be appreciated. A diet of three parts of rice-meal to one of barley, cooked and fed when cool, will put flesh on pigs in a most surprising manner, and has rather a beneficial effect on their general health. The hardy little Manipoor ponies used by the planters in Assam and Cachar are almost entirely fed on paddy. The stamina of these hill ponies and the weights they carry over long journeys on a paddy diet are ample testimony to its nutritive value—in fact, a very large proportion of the equine race in India have paddy as their sole food. Sheep, goats, cows, and pigs eat it with relish, thrive on it, and indeed are exceedingly fond of it. Elephants are also fed on it, and their liking for it is so great that next to the wild pig the elephant is reckoned by paddy-growers as the most destructive enemy they have to a growing crop. Rice straw chaffed and mixed with molasses or linseed meal as a diet for milch cows is thought highly of. Rough rice, or "paddy," is therefore valuable as stock feed. The following analyses by Mr. Norman Tait, of Liverpool, show this clearly :—

	Rice meal.	Indian meal.	Rice husk.
Flesh-formers	12·30	11·27	4·18
Oil and fatty matter	9·00	6·50	1·10
Starch, sugar, &c..	57·00	60·98	44·94
Woody fibre	4·40	5·02	26·80
Ash	7·20	1·27	13·18
Moisture	10·10	14·96	9·80
Total food	78·30	78·75	50·22

It will be seen that corn meal is a little in advance of the rice meal, but it costs about double the price of rice meal. The straw also makes a capital bedding for horses, and is universally used in all well-kept stables. For mulching purposes it cannot be beaten.

Rice, in comparison with potatoes, as the following analyses show, contains just three times as much nutriment :—

	Rice.	Potatoes.
Water	13·0	75·0
Flesh-formers	6·5	1·4
Starch, &c....	80·0	22·6
Total food	86·5	24·0

Hence 1 lb. of rice is equivalent to 4 lb. of potatoes. Rice, from its composition, is essentially an article of diet suitable for tropical countries such as Queensland, and were more of it and less beef consumed, the doctor's services would soon be at a discount. Rice can be made up into a variety of enticing dishes, cleanly, nourishing, strengthening, and healthful. Probably only one European cook in a hundred knows how to cook rice. In properly cooked rice each grain should be of a firm consistency, and separate—not as one sees it on most tables, in a mashy, lumpy, sticky state, positively uninviting. A description of the proper method of cooking rice as practised by

Orientals will not come amiss in a paper "on rice." In the first place, the rice requires to be thoroughly washed in cold water; it takes three or four washings to do it properly. It should then be placed in a saucepan or other vessel three parts full of water, and allowed to boil just long enough to soften the grain, which is ascertained by taking a grain or two from time to time and pressing between finger and thumb, and when found to be soft it should be taken off the fire immediately, the lid of the vessel opened a bit, and the vessel inverted to allow the water to drain off thoroughly; the lid should then be fastened tight and the rice allowed to steam. It is then turned out, and will be found to be quite white, with each grain separate. Rice should never be stirred while boiling. The great mistake made in cooking rice consists of not allowing sufficient water, and overcooking. When it is considered that rice, in boiling, absorbs three times its weight of water, the advisableness of allowing a larger quantity of water is obvious.

PRODUCTS FROM RICE.

In India a very intoxicating spirit named "arrack" is distilled from rice, and is consumed by the lower classes principally. In Japan a rice beer, known as "sáke," is extensively brewed, and is the principal fermented beverage of the inhabitants.

Rice contains 70 per cent. of starch, and is largely used by starch-makers, so that a good demand exists for it for that purpose.

STATISTICAL.

Queensland imported in 1890 nearly 3,350 tons of rice, valued at £47,193, and exported during the same period 215,167 lb., valued at £1,304, leaving for home consumption over 3,200 tons, valued at £45,889. The greater portion of this rice came from Hongkong. Australasia imports annually nearly 20,000 tons, worth £250,000. Allowing 30 bushels as the average yield per acre of paddy, it will require close on 18,000 acres of land under paddy to produce the quantity of rice at present annually imported into these colonies. Rice cultivation has been in existence in Queensland, principally in the hands of Chinamen, for some years past. In 1886 there were 887 acres under rice in the Colony; in 1889 this area decreased to 249 acres, and in 1890 a slight increase is observed, the area being 300 acres—16 acres in the Southern portion of the Colony and 284 in the Northern. The produce of 887 acres in 1886 amounted to 1,741,320 lb., in 1889 249 acres yielded 230,781 lb., while in 1890 300 acres yielded 590,989 lb. Since 1886 there has been a very great falling off. The cause is not far to seek—a want of judicious seed selection, the crop produced from inferior or old seed being liable to parasitic or fungi attacks, which was the case in 1887 and 1888. Of the total amount of rice produced in 1890, Cairns supplied 367,520 lb. from 164 acres, Port Douglas, with an area of 61 acres, furnished 77,680 lb., Cooktown, 62,445 lb. from 37 acres, and Mackay, 57,584 lb. from 22 acres. It will be seen from these figures that the average yield per acre at Cairns was just 1 ton, Port Douglas just under $\frac{3}{4}$ of a ton, Cooktown just over $\frac{3}{4}$ of a ton, and Mackay over 1 ton. The 16 acres in the Southern portion of the Colony yielded 25,760 lb. of rice, or an average of nearly 27 bushels per acre.

SUITABLENESS OF QUEENSLAND FOR RICE CULTIVATION.

There can be no two questions about this. Queensland, as the above statistics show, is eminently suited to the growth of this cereal. We have here the rainfall, temperature, and soils best adapted to the growth of the plant. The average yield per acre obtained in 1890 was over 32 bushels, while the average obtained in India does not exceed 12. Within the last few years the Indian Government have spent a large amount of money, time, and patience in trying to educate the natives out of their prehistoric methods of cultivating rice, with the result that where improved ploughs were used and deeper cultivation given, a yield of 40 bushels per acre has been obtained. This only serves to show that with our rich soils and modern farming methods and appliances an average yield of from 60 to 70 bushels per acre can and should be obtained. Mr. McPherson, in his experiments in Brisbane, obtained at the rate of 68 bushels per acre. In the Mackay district 2½ tons to the acre, value £20 per acre, was got by Mr. Thomas in 1887. In the previous year, 84 bushels per acre was the return. Queensland possesses immense tracts of what are commonly designated wretched swamps, and there is scarcely a farm in the whole Colony which has not a few acres of this sort of country; but it is not fully recognised that these very same swamps can be made to produce untold wealth; were the value of rice cultivation more generally known, thousands of acres of such swamps would in a short while be transformed into waving paddyfields, surrounded by the cottages of a prosperous and contented community. The knowledge requisite for rice-growing can be easily imparted, no very great agricultural skill being wanted. On the Herbert River innumerable acres of the finest paddy land the writer ever saw are lying fallow, and the same is to be said of almost every district in the North. Whether the cultivation of rice in Queensland will stand by itself or not, there can be no doubt about its being a valuable adjunct to other products. Rice is an article for which the demand is not at all likely to decrease, and with an increased cheap production an increased consumption must come about.

PROLIFIC NATURE OF RICE.

The following extract from the *Florida Despatch* is sufficiently interesting to warrant insertion in this paper, as showing the prolific nature of rice:—"There came up in my garden in a hole of water, may be 6 inches deep, a single grain of rice. It produced more than ninety heads at the first crop, and over 110 for the second. The first crop was stripped from the heads, and the grain poured into water, and the imperfect grains floated off. Then the mass was measured with a spoon. The spoon was filled three times and each spoonful counted by itself. The three were then added and an average struck. Equal care was bestowed on the second crop. The whole number of grains from that one grain I found to be 25,706."

VARIETIES OF RICE.

The varieties of rice cultivated nowadays are so numerous it is utterly impossible to specify them. In India alone there are several hundred varieties, the classifying of which is further complicated by their having different names in different localities. The prevalent custom has been to classify them according to the seasons in which they are sown. All these innumerable varieties, therefore, have been classed under the following three heads:—"Aus," "aman," and "boro."

The "aus," or early crop, so called because it is sown in the spring, comprises all the varieties that do not require flooding and are grown on higher lands. These varieties are known in European countries as "upland or mountain rice." A very mistaken notion is prevalent about this "upland" rice, some people being under the impression that it is entirely a dry land rice—that is to say, it is independent of water, either in the shape of rain or irrigation. No greater delusion can be imagined. Rice is an aquatic plant, pure and simple, and requires a fair amount of water or moisture for its successful cultivation. Be it planted on the top of a mountain or in a swamp, moisture it must have, either in the shape of rain, irrigation, or a naturally moist soil. It is true, however, that there are certain varieties of "aus" rice which require less water than others, notably the "jetka" and "chally," cultivated principally in the Bankura district in India. Some highly valued varieties are also raised in Burmah. In Siam a variety known as "na moong," procurable in Bangkok, is also said to possess this property, and is highly prized; in addition to requiring less water it is said to need less attention during growth. In Assam, on the Garo Hills, a variety is grown which is as nearly a dry land rice as can be grown. In Madagascar, again, a variety known as "rajafatsky" has also the same properties. The famous Carolina rice, so much thought of in the United States, is nothing more nor less than this same "rajafatsky" variety, altered by careful seed selection and improved cultivation; till now some of the choicest Indian varieties of rice are grown from Carolina seed. Another curious point about this so-called "upland" rice is that it can be grown under exactly the same conditions as the swamp rice and give exactly the same results—that is to say, "upland" rice planted in a swamp will produce as good a crop as if planted on a dry ridge, and the same can be said of the swamp rice when planted on a dry ridge. This is no theory but actual fact, as anyone who knows anything about rice cultivation can prove. The "aus," as its name implies, is an early crop, and is a quick grower, some varieties ripening in two months. The quantity of this crop grown in India is limited, being very much smaller than any of the others. These extra dry varieties are not considered quite so nourishing as the swamp or wet rice, nor so palatable.

The "aman"—literally cold weather—is a late crop, and is reckoned the most important—in fact, it is the staple crop, and where this fails famine is the result. The varieties grown under this head all require a good deal of water in the shape either of rain or irrigation to insure successful crops. A variety in Siam known as "na soon" is said to be far superier to any of the Indian varieties, commanding the highest price in Siam. This would be worth importing here. All the "aman" varieties are first grown in nurseries, and transplanted when three weeks old on to the fields, which are prepared by being puddled—that is to say, after the land is well ploughed, and just before the time for planting arrives, water is let on to the field, and the soil puddled, by tramping about on it. However, this puddling is not absolutely essential, provided the soil is soft and moist when transplanting, or having 2 inches or 3 inches of water covering them, and during the whole period of their growth having more or less water lying on the fields.

The "boro," or big-grained, the poor man's crop, for value ranks third. This is a coarser variety of rice than the others, is grown on swamps subject to inundation, sown either broadcast or transplanted, and is dependent on the rapidity or otherwise of the rise of water. Owing to the length of time the water submerges the land, the straw of this crop is useless and is usually burnt.

Of the above-mentioned three, the "aman," or wet land rice, is by far the most profitable, and is advocated in preference to the others, where a good table rice, nourishing, palatable, and having a heavy crop is desired. Before entering into rice growing, the intending grower should satisfy himself first what crop he intends to grow. If a table rice, for stock feed, or for starch, he should get seed accordingly, for it is very certain that a coarse, dark-coloured rice suitable for stock feed, although very nourishing and palatable, will not suit the present demand for a short, plump, pearly white table rice, and *vice versâ.*

The rice consumed most extensively in Queensland at the present day is that known as "Japan" rice, a short, plump, bright yellow grain, which when hulled gives a pearly-white grain; and rice-growers are earnestly advised to grow this, and this only, for the present. For the last two years a variety of rices have been grown, the principal features of the majority of them being a thin, long grain, which has been practically unsaleable, to the great discouragement of the growers. Farmers must study the public taste for rice, for the present, at all events, till the industry has assumed bigger dimensions, by which time the public will have been educated to appreciate some of the finer varieties of Indian rices, when a change of variety will be found profitable. In the meantime the demand for this short, plump, pearly rice exists, and varieties, be they from Japan or India, having this characteristic, should only be cultivated, in view of which fact, the Department for Agriculture has ordered a quantity of this Japan variety for distribution.

Black Burmese Rice.—A notice of this rice has lately appeared in the proceedings of the Agri-Horticultural Society of India, wherein it is mentioned that the black Burmese "Jooma Choul" is grown by Mughs in Chittagong and the hill tracts, in the Jhooms, or newly cleared jungle land. This paddy is sown in April and cut in October, and is more glutinous and nutritious than ordinary rice. This rice indeed is described as getting quite glutinous when cooked, and for this reason it is frequently steamed instead of being boiled in the ordinary manner. Besides being used as a food in the regular way, it is made into a sort of pudding flavoured with scraped cocoanut. The black rice is not procurable in any large quantities on the Arracan coast, but is more plentiful on the Martaban coast at Moulmein, Rangoon, &c., and is only used for sweetmeats. Professor Church, reporting to the Royal Gardens, Kew, on Burmese Rice, states that the results amply confirm the opinion entertained of its high dietetic value, and that in flesh-forming substance, in oil, and in mineral matter this black rice shows a marked superiority over all samples of other varieties hitherto examined.

The most noticeable peculiarity of this rice is its unusual richness in albuminoides and in oil. Some of the most highly esteemed of the Japanese glutinous rices have indeed been found to contain from $1\frac{1}{2}$ to 2 per cent. of oil, instead of the 0·4 or 0·5 per cent. commonly present in Carolina rice, but then they are comparatively poor in albuminoides. In the sample now under discussion it was found that the coagulable albuminoides, as determined by the phenol method, amounted to 8·5 per cent.—a figure which compared favourably with the average—namely, 7·3 per cent. present in other Indian rices. And it must be remembered that a similar reduction (say 0·6 per cent.) must be made in the latter figure, in order that a fair comparison between the two percentages may be made. The numbers will then be—true albuminoides in 100 parts of black Burmese rice, 8·5; other Indian rices, 6·7. One of the results of this richness in albuminoides, according to Professor Church, is brought out on calculating the nutrient ratio of this Burmese rice, which is much nearer to that of a complete food than is the case with the common kinds of Indian rice. These latter are likewise poorer in phosphoric acid than the Burmese variety.

SEED.

Too much attention cannot be paid to a choice of seed; only good seed from vigorous plants should be selected. Age has to be considered as well in selecting seed. Both new and old seed have to be avoided. Seed about twelve months old is reckoned the best. New seed will come up soon, and grow rapidly, but will give a very light crop; old seed will either not germinate or give a very straggly crop and weak plants. Good seed not only gives an increased yield per acre but produces a hardier plant—one less liable to the attacks of parasitic or other diseases. Another matter not to be lost sight of in selecting seed is to see that it is pure, of one variety only, not mixed, otherwise an unsatisfactory crop is the result. Most of the seed rice used in the Colony was originally imported from China, and the product sown again and again; the original rice was by no means the best, and the practice of replanting the same year after year cannot be too strongly condemned. An entire change of seed is wanted. Rice-growers would do well, if they have not got the seed through this office, to submit a sample of it to the Department ere planting. By this means they will avoid growing a variety for which there might possibly be no demand.

RICE SOILS.

Provided the water supply, be it rainfall or irrigation, is ample, rice can be grown on almost any soil, and throughout the year. But the "beau ideal" of a good rice soil is a naturally stiff clay, having an abundance of silica and potash. The roots of the rice plant are very delicate; good tilth is absolutely necessary to enable the tender rootlets to push their way down. The Carolina rice has much longer roots than the ordinary Bengal varieties, due entirely to the deeper cultivation, hence permeability of the soil, enabling the roots to get lower down. In the Bengal methods of cultivation 3 to 4 inches is the lowest depth of tilth, and under this is a hard pad, hence the roots are shorter and travel laterally in search of food, and were no water provided the plants could not survive. It is certain that varieties of paddy imported from Bengal and treated to scientific farming would develop good root growth, and in the course of time, with careful seed selection, a variety could be produced which would really be a dry land crop—that is, entirely independent of added moisture, and one not likely to fail with a moderate drought, as by having longer roots, and good tilth being provided, the plant would receive nourishment from the subsoil, which in the dryest of seasons has a sufficiency of moisture if get-at-able by the plant.

There need be no fear when entering on rice cultivation at the want of a market; the existing demand is ample to guarantee a financial success. Where it is seen that rice cultivation is being taken up, the mill-owner will not be long in following. In the event of our farmers having to consume their own crops or put it into pigs for a time, they would still be the gainers. Further on it will be shown how small quantities of paddy may be prepared for home consumption.

CULTIVATION OF RICE.

The farmer having decided on the variety of rice he intends going for—say any one of the varieties of the "aus" or "aman" crops—will proceed to get his land ready. If intending to plant the "aus," or so-called "upland" varieties, all he has to do is to select a piece of land, from a quarter to one acre in area, on the highest part of his farm, on a slope if possible, or even on a level bit if the country behind his higher, so as to catch the rainwater, if necessary, by raising an embankment. He will plough, cross-plough, and harrow this land, and bring it to as fine a degree of tilth as possible. The land should be got ready against the first rains, say the end of September or beginning of October.

SOWING SEED.

There are three methods of doing this: (1) Broadcast; (2) in drills; (3) transplanting from a nursery. Of the three systems the last is by far the best, as it insures a greater regularity in the crop, is a great saving of seed, and what is of infinite importance, superiority in weight and fulness of grain is attained by it, hence increased nutritive qualities. This third method is necessary with the "aman" varieties. Having got the land ready as abovementioned, as soon as possible after the first rain falls the land should be immediately cross-ploughed again and harrowed, and if broadcasting or drilling be decided on, the seed immediately sown, and the land harrowed over with a bush harrow. If he sows broadcast, 60 lb. of seed will be plenty; if in drills, 12 inches or more apart, 40 lb. will be ample. Nothing more need be done. If the land was clean, the weeds will not trouble. As before said, the "aus" varieties are quick growers, and will soon cover the ground.

If the farmer decide on planting "aman" varieties, and by transplanting, he must prepare a nursery, the area of which, to plant an acre from, should be 30 feet square, or two or three such beds 10 feet or 12 feet square may be made near the field to be planted. If only a quarter of an acre is to be planted, then a bed 19 feet square, or three beds 6 feet square, will be necessary. The amount of seed required for a nursery to plant one acre will be about 8 lb., and for a quarter of an acre 2 lb. That these nurseries must be thoroughly ploughed and the soil well pulverised need hardly be said. As the space required is so small, this work should be thoroughly done, the object being to get vigorous plants.

The seed should be steeped in water for twelve hours to assist germination; it is then sown in the beds and lightly raked over. The seed beds must be kept moist, in the absence of rain, by the use of the watering-can. In making a nursery, it is always best to use a little extra seed, and select the best plants for transplanting. The nursery will be ready for transplanting in three weeks. Some judgment will have to be exercised in getting this nursery ready, so as to hit off the proper time; for it will not do to have the nursery ready too early, and before enough rain falls to enable its being planted out. But should this occur, on no account should the transplanting be delayed longer than a week more; for if the field is in good tilth it is better to put the plants out when three or four weeks old than to wait five or six weeks for rain ere doing so. In lifting the plants from the nursery they are simply pulled up by the hand and tied in bundles and carried on to the field, where they are dibbled in, putting two or three plants in each of the holes, which are about 6 inches to 9 inches apart. Regularity of lines is not essential. Three men should plant an acre in a day. No further attention is required till the crop begins to ripen. If the farmer has had to transplant from the nursery to save the seedlings getting too old, he will be wise if he raises an embankment about 4 inches high all round the lower end and two sides of the field, so as to catch the rainwater and give the land a good soaking. This can be done cheaply and speedily by turning up a couple of furrows with the plough. In transplanting, it is often the custom to crop the tops as well as the roots of the seedlings, when pulled from the nursery, before planting them out, the reason being that it not only makes the plants handier for transplanting, but prevents their falling down and the remaining leaves withering, as growth begins at once. This system has a good deal to recommend it, and is advocated.

To sum up, the "aus" or dry land rice requires a moderate rainfall to insure success, and can be treated in exactly the same way as wheat is cultivated, whereas the "aman" or wet rice requires to be planted just before the heavy rains set in, requires wet weather during the whole period of growth, and should, if possible, have an inch or two of water always on the field, best secured by raising a low embankment all round the field to retain the rainwater or irrigation adopted. The land for the "aman" does not require to be exactly a swamp, as for the "boro" varieties; but should be next door to a swamp—very wet during the whole period of growth. Possibly a spell of dry weather may be experienced about the time the nursery is ready to transplant, or shortly after transplanting has been effected, in which case the prospects of the crop may be jeopardised. The following cut is a modification of what is known here in Queensland as a "whip," and in Oriental countries as the "Piccotta" or lever water-lift, used all over the East for irrigating land, and consists simply of one forked sapling, to which is fastened another sapling, having a bucket attached at one end, and a counterpoise in the shape of a log or a bag of sand at the other. This primitive appliance needs no engineering skill to set up or work, and rather than stand by and allow one's crop to perish, might with advantage be adopted.

The appliance works well and cheaply for lifting water from a depth of 12 feet, over that depth it becomes costly.

The following calculations from "Professional Papers," Vol. I., will illustrate what can be done in this way:—Water raised 16 feet;

contents of bucket, $= \cdot 45$ cubic feet; number of discharges per minute, 3; discharge per hour, 81 cubic feet; actual discharge per hour, 72·9 cubic feet, or 455·4 gallons per hour.

By making small shallow drains and little embankments here and there over a patch of rice, the crop can be irrigated at will, wherever water can be got at a depth of 12 or 16 feet. The deeper the well the higher the forked sapling must be.

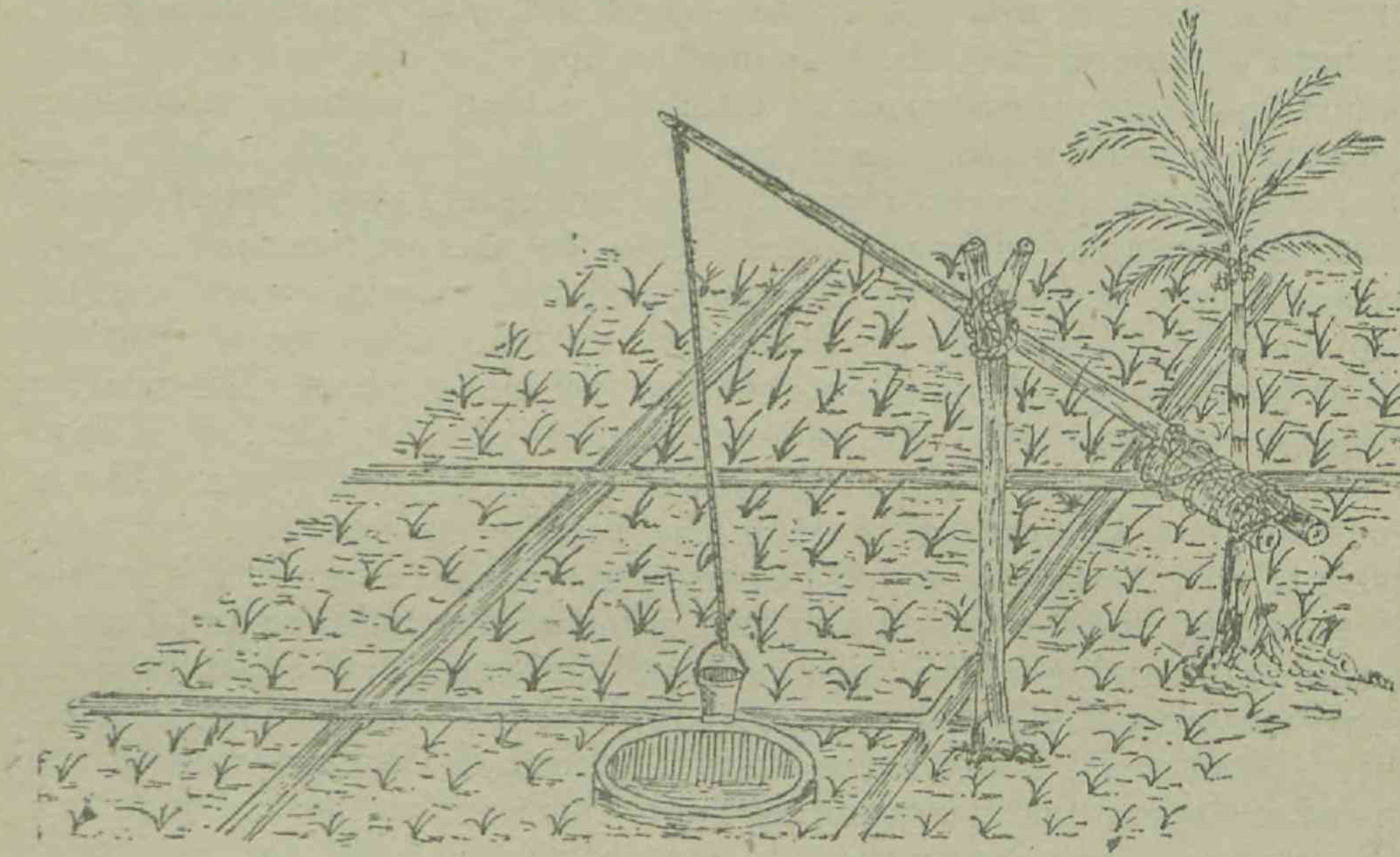


Fig. 1.—Water-lift.

Most farms have a bit of a hollow or low land, dry in summer and very wet in the rains. Now, this is just the land for any of the varieties of the "aman" crop. All that is necessary to do is to run a drain, say 3 feet deep, down the centre, with the fall towards the lower end. At this end an embankment about 1 foot high should be raised the whole width of the field. The land should be ploughed, cross-ploughed, and got ready. On the setting in of the rains, the end of the drain is closed up, and the water allowed to rise and flow over the sides and thoroughly soak the whole field. It is then allowed to run out. The seed may now be sown broadcast or by transplanting as inclination suggests. By occasionally closing the end of the drain the field may be irrigated at one's own will, and accordingly as it is observed the crop requires the application of water. It is not absolutely necessary that the water should lay on the field during the whole period of growth, but the land should be kept moist during growth, and the above method is the simplest, cheapest, and most effective method of doing it.

The largest yields of rice are got by turning the water on when the plant bunches for blossom, and should remain on until fully ripened for harvesting. This is done to mature the grain uniformly. Irrigation works in connection with rice-growing make it, without exception, one of the most paying crops to grow. The moral is obvious.

In the "boro" varieties, the land should be prepared against the rains setting in, and the seed may be sown broadcast, just after the first two or three showers have fallen, when as the hollow gets covered with water the plants will grow so as to keep their heads above. Broadcasting is not advocated; it is better to prepare a nursery, as before mentioned, and as soon as the hollow has an inch or two of water on to commence transplanting. The "boro" varieties must always have water lying on the field. No further care is wanted till the crop is ready for reaping. As before said, the "boro" is a big-grained, coarse rice, not a table rice, and is capital feed for pigs, and if grown for this purpose alone, and fed to the pigs whole or ground up as meal, will more than repay the farmer for his trouble. With the stoppage of the rains the water begins to dry off the land, and the crop ripens; it is then harvested.

HARVESTING

Owing to the brittleness of the crops, the harvesting must be done with sickles or reaping-hooks. Care must be taken, however, to cut the crop before it gets thoroughly ripe, as a deal of grain is shed, consequently lost. Some difference of opinion exists on that point. Experience in the Cairns district goes to prove that when thoroughly ripe, the ears are not so brittle or liable to drop off as is the case in India. Harvesting is therefore done when the crop is thoroughly ripe. If this is a fact, then there is no reason why mowing or reaping machinery should not be used in the harvesting. When cut the crop is tied in bundles and carried off to the thrashing floor at once, or if the weather be fine and dry, it may be left on the fields for a day or two to dry. To save the straw, which is good fodder for cattle, the crop should be cut as close to the ground as possible.

In Louisiana, Florida, and the other rice-growing States of America where large areas are put under rice, harvesting machinery has of a necessity to be used. The ordinary wheat-harvesting machinery, "reaper and binder," or, still better, a "stripper" could be made to answer the purpose, by having broader tyres to the wheels, so as to prevent the machine sinking into the soft, wet, rice lands. An ordinary mowing machine, with the same improvement to the wheels, would be effective. The price of harvesting machinery, however, being great, the expense would only be warranted with large areas under rice.

PREPARING CROP FOR MARKET.

Up to this point the crop is known as "paddy," and before it can be called "rice" it has to go through the following processes:—Thrashing, to separate the grain from the straw and stalks; hulling, removing the outer skin or husk; separating, cleaning the rice of thrash and any unhulled grains; and, finally, polishing, to complete the process of rice cleaning for the market by removing the inner cuticle. Machinery for the above operations can be purchased in sets or separately for either hand, animal, or steam power. A complete set of hand-power rice-cleaning machinery, with a capacity of from 300 lb. to 500 lb. per day, will cost £53 2s. 6d. in New York; a set for animal power of same capacity, £87 10s.; a set for steam power, including engine and boiler, with a capacity of from 600 lb. to 1,000 lb. per day, £225. The best known manufacturers of rice-cleaning machinery are the Geo. L. Squier Manufacturing Company, of Buffalo, New York, their machinery being in use in almost every rice-growing country in the world, and giving universal satisfaction. A set of this firm's machinery, known as the "No. X." set, is in use in Cairns at the present time by the local rice company. With the use of a huller, only costing £16 13s. 6d., our farmer can consume his own rice, the thrashing being done as described further on. Hullers are procurable capable of producing as finished an article, polished and all, as comes out of the modern rice mills. Where small quantities of rice are grown, and intended for home consumption, the following primitive method of manufacture, in use by the natives of India, may be adopted.

THRASHING.

A level bit of ground will have to be got ready, the crop spread out evenly over this, and trampling resorted to by means of two or three bullocks, yoked abreast and tethered to a post sunk into the ground, being made to move round and round, forking up the straw now and again; or the thrashing may be done by beating it out by handfuls over a block or into a box, with two or three bars nailed across; the bundles of paddy are struck over these bars two or three times, and the paddy drops into the box, or beating with flails until all the grain has been detached from the straw. It is then winnowed to remove light and inferior grain. The winnowing is performed by letting the grain drop from a height in a light breeze; the grain falls on one side, and the chaff and light stuff to leeward. With the use of a modern hulling machine the winnowing is not necessary. The thrashed paddy has only to be put in the machine, and it is delivered clean rice. The grain—still paddy—should then be spread in the sun for a day or two, then packed away in bags, out of reach of moisture or rats, till wanted for use or sale to the mill-owner. For home consumption, small quantities of the paddy can be prepared as follows:—The implement most commonly used by the natives of India for hulling or removing the husk is known as the "dhekoli" (see Fig. 2), which consists of a heavy

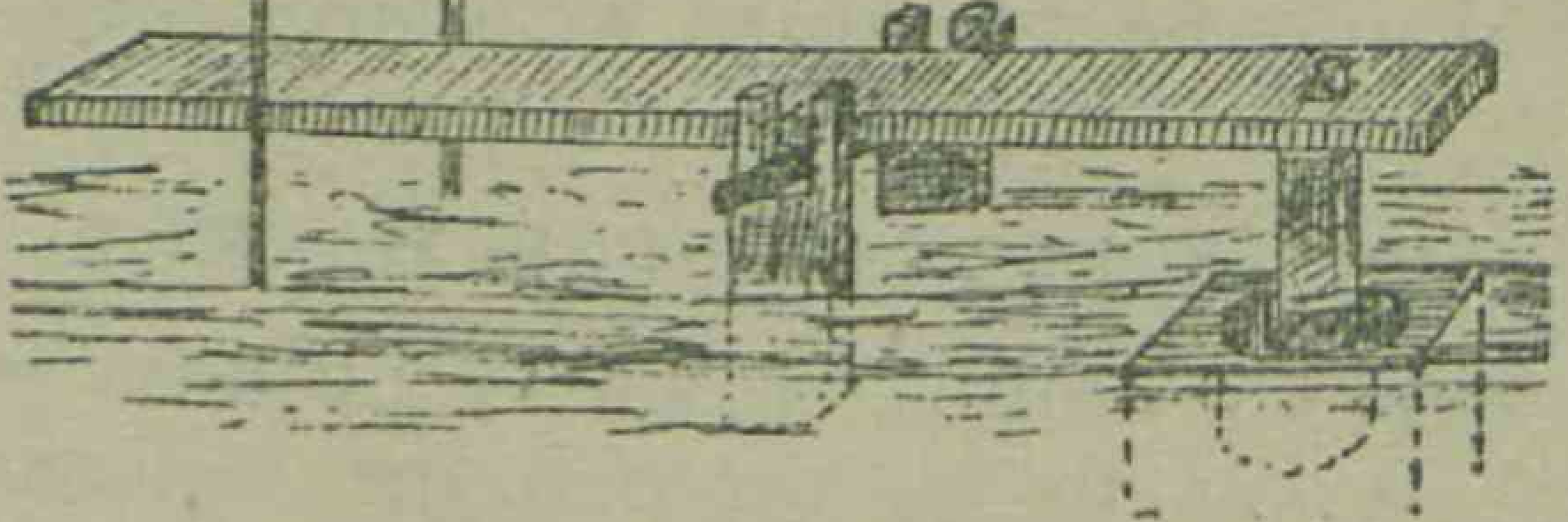


Fig. 2.—"Dhekoli."

beam of timber or round log, 8 feet long, and weighing about 300 lb., into one end of which a short staff shod with iron is fitted at right angles to the log. The centre of the beam rests on a cross bar, to which it is fixed, resting on two uprights sunk into the ground. The iron-shod shaft rests in a wooden cup sunk below the level of the ground. The implement is worked by one or more persons pressing the free end of the log down with one foot, and letting go, when the shod end drops into the cup holding the paddy. A cross bar is usually fixed breast high, by leaning on which assistance is afforded in depressing the log. One person is constantly engaged in pushing back the grain into the cup as the pounding goes on. The other implement is in reality a pestle and mortar made of wood, and is known as the "ukhli." A block of wood 2 feet in length by 18 inches in diameter is hollowed out to 9 inches in depth. The paddy is placed in this mortar and pounded with a shaft 5 feet in length, shod at one end. (See Fig. 3.) The shaft is grasped by the middle, raised to the full

Fig. 3.—"Ukhli."

extent of the arms, and dashed into the mortar, this pounding continuing till all the grain is husked. Two or three may engage in the work, and, as in the firstnamed implement, one person has to attend to the mortar and keep pushing the grain in. There is considerable waste by this process, as the rice gets broken and is winnowed out with the husk and dust. But it need not be lost. If all this is collected and fed to pigs and cows, the gain to the farmer will more than counterbalance the actual loss in rice.

Another system of husking is to pass the paddy through a small pair of millstones or cylinders of the same shape, made of hardwood, set on end and grooved on the working surface. The distance between is regulated, so as to remove the husk by friction without breaking the grain, the grain and chaff being winnowed as before described. After the husk is off, the inner skin covering the grain has to be removed by pounding in a mortar. The paddy should be one year old before husking, old rice being preferable to new in point of flavour.

The above primitive methods of preparing rice are certainly slow and tedious, and likely to disgust the would-be rice-grower, but in the absence of winnowing and husking machinery they are the only possible makeshifts, and can be worked by himself and family. The greater proportion of the paddy prepared for the market in India passes through a steaming and soaking process before being husked, which serves to render the removal of the husk easier and to minimise breakage. The paddy is steeped in water for forty-eight hours, and is then put into another vessel with a small quantity of water and placed over the fire; just sufficient water is used to merely steam the contents. After this it is dried thoroughly in the sun for two or more days, and then pounded in the mortar before mentioned. The paddy loses one-third in weight by husking; that is to say, three bushels of paddy when husked will give two bushels of rice. A bushel of paddy equals from 40 to 45 lb., and a bushel of clean polished rice 60 to 65 lb., dependent on the size of the grain.

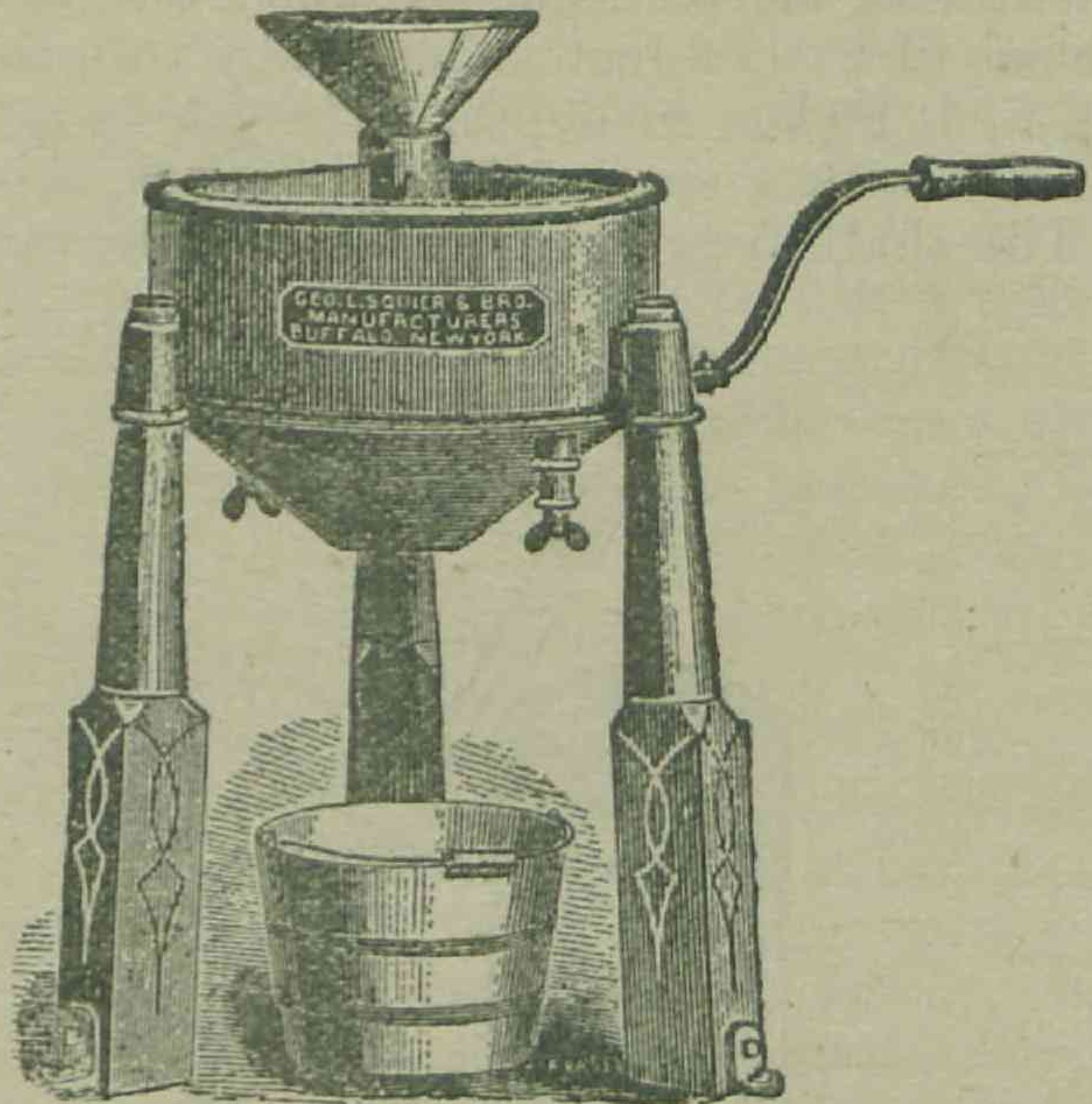


Fig. 4.

Fig. 4 is a cut of an American hand rice huller, manufactured by the above firm, has a capacity of 200 lb. of rough or paddy rice in twelve hours, and costs £10 8s. 4d. in the States. The machine is simple in construction and is durable.

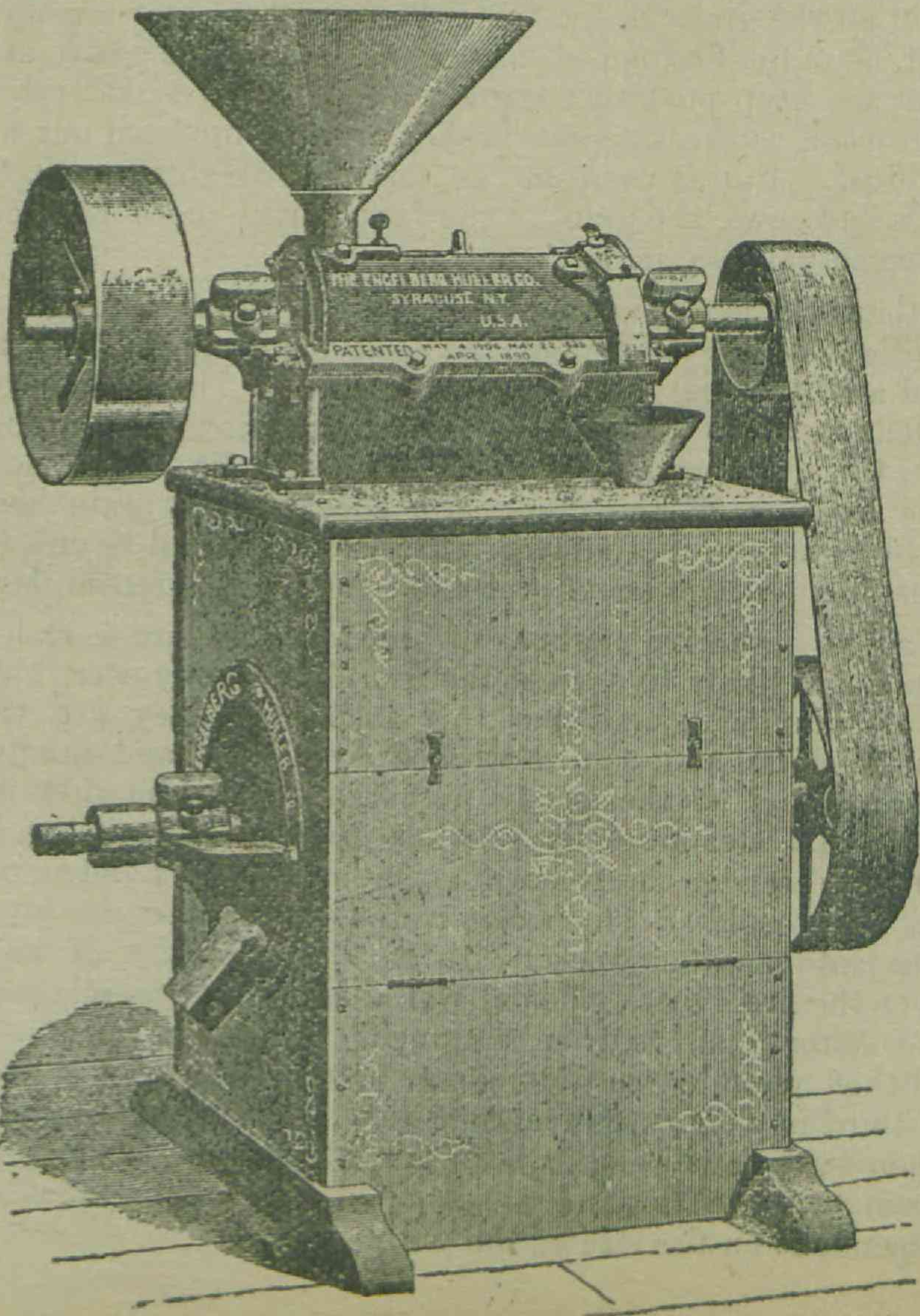


Fig. 5.

Fig. 5 represents a huller and polisher, manufactured by the Engleburg Huller Coy., of Syracuse, U.S.A. This machine has a capacity of from 75 to 150 bushels in ten hours, and both hulls the rough rice and polishes it in the one operation, and costs £100.

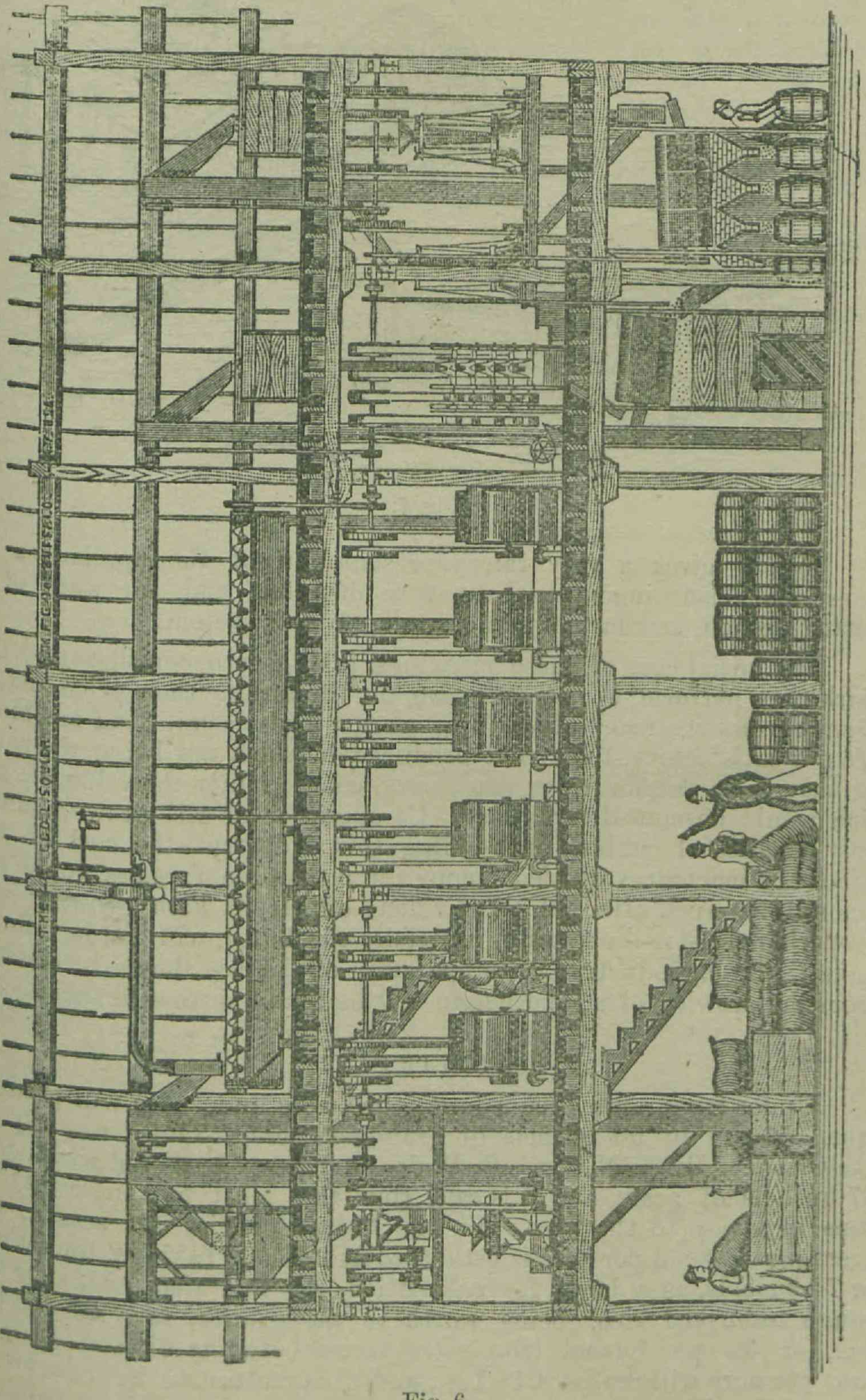


Fig. 6.

Fig. 6 is a cut of a modern rice mill, is automatic in action, and can put through 13,000 lb. or 300 bushels of rough rice per day, and costs about £1,230

The above modern rice machinery has all originated from the primitive appliances used from the days of Abraham, and which may, even in these days, be seen at work in the East.

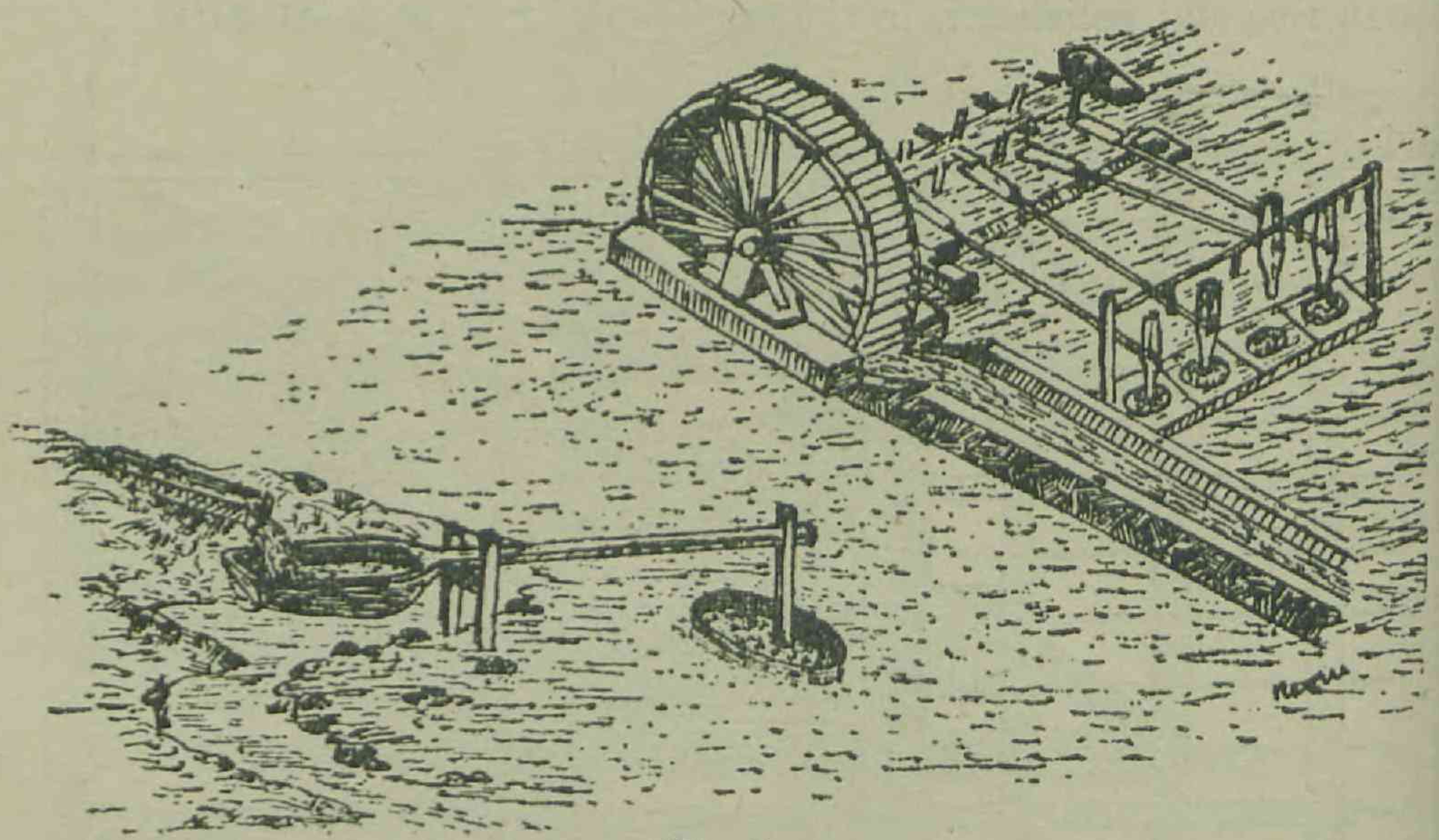


Fig. 7.

Fig. 7 gives a very fair representation of the appliances in question. Their ingenuity cannot be disputed, and for want of a better method, any farmer can easily apply this system.

The initial cost of these machines, taking into consideration the work they perform, is not excessive, but doubtless their price places them beyond the reach of small growers. These small hand machines are not satisfactory, the article produced by them not being the same as that from higher class machinery, consequently the value of the rice would be considerably less. Co-operation of rice-growers is the only successful method of tackling this industry—the cost of the necessary machinery divided among ten or a dozen farmers would not amount to much after all. Individual efforts in both growing and preparing rice for the market, especially the latter, will end in failure. Like the sugar industry, the preparation of the rice should be distinct from the growing of it, and herein will be found success financially.

WILL IT PAY?

Under favourable circumstances one acre under rice will produce from 50 up to 90 bushels of grain per acre. Quite recently on the Clarence River, New South Wales, a crop was gathered which gave 67 bushels of grain, and it is said (but this must be a misprint), 80 tons of straw to the acre. In the Cairns district last season, the average rice yield per acre is estimated at 2 tons. Taking 2 tons, then, or 74 bushels, as a basis for calculation, we find that paddy, or the rough unhusked rice, being worth to the grower, say, £9 5s. per ton, or 5s. per bushel (the price varies between £8 and £10), 2 tons per acre will realise £18 10s., and this multiplied by two crops, gives £37. Then the straw, being good feed, would, in all probability, meet with a ready sale, if done up into bales, at from £2 to £3 10s. per ton, and, taking the yield of straw at 5 tons to the acre, so realise another £10 per acre, or in all, £57 per acre for the two crops. The cost of putting the land under crop will be amply met if set down at £9 per acre. Profit per acre, say, £18 10s., at which price it cannot but be admitted that rice growing will pay.

Rice milling is also a remunerative enterprise. Taking rice at the present market value—viz., £23 per ton, to produce which 3 tons of paddy would have to be milled, we find 3 tons of paddy at £9 5s. equals £27 15s., producing 2 tons rice at £23 equals £46.; difference, £18 5s., or equivalent to £6 1s. 8d per ton of paddy, from which deduct the cost of milling, amply met by, including all charges, £2 per ton. Net profit, £4 1s. 8d. per ton. Further, rice chaff has a commercial value, and is commanding a good price in Europe to-day. It is used extensively for packing glass, canned goods, and like packages, for which purpose it cannot be equalled. This chaff realises in the German market something like from £3 to £4 per ton.

By Authority: EDMUND GREGORY, Government Printer, William street, Brisbane.

[September, 1894.

Queensland.

DEPARTMENT OF AGRICULTURE, BRISBANE.

BULLETIN No. 3.

SECOND SERIES.

MANURES: their Management and Use,

WITH

SPECIAL REFERENCE TO QUEENSLAND CONDITIONS.

BY

E. M. SHELTON, M. Sc.,

INSTRUCTOR IN AGRICULTURE.

The Bulletins of this Department will be sent free to such Individuals interested in Farming as may request them. Address all applications to "The Under Secretary for Agriculture, Brisbane."

BRISBANE

BY AUTHORITY: EDMUND GREGORY, GOVERNMENT PRINTER, WILLIAM STREET.

1894.

CONTENTS.

MANURES: THEIR MANAGEMENT AND USE.

Chapter I.

THE NEED OF MANURING SOILS.

The question of adding artificially to the supply of plant food in the soil, by any process of manuring, is, like all other agricultural operations, to be determined by its ultimate profitableness. There are few soils that are not benefited—*i.e.* made more productive—by the addition of some form or other of fertiliser. It by no means follows that the profits of the operation are alike universal. "Will it pay to manure?" is the question, but the answer is not likely to be reached from considerations purely theoretical. The expense of applying fertilisers upon a considerable scale, even when their first cost is not great, is certain to be a large item. This, to the farmer, is a present and entirely appreciable reality; the returns from the operation, on the other hand, are remote, and contingent upon events connected with the seasons, markets, &c. It is not surprising, therefore, that the use of manures, particularly by cultivators in new countries, is almost constantly deferred, until failing crops and profits enforce the need of making up to the soil the losses due to constant cropping. There are doubtless soils here and there that would be positively injured, in their crops, by manure, and there are others that would be improved by the application, without giving returns commensurate with the cost of applying the fertiliser; but unquestionably a very large proportion of Queensland soils demand fertilising in order that profitable returns may be realised from them. I feel perfectly safe in saying that not one-tenth of the crops grown annually in Queensland owe anything to the action of manures artificially applied. The true course for the farmer of new countries is to carefully conserve the natural riches of his soil. This he can do with least expense—(1) by a judicious alternation of crops; (2) by laying down his lands for a time as stock pastures; (3) by the use of green manures; and (4) by returning to the soil all wastes of the farm. The true test of the good farmer is the uniform maintenance of large and profitable yields. The inevitable signs that the farmer is losing his grip upon his acres are the gradual loss of cropping power in the land, or the growth of good crops only during favourable seasons, and the increase of weed growths with consequent increased cost in cultivation.

The Resources of Soils.—Sir John Bennet Lawes, in his celebrated experiments, has grown wheat continuously for forty-eight years upon the same land unmanured, getting an average yield of 13¾ bushels of grain per acre. In some parts of Europe crops of wheat, and in others of barley, are grown, one crop every two or three years, the land lying idle in the intervals of cropping; and this process has been going on for centuries with a steady average annual yield. In South Australia a similar practice in respect to wheat has been in vogue many years. Facts like these, which might be greatly multiplied, serve to show the vast resources of agricultural soils in plant food. In recent years, the word exhaustion, when used in connection with the soil, has taken an entirely different meaning to that originally given it. Now, exhausted soils are those which no longer produce crops to a profit. To recoup the soil for waste of all sorts, waste from excessive cropping, waste from the wash of soils and the incessant chemical and other changes going on in them, and to increase the store of plant food in naturally poor soils, at the same time compelling them to yield profitable crops, is the problem set before every cultivator. The soil is rich in the elements of plant food, and these are being crumbled down and shaped for the use of growing vegetation. Even the most enduring rocks are being constantly dissolved and changed into new forms or compounds by this process of weathering. There is no doubt that agricultural soils—that is, those which are productive when first broken up and subdued—can be made to produce crops, up to a certain standard, indefinitely, without the aid of manures. This standard, however, will only rarely meet the requirements of the modern farmer. He must, to meet taxes, pay labour, and support his family, compel the land to do more than it is *naturally* able to do. To accomplish this he must add to the resources of his soil by the use of manure in some form.

Wastes in the Soil.—One of the important objects sought in ploughing, harrowing, and tillage operations generally is to put the soil in such shape that weathering will go on most rapidly. The crop that follows this cultivation gets the benefit of the provision thus made for it in part only. Do what we will we shall not be able to gather all the plant food that has been broken down and prepared for plants, in the course of each season's cropping. Some of the nitrogen, in the form of ammonia, escapes from the soil as vapour; the nitrates, with lime and smaller amounts of potash and phosphoric acid, are carried into the soil beyond the reach of plant rootlets, or out of it, in drainage water. In a sense, then, cultivation may be said to be a source of waste. This fact doubtless explains the decadence of the practice of fallowing. Seventy years ago the summer fallow had a place in most systems of farm management. Now it is practised only rarely, usually for a special purpose, like the cleaning of very foul lands. In warm countries, where the rainfall is heavy, as in the coastal districts of Queensland, this natural waste must be enormous. Here well nigh every condition favours chemical and biological changes of the greatest intensity. The soil is nearly always warm and moist, and almost as constantly subject to the copious washings of tropical rains. As a result humus does not accumulate in the soil generally as it does in cooler regions. Instead, the elements of which humus is formed are dissipated as vapour, or carried through the soil and into drainage streams. The following description, by a traveller, of the soils along the Amazon, quoted by Storer, "Agriculture in its Relation to Chemistry," vol. 1, p. 454, explains the want of fertility on many Queensland scrubs and forest soils:—"The ground is sandy, as it is almost everywhere along the Amazons, and not very rich; it is nearly bare above, for mould does not form in the tropics, except about swampy places. At the north the leaves fall together and rot under the snow, but here they drop one by one all through the year; they dry up, are broken to dust, and so pass away in the air. Fallen logs and branches are eaten by insects.

There is nothing left to form a rich soil of. In fact it is a mistake to suppose that all this rampant tropical growth depends upon any inherent fertility of the ground. The sun and the moist air make up for barren soil. Besides the rains there are the heavy dews, and the winds are always soaked with moisture. The sand has no richness of its own, but it aids growth by carrying rain to thirsty roots." To this Storer adds: "So, too, when land in temperate climates, instead of being left to itself, comes to be cultivated, there will then be in many cases a constant drain upon the humus; and in order to keep up the fertility of the field there will be no need of applying to it new quantities of nitrogen, either in the form of farmyard manure or of peat taken from some place where humus has accumulated in excess."

The sources of waste in our soils are strikingly shown in the celebrated Rothampstead experiments of Sir John Bennet Lawes. It was there found that while thirty-seven days were required for nitrification—the process by which nitrogenous materials are changed into nitric acid by the action of an organic ferment or microbe—at a temperature of 52 degrees, the same process was completed in eight days at a temperature of 86 degrees. Investigators have shown that at 98·6 degrees nitrification is ten times more rapid than at 57 degrees. We thus see how rapidly the Queensland climate acts in changing crude nitrogenous materials into the easily soluble and easily lost form of nitric acid. How the elements of fertility thus changed are lost to the soil is shown in the following slightly abridged table, taken from reports of the Rothampstead experiments:—

NITROGEN supplied in MANURE, recovered in the CROP and in DRAINAGE, and unaccounted for in CROP or DRAINAGE, in the EXPERIMENTAL WHEAT FIELD—Two years.

—	In Pounds per Acre. Nitrogen per Acre per Annum.				
	In Manure.	In Crops.	In Drainage.	In Crop and Drainage.	Unaccounted for.
Unmanured continuously	0	12	15	27	+27
Mixed mineral manure ...	0	16	17	33	+33
Mixed mineral manure and 200 lb. ammonia salts	44	27	22	49	+ 5
Mixed mineral manure and 600 lb. ammonia salts	132	49	43	92	40
400 lb. ammonia salts alone	88	14	50	64	24
400 lb. ammonia salts and superphosphates	88	29	39	68	20
400 lb. ammonia salts and mixed mineral manure	88	32	74	106	+18
Unmanured 1865 and since	0	14	16	30	+30

This table well deserves the careful attention of Queensland cultivators. It must be borne in mind, however, that the conditions favouring nitrification and subsequent waste are vastly more active in Queensland than in the comparatively cold and slow climate of England. We here see that the crops recovered from the land are not the sole, or even the principal, sources of waste in cultivated lands. These facts explain why, in common with those of tropical and semi-tropical countries generally, Queensland soils are so constant in their demands for manure in some form.

Queensland Soils.—All Queensland farm lands are not situated within the tropical belt, although in all the country between the main range and the sea the climatic influences are essentially tropical. Moreover, enormously productive soils are found in large areas, the whole length of the coast. These rich lands may with sufficient accuracy be classed as volcanic, black, or chocolate soils, and alluvial lands. The volcanic soils owe their fertility to inherent qualities, great depth, fineness of particles, and often friability and natural drainage. The black soils are, as a rule, naturally very fertile and deep, but often lack drainage. They were rich to begin with, and part with their wealth slowly under cultivation. The chocolate soils, on the other hand, are generally very deep, as well as uniform above and below, well drained and exceedingly loose and permeable. To these qualities rather than to intrinsic fertility do most of the coastal chocolate soils owe their productiveness. Here the feeding ground of plants is enormous, and as air and rains penetrate the soil readily, the plant easily finds its compensation for more condensed fertility. For the fertility of alluvial lands Nature has made herself directly responsible by piling upon them, at irregular intervals, the wastes of other soils. The poor lands of Queensland owe their condition to their original lack, perhaps, of fertility but certainly of depth and fineness, and to those climatic influences which are constantly operating to prevent accumulations of plant food in them. The constant heat hastens decomposition* and thus produces waste, while the washings of heavy rains adds to the loss. If our poor forest soils were clothed with deciduous trees, with their autumnal profuse downcast of leaves and branches, held to the ground by snow and ice, and to slow decomposition by prolonged low temperature, these poor lands would be rich, as lands similarly situated are in "cold" countries. It is plain to me that the Queensland farmer of the future will be forced to manure his fields, or to practise those methods of conserving fertility which are understood by, and practised by, the skilful husbandman of other lands. At the present time our cultivators, as a rule, are, in common with the farmers of all new countries, taking the best from the best soils, and giving nothing in return. Washington, in the course of a letter to Arthur Young, stated the exact truth when he said, "In all countries where land is cheap and labour is dear, the people prefer cultivating much to cultivating well."

Checks upon Waste.—Despite the natural influences tending to waste the elements of fertility in soils, most of them in a state of nature lose nothing from year to year; many undoubtedly slowly increase in fertility. This is true of most scrub soils, and alluvial lands in general, and even forest soils, most likely, hold their own in the progress of time. The behaviour of soils in a state of nature ought to give the farmer a clue to the means of preventing loss of fertility in cultivated lands. Without stopping to point out reasons or analogies, we may say:—

1. The system of cropping which keeps the ground covered, as with a mulch, is advantageous in this respect: to leave soils bare during much of the season is always wasteful and exhausting.

* This word is used for convenience, and at the expense of accuracy. It really stands for all those complex chemical, biological, and physical changes which are known to be going on in the soil, and which really are a very different thing from decomposition.

2. During the growth of leguminous crops (clovers, vetches, peas, beans, &c.), and to a less extent where the land is laid to grass, the soil gains in fertility. In a general way, it may be said that lands which are not disturbed increase their stores of nitrogen—in other words, become more fertile. The loss sustained by soils is not, in large part even, due to the removal of crops from the soil, but from washing and other causes incident to cultivation.

3. Long periods of drought are undoubtedly favourable to the retention of nitrogen in the soil, as is also prolonged cold weather.

The practical man will not find it difficult to see which, if any, of these suggestions is applicable to his surroundings.

Chapter II.

GREEN MANURING.

By the phrase "green manuring" the practice of ploughing under some crop, in its green state, for the benefit of succeeding crops is meant. This is one of the cheapest and simplest methods of fertilising large areas of worn land. The practice is probably as old as agriculture, and its utility has rarely been questioned. Nevertheless, it has a recognised place in few systems of farming, except in connection with the growth of red clover. The labour of ploughing the land and seeding the same to some crop, is so light, as compared with the labour and expense of applying fertilisers, that the wonder is that the merits of green manuring have not received more general practical recognition. A long list of cultivated plants, nearly all quick growing bulky annuals, have been employed for this purpose. In different parts of England and the Continent, the vetch, rape, spurry, and lupines have been favourites for green manuring; while in America rye, oats, buckwheat, setaria, and in the Southern States the cow pea (*Dolichos sinensis*), have each been found useful as sources of soil fertility.

Leguminous Crops as Fertilisers.—The recent investigations of scientific men proving the ability of leguminous plants—peas, beans, clovers, vetches, and the like—to appropriate free nitrogen from the atmosphere has awakened fresh interest in the subject of green manuring. It has long been known that crops of clover and lucerne greatly improved soils, even where only the stubble of these crops was ploughed under. The reason for this is now apparent, and old practices, in this respect, admit of rational explanation. It is now clearly understood that the farmer has, in this great class of plants, an agent for the transformation of the nitrogen, existing in boundless quantities in the atmosphere, into the humus of soils. How this is done has not yet clearly been made out. The fact itself is, for all practical purposes, sufficient. We are not to understand that green crops other than the leguminous are worthless as a source of fertility, even though they derive their nitrogen almost entirely from the soil, and so make no real addition to it. Withal they have most useful features; equally with leguminous crops they cover the soil during the period of their growth, and so check natural wastes, and when ploughed under greatly improve the physical condition of heavy lands, making them more friable and so amenable to tillage operations. Moreover, the non-leguminous crop represents a season's accumulations in the soil, and this, in the most available form, is at the disposal of the succeeding crop. Without doubt, all the advantages derivable from the use of crops other than leguminous are to be obtained from the use of legumes, and besides the important one before alluded to, so that, when the latter are available, sound policy will dictate their use. The list of leguminous plants of proved suitableness for field cultivation in Queensland is far from complete. Nearly all the crops of this family, occupying a large place in agriculture, come to us with reputations established in cold countries. Most of the clovers fail in Queensland soil. It is true that lucerne thrives well in all parts of the colony, but its slow early growth and perennial habit unfit it for the short and quick work demanded of a manuring crop. Besides, lucerne can only be successfully grown on the richest of soils, those which, for the present, at least, need no additions to their fertility. Experience with the lupin is wanting in Queensland, but, from theoretical considerations, this crop is a promising one for use in fertilising our run-down soils. Vetches and field peas are too costly, in seed, and the crop is too precarious to warrant cultivation for fertilising purposes alone.

THE COW PEA.—From our present knowledge of this subject we are clearly warranted in placing the cow pea (*Dolichos sinensis*) at the head of the list of legumes suited to this purpose. This plant has been extensively grown in the Southern States of America, where its reputation as a green manuring crop, always good, is rapidly extending. It has there been shown that an annual crop of this plant has contained nitrogen worth £5, valuing nitrogen at its prevailing market price in other fertilisers. In Queensland, although of recent introduction, it has found universal favour with cultivators wherever it has been tried, either as a fodder plant, for which it is well suited, or as a fertilising crop. The cow pea has the great advantage over most other crops for this purpose, in that it makes a vigorous growth even upon very poor soils, where heat and moisture are not wanting. Other promising legumes for green manuring are a variety of Mauritius bean which has been tried on a limited scale in North Queensland, the crimson clover (*Trifolium incarnatum*), and white lupines. The cow pea is natural to hot moist climates, and while it endures periods of drouth well, it will not thrive in cold climates or during the cold season of warm countries. It also makes a very quick growth, three crops being harvested in a single season at the State Nursery at Kamerunga, near Cairns. Upon poor soils which it is desired to hurry into condition, a dressing of mixed superphosphate and potash would prove most useful. The dose would vary with the apparent needs of the soil, but not unlikely 250 lb. of bone meal and 300 lb. of kainit or 75 lb. of muriate of potash would be a fair average application. Such preliminary dressing, besides securing a vigorous growth of the green crop and ultimate large stores of nitrogen, would leave valuable residues for succeeding crops. There is a very long list of varieties of the cow pea, although only three—the Clay Coloured, Whip-poor-Will, and Black Eye—have, to my knowledge, found their way to Queensland. Of these the best, by far, for our purpose, is the Clay Coloured, distinguished by its yellowish clay coloured seed and rampant growth of vines. It should always be borne in mind by the cultivator that in preparing the soil for the green crop we are in reality working for the moneyed crop which is to follow. The better the tillage given the soil for the cow pea, the quicker and surer the ultimate success of the entire operation. After this thorough preparation of the soil, the cow pea may be broadcasted at the rate of one bushel to a bushel and a-half of seed per acre. As soon as the crop begins to show ripened pods about the field it is in condition to be turned under; and in case seed, for future sowings, is required, the crop may remain untouched until a sufficient supply of ripe seed pods has appeared. These may be hand-picked, and the crop of vines ploughed in immediately afterwards. It is better to plough the crop under in a somewhat over-ripe condition rather than in the opposite state of extreme greenness and succulency. It is commonly complained that a heavy crop of under-ripe pea vines "sours" the ground injuriously. The question when to plough under the green crop so that the most may be obtained from it is one that is best answered in the case of the particular crop that is to follow the green manuring. To plough the green crop under in the autumn, for a spring planted crop, is certainly, in the Queensland climate, and on light and well-drained soils, wasteful practice. The process of nitrification goes on, more or less, actively all the winter, and long before spring the bulk of the nitrogen of the green crop has got beyond the reach of the crop for which the green one was a preparation. In Louisiana the practice is to plough under pea vines early in September, the cane planting following about one month later. Upon very light soils, I should certainly leave the pea vines untouched until the near time of planting, even though much of a winter season intervene. Upon heavy lands, having a large admixture of clay, on the other hand, excellent results are obtained from turning under the green crop in the autumn. Such lands, besides being made more friable by this treatment, show their ability to retain the nitrogen of the green crop, in greatly increased cropping power. The operation of ploughing under pea vines and other green crops is best performed with a plough cutting a wide furrow and equipped with a keen rolling coulter and one of the devices, figured below, for dragging under the rampant surface growth.

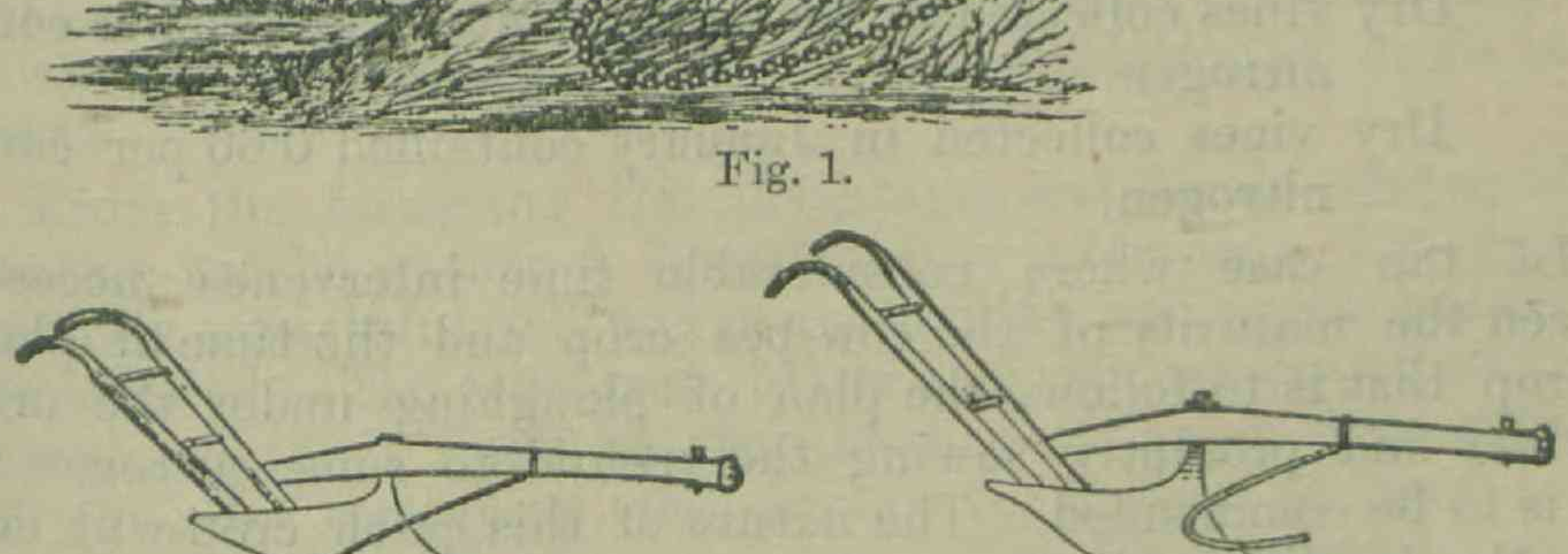


Fig. 1.

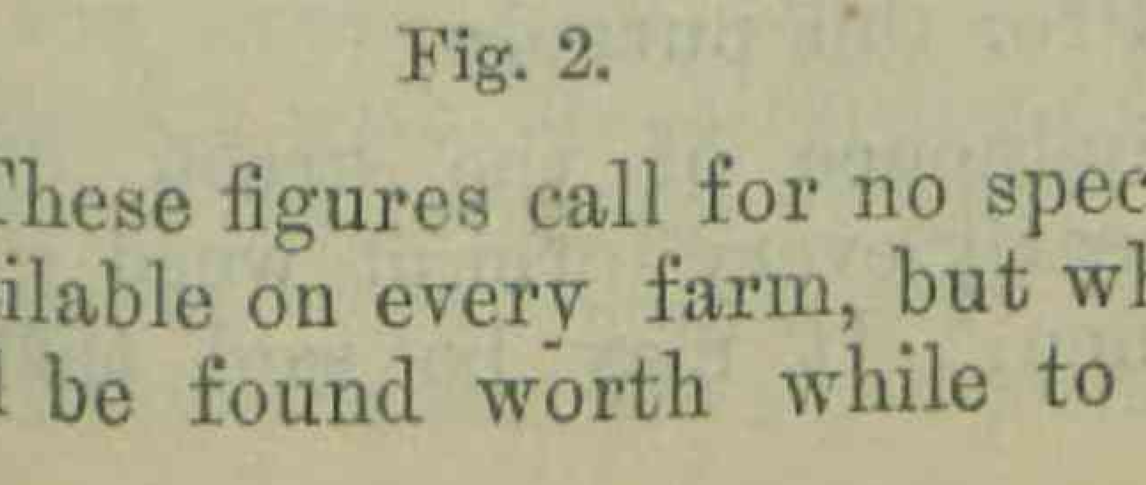


Fig. 2.

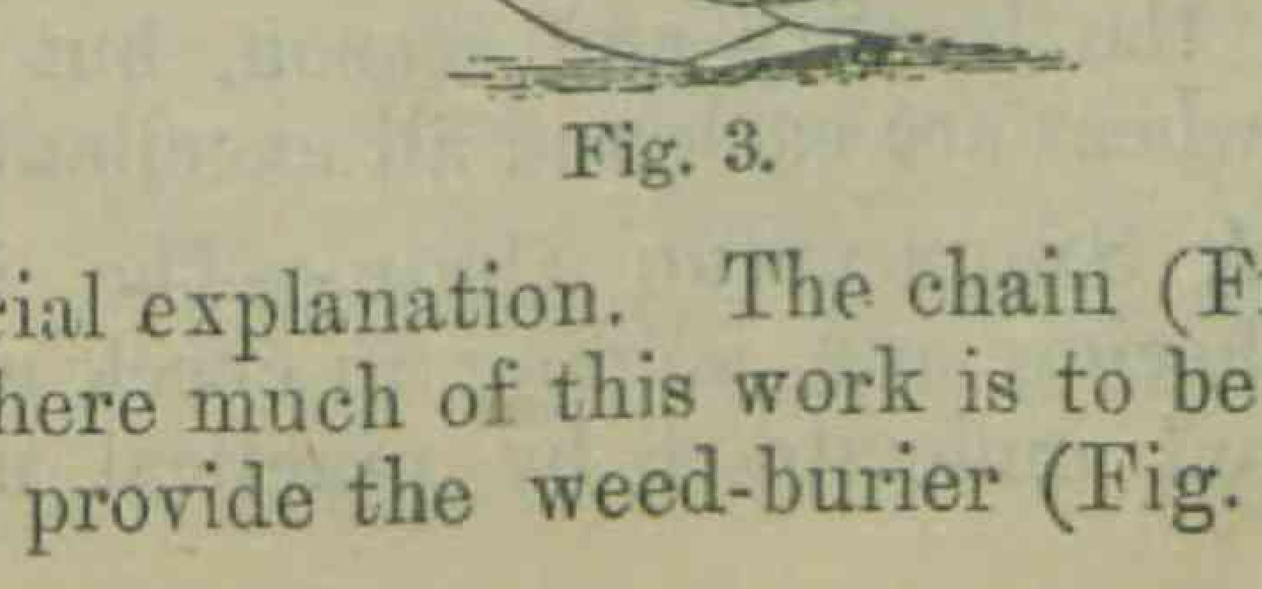


Fig. 3.

These figures call for no special explanation. The chain (Fig. 1) is available on every farm, but where much of this work is to be done it will be found worth while to provide the weed-burier (Fig. 2) or weed hook (Fig. 3). The straight rod has the advantage that it is not liable to be caught by obstructions, but it is really less efficient than either the chain or curved rod. In common practice the chain is attached at one end to the swingle bar and at the other to the beam of the plough, the chain forming a loop, the bight of which hangs over the revolving furrow. The chain should be so adjusted as to just drag the green stuff under without being caught by the furrow. I have found, in practice, that the best results are obtained by attaching the chain near the end or "bridle" of the beam rather than at its middle, as shown in the figure. A very little practice enables any ploughman to adjust either device, so that really excellent work will be accomplished. For the rods shown in the cuts, steel should be employed, as elasticity is desirable to enable them to pass safely over obstruction. The steel rods in use for making rake teeth are excellent for this purpose. Where the cow peas or other green crops are not thoroughly buried beneath the soil a rank growth, often very difficult to destroy, marks the lap of every furrow.

Circumstances will dictate the treatment of the field after it has received this green crop. Where the land is really poor, or where the time of planting the crop, for which the green manuring is a preparation, will admit, it may be advisable to treat the soil to one or even two more green crops before the final planting of the field. In any case the land must not be allowed to remain long unoccupied and uncovered. It is absolutely essential to the success of this operation that planting follows swiftly upon ploughing in of the final green crop. In a climate like that of Queensland, so energetic in its influences tending to waste fertility in soils, it is preferable to allow the green crop to become over-ripe and lie for a considerable time upon the surface before ploughing, provided it covers the ground completely. Here again we have a case in which judgment is demanded in a choice of evils. If the ground is allowed to remain fallow after receiving the green crop, there is an undoubted loss of nitrogen, and there is certainly a loss where the green crop becomes over-ripe before being incorporated with the soil. The extent of deterioration in pea vines after their maturity is shown by analyses of a crop, made at different dates during the autumn and winter of 1889-90 by the Alabama (U.S.) Experiment Station:—

Green vines collected in October contained 2·62 per cent. of nitrogen.

Dry vines collected in December contained 0·81 per cent. of nitrogen.

Dry vines collected in January contained 0·66 per cent. of nitrogen.

In the case where considerable time intervenes necessarily between the maturity of the cow-pea crop and the time of planting the crop that is to follow, the plan of ploughing under the crop of pea vines and promptly sowing the ground to some nitrogen fixing crop is to be commended. The nature of this catch crop will depend upon the locality and season, but setaria, rape, rye, oats, wheat, or buckwheat are each and all excellent for this purpose.

A Smothering Crop.—The influence of the green crop in smothering and holding in check nearly every form of weed growth is well understood by practical men. It may be said that this smothering function of the green crop is altogether peculiar to it. The application of direct fertilisers is often attended with great risk of introducing to the field some new form of weed growth, and all forms of manure stimulate and invigorate indifferently the crop and its rival growth of weeds. The farmer who has allowed his acres to become foul with weeds will find, in a succession of manuring crops, a cheap and easy means of cleansing and fertilising his lands at one operation. It has been brought to my attention that a strong growth of cow peas has proved efficacious in subduing a rank growth of that, in some respects, most pernicious of weeds, nut-grass. To get the full benefit of the manuring crop, in holding weeds in check, this green crop must be given a clear advantage over the weeds in the start, otherwise the operation will be reversed, the weeds smothering the green crop. The necessary precaution is that the ground shall be ploughed in such condition and season as will ensure the prompt and vigorous early growth of the smothering crop. To this end it is imperative that seeding follows ploughing with the least possible delay.

Green Manures in Different Soils.—One great and unquestioned advantage of the green crop used as a manure is the increased friability of soils due to its action. Farmers who have had experience with green manuring delight to tell how like an "ash heap" the most stubborn clays have become through the action of a crop ploughed under. This fact explains the preference so generally given heavy land for the application of green manures. It also, in a large degree, gives us the reason for the favour shown crops other than the legumes for this purpose. Heavy soils carrying abundant clay and rich in humus are, besides being improved physically—mellowed—much more largely benefited chemically, than sands. Chemical action goes on in them much less rapidly than in loose soils, and they grasp and retain the nitrogen of the green crop more completely. On the other hand, light lands may, for the time, receive positive damage from a green crop turned under. Loose sands, for instance, turned by the plough are quickly penetrated by the atmosphere, and thus part with their moisture rapidly. Seeds sown upon such land fail to find the condition for vigorous growth either in the soil above or the souring mass of vegetation beneath. These are the facts, briefly stated, which explain the common failure of green manuring upon loose soils. The familiar agricultural principle, that heavy lands need breaking up and disintegrating, and light lands consolidating, cannot be lost sight of in making plans for the application of crops as green manure.

From the foregoing the advantages and disadvantages of green manuring will be gathered directly or by inference. The practice is essentially a wasteful one, and so unscientific, and cannot be universally recommended. The cane crop, better than almost any other grown in Queensland, lends itself to the practice of green manuring. The sugar-cane by occupying the ground for a series of years creates a keen demand for nitrogen in it, as well as for the smothering action of the green crop upon weeds. Besides, cane-growing is never connected with stock-raising or other manure-making agency. The essential wastefulness of green manuring becomes apparent when we remember that a single acre of cow pea has a feeding value close to £5, while the manure made from this fodder would be worth something over £4. Green manuring may be unreservedly recommended for bringing large areas of run-down land into condition, such that green manures are no longer needed for their successful management; for occasional use as a smothering crop, and for a much more general use in connection with those crops or systems of farming which compel the farmer to constantly look outside of his own farm for the means of maintaining its fertility.

Experiences with Green Manures.—This topic may be appropriately concluded by references to the experiences of a few large and successful Queensland cultivators with green manuring. The subjoined extracts are from letters recently received by the writer:—

Messrs. A. H. and E. Young, Fairymead Plantation, Bundaberg, write—"We are very much pleased with the cow pea as a green manure. Unfortunately we are unable to give actual results, owing to the floods of 1893 having destroyed over 200 acres of a magnificent crop of peas which we were on the point of ploughing in. The land on which this crop grew is now in cane and promises well, but as the whole of the crop of peas disappeared leaving only the roots, the experiment was spoiled. Last September, however, we again sowed about 200 acres with cow peas and again had a splendid crop, the ground being covered with a dense growth eighteen inches high, every inch of the ground being covered. This crop we ploughed in in the month of March, 1894, and after giving it three weeks to rot, we drilled the ground and planted it with cane (we found three weeks' time sufficient to rot the peas). This cane is still very young but is looking well, and promises a good yield.

"We have the highest opinion of the cow pea for green soiling; the land turns up in splendid condition after it; and such a mass of vegetable growth cannot fail to enrich the soil greatly. We have also found it a most valuable fodder, both horses and cows being very partial to it. Our horses thrive remarkably upon it, rapidly putting on flesh and showing a beautiful sleek skin. As far as our experience goes, the best time in this district to sow is in the month of September, after all fear of frosts is over, and it should be ploughed in when in blossom and the green peas are showing. We found half a bushel* of seed to the acre, sown broadcast, ample. It should be sown on the ploughed ground, and covered with the drag on disc-harrow. The land should be well drained and no surface water allowed to lodge on it, for the cow pea is very sensitive to excess of moisture. In our opinion this is one of the most valuable plants ever introduced into the colony. * * * * * * The practical difficulty of ploughing in and covering such a mass of material gave us great trouble, and we found it necessary to roll the peas down in front of the ploughs. The latter should be very high in the beam to give plenty of clearance, and the wheels should be as much forward as possible, so that the furrow being turned by the plough is not jammed between it and the furrow-wheel. We found sulkey ploughs the only ones that would cover this crop effectually."

* This amount of seed is certainly too small for light or inferior lands.—E. M. S.

Mr. Edward W. Knox, General Manager, Colonial Sugar Refining Company, Limited, Sydney:—"So far we consider the American cow peas excellent for green manuring for cane crops; but that, as you suggest, there may be found other beans equally good, or, in some respects, even better. To these apparently belong the black and the red Mauritius beans, and, although opinions differ as to their merits—perhaps because these beans were amongst the first green manures introduced by us, when green manuring was not understood—we have received some very encouraging reports on them from several of our cultivation officers. At Homebush, in the Mackay district, these beans have been found to even smother nut-grass, and as they are perennial, the killing of the nut-grass is probably only a question of time."

Mr. R. M. Boyd, Ripple Creek, Herbert River:—"I have pleasure in informing you that I find them (cow peas) of great benefit on sugar land: not only is their manurial effect most marked, but they appear to increase in beneficial effect on the soil, which ploughs up in looser and better order where these plants have been grown. The cow pea grows with us all the year round, and we plant it at any time we have a field to fallow. We endeavour to take a crop of seeds before ploughing in, but believe that when in blossom is the best time for turning it under. I find that this plant will stand excessive rain on well-drained land, but standing water quickly kills it. I plant broadcast if seed is plentiful, and drill in two-foot rows with a corn-planter if my stock is small."

Chapter III.

FARM-YARD MANURES AND THEIR APPLICATION.

By the phrase "farmyard manure" is here meant all the various liquid and solid accumulations of farm and garden, having value as fertilisers but worthless for most other uses. The term includes the excrements of animals, the litter used in connection with them, and the combinations of these substances, fermented and otherwise. The farm and farmyard is by far the most important source of farm fertility. The great body of cultivators employ no other manures than those produced in the course of their own operations. There are almost innumerable instances of farms maintained in a high state of productiveness through judicious cropping and the conservation and application of those residues of the farm which go under the general name of farmyard manures.

Where More Manure is Called For.—The farmer who finds that under his system of management this supply of home-made fertilisers is inadequate to the demands of the land may often, by a slight change of cropping or in the general plan of his operations, increase the available supply of manure without the necessity for outside purchasing. What these changes should be will depend upon local circumstances, but in a general way it may be said that—

1. Increased attention to live stock;
2. The growth of larger supplies of stock foods for home consumption;
3. Feeding purchased foods; and
4. Laying down the land to grasses or clovers—

are the lines along which the farmer must act to increase the home supply of fertilisers. The fruit-growers and market gardeners along the Queensland coast, who are now paying large prices, with miles of cartage added, for city refuse, would often find profit in one of the diversions from their ordinary practices indicated above. There is no necessary antagonism between market gardening and dairying, for instance, or between banana-growing and pig-feeding. As a rule, the cows or pigs might be relied upon to pay their way in the ordinary products of feeding; but if in the transaction no more than the manure could be put aside as clear gain the business will generally be accounted a profitable one. The farmer who undertakes to increase in this way the available manure supply will find profit in the study of the tables, further on, giving the manurial values of different stock foods. The philosophy of this suggested plan of feeding boughten foods upon the farm is, that such foods are sold presumably *for their feeding value alone*, thus giving the purchaser and feeder the manures resulting at a nominal cost. The following figures obtained from actual feeding experiments, made at one of the American experiment stations, is of interest in this connection as showing the value of manure produced by different animals under ordinary conditions of liberal feeding:—

Animals.	Food.	Food consumed per animal daily.	Manure excreted per animal daily.	Composition of Manure.			Value of Manure.	
				Nitrogen.	Potash.	Phosphoric Acid.	Per ton (2,240 lb.)	Per Animal daily.
		lb.	lb.	per cent	per cent	per cent	s. d.	d.
Cows ...	Hay, silage, beets, wheat, bran, corn meal, cotton seed meal, malt sprouts	75·5	81·5	0·50	0·29	0·45	11 1	4½
Horses (at work)	Hay and oats (estimated ⅗ manure collected)	...	52·5	0·47	0·94	0·39	12 9	3½
Sheep ...	Grain, beets, and hay	5·3	7·2	1·00	1·21	0·08	19 6	0¾
Swine ...	Corn meal, or corn meal and flesh meal	3·6	3·5	0·83	0·61	0·04	14 10	0¼

This table shows in a striking way the important relation which live stock sustain to farm fertility. The direct loss sustained by farms from which the substances here fed are marketed in the usual way may here be roughly computed. Different foods would undoubtedly have given different results; foods rich in nitrogen, potash, and phosphoric acid will invariably give manures correspondingly rich in these elements of fertility. Moreover, it is known that the bulk of the nitrogen, potash, and phosphoric acid are voided in the manure in nearly the same proportions as existing originally in the food. This has been clearly shown in the feeding trial made in another of the American stations (Maine). In this experiment two lots of sheep were fed, one with a ration rich in nitrogen, and the other upon foods deficient in this element. The results of five days' feeding of the two lots are given in the subjoined table:—

—	Hay and Cotton Seed Meal.		Hay and Corn Meal.	
	In Food.	In Manure.	In Food.	In Manure.
	Oz.	Oz.	Oz.	Oz.
Nitrogen	3·6	3·9	1·6	1·5
Potash	2·2	2·0	1·1	0·8
Phosphoric acid	1·4	1·3	0·5	0·4

In the report of this experiment the results are summarised as follows:—"The amounts of nitrogen, phosphoric acid, and potash in the manure residue stand in direct relation to the amounts of the same ingredients in the food, the loss in the present instance averaging only about 10 per cent.

"The urine contained nearly half the potash of the total excretion, and from half to three-fourths the nitrogen, but no phosphoric acid, the latter being wholly in the solid excrement."

These facts indicate authoritatively the means by which poor Queensland soils may be made better, and the rich soils kept up to a high average of cropping power. If it be said that much, particularly of the tropical farming of Queensland, cane-growing for example, does not admit of stock-keeping as an adjunct, there is still open to these cultivators green manuring in connection with the moderate use of purchased fertilisers, and upon every plantation there are vast possibilities of increasing the supply of manure, through careful husbanding of the various odds and ends of sugar-growing, begasse, trash, filter press cake, the manure of working animals, and the like, which alone will go far towards placing the plantation on an independent basis as to the manure supply. This, to my mind, is perfectly certain. Sugar-growing, no more than any other branch of farming, even where pursued only on the best scrub soils, as is now generally the case, can long stand the scourging system now in vogue, which, for the most part, takes everything from the soil and gives nothing in return. Every calculation of the profits of the business which does not take into account the inevitable outlay for manure supplies is a faulty one, and is sure, if acted upon, to bring disappointment in the end. The question set before intending cane-growers is not what are the profits of virgin soils from cultivation alone, but how to maintain the standard of profit and the fertility of the plantation at a common and high level.

The Value of Manures.—The quality of manure and its consequent value depend upon the food from which it is made, and the care taken in preserving it. The droppings of animals fed upon straw, grass, and herbage deficient in nutriment, are deficient in the elements of fertility. The passage of these substances through the digestive system of the animal adds nothing to their value. Indeed, as has already been shown, the animal retains a certain and appreciable amount of the nitrogen, potash, and phosphoric acid of its food, the manure showing a corresponding loss, even where the urine has been carefully saved. The amount of these substances retained will vary considerably with animals under different treatment. Young and growing animals, milch stock, and animals gaining in flesh rapidly will, other things being equal, retain the largest amounts of fertilising constituents contained in foods. The common mistake of farmers is their assumption, in practice, that all manures of a particular kind have equal value. Stable manure, for instance, is generally valued at so much the load, although it is possible for one load to be worth four or five times as much as another. This is shown in the following table of the manurial value of a few foods, in which allowance has been made for the amount of fertilising constituents retained by the animal. The current prices of commercial fertilisers is the basis of this calculation of values:—

VALUE OF MANURES FROM ONE TON OF FEED.

	£	s.	d.
Lucerne hay	2	3	9
Maize fodder	1	15	7
Oaten hay	1	13	10
Millet-setaria—green	0	13	0
Cow-pea vines—green	0	10	6
Cow-pea vines—hay	2	13	11
Sorghum—green	0	8	6
Barley straw	1	2	10
Oat straw	0	9	9
Wheat straw	0	15	1
Barley	2	1	10
Maize	1	15	0
Oats	1	13	3
Linseed	3	3	8
Wheat bran	3	10	9

Undoubtedly the quantity of food, the amount of daily ration, has much to do with the value of the manure obtained as a result of the feeding. An animal fed sparingly upon even the best of foods will give a manure much less valuable than that obtained from full feeding. This fact explains the preference shown by English farmers for manure from highly-fed work horses and fattening cattle.

WASTES IN MANURES.—One has but to consider the possibilities of loss in manures to see how small a portion of farm-made fertilisers is utilised by the farmer. In the first place, about one-half of what may be called the manurial contents of food is discharged in the liquid excrements. This is practically all lost in nearly every stable and stockyard in the colony. Then the loss from the fermentation and washing of manures piled in the open is undoubtedly very great. The writer, at the Kansas Experiment Station, made a series of careful experiments, which were carried on through two years, to test this point. It was here found that exposed piles of manure in the course of six months lost fully one-half in weight, and parted with about 40 per cent. of its nitrogen. Like results have been made from experiments made at other American stations. From these facts it would seem that the farmer who allows the urine of his animals to go to waste, and exposes the solid excrements to the weather in piles without protection for several months, has for his soil not much more than 25 per cent. of the fertiliser actually available to him.

THE PRESERVATION OF MANURES.—Considering the possibilities of loss in manures kept for a length of time, it may well be questioned whether under the ordinary conditions of the farm it is worth while to attempt its storage. My own practice has been, wherever circumstances allowed, to haul the manure afield as fast as it was made, spreading it evenly over the ground from the cart. Manure thus spread dries out at once in fine weather, and fermentation ceases, while the rains which leach through it carry with them into the soil the soluble constitutents of the manure. Even where the field is to remain unploughed for a considerable time it is more economical, where circumstances permit, to spread the manure upon it in this way than to leave it exposed to the risks which attend ordinary methods of storage. In many cases it will not be found practicable to follow the plan above outlined; the land may not be ready to receive the manure, or conveniences for carting may be wanting. Besides, a fertiliser that acts quickly, as well fermented dung does, may be wanted for some special crop. These considerations raise the question how best to store manures so that they may be carried on for future use with the least waste?

The two chief sources of waste in manures are due to fermentation and the escape of resultant gases, and the leaching action of water percolating through the manure mass. The waste through fermentation or decomposition is always slight—so slight, in fact, that its influence may generally in practice be disregarded. The elements of fertility exist in farmyard manures for the most part in an insoluble condition. Of nitrogen there is only a small amount in soluble form, while the contained phosphoric acid and potash are largely insoluble; but in any case these valuable minerals can only be lost in appreciable quantity through the action of water. The result of fermentation, then, is to increase the solubility of a manure, and where this process is a slow one, as is the case in compact piles, the bulk of the ammonia is caught before it can reach the surface, and held in the form of soluble salts. How the putrefactive changes going on in the manure pile are brought about need not to be discussed here at length. Modern science has shown us that through the agency of various species of microbes the organic constituents of manures are speedily broken down or "decomposed," and their elements rearranged in new forms. As a result of the activity of these peculiar organisms, the insoluble mass of the manure pile is made soluble, and so available to plants. Nitrogen takes the form of ammonia or nitric acid, and mineral elements are released from combination with materials, all taking on the forms easiest available to plants and most easily lost to the farmer. To preserve manures with the least possible loss, while undergoing this fermenting process, a course is open to the farmer which is justified alike by science and sound practice—

1. The manure must be kept in solid masses. Such compact piles, under ordinary conditions, retain their moisture throughout; fermentation proceeds slowly in them, and the gaseous products of

fermentation are retained in the heap. The old-fashioned practice of frequently turning the manure heap, whatever its value in cool climates, ought to be abandoned in Queensland, because of the inevitable waste that attends it.

2. The manure pile must be so placed that water must not leach through it, either into the ground beneath or out upon the surface. Ordinarily the annual rainfall will do no more than to keep the manure suitably moist. The danger from leaching is to be expected rather from the water which flows upon the manure from a higher level. Necessary measures must be taken to prevent this, either by diverting the water from the manure by means of ditches, or by locating it so that precautions of this kind are unnecessary. The need of an abundant supply of litter to retain the urine and other liquids of the manure will be apparent from the above considerations. The escape of these liquids into the ground beneath will be prevented by making it impervious to water, by the addition of a layer of wet clay thoroughly worked (puddled) with the hoe, and if a concave form be given to the bottom of the yard, loss from leaching of water will be small indeed. The farmer who keeps his stable manure in masses made solid by the tread of animals or other means, meanwhile cutting it off from the inflow and outgo of water, will have small cause of complaint of loss in storing manures for limited periods of time, even in hot and warm seasons.

Application of Manures.—The constant tendency of manurial elements, particularly all forms of nitrogen, towards lower levels in the soil, through the action of water, until they pass beyond the reach of plant roots or escape from the soil completely in drainage waters has already been pointed out. This fact furnishes the reason for the modern methods of applying fertilisers. The old practice was to haul the manure afield, dumping it in heaps, afterwards spreading the heaps as suited the convenience of the farmer. These heaps became at once the seat of active fermentation, and the products of fermentation were rapidly carried into the ground directly beneath the heaps with each recurring rain; moreover, unless great care was practised the heaps were not likely to be equally distributed over the ground, the finer and best rotted portions remaining about the position of the heap, giving to the crop following a spotted appearance, caused by overgrowth at these points. It is best therefore, where circumstances permit, to spread the manure directly from the cart, a practice which has an additional advantage in being economical in labour.

The following rules for the application of manures serve to illustrate principles as well as the best practices of modern farmers in this regard :—

1. Heavy application of manure, at one time, is almost certainly wasteful. Small doses and often should be the rule with fertilisers, whatever their nature may be. Better far to give the land 10 tons of manure for three years in succession than 30 tons once in three years. The loss and dissipation of manurial elements in the soil go on constantly, while the crop feeds only at certain seasons of the year. Excessive manuring is wasteful, because it loads the soil with plant food beyond the present requirements of the growing crop, while the waste from large masses of manure in the field is large and constant. Modern

methods bring us constantly towards the Eastern method of manuring the plant rather than the soil. Certain crops, again, are notoriously gross feeders, making constant and large demands on the resources of the soil and showing, by rapidly diminishing yields, any failure on the part of the soil to meet their natural demands. These are, for the most part, coarse-growing broad-leaved plants, like the banana, sugar-cane, maize, and among vegetables the cabbage and the beet. With these crops it is difficult to overdo with manures, although the crop may be damaged in special products like the sugar of the cane and beet by a too generous application of nitrogenous manures.

2. Whenever practicable, haul the manure to the field as fast as made and spread directly from the dray. This is economical in practice and sound in principle. There is no danger of loss from the escape of the volatile matters of manure that is in direct contact with the soil.

3. The more nearly manure is kept to the surface of the soil, and the more thoroughly it is mixed with it in cultivation, the better. Probably the best treatment that can be given manure on the soil is to spread it on the surface of the ploughed ground, and afterwards work it into the soil with the harrow or cultivator. The subsequent tillage operations in connection with the growing crop generally forbid this course, and make the ploughing under of manure a necessity.

4. In respect to the time of applying manures (to the crop) hard and fast rules are difficult to make. In a general way, well-rotted manures and others, like horse or sheep manure, which are quick in action, had better be applied in the spring, or at such time as to meet the immediate requirements of the crop. Crops, however, vary enormously in respect to their manurial requirements. A grain crop manured in the spring is often stimulated to a late growth of rank feeble straw, which gives a diminished yield of grain. Other crops, fruit trees, pineapples, bananas, &c., often demand the forcing effects of manure late one season in order to make the crop of the next. In the climate of Queensland, manures, as a rule, may be applied with the expectation of receiving quick returns for the application.

Chapter IV.

THE ELEMENTS OF FERTILITY IN SOILS.

All of the various forms of material things are, so far as present knowledge goes, combinations of certain chemical elements about seventy in number. By chemical element is meant a substance that cannot by any means be separated into other substances. Thus iron and nitrogen and gold are called chemical elements, because whatever treatment they may be made to undergo they cannot be made to yield up aught but iron, nitrogen, or gold, as the case may be. These seventy elements, by combination in an infinite variety of ways, serve to make all the varied and wonderful objects of earth and air. The soil is but a combination of a few of these elements, and the plants growing from the soil represent another blending of certain of these same elements. The many ways in which these elements vary in form, chemical qualities, and methods of combination need not to be dwelt upon at length here. So far as agriculture is concerned, our interest in this subject is limited to the comparatively small number of elements that go to make up soils, fertilisers, and vegetable products.

Elements of Soils and Crops.—Soils vary greatly in composition as they do in fertility, but the best and most fertile rarely contain more than fourteen of these chemical elements. Soils primarily are the result of chemical action and the weathering process upon rocks. They come to us as a crude compound of coarse and fine materials, mixed with a greater or less amount of the remains of vegetation (organic matter) combined with more or less of moisture. The following table fairly shows the groupings of these elements in familiar substances as shown in the composition of fertile soils :—

4·0	per cent.	of	organic matter
0·1	„	„	nitrogen
20·0	„	„	water
75·9	„	„	mineral matter.

Of the seventy elements of our soils, it is known that only fourteen are absolutely essential to the production of the various forms of vegetable growth. These elementary substances are named as follows :—Carbon, hydrogen, nitrogen, oxygen, phosphorus, sulphur, chlorine, silicon, calcium, sodium, iron, magnesium, manganese, and potassium. If we subject vegetation to the action of fire, we find that a certain and small amount only remains with us in the shape of ash. This incombustible ash represents the mineral constituents of the plant derived from the soil. A large portion of the plant, however, has escaped during the process of combustion, in the form of gas. This destructible portion of plants is made up of the following elements :—Carbon, oxygen, hydrogen, and nitrogen, and in a less degree sulphur and phosphorus. These two classes of elements, the mineral and the gaseous constituents of plants, differ in several important respects. First, in their source ; with the exception of sulphur and phosphorus, the combustible portions of plants are derived directly or indirectly exclusively from the air, while the mineral elements are received wholly from the soil. Again, the two classes exist in widely different proportions in vegetation. Thus, the gaseous or air-derived elements constitute nearly 95 per cent. of the vegetable kingdom, taken as a whole, while the mineral elements of plants vary greatly between a fraction of 1 per cent. and 10 per cent., or even more.

Importance of Chemical Analysis.—These facts and much besides, the whole forming the subject-matter of agricultural chemistry, have come to us through the industrious labours of modern chemists. They have shown us the reasons for many of the practices of the farmer, the causes of his success and failures, and have suggested many of the improvements which characterise modern agriculture. From the great benefits which chemistry had already conferred upon agriculture, it was expected that striking advantages would be derived from the analysis of soil and the plants growing from it. It was assumed that we had only to know the composition of the soil and the demand that crops made upon it, in growth, to be able to control all the conditions of successful cultivation. These expectations have never been realised. This failure is not due to the imperfection of chemical methods; it is owing rather to the fact that profitable production in farming is in a large degree contingent upon causes quite outside the domain of chemistry. A soil, for example, may be fertile, but for *physical* causes unproductive. Again, soils not abounding in the elements of fertility are productive because physically their condition is good. Some of the richest agricultural districts of Queensland owe their prosperity to a soil that is, from a chemical standpoint, far from rich; this soil is in the condition of an impalpable powder, so that every part is accessible to the rootlets of plants. It is also very deep and well drained, and to these facts its productiveness is due. Again, fertility in soils depends, not upon the gross amount of this or that element of value, but upon the comparatively small amount which is soluble and so available to plants. The *existence* of elements of agricultural value in the soil chemistry can determine, but their *condition* or suitableness to the wants of plant life is not brought out by chemical analysis.

After this statement of the inutility of chemical analysis, the question where and under what condition it may be usefully employed is sure to be raised. An eminent agricultural chemist (Dr. R. C. Kedzie, of Michigan, U.S.A.) says:—"Chemical analysis of the soil is of value in determining whether a soil is capable of fertility or the contrary, also in determining the measure of its possible fertility. There are certain ash constituents which are absolutely necessary for plant growth, in the absence of any one of which vegetable growth is impossible; if the supply is relatively limited, plant growth will be limited correspondingly. If all the ash elements are present in sufficient amount and in available form, such soil is capable of fertility. Hence, chemical analysis of a soil is of importance in determining possibility of fertility and of the relative fertility which may be secured under favourable circumstances."

The Elements of Applied Fertility.—Of the fourteen elements above referred to as necessary in the soil to the perfect development of plants, only three—nitrogen, phosphorus (in the form of phosphoric acid), and potash—come within the scope of the farmer's care and skill, and so need consideration here. The remaining eleven are always to be found in agricultural soils, and generally in quantity sufficient for the needs of growing crops. The loss or failure of any one of these three elements in the soil is attended with prompt failure of cropping power, while the return of one or more to poor or worn soils is always followed by increased productiveness. The important place held by these three substances in the economy of agriculture warrants a brief statement here of their qualities and relations as elements.

Nitrogen.—This is the element that is easiest lost to the soil, and that costs most to replace when once parted with. We have already drawn attention to the constant loss of nitrogenous compounds to the soil, through the leaching action of water. In like manner both phosphoric acid and potash are subject to waste, but in a much less degree. Nitrogen is a gas without colour, taste, or smell. It forms, without combination with other elements, about four-fifths of the air we breathe, and in combination with other substances occupies a large place in nature. Nitrogen combined with hydrogen forms ammonia, a gas that is formed in the decomposition of vegetable and animal substances containing nitrogen, and which is distinguished by its pungent odour. Combined with both hydrogen and oxygen again, nitrogen forms *nitric acid* or *aqua fortis*; and if in nitric acid some metal like sodium is substituted for the hydrogen of the acid we have formed a *nitrate*, in this case the nitrate of sodium. Under certain conditions of temperature and moisture, the nitrogen of vegetable and animal substances is rapidly changed, through the instrumentality of microbes, into nitric acid and the nitrates. This process is known as nitrification.

Nitrogen as it exists in the uncombined state in the atmosphere is available to plants only in a limited and obscure way. The great class of plants known as leguminous undoubtedly take uncombined nitrogen from the air. Nitrogen in the form of ammonia is taken by certain plants directly from the atmosphere, while others utilise the ammonium salts existent in the soil. But by far the largest part of nitrogen used by plants is taken through their roots in the form of nitrates. It is in this form that nitrogen is most available and most valuable to growing plants.

Phosphorus.—Next to nitrogen, phosphorus is the most costly ingredient of fertilisers, and that in greatest demand. Phosphorus, in the free or uncombined state, is nowhere found in nature. When isolated by the chemist it oxydises rapidly, taking fire at once if exposed to the atmosphere, the phosphorus uniting with the oxygen in the proportions of two atoms of the former to five of the latter. Most usually phosphorus is found united with oxygen and calcium (lime), the combination going under the name of phosphate of lime or calcium phosphate. It also combines variously with potash, soda, alumina, and other metals.

The chief sources of our supplies of phosphoric acid for use as fertilisers are: 1st. Bones, fresh or otherwise; 2nd. Deposits of animal remains found in caves along the Queensland coast and elsewhere in tropical countries; 3rd. Fossil remains of animals, chiefly excrementitious matters; 4th. A by-product of the process of smelting iron, known as Thomas Slag. Phosphoric acid in the form of phosphate is found in small amounts in all soils, but is rarely abundant. These soil phosphates being only sparingly soluble, yield a moderate but steady supply of plant food from year to year, and thus are placed beyond the power of the husbandman to waste them.

Phosphoric acid is found in three principal forms; *soluble phosphoric acid* implies phosphoric acid that is freely soluble in water. This form, whatever its origin, tends slowly towards the second form of *reverted phosphoric acid*, which is insoluble in water but soluble in ammonium citrate. Experiments show the soluble and reverted forms of phosphoric acid to be nearly equally valuable as plant food. *Insoluble phosphoric acid* is often unavailable to plants on account of its insolubility. Very fine grinding of the materials, treatment with sulphuric acid, or subjecting them to the influences of decay, are some of the means by which the insoluble phosphates are fitted for use in the field.

Potassium.—This element, like phosphorus, is never found in a free state in nature. It is a constituent of many minerals: united with oxygen, in the proportions of two atoms of potassium to one of oxygen, we have the potash of commerce. Potassium, as a constituent of fertilisers, ranks next to phosphorus in costliness. In plants, soils, and fertilisers it exists as chloride, sulphate, carbonate, &c. It is most costly in the form of sulphate and cheapest as chloride (muriate). The supply of potash, used as fertilisers in Queensland, comes chiefly from wood ashes, very variable in quality but everywhere abundant, and small quantities of Kainit recently imported from the celebrated Stassfurt mines of Germany. My own observations of Queensland soils lead me to believe that the forest lands, particularly those distributed along the coast, are often deficient in this element, and that in consequence fertilisers rich in potash might often be applied to great advantage.

Chapter V.

COMMERCIAL FERTILISERS.

By the term "commercial fertiliser" is meant any substance or artificial mixture put upon the market, under a peculiar name, for use as a fertiliser. The value of manures and the profitableness of manuring are rarely questioned by practical men, but the policy of using commercial fertilisers for soil amendment is a constant subject of debate. Abundant experience has shown us that great crops are possible from the use of artificial manures, but large crops are not necessarily profitable ones. It may often happen that to produce an extra ton of cane or bushel of maize per acre requires an outlay for manure that carries the cost of the entire crop beyond the line of profit. The view all along held by conservative farmers has been that commercial manures were profitable only when applied in special cases—to give particular crops an early start, to stimulate worn-out lands to the production of manure-making crops, and in particular to reinforce the supply of home-made dung. This view of the function of commercial fertilisers in the economy of the farm has undoubtedly been considerably modified in recent years. Commercial fertilisers now find a larger and more profitable general use than ever before: where a few used them occasionally, and for a special purpose, the many now give them a large place in every year's operations. The present cheapness of these fertilisers, their great variety and excellence, due largely to the utilisation of the wastes of manufacturing establishments, have contributed to the modern change of sentiment respecting their use.

Soil Residues.—The common charge made against commercial fertilisers is that they act, like alcohol in the animal body, as mere stimulants to growing crops, leaving the soil hungrier and more attenuated than before with each crop grown by them. Doubtless this idea owes its inception to the fact that a few hundredweight per acre, more or less, of a concentrated fertiliser is quickly parted with by the soil, leaving none of the residual humus, that more or less permanent form of fertility which remains after a dressing of farm-yard dung. This fact is strikingly shown in the experiments of Messrs. Lawes and Gilbert. The manuring given certain plants, their average produce, with the alteration in the nitrogen content of the first nine inches of soil, during sixteen years, is shown in the table here reproduced :—

Plot.	Manures per acre annually supplied—1865-1881.	AVERAGE PRODUCE PER ACRE.		NITROGEN PER ACRE IN FIRST 9 INCHES OF SOIL.		
		Dressed Grain.	Total Produce.	1865.	1881.	Gain (plus) or loss (minus) in 16 years.
		bshls.	lb.	lb.	lb.	lb.
3	Unmanured... ...	$11\frac{1}{8}$	1,715	2,507	2,404	−103
5A	Mixed mineral manure	$12\frac{3}{4}$	1,963	2,574	2,328	−246
10A	Ammonium salts, 400 lb.	$17\frac{7}{8}$	2,881	2,548	2,471	−77
11A	Ammonium salts with superphosphate	$23\frac{1}{4}$	3,856	2,693	2,676	−17
7A	Ammonium salts with mixed mineral manure	28	4,993	2,829	2,908	+79
9A	Nitrate of sodium, 550 lb., and mixed mineral manure	36	6,949	2,834	2,883	+49
16A	Unmanured... ...	$13\frac{1}{2}$	2,194	2,907	2,557	−350
2	**Farmyard manure, 14 tons**	**$31\frac{1}{2}$**	**5,356**	**4,329**	**4,507**	**+173**

The great difference in the results obtained from the different applications is apparent in this table, but in nothing is this disparity seen as in the marked decline or small gains of soil-nitrogen shown in all except the plot receiving farmyard manure. Speaking to this point, Mr. Robert Warrington, an associate of Lawes in the work at Rothampstead, says :—"The plots which have received farmyard manure show, as in the wheat experiments, the largest amount of nitrification; in the barley experiments there is, however, a point of special interest. After twenty years' continuous application of farmyard manure, the plot was divided, and one-half has since received no manure. The sampling of the soil took place ten years after the application of farmyard manure had ceased. The effect of the residue of the previous manuring was, however, still very apparent. The soil contained both more nitrogen and more nitric acid than any other plot, save the one continuously treated with farmyard manure. We have here a striking example of the slowness with which residues of farmyard manure decompose in a clay soil. The effect of the old manuring is very distinctly seen in the crop."

This writer points out that the variation of the nitrogen residues of the soil shown in the table depends not so much upon the amount of nitrogen supplied in the manure, as upon the size of the crop obtained from the different applications. "The figures in the table show, however, that the nitrogen in the soil did stand in a plain relation to the amount of crop grown on the land. Where the ammonium salts were applied without ash constituents—Plot 10A—the produce was the smallest, and so is the nitrogen in the soil; and this nitrogen, like the crop, is a diminishing quantity. Where superphosphate was supplied with the ammonia, the crop is considerably increased, and so is the nitrogen of the soil, which has shown little change in sixteen years. Where the ammonia is used with a full supply of ash constituents the produce is the largest; the nitrogen, too, is largest, and shows a tendency to rise."

Without touching the question of profits—which is quite another matter—these experiments indicate very clearly that chemical fertilisers applied to suit the wants of soil and crop are not necessarily an injury to soil—may, indeed, be a lasting benefit to it.

Market Fertilisers used at a Profit.—The profits growing out of the use of commercial manures are chiefly dependent upon the cost of the fertiliser and the price of the resultant crop. Like ploughing, fallowing, or draining, therefore, the use of purchased fertilisers is to be determined by economical considerations, and not by chemical or other theories concerning them. The writer offers, without argument, a few of the practical considerations likely to be helpful to the farmer who contemplates using them.

1. It may be questioned whether commercial fertilisers can ever be profitably used with crops of low average value, the profits of which come through the cultivation of large areas of cheap land by the use of improved machinery. Wheat, at present prices, with other grain crops and the grasses, generally clearly come within this category. After five years of continuous experimental cultivation of wheats and oats, and six years with maize, using a great variety of fertilisers on a considerable scale, the Director of the Ohio (U.S.A.) Agricultural Experiment Station thus comments on the results of the work: "At present prices of cereal crops and of fertilising materials respectively, the profitable production of corn, wheat, and oats upon chemical or commercial fertilisers or upon barnyard manure, if its cost be proportionate to that of the chemical constituents of fertility found in commercial fertilisers, is a hopeless undertaking, unless these crops be grown in systematic rotation with clover or a similar nitrogen storing crop; and the poorer the soil in natural fertility the smaller the probability of profitable crop production by means of artificial fertilisers.

2. They have an undoubted position in practical farming in piecing out or reinforcing the natural supply of farm dung, and, even where the home supply is ample, an addition to it of some concentrated fertiliser may often be made to advantage Lawes and Gilbert have shown that mineral elements available to the wheat crop are greatly in excess of nitrogen supplied in farmyard manures. Hence nitrogenous manures, added to that obtained from the barnyard, gave a largely increased yield. This idea ought not to be lost to colonial sugar-growers. The great masses of fermenting megass so often seen about the plantations might easily be made the basis of a really valuable fertiliser by treatment something as follows:—Give to the megass a liberal dressing with lime to reduce acidity and promote nitrification; then, after applying the megass in quantity such that it may be readily turned under, give the land (subject to such modification as the condition of the soil suggests) 200 lb. sulphate of ammonia, with 250 lb. of bone meal and an equal quantity of kainit.

3. They may often be used to great advantage, in conjunction with some green crop like the cow pea, in lifting worn-out soils into profitable condition. A dressing of, say, 300 lb. of kainit or equivalent

potash fertiliser per acre, with 250 lb. of bonedust, if applied the preceding autumn, might be expected to give a green crop sufficient to furnish to the soil a large supply of needed nitrogen.

4. Special manures are frequently in demand by Queensland soils deficient in one or more of the elements of fertility. Along the coast and in "forest" soils the want often is potash, or it may be nitrogen, or the phosphates. To give such soils a complete manure (one containing nitrogen, phosphoric acid, and potash) like farmyard dung, would, aside from the waste of the operation, fail to meet the requirements of the soil.

5. What the soil requires and how much in the way of artificial fertilisers, cannot, as has been shown, be determined by a chemical analysis or from purely theoretical considerations. Our only recourse is actual trial of the different fertilisers representative of the three elements of value in manures. The differences of soils, in respect to fertility, and the variable demands of crops upon them, is the explanation of this fact. The farmer who would know what his soil needs must resort to the same means he is accustomed to employ in learning the capacity of his farm in other respects, for wheat, or maize, or sugar-cane, for example. This is best done by dressing small areas of land designed for planting, with ammonia sulphate, bonedust, kainit, or wood ashes, and mixtures of these in measured quantities, and carefully noting the results. The conclusions reached as a result of such experimental undertakings are not likely to be set aside by the results of subsequent field work.

Manures for Special Crops.—A long experience with artificial fertilisers has taught the English farmer that, under the conditions there prevailing, certain crops have a special affinity for particular manures. The grasses, generally, it has been found, give best returns for the use of the nitrates, while leguminous crops (lucerne, clovers, peas, beans, &c.) are most favourably influenced by mineral manures, and root crops, particularly turnips, by superphosphate. In a similar way it is shown that phosphates must, except with very run-down soils, be a prominent ingredient of all manures designed for the sugar-cane, too much of the nitrates tending to give excessive growth of stalk and blade, with low density of the juice and hard milling qualities. Tobacco and potato growers again are cautioned against the use of muriate of potash as an application to these crops, as tending to give a bad burning leaf in the one case, and sogginess and bad flavour in the other. These facts, to my mind, suggest caution in the use of artificial manures, and nothing more. They represent undoubted tendencies which generally may be heeded, in practice to advantage, but which upon particular soils may be ignored to equal advantage. For example, a heavy crop of cow peas, with its great burden of nitrogen turned into a soil of moderate fertility, may be expected to give a profitable crop of cane, while a dressing of well-rotted dung is often the one thing necessary to a successful crop of potatoes or tobacco. All this leads to the remark that the so-called special manures—"potato manure," "cane manure," and the rest—with which enterprising manufacturers have loaded the markets, are, taking all the circumstances of farming into account, even when honestly made, likely to prove a disappointment. Professor S. W.

Johnson, than whom there is no higher authority, says, concerning the analysis of certain special manures: "An examination of these analyses and those of special fertilisers made in past years abundantly justifies the conclusion that on the farms of this State it is quite as rational to use a 'corn manure' on potato land as a 'potato manure' for the tobacco crop, as any other way. To attempt to construct a fertiliser specially adapted to growing a particular crop on soils which differ so widely in composition, and have been so differently fertilised and tilled as those of Connecticut, is irrational and useless. Objection to these goods only applies to their names, and to the theory on which they are made and on which their special claim rests." This is in all respects as true of Queensland as it is of the American State.

The old idea of the commercial fertiliser was that it should be so compounded as to return to the soil as nearly as possible the exact amounts of those elements which were removed by the crop. Doubtless this is the theory underlying the compounding of many special manures now in the market. The familiar practice before referred to of applying mineral manures to leguminous crops rich in nitrogen, superphosphates to root crops deficient in phosphates, and nitrogenous manures to grass lands certainly not abounding in nitrogen, seems to show how often well-meant theories are set aside in practice. Speaking of their experiments, Lawes and Gilbert say: "There is no conceivable condition of chemical combination and of distribution within the soil in which the various constituents could be annually supplied so as to be all annually taken up by growing vegetation. . . . Further experience teaches that, in the actual conditions of our soils and of agricultural practice, the exact composition of the crops we remove or wish to grow is no direct guide to the description and the amount of manurial constituents which will be most effective. It is, then, under the existing conditions of practical agriculture, certainly not necessary to supply to the land all the constituents that have been removed from it, or that would be contained in the crops it is wished to grow."

NITROGENOUS FERTILISERS.—The absence of a sufficient supply of nitrogen in the soil is speedily shown by a feeble, spindling growth of plants of a pale-green or yellow colour. The first effect of abundant nitrogen in the soil is to greatly promote the growth of branches and foliage at the expense of flowers and seed. The foliage assumes the deep-green colour which we are accustomed to associate with perfect plant healthfulness, and the growth of stems and leaves is likely to be continued past the time when, normally, the energies of the plant are directed towards seed production. Nitrogen alone tends to give a late crop, deficient in seed, but having abundant coarse, lush stalks and foliage.

In Queensland nitrogenous manures can scarcely be said to have a place in the market. Stable manure is generally used and appreciated probably at its full value; this, with smaller amounts of the refuse of meat works, breweries, and tanneries, and sulphate of ammonia, nearly completes the list of artificial supplies of nitrogen used by Queensland cultivators. Our feeble interest in this question is shown by the fact that not one of the gas companies of the colony utilises its liquors in the manufacture of the sulphate of ammonia;

while, except in the case of one establishment, all the blood and much of the tankage and other refuse of meat-works and slaughter-houses is carted away as waste, to be disposed of by the least laborious method available. The following are a few of the more common of the nitrogenous fertilisers in the market:—

NITRATE OF SODA, sometimes called Chili saltpetre, is obtained from certain desert regions of South America, particularly Peru, where it forms in places a crust over the soil. With every 100 lb. of pure nitrate of soda there are 63 lb. of nitric acid, equivalent to nearly 16½ lb. of nitrogen and 37 lb. of soda. This nitrate is one of the quickest acting of the manures of commerce. On this account it is customary to apply it in the spring, or even upon the growing crop. It is very commonly used to reinforce other manures—stable dung, for example—deficient in nitrogen, although it is often used alone to stimulate the early growth of garden vegetables, and even flowers. In England 100 lb. to 150 lb. are often applied per acre, in connection with a dressing of stable manure.

SULPHATE OF AMMONIA is produced in the treatment of the ammoniacal liquor of gasworks, with sulphuric acid. Generally speaking, ammonium compounds find less favour with the farmers than do the nitrates. Every 100 lb. of the sulphate contains about 25 lb. of ammonia, equivalent to about 20½ lb. of nitrogen. It is put to substantially the same uses for which the nitrates are employed, and, like them, should be applied to growing crops and in frequent small doses, otherwise the loss from leaching will be great.

PERUVIAN GUANO is obtained from certain rainless islands on the coast of Peru; it collects as a result of the constant droppings of sea fowls. This is a very concentrated and active form of nitrogenous fertiliser. The purest quality contains 12 to 13 per cent. of nitrogen, and nearly an equal amount of phosphoric acid. Accumulations similar to those of the Peruvian coast occur at various points on the Queensland coast. These, however, are wanting in nitrogen, this element having been lost through the leaching action of the prevailing rains.

Other important sources of nitrogen mostly available to the Queensland farmer, with the percentage of contained nitrogen in parentheses after each, are:—Dried blood (10 per cent.), tankage (7 per cent.), cotton-seed meal (7 per cent.), horn and hoof waste (13 per cent.), meat scrap (10 per cent.), wool waste (6 per cent.).

It is possible for nearly all farmers to maintain this costly, easily lost, element nitrogen with only the occasional necessity for resorting to purchased supplies of nitrogen. The dung of grain-fed horses is a valuable, generally accessible manure rich in nitrogen; blood and the various other waste of meat works and slaughter-houses, often containing as high as 11 per cent. of nitrogen, are a few of the other nitrogenous fertilisers which come within the means and circumstances of many cultivators. Withal, it should never be forgotten that in the cow pea crop we have, as pointed out in a previous chapter, a means of restoring the fertility of lands, *at wholesale*, that is within the reach of every farmer owning a team and a plough.

PHOSPHORIC ACID MANURES.—Phosphatic manures in various forms are more generally and extensively used in Queensland than either nitrogenous or potash fertilisers or both combined. The great abundance and cheapness of fertiliser materials rich in the phosphates in part explains their popularity with colonial farmers.

Phosphoric acid plays an important part in the life of all plants, albeit its precise function in plant nutrition is not clearly made out. Undoubtedly it aids in the nutrition of plants, besides giving them the ability to assimilate other ingredients, particularly mineral elements. The phosphates induce an early development and maturity of the plant, especially in its seed, on which account it is valuable in balancing in the plant excessive growth of leaf and stalk induced by nitrogenous applications.

Bone is the principal source of the phosphatic manures in use in Queensland. As a rule, these manures are either ground bone or the residual products of the digestors of meat works (tankage), although phosphatic guanos, obtained at various points in the tropical section of the colony, are finding favour with the considerable number of farmers who have tried them. Ground bones, however, on account of their abundance and cheapness, are likely to hold their own in the market for phosphates for years to come. Bone phosphate, existing in the form of a tri-calcite (three-lime) phosphate makes up about 90 per cent. of the ash or earthy ingredients of bone. A good article of ground bone should contain about 23 per cent. of phosphoric acid and 4 to 6 per cent. of nitrogen. The value, however, of bone dust as a fertiliser is not contingent alone upon the amount of nitrogen and phosphoric acid which it contains, as will be inferred from the following statements of fact:—The three-lime phosphate is insoluble in water, but dissolves in acid and solutions of certain salts; it may by chemical treatment be converted into one-lime phosphate (*superphosphate*), in which condition it is readily soluble in water. Again, green bone contains much fat, which hinders decomposition, cutting off each particle of bone from the solvent action of plant roots and soil water.

Bone dust is, other things being equal, valuable in proportion to the fineness with which it is ground. This fine bone dust decomposes rapidly, liberating at once its contained nitrogen and phosphoric acid. The importance of fine grinding is shown by the relative values assigned by chemists to the nitrogen and phosphoric acid found in ground bones. Storer tells us that at the New Haven (Connecticut) laboratory the nitrogen and phosphoric acid of bone dust that passes through a sieve whose meshes measure $\frac{1}{50}$-inch is valued at 9d. and 3d. respectively. That from bone which escapes through meshes between $\frac{1}{25}$ and $\frac{1}{12}$-inch is rated at 7d. and $2\frac{1}{2}$d., while everything larger than $\frac{1}{6}$-inch has its nitrogen and phosphoric acid rated at 5d. and 2d. the pound. The old plan was, and is now, in Queensland, to some extent, to haul to the field roughly broken fragments and splinters of bones, at the rate of one to two tons per acre, which were ploughed under in the usual course of tillage operations. A more wasteful method of handling a valuable fertiliser can with difficulty be conceived. Such coarse fragments of bone are, undoubtedly, lasting in the soil, but their influence is always feeble. Two annual dressings of 400 lb. each of finely-ground bone dust would, under nearly all conditions of soil and climate, give greatly larger crop returns than this excessive application of coarse bones. *Finely*-broken bones worked into the ground, in liberal quantities about such permanent occupants of the soil as fruit trees, vines, &c., are often advantageous in assuring the plantation steady supplies of plant food. But even here the same amount applied in annual small doses of finely-ground dust would, besides acting more quickly, on the whole give greatly better results.

There are in vogue various methods of reducing bones other than that of grinding. A common and successful practice is to prepare a pit or other water-tight receptacle—even barrels or hogsheads are used for the purpose—and placing in this bones and wood ashes in alternate thin layers, keeping the mass constantly moist. At the expiration of a few months the bones are found so much disintegrated that they crumble to a powder under slight pressure. In like manner, bones kept in a damp manure pile become friable and soft, although the time required for such reduction is greater than in the treatment with ashes.

Superphosphate of Lime.—This highly valued phosphate has never received much attention from the cultivators of Queensland. Nor is it likely or particularly desirable that it should compete in a market that already is overstocked with the cheap products of the meat works and numerous boiling-down establishments of the colony. The reforms most needed in the preparation of fertilisers desired for colonial use are the most careful conservation of the wastes of slaughtering establishments, particularly blood, and greater attention to the reduction by grinding or otherwise of the abundant supplies of phosphatic materials. While superphosphate has little more than theoretical interest for Queensland farmers, it might without doubt often be hopefully used in the case of several crops; in giving an early growth to plant cane, and particularly with potatoes and in gardening operations generally.

The superphosphate of lime does not occur in nature. As before shown, the phosphate of lime exists in bones in the form of an insoluble tri-calcite, which when treated with sulphuric acid becomes the soluble mono-calcite (one-lime) superphosphate. By treatment with sulphuric acid a portion of calcium is taken from the phosphate and united with the sulphuric acid, forming the comparatively valueless sulphate of lime. This sulphate, with the soluble phosphate remaining, forms the superphosphate of commerce. Storer gives the following method of manufacturing "home-made" superphosphate, which serves, besides, to illustrate the principle of its manufacture:— "Pour 50 lb. of oil of vitriol (sulphuric acid) into a volume of water equal to that of the acid, stirring the water meanwhile with a stick. Pour this diluted acid upon 100 lb. of bone meal that is contained in a wooden trough, and stir the meal carefully with a hoe. The product admits of being dried, after a fashion, by stirring it up with earth or with gypsum." In the manufacture of lime superphosphate great care is required in apportioning the acid to the raw phosphate. Where an excess of acid is used, aside from the waste of acid, the product is a pasty mass that is handled with difficulty. Where, on the other hand, a too small quantity is employed, the dissolution of the raw phosphate is very imperfectly accomplished, and thus the solubility of the entire mixture is affected.

Other sources of phosphates available as manures are the spent bone black obtained from sugar refineries, containing 58 per cent. of the phosphate of lime; bat and other guanos, very variable in composition but often really excellent fertilisers; and the modern Thomas Slag, a by-product of the manufacture of iron and steel, containing from 19 to 30 per cent. of phosphoric acid in a form easily utilised by plants.

Potassium Compounds.—It is not easy to state precisely the rôle which potash plays in the nutrition of plants. Its deficiency in any soil is made speedily manifest by the enfeebled growth of the crop it bears; although the plants do not perish outright where potash is lacking in the soil. It contributes greatly to the growth of wood and the fleshy parts of fruits, and in a remarkable degree gives tone to growing plants. Trees, for example, which fail to set their fruit after flowering, or drop their fruit prematurely, may often be cured of these bad habits by a liberal use of some potash fertiliser. All soils contain potash in greater or less quantity, but the amount made annually available to plants is not large. The loss of potash through the action of drainage water is small. The tendency in most soils is to change soluble potash into a more insoluble form which is only slowly redissolved to meet the requirements of growing crops.

The following are the more familiar forms in which potassium compounds are used as fertilisers:—Kainit, wood ashes, muriate of potash, chloride of potash, nitrate of potash (saltpetre), cotton-seed hull ashes (24 per cent. potash), and tobacco stems (6 per cent. potash).

Kainit.—This form of potassic fertiliser has recently been introduced to Queensland cultivators with whom it has found favour. It comes to us from the celebrated mines located in and about Stassfurt, in North Germany. Kainit is a crude mixture of several compounds, chief of which are chloride of sodium (common salt) with the sulphates and chlorides of potassium (13 per cent.), sodium, and magnesium. In view of the fact that materials like common salt, of slight or doubtful value to the soil, make up nearly 80 per cent. of kainit, the question of refining away these crudities in the interest of cheapened transportation, if for no other reason, should receive the attention of manufacturers and vendors of this commodity. Kainit is recommended particularly for light soils, which, it is claimed, are rendered very compact and retentive of moisture by it. It may be applied for all the uses to which the muriate of potash is put. Experience shows that for tobacco, potatoes, and sugar beets kainit should not be used, as it injures the burning qualities of the tobacco, and is prejudicial in various ways to the other crops mentioned. As much as 700 lb. of kainit are used per acre, although the amount commonly used is much less than this. Its best effects are seen when used in connection with some nitrogenous or phosphatic fertiliser. Bone dust may be used to excellent advantage in this way, using equal weights of each.

From Europe and America come reports of the very effective use of kainit on soils infested with wire worms, cut worms, and the other forms of insect life hibernating or living in the soil. Experience had here and there seems to show that in Queensland it is equally useful in dealing with this numerous class of insects. Repeated trials, made by the writer, show that the destructive "grub" of Queensland cane-fields is apparently not in the least inconvenienced by the presence of kainit, in large quantities, in the soil infested by this pest.

Sulphate of Potash.—This is another product of the North German mines which is much in vogue as a fertiliser. It is the basis of nearly all of the potash fertilisers on the market; it is costlier but much more efficient, in general experience, than the muriate. This form of potash is obtained with difficulty in the pure state, it being very commonly mixed with the cheaper muriate. Pure potassium sulphate contains about 50 per cent. of potash, although the article usually found on the market will rarely give more than 35 per cent.

Nitrate of Potash or saltpetre is a valuable fertiliser on account of both the nitrogen and potash which it contains. The demand for this chemical in the manufacture of gunpowder has carried the price beyond the point at which it can be used as a fertiliser.

Cotton Seed Hull Ashes are in great demand in America as a fertiliser for the tobacco crop. They vary a good deal in composition, yielding from 15 to 30 per cent. of potash and 5 to 10 per cent. of phosphoric acid. Bright ashes—those white in colour—show a much larger proportion of contained potash than the dark coloured article.

Wood Ashes.—The amount of potash contained in wood ashes varies greatly in the different varieties of trees. Speaking from observation alone, my impression is that the ashes obtained from our forest trees are often deficient in potash, while those from the scrub timbers, including the mangrove, are often rich in this mineral. It exists in wood ashes, mainly in the form of a carbonate, the amount varying between 4 and 7 per cent. Wood ashes that have been exposed to the action of water (leached) are worthless as fertilisers. Coal ashes contain no element of value as a fertiliser, and, except as they are of occasional advantage in meliorating heavy soils, are worthless as a manure.

Lime or Carbonate of Calcium. — Lime is a necessary ingredient of every agricultural soil. Without it plants cannot grow. Further, there are few soils that do not contain it in quantity sufficient for the needs of every crop. On this account lime is rarely applied as a direct fertiliser; its value depends chiefly upon its marked ability to improve the texture of soils, particularly heavy clays, and to hasten the decomposition of mineral and organic matters of the soil. This latter effect, in the opinion of Storer, "is probably one of the most important produced by lime." (Agriculture, Storer, vol. 2, p. 146.) Besides, lime fixes in the soil valuable materials like ammonia and potash, which otherwise might be lost; it reduces acidity in soils, binds together the particles of loose sands, and often destroys insects, worms, and fungi infesting soils. Withal lime has small place in the agriculture of Queensland, I am persuaded. Its cost probably precludes its use in improving the texture of clay lands, and in this climate, its effect, whatever it might be in decomposing organic materials in the soil, would be a positive injury to the great majority of our soils, which already part too freely with their organic contents. Colonial farmers who may wish to put in practice, in Queensland, old country ideas in respect to liming land will do well to bear in mind the difference in the demands which climate, soil, and crop make upon the cultivator in Queensland and in Great Britain.

Considerations in Purchasing Fertilisers.—As a rule it will be found that the more concentrated fertilisers, while expensive in first cost, are cheapest in the end. In purchasing these concentrated forms of fertility, we save freight and storage charges, in the first instance, and much heavy work in subsequent handling. For example, a ton of sulphate of ammonia, costing £12, will contain something more than three times the nitrogen contained in a ton of tankage, costing £4 per ton. The gain to the farmer in this case in handling and applying the concentrated sulphate will appear to every practical man. Fertilisers cannot be too finely ground and screened. We have already shown that the value of bone dust is dependent directly upon the fineness with which it has been reduced, but, to a certain extent, this is true of all classes of fertilisers. Again, excessive moisture is undesirable in fertilisers. Besides adding to the weight and cost of the fertiliser containing it, moisture adds to the labour of handling, and induces a more or less rapid decomposition in fertilisers of organic origin.

Valuation of Fertilisers.—To most farmers who use purchased fertilisers, the chemical guarantee which accompanies the goods is of small significance. The purchaser knows, in a general way, that the manure is chiefly valuable for the nitrogen, phosphoric acid, and potash which it contains; but the varying shades of value in the different forms of nitrogen, and the relative value of the three ingredients themselves, he does not, as a rule, concern himself about. Where the fertiliser trade has assumed considerable proportions, manufacturers guarantee the particular article sold to contain such a per cent. of nitrogen, phosphoric acid, or potash, as the case may be. Generally this guarantee is subjected to constant test by analyses made by a competent government chemist, who certifies to the character of the goods examined by him. Where, as in Queensland, there is no Government oversight of the business in commercial fertilisers, we must rely wholly upon the honesty of the manufacturer, unless we care to go to the expense of securing a private analysis of each package of fertiliser bought, which, it is needless to say, few purchasers care to do.

The value of a fertiliser is its market price, and not its efficiency in the soil, as shown by the increased crop which it gives. This value, then, may be less or more than its real value, although for business reasons the two values are not likely to be kept widely separated for any considerable length of time. How this market value of a given fertiliser may be estimated is shown in what follows.

In the entire absence of Queensland data, I use here the trade values of fertilising ingredients adopted by the American experiment stations, although most likely they average too high, by nearly or quite one-fifth, to suit Queensland conditions.

	Price per lb. in pence.
*Nitrogen in ammonia salts	$8\frac{1}{2}$
Nitrogen in nitrates	$7\frac{3}{4}$
Nitrogen in meat, blood, and mixed fertilisers ...	$8\frac{3}{4}$
Nitrogen in fine-ground bone and tankage ...	$7\frac{1}{2}$
Nitrogen in coarse bone and tankage	$3\frac{1}{2}$
Phosphoric acid, soluble	$3\frac{1}{4}$
Reverted phosphoric acid	3
Phosphoric acid in fine bone and tankage ...	3
Phosphoric acid in coarse bone and tankage ...	$1\frac{1}{2}$
Phosphoric acid in wood ashes	$2\frac{1}{2}$
Potash, high grade sulphate	$2\frac{3}{4}$
Potash, kainit	$2\frac{1}{4}$
Potash, muriate	$2\frac{1}{4}$
Organic nitrogen in mixed fertilisers	$8\frac{3}{4}$
Insoluble phosphoric acid in mixed fertilisers ...	1

Chemical analyses often show the three elements in combination not referred to in this tabulation. There the nitrogen may be given as ammonia or the potash may appear as the chloride or sulphate, in which case it will be necessary to reduce such compounds into their equivalents of the element or other compound required. These conversions may be made by the use of factors as shown below:—

1. To change ammonia into equivalent nitrogen, multiply ammonia by ·8235.
2. To change nitrogen into equivalent ammonia, multiply nitrogen by 1·214.
3. To change muriate (chloride) of potash into equivalent potash, multiply muriate by ·63.
4. To change potash into equivalent muriate of potash, multiply potash by 1·585.
5. To change sulphate of potash into equivalent potash, multiply sulphate by ·54.
6. To change potash into equivalent of sulphate of potash, multiply potash by 1·85.
7. To change phosphoric acid into equivalent phosphate of lime, multiply phosphoric acid by 2·183.
8. To change soluble phosphate into equivalent phosphate of lime, multiply soluble phosphate by 1·325.

How these tables are used will be best seen by means of an example. Suppose one of the mixed fertilisers common in the markets be purchased, which is guaranteed to contain—nitrogen 3 per cent., soluble phosphoric acid 6 per cent., reverted phosphoric acid 4 per

* These data, and much of the tables that follow, are taken from Bulletin 55 (new series) of the New York (U.S.A.) Agricultural Experiment Station, prepared under the direction of Dr. Peter Collier.

cent., potash 2 per cent. The commercial value, first of 100 lb. of this fertiliser and then of one ton (2,240 lb.) will be shown in the following calculation :—

	s.	d.
3 per cent. nitrogen—in 100 lb., 3 lb.—at $8\frac{3}{4}$d.	2	$2\frac{1}{4}$
6 per cent. soluble phosphoric acid—in 100 lb., 6 lb.—at $3\frac{1}{4}$d.	1	$7\frac{1}{2}$
4 per cent. reverted phosphoric acid—in 100 lb., 4 lb.—at 3d.	1	0
2 per cent. potash—in 100 lb., 2 lb.—at $2\frac{1}{4}$d. ...	0	$4\frac{1}{2}$
Value of 100 lb.	5	$2\frac{1}{4}$

Multiplying this value of 100 lb. ($62\frac{1}{4}$d.) by 22·4 gives us as the value of one ton (2,240 lb.) of this fertiliser, £5 16s. 6d.

To take another example, in this case a Queensland manufactured bone-dust. The analysis shows for this article the following composition :—

	Per cent.
Moisture	5·38
Organic substances (containing 3·78 per cent. nitrogen, equal to 4·59 per cent. ammonia)	40·10
Lime	29·15
Phosphoric acid (equal to 48·78 per cent. phosphate of lime)	21·42
Carbonic acid	1·06
Insoluble (sand, &c.)	0·72

The only ingredients of this fertiliser that have a money value are the nitrogen and phosphoric acid. Arranging these as before, and we have in tabular form the value of 100 lb. of this fertiliser with the calculations for one ton.

	£	s.	d.
3·78 per cent. nitrogen—in 100 lb., 3·78 lb.—at $7\frac{1}{2}$d.	0	2	$4\frac{1}{4}$
21·42 per cent. phosphoric acid—in 100 lb., 21·42 lb.—at 3d....	0	5	$4\frac{1}{4}$
Value of 100 lb.	0	7	$8\frac{1}{2}$
Value per ton of 2,240 lb. ...	8	12	8

It is possible for every user of commercial fertilisers in this way to estimate the value of any of the various goods that are offered in the market. The price here named is much too high for the Queensland markets. To get the actual selling price of this class of goods, delivered in Brisbane, without railway charges or the profits of middlemen, it will be necessary to reduce the price given by nearly 50 per cent. As before stated, the great bulk of slaughter-house refuse and the by-products of meat works and boiling-down establishments are utterly lost to agriculture. Of that which is manufactured and put in condition for use, by far the larger part goes out of the colony, largely to New Zealand. So long as this condition of things continues in the colony, the values of fertilisers will remain low, and for the most part no more than nominal.

Below are given analyses of a considerable number of fertilisers and fertilising materials—mostly from American sources—with estimated values. We wish to say again that these values are mostly too high for Queensland conditions. However, these prices given will be found useful in showing the *relative* values of different substances bought for fertilising uses, if for no other reason :—

COMPOSITION OF FERTILISERS AND FERTILISING MATERIALS.

—	Moisture.	Nitrogen.	Potash.	Phosphoric Acid.			Value per ton of 2,240 lb.
				Available.	Insoluble.	Total.	
Materials containing phosphates.							£ s. d.
Bone dust (Runcorn, Queensland)	8·68	3·64	...	...	...	23·29	
Bone dust (Lake's Creek, Queensland)	5·38	3·78	...	...	...	21·42	
Bone ash...	7·00	...	...	...	...	35·89	3 6 1
Bone black	4·60	...	...	..	...	28·28	2 12 8
Bone meal	7·47	4·12	...	8·28	15·22	23·50	9 8 4
Bone meal (free from fat) ...	...	6·20	...	...	...	20·10	9 19 4
Bone meal (dissolved)	..	2·60	...	13·53	4·07	17·60	4 15 5
Thomas Slag (English) ...	...	...	...	6·09	13·31	19·40	3 5 9
Guano (Rock Islet, Gulf of Carpentaria)	8·26	...	...	...	...	28·51	
Materials containing potassium.							
Cotton-seed hull ashes ...	7·33	...	23·80	...	...	8·50	6 19 7
Kainit	3·20	...	13·54	...	...	...	2 16 10
Muriate of potash	2·00	...	52·46	...	...	...	11 0 3
Nitrate of potash	1·93	13·09	45·19	...	...	...	18 19 1
Spent tan-bark ashes	6·31	2·04	...	...	...	1·61	0 17 11
Sulph. potash	1·25	...	38·60	...	...	...	9 18 1
Sulph. potash and magnesia...	4·75	...	23·50	...	...	...	6 0 7
Wood ashes (American) ..	12·00	...	5·50	...	...	1·85	1 16 10
By-products and refuse.							
Cotton hulls	10·63	0·75	1·08	...	..	0·18	4 17 10
Cotton-seed meal	...	6·52	1·89	...	...	2·78	6 9 2
Hop refuse	8·98	0·98	0·11	...	...	0·20	0 17 5
Linseed cake (new process) ...	6·12	5·40	1·16	...	...	1·42	5 0 9
Linseed cake (old process) ...	7·79	6·02	1·16	...	...	1·65	5 12 0
Malt sprouts	10·28	3·67	1·60	...	...	1·40	3 14 8
Oat bran...	8·19	2·25	0·66	...	..	1·11	2 3 4
Spent brewers' grains (dry) ...	6·98	3·05	1·55	...	...	1·26	3 3 7
Spent brewers' grains (wet) ...	75·01	0·89	0·05	...	...	0·31	0 16 7
Wheat bran	11·01	8·88	1·62	...	...	2·87	3 8 8
Materials containing nitrogen.							
Cotton-seed meal	6·80	6·66	1·62	...	...	1·45	5 17 7
Dried blood	12·50	10·52	...	...	...	1·91	9 0 8
Horn and hoof waste	10·17	13·25	...	...	...	1·83	4 15 1
Meat scrap	12·09	10·44	...	...	...	2·07	9 0 1
Nitrate of soda (pure)... ...	...	16·47	...	...	...	...	11 18 0
Sulphate of ammonia	1·00	20·50	...	...	...	...	9 16 1
Tankage	13·20	6·82	...	5·02	6·23	11·25	7 7 11
Tobacco stems	10·61	2·29	6·44	...	...	0·60	3 11 1
Wool waste	9·27	5·64	1.30	...	...	0·29	2 4 0
Castor pomace	9·98	5·56	1·12	...	...	2·16	4 15 8

By Authority: EDMUND GREGORY, Government Printer, William street, Brisbane.

[October, 1894.

Queensland.

DEPARTMENT OF AGRICULTURE, BRISBANE.

BULLETIN No. 4.

SECOND SERIES.

The Disease Affecting the Orange Orchards of Wide Bay,

AND

The Insect Pests Prevalent Therein.

BY

HENRY TRYON,

ENTOMOLOGIST.

The Bulletins of this Department will be sent free to such Individuals interested as may request them. Address all applications to "The Under Secretary for Agriculture, Brisbane."

BRISBANE:

BY AUTHORITY: EDMUND GREGORY, GOVERNMENT PRINTER, WILLIAM STREET.

1894.

PREFACE.

This Report, which was at first intended for private information, has a most important bearing, relating as it does to a branch of the Agricultural Industry that is rapidly assuming large proportions in Queensland. And as the area under citrus fruit is yearly being increased, and insect pests are so much dreaded, it has been considered advisable to issue this Report in bulletin form, in the hope that it will not only prove of interest to our Orange-growers but benefit them by affording such instruction whereby they will be enabled to combat the attacks of those insects to their advantage and profit.

Department of Agriculture,
October, 1894.

REPORT ON A SO-CALLED DISEASE AFFECTING THE ORANGE ORCHARDS OF WIDE BAY, AND ON INSECT PESTS PREVALENT THEREIN.

Prior to instituting this inquiry, it had been announced that the orange orchards of the Maryborough district were "getting diseased, and that, in spite of all the growers could do, it (the disease) was spreading"; that "some of the orchards looked incurable"; and that, "if the disease was not checked at once, in five years there would not be an orange in the district." At the outset, then, the assurance may be given that the facts elicited in the course of the present investigation have served to warrant the assertion that there is no justification for this extreme view of the situation; that, in fact, there exists no disease—strictly so called—that is affecting any particular orchard, much less one generally prevalent in the orange plantations of the district.

The inquiry alluded to has involved the inspection of the following orange orchards and farms on which a greater or less number of citraceous plants were being grown:—

Mary River.—Woodman's Orange Grove (W. Perry); Cheyne's Gardens (W. Ely); Bridge Orchard (M. McGreggor); and Victoria Farm (G. A. White).

Tinana District.—Mount Grove Orchard (P. Brennan); Teddington Road Farm (J. Park); Melrose-Gympie Road (F. Copeley, H. Habbler, and four others).

Burrum River.—Whitby Farm (M. Walker); Sheffield Farm (H. Smith); Ark Farm (N. Richards); and the orchard owned by E. A. Burgess.

Tiaro District.—Cowal, Mount Bauple (A. McKellar); Bryium (P. Biddles); River Bank (L. H. Biddles).

The majority of citraceous trees grown in these orchards were found to be infested by injurious insects, and these, the symptoms denotive of their presence, and the changes to which they had given rise were generally spoken of by the growers as "disease." These injurious insects, with one exception—a species of "Soft Scale," *Lecanium*, sp.—were such as are already known to occur on fruit trees in other parts of the colony also. Some of them, it may be remarked—as, for instance, the Circular Black Scale (*Aspidiotus ficus*)—did not range throughout the entire district, nor was any one of them everywhere so prevalent as to occasion general apprehension. The principal plant pests which were observed are the following:—The Orange Fruit Mite (*Phytopus oleivorus*); the White Scale (*Chionaspis citri*); the Circular Red Scale (*Aspidiotus coccineus*); the Circular Black Scale (*Aspidiotus ficus*); the Long Mussel Scale (*Mytilaspis gloveri*); and the Soft or Black Scale insects, *Lecanium longulum*, *L. depressum*, *L. hesperidum*, *L. hemisphericum*, and *L.*, sp. indet. In addition, the work of the larvæ of beetles, popularly designated "borers," was not infrequently noticed; also a "bark canker" of doubtful origin affected certain trees in two or three different orchards.

FRUIT MITE (PHYTOPUS OLEIVORUS)—FRUIT DISCOLOURATION, OR "MAORI ORANGE."

This malady of the orange which, though noticeable elsewhere, was especially prevalent in some of the orchards along the banks of the river Burrum, in some instances affected a large proportion of the fruit. The following symptoms characterise its presence:— The fruit is covered to a greater or less extent with a brown stain which not infrequently involves the entire surface, the natural hue being in the latter event entirely obscured. This discolouration is sometimes even almost black, and, as also the malady seldom affects all the fruit upon a tree whereon it occurs, the contrast between the ordinary-coloured oranges and these which are modified in the manner described is a very striking one. The fruit exhibiting these symptoms maintains its rounded form; but, when this change has early supervened, is smaller than it should otherwise be, readily yields on pressure, and exhibits an evident loss of elasticity. In the latter event, too, the flesh is soft, discoloured, and decidedly sour; but, ordinarily, these "Maori Oranges" are exceptionally sweet and juicy. Their peculiar colouration, however, renders them almost unsaleable; but this prejudice in the case of the sweet and sound fruit is quite unwarranted, seeing that the substance in which the dark colour resides is quite superficial on the rind, adheres to it with tenacity—being only removable by special solvents—and does not injuriously affect the human system when partaken of. Were it the constant accompaniment of a special variety of orange—the fruit in this instance being comparable to a certain type of apple—instead of being of accidental occurrence, this unsaleability would not, it is thought, be experienced.

The peculiar affection is caused by minute colourless plant mites belonging to the genus *Phytopus*, which occur in myriads upon the rind of the fruit when the orange is still green, at which period the injuries for which they are responsible are principally occasioned. These mites are invisible to the naked eye, but when the surface of a "Maori Orange" is viewed by aid of a lens numerous minute white shreds—all of equal length and thickness—are observable on the dark background, and these are the cast skins of the tiny depredators. The peculiar symptoms to which the latter give rise are thus explicable. In feeding they puncture and so irritate the surface of the orange that the oil-cells of the rind gradually discharge their contents. This oil—now almost completely covering the orange—when thus exposed to the atmosphere oxidizes, and thus forms the resinous substance which the matter forming the dark stain is proved by its chemical reactions to be. The process of growth is checked by this thin but close investment, but the latter yields somewhat to the expanding fruit and exhibits accordingly a minute network of fissures. The *Phytopus oleivorus* (the technical designation of the mite), it may be added, not only may be found upon the green fruit before any of the above changes have as yet arisen, but it is also to be met with upon the foliage of trees yielding "Maori Oranges" also. The fruit of the mandarin type of orange seems to be less affected by the mite than is that of the ordinary variety. The discolouration in this case is, however, frequently noticeable as a pale-grey glossless stain.

SCALE INSECTS, OR COCCIDÆ

The insects which most seriously interfered with the successful growth of citraceous trees in the Wide Bay district were undoubtedly the Coccidæ, or Scale insects. Reviewing in a brief manner the different kinds observed in connection with the injuries which they occasioned, mention may be, in the first place, made of one whose work is most extensive and whose ill-effects are generally experienced.

The White Scale Insect (Chionaspis citri).—The presence of this insect is recognised by the occurrence of numerous small white elongated parallel-sided objects, measuring from $\frac{3}{100}$ to $\frac{1}{25}$ inch in length, which occur here and there on the surface of the bark of the trunk and branches especially, but are also met with upon the leaves and fruit, of affected trees. So thickly, indeed, may these be sprinkled over their surfaces of support, in some instances, that their presence is discernible from a considerable distance, the branches in these cases being rendered quite white, and blotches of the same colour being noticeable upon other parts. When viewed with a lens, these white objects are seen to be dark at one extremity, by reason of the fact that the skins cast off by the insect during its earlier stages of growth are deposited in this situation. They may also be observed to have three keels extending from one end to the other. They also ultimately give rise to minute two-winged flies, and are, in fact, the male scale insects—which in the case of this coccid comprise the most conspicuous sex. The female *Chionaspis* is very much larger. It is brown and narrowed to almost a point in front, and greyish-brown and widened in the opposite direction, so as to form a convex shield whose two sides meet in a central ridge. Externally the insect is covered by the larval skins and secreted shield, which together afford its external characters, as above described, and beneath these the eggs are deposited. These female scales, owing to the fact of their colour harmonising closely with that of the bark, and from the circumstance of their presence in this position causing the latter to darken and become rough, are not readily discernible when occurring thereon, but in the case of badly infested trees become conspicuous objects from their habit of becoming established on the leaves and fruit. The White Scale insect was observed in many instances to exercise a very prejudicial effect upon the growth of the orange tree. It had checked the fruit in its development, and caused the leaves to become more or less yellow and drop off. It had killed the smaller branches, especially those arising in the centres of the trees, and thus had allowed the larger ones to become subjected to the damaging influence of direct sunlight. The bark itself of the trunk and its main divisions had been hindered, owing to its attack, from expansion; and the whole tree had become indirectly injured, large limbs one after another dying from this cause, and ever lessening the chances of the resuscitation of the remaining stock. This destructive insect is undoubtedly an early importation into the Wide Bay district, though the date of its introduction cannot be now ascertained. It was probably derived in the first instance, on plants, from New South Wales, where it has long been recognised as a formidable opponent to successful orange-growing. Reimportations from the same source are now being made. A settler residing on the Burrum River, being asked if he could throw any light upon its local origin, stated that in his orchard it had first appeared on six grafted mandarin trees received from Sydney five or six years since. Afterwards it showed itself upon trees growing adjacent to these, and had since proved a worse and worse pest, and become more generally distributed, in his orchard.

Red Scale Insect (*Aspidiotus coccineus*).—This insect externally manifests itself as a circular, almost flat, scale about $\frac{1}{11}$ inch in diameter, with a nipple-like prominence in the centre. It appears when alive as a bright reddish-brown object with the central third darker, the reddish hue being due to the colour of the living insect, which is beneath the actual scale, which is itself grey. To quote from a previous report, it may be added that "the Red Scale occurs equally on trunk, branches, leaves, and fruit. Every accessible spot on the bark of infected trees is at times occupied by it—a complete encrustation being thus formed. Oranges, if the scale has settled upon them in any quantity, after gathering, become disgustingly black with their dead and discoloured remains; and previous to their ripening their natural bright green colour gives place to a pale yellow, their growth is retarded, they do not reach their full size, and they may even fall from the tree. When the leaves are attacked by them, they exhibit conspicuous yellow-green spots, the centres of which are occupied by the scale insects themselves, and either the assimilating power of the foliage is much diminished, or, worse, the leaves are shed, and by both of these events is the health of the tree considerably impaired. When on the bark itself, unless this still maintains its original green colour, their presence is not quite so conspicuous, owing to a certain harmony of colour being maintained, but the injury which they occasion when in this situation is none the less."—*Insect and Fungus Pests*, page 129.

The presence of this Red Scale insect could be detected in all the orange orchards visited. As a rule, however, it did not appear to be occasioning much damage, being generally held in check by a minute hymenopterous parasite, and also by a small scarlet fungus, *Microcera coccophila*, which very generally preyed upon it.

Circular Black Scale Insect (*Aspidiotus ficus*).—Like the Red Scale insect, this is also circular, measuring, when full grown, about $\frac{1}{12}$ inch in diameter. It is, however, more convex, and of a dark reddish-brown (almost black) colour, the central boss only being light reddish-brown. It infests also the limbs, leaves, and fruit, and is especially injurious to young trees. The effect produced by its presence is similar to that occasioned by the Red Scale, although, from the fact of its seldom occurring aggregated upon the young wood, the injuries to which it gives rise are less severe, and it rarely, if ever, destroys its host-plant, as does the latter insect. The Circular Black Scale does not appear to have as yet visited any of the orchards situated on the Burrum River; it is, however, commonly met with at Maryborough, and generally along the banks of the Mary itself. In one instance it was observed to be of very plentiful occurrence on plants which were too young to be placed in their permanent stations, some of those infested having already shed a large proportion of their leaves owing to its presence. It was also found on orange trees of larger growth, which, planted elsewhere, had been derived from the same nursery where the above stock was being grown. Growers of orange trees who are anxious to maintain the reputation which the Maryborough fruit has already attained in outside markets, and to avoid restriction being placed on its free admission to the various emporiums of trade, should take special precautions that the fruit that leaves their hands does not harbour this scale insect. Queensland is the only country—Florida alone excepted—in which the Circular Black Scale is reported to have become established, and orange-growers elsewhere are naturally anxious to enjoy freedom from its presence in their orchards. The adult scales may, it is true, be removed from fruit by brushing the latter; but not so the immature individuals. These are minute objects, and lodging in the pores of the rind are not readily removed, even if noticed at all. Moreover, as they can continue their development upon the fruit, they have generally already become conspicuous objects by the time this has reached distant marts.

The Long Mussel Scale Insect (*Mytilaspis Gloveri*).—This insect, which is of general occurrence in the Wide Bay orchards, usually accompanies the White Scale insect; the two insects being found intermixed on boughs and foliage of infested trees. It may be recognised by the following description of the scale of the female (the sex which is usually exclusively met with):—This is an elongated, straight, or more or less curved, slightly convex, glossy, pale-brown object from 1 to $1\frac{3}{4}$ lines in length, narrowed and blunt at one extremity, but immediately behind this widened, then paralled-sided for the remainder of its length, and terminating roundly at the other. Like the insects previously mentioned, it occurs on all parts of the orange tree, even including the leaves and fruit. When a tree is badly infested by it, it will form a complete covering to the still green wood, and even thus completely invest the thorns of seedling trees. On the fruit itself it will be occasionally met with, covering small areas of the surface, in patches. During this investigation no instances were met with of the Long Mussel Scale insect doing any very serious damage when alone infesting trees. It was otherwise, however, if it was present with one or more of the foregoing scale insects, as frequently happened. It has, too, been recorded of it that on its first introduction to the orange groves of Florida it proved a most pernicious insect, totally destroying many of them.

Brown and Black Scale Insects (*Lecanidæ*).—These, of which no less than five different kinds were observed, are much larger than are any of the scale insects already referred to. They are also, unlike them, of a brown or black colour and of a much softer consistency. Two of them only are of general occurrence in the district, the remainder being observed in each case on but a few trees only. A common feature, which distinguishes them from the Coccidæ previously mentioned, resides in the circumstance that they do not secrete a special covering for themselves and their eggs, but are protected by their own horny investment. They are again peculiar from the fact that their presence is invariably accompanied by a sootiness which covers the plants which they infest. This sootiness—elsewhere referred to as fumagine—is composed of the spawn threads and reproductive organs of microscopic fungi, which are not true parasites of the plants exhibiting them, for they grow only upon a sweet secretion emitted by the scale insects and shed by them upon immediately surrounding objects. The same sweet secreted matter also supplies food for flies and especially sustenance for several species of ants—the latter protecting the scale insects to which they are in this way beholden, and even aiding in their dissemination.

The scale insects coming under the above designation were those technically known as *Lecanium longulum*, *Lecanium depressum*, *Lecanium hesperidum*, *Lecanium hemisphericum*, and a fifth species not yet determined. It would unduly protract this report to mention the characters by which these different Lecanidæ are distinguished one from the other. In their habits they closely agree, and for practical purposes may be regarded as one. With this apology, further reference to them may be now omitted. Growers, however, cannot afford to make light of their occurrence, as they are indeed formidable opponents to successful orange-growing.

General Remarks on Scale Insects.—All the injurious insects referred to as scale insects are alike from the fact of their having been introduced into the Wide Bay district from without; and, moreover, insomuch as the reproductive individuals are wingless, these do not of themselves become widely disseminated, but are beholden for their transportation from place to place to accidental circumstances, and especially to man's intervention. Thus it will happen that should a settler living in an isolated locality, remote from the vicinity of insect-infested trees, raise citraceous plants from seed, and exercise reasonable care to secure his trees from infestation, he will not be troubled with such pests as have been mentioned, and thus reap all the advantages inseparable from this circumstance. The orange orchard at Cowal, Mount Bauple, is a case in point. On inspecting this it was soon found that, with the exception of an occasional Red Scale insect here and there, the presence of which could be accounted for by accidental infestation, the trees were absolutely free from insect pests. These trees were four and eight years of age, and the elder ones had already attained a height of eighteen feet; in some instances were proportionately well grown, and had, moreover, yielded excellent fruit. Scale insects, when adult, are practically stationary upon their food-plants, but when young move with facility from spot to spot thereon. In this latter condition also they attach themselves readily to objects with which they may be temporarily in contact, such as the limbs of other insects and the feet of birds, and thus both insects and birds do no doubt occasionally serve to transport them from orchard to orchard. Flood waters may again serve the same purpose within certain limits. For an orchardist, then, to grow orange trees free from insect pests of this description, whether originally so or rendered so by special treatment, it is essential that influence be brought to bear on neighbouring fruit-growers to keep their trees "clean" in this respect also. Again, there can be little doubt but that, as has been previously suggested, the introduction and dissemination of the various insects now injurious to citraceous trees in the Wide Bay district have been principally accomplished by the growers themselves, without knowledge of the fact, and therefore in ignorance of the significance of the work being accomplished. The precise period at which these plant enemies were first established there cannot now be ascertained, since orange trees have been imported into the district for at least fifty years, and local naturalists do not appear to have given this matter their attention. How insect pests, however, are brought to a new district has been shown in dealing with the White Scale insect; whilst the following incidents will show how they are disseminated:—A settler residing near Tiaro, Mr. P. Biddles, imported in 1869 orange trees from Sydney, and planted them at his homestead, then on the left bank of the Mary River. Some of these trees are still living, and were observed, at the time of my visit, to have been long infested with the scale insect, *Chionaspis citri*, which has proved injurious to orange groves in the mother colony for nearly half a century. Some ten years since Mr. Biddles raised on the opposite side of the river some seedlings, planting out there nearly 200 trees thus procured. These for a while were quite free of insects, but some three or four years since they became infested with the above scale, notwithstanding every precaution had been taken to ensure their healthy development. Again, more recently the same planter, Mr. P. Biddles, had purchased at Maryborough 140 citraceous trees raised from seed there. These, at the time of my visit, were found without exception to be infested with further kinds of scale insects, and in some instances to be quite checked in their growth owing to their presence. One of these—the Circular Black Scale (*Aspidiotus ficus*)—occurred nowhere else in the district, but had been observed by me still badly infesting nursery stock in the orchard whence Mr. Biddles' trees had been derived. Again, from the same Maryborough depôt Mr. A. McKellar, of Cowal, Mount Bauple, an isolated locality, had some years previous to this obtained 100 orange trees. These, though planted out in soil highly suitable for orange cultivation, were from the very first covered with scale insects, and in consequence eventually died down to the ground, notwithstanding on several occasions attempts had been made to combat their insect depredators with Gishurst's Compound, tomato infusion, and other reputed insecticides. The stocks of these plants in turn gave rise to suckers, and on these the destroyers of the original trees for a while subsisted. Further, these recent growths had evidently served as the means for infecting the locally-raised seedling trees, previously alluded to as constituting the present orchard and otherwise quite free from scale insects, with the exception of a single species of insect of this class. Two of the original stocks from which suckers had recently arisen were found at the time of my visit, and these still harboured scale insects, not elsewhere occurring on the plantation, which were regarded as similar to those received on the trees from Maryborough which formed the first orange orchard. These incidents are mentioned for the purpose of showing that freedom from the insect pests mentioned in this report can be secured by future growers of citraceous plants in the Wide Bay district by the exercise of a certain amount of foresight on their part and the adoption of measures of precaution. Insomuch also as certain of the insects mentioned do not occur in all the districts mentioned—the Circular Black Scale, for instance, having not yet been observed in the orchards on the Burrum River—these statements may be pondered also with advantage by those at present engaged in the industry. Again, there are other insects affecting the orange tree even elsewhere in Queensland which, as far as can be learnt, have not as yet found their way to Wide Bay, though they may be brought there any day through commerce. The Wax Scale insect (*Ceroplastes ruber*), the Mussel Scale (*Mytilaspis citri*), the Black Scale (*Lecanium oleæ*), amongst others, may be mentioned in this connection. Reference to them again has suggested the expediency of remarking in this connection that living plants other than the orange may serve as the vehicle for the introduction and dissemination of insects injuriously affecting that plant. On the other hand, orange trees themselves do not necessarily serve in this capacity. Thus, whilst inspecting the Burrum orchards, several young citraceous plants recently imported from New South Wales were closely examined with a view to discovering if they had been the carriers of insect pests; but none such were detected upon them. As above suggested, the orange-grower should look with suspicion on other fruit trees, and especially shrubs and ornamental plants generally.

Take the case of the abovementioned insects: *Mytilaspis citri* especially affects *Murraya; Lecanium oleæ*, a number of different shrubs; and *Ceroplastes ruber*, both woody and herbaceous plants in great profusion, not excepting ferns. Take the case, again, of some of the insects already occurring on the orange tree at Maryborough: The Red Scale affects several shrubs, including even the rose; and the Circular Black Scale (*Aspidiotus ficus*), the camphor laurel, the bean tree, and other plants used in landscape gardening. In fact it was on the foliage of the camphor laurel that this insect was first met with at Maryborough in the progress of this investigation. Further than this, ordinary garden or street sweepings, as well as urban refuse generally, may serve as agents for disseminating these insects, especially when employed for manurial purposes. There are at least four different kinds of scale insects occurring at Maryborough that cling more or less pertinaciously to the rind of the orange tree, and at certain periods subsist for weeks thereupon after this has been thrown out. Again, a noticeable feature arising from the presence of scale insects, such as the Circular Black Scale, is the shedding of the foliage, and hence the insect may be carried to wherever fallen leaves are borne by the wind or otherwise transported.

REMEDIAL MEASURES.

The Phytopus Mite—Fruit Discolouration or "Maori Orange."—In contending with this affection it is obvious that preventive treatment is alone available. When orange trees, on which the discoloured fruit occurs, is infested by scale insects also, as generally happens, the washes presently to be recommended for their destruction will, if applied, kill the *Phytopus* mite also. When, on the other hand, the malady under notice is alone to be obviated, special measures may be more advantageously resorted to. Instead of using one of the preparations to be referred to as suitable for scale insects, either of the following washes may be employed:—(1.) Composed of flowers of sulphur, soap and water, 1 lb. of sulphur and a similar amount of soap being mixed in 50 gallons of water. (2.) A wash composed of potassium sulphide dissolved in soapy water in the proportion of 2 oz. of the salt to every 2 gallons of water. These preparations must be sprayed upon the trees by means of a force-pump, to the delivery-tube of which a cyclone nozzle is attached. They should also be applied preferably—1st, in the spring prior to the commencement of new growth; 2nd, when the fruit is of the size of an ordinary marble; and 3rd, when it is two-thirds grown.

Scale Insects.—As scale insects feed by suction, seeking their sustenance beneath the surface of the plant whereon they occur, they can alone be killed (1) by contact with some potent reagent; (2) by depriving them of air, and (3) by vitiating this with some poisonous gas or vapour. Kerosene will meet the first requirement, but in its undiluted condition it has the disadvantage of being destructive to the bark of many trees, including that of the orange. To render it available, therefore, for use without the risk of injuring the tree to which it may be applied, it should be maintained in a state of extreme division, which is accomplished by emulsifying it. A very suitable kerosene emulsion is prepared as follows:—Make a soap solution (by boiling) of common hard soap, whale oil soap, or soft soap, using $\frac{1}{2}$ lb. of hard soap or whale oil soap, or 2 quarts of soft soap, to every gallon of water. Cut the hard soap previous to boiling in thin slices to assist solution. To every gallon of boiling soap solution (off the fire) add 2 gallons of kerosene. Then churn the mixture violently with the force-pump and nozzle or syringe, driving it backwards and forwards through the nozzle, keeping the latter always beneath the surface during the process. By this means the kerosene emulsion will "come," or jelly, within five minutes or so. The emulsion, if perfect, should be of the consistency of cream, should not grease glass; the oil should moreover not separate out, even if the emulsion be kept standing for days, and it should mix freely with water in any proportions. This, when required for use, should be mixed with no less than nine times its bulk of water, which, if used warm, will facilitate dilution in the event of the emulsion having become lumpy. This should be applied to the trees in the form of a mist or very fine spray, such as is obtained by use of the cyclone nozzle in connection with a force-pump.

In killing the insects by suffocation, a wash made of starch has in some hands proved very serviceable. The preparation of this is thus described by Mr. J. Patterson of Tamworth: "Two pounds of the ordinary household starch are dissolved in a little cold water, then about 2 quarts of boiling water are poured over the starch solution, and the whole is stirred until thoroughly mixed. To this is added 16 gallons of cold water, with further stirring." A compound formed of caustic soda and resin will, however, be found more efficacious than the starch solution, but is more troublesome to make. In preparing this take 5 lb. of caustic soda and 15 lb. of resin, place these in a boiler, cover them with water, and boil briskly for two or three hours. Then when they have become assimilated, gradually dilute with water so as to make 100 gallons of wash, which, after being strained through sacking, is ready for use. In dealing with those scale insects which occur on the trunks and larger limbs, much benefit will be derived also from the use of some adhesive paint applied by aid of a brush. For this purpose either of the following preparations will prove serviceable:—(1) Flowers of sulphur, 4 lb.; soft soap and water, 6 gallons. (2) A thin flour and sulphur paste containing three parts by weight of sulphur to every one of flour, the paste to be made by boiling in the ordinary way, and the sulphur to be stirred in whilst the latter is still hot (*Parker's Remedy*).

In using resin compound, starch solution, kerosene emulsion, or other wash, it must be borne in mind that it is essential for success that every part of the tree be wetted, whilst at the same time regard should be had to economy of expenditure of material. It is therefore necessary, for distributing the wash, to employ a force-pump, to the delivery-tube of which a cyclone nozzle of the Riley or Vermorel type is attached, and by the aid of which a mist-like spray is generated. The delivery-tube should be encased in a bamboo rod, the joints of which have been previously knocked or burnt out. This rod is used as a director in passing the nozzle up through the centre of trees, and at the same time serves to protect the tube from injury arising from frequent contact with thorns. Suitable apparatus, which will accomplish the work required and is at the same time portable and of durable construction, is manufactured by the Nixon Nozzle and Machine Company, of Drayton, Ohio, and is supplied by their Australian agents —Messrs. F. Lasseter and Co., of Sydney.

It must be borne in mind, however, that whatever insecticides are employed, satisfactory results cannot reasonably be anticipated from but a single application. Moreover, there are particular times and seasons when their use will be attended with much better consequences than at others. For instance, a scale insect, which will withstand the most potent reagent when it is full grown, and whose eggs, again, are similarly resistant, will readily succumb if assailed when recently hatched out and whilst still unprotected by its cast skins or special protective secreted covering. Again, an insecticide which is highly serviceable in the case of one scale insect may scarcely affect another by reason of the variability of organisation which different species exhibit. But at the present stage of the inquiry, and whilst the study of economic entomology in Australia is still but little advanced, recommendations regarding the methods to be pursued in contending with these scale insects cannot be framed with such reference to these important details as might otherwise be the case.

Spontaneous Destruction of Scale Insects.—More than one grower of citraceous plants in the Wide Bay district drew attention to the fact that their insect enemies, though conspicuous by their depredations in one season, did not assert themselves in this manner to the same extent in the succeeding one. Of late, however, this does not appear to have been the common experience, the White Scale and the dark-skinned oranges having become more and more noticeable. The former observation may be explained when the work of natural checks on these pests are taken into consideration. These checks, to which special reference may be made, are afforded by the presence of predaceous insects and both animal and vegetable parasites, and each of which occasionally effect the spontaneous destruction of the scale insects. The most noticeable of the predatory insects was a minute tineid moth having orange forewings which was met with in its caterpillar phase feeding extensively upon the White Scale, its presence being rendered noticeable on the bark owing to its habit of forming patches of greater or less extent of a fine felt-like web, in which the white particles of the male *Chionaspis* were inwoven, and which it extended as—living beneath it—it devoured one after another of these pernicious insects. Several caterpillars and chrysalides were as a rule discernible beneath each sheet of web. This friendly insect does not, however, at present occur in such numbers as to render it advisable to suspend the adoption of artificial means for extirpating the pest which it devours. Different beetles, both scymnids and lady-birds, also performed similar useful work, but it being winter time, they were not much in evidence. The Red Scale and the Circular Black Scale were, however, extensively parasitised by minute hymenopterous parasites, which as a rule destroyed them long before they had reached their full size, a fact demonstrated by the occurrence of ruptured and perforated summits—features occasioned by the exit of the tiny parasite. The most formidable foes to the different scale insects were, however, three or four species of parasitic fungi. Thus the above White Scale was not infrequently attacked by *Microcera rectispora*, being rendered quite invisible by brown rounded granule-like bodies or little white tufts, composed of large elongated radiating spores, according to the particular phase exhibited by the parasite. The Red Scale, the Circular Black Scale, and the Long Mussel Scale were, again, frequently killed by another parasite, *Microcera coccophila*, the reproductive organs of which could commonly be observed as small compact scarlet masses emerging and ascending from their edges. Again, the soft Brown Scale (*Lecanium longulum*) was so commonly destroyed by a similar agency that in some orchards which this pest numerously affected it was scarcely possible to find a living example, one scale insect after another being dead upon the trees and surrounded by a halo of fungus threads.

It may be advanced that these insect pests affecting the orange groves of Wide Bay and elsewhere are likely to entirely succumb through the operations of the above-mentioned natural enemies. The experience of the past does not lend much support to this contention, but has rather an opposite tendency. There is, however, abundant evidence that if citraceous trees are placed under perfectly suitable conditions, and subjected to careful culture, their inherent vitality will assert itself; and this, assisted by the action of predatory and parasitic organisms upon their insect foes, will enable them to successfully meet and perchance overcome the attacks of the latter. It is the part of the horticulturist to indicate what are the circumstances that are conducive to the growth of perfectly healthy citraceous trees. It may, however, be permitted me to point out, from observations made in the Wide Bay district, conditions under which these trees are occasionally grown, and which seem to favour an abundant development of insect life upon them. These are—(1) growth upon uncongenial or ill-drained soil; (2) the ground covering their roots so hard and compact as to be scarcely in a fit state to grow weeds; (3) injury to the roots through use of the plough so freely in their vicinity that their outward limit is defined by the figure of a square; (4) loss of surface soil, the roots being thereby exposed to the full heat of the sun; (5) mechanical injury to the parts above ground, large branches still in a state of health being lopped off; (6) use of nitrogenous and other manures in too large amounts; (7) soil impoverishment, its richness being regarded as inexhaustible; (8) the presence of exacting vegetation, the orange having to contend for its food supply with pineapples and other such plants; (9) overbearing and consequent constitutional weakness, especially noticeable in the case of the Lisbon lemon, which is often suffered to carry continuously an abundance of fruit; (10) too close planting; (11) the treatment of citraceous plants as deciduous trees, vigorous pruning being resorted to, whereby the tender bark of the limbs is allowed to become exposed and consequently sun-scalded.

THE PRESENCE OF INSECT PESTS—AN IMPORTANT CONSIDERATION.

Past events have shown that the insect enemies of the orange-tree occurring in the Wide Bay district will, if unchecked, seriously injure the trees on which they are met with, and in some instances gradually effect their destruction. The fruit of insect-infested trees, again, is inferior in quality to that otherwise conditioned, even when it is not less in amount. The darkening of the skin of the orange, occasioned by the *Phytopus* mite, seriously affects its selling value, even if, indeed, a market for it can be obtained at all. By way of illustration of this fact, Mr. M. Ely stated that he had gathered and delivered locally 200 cases of this discoloured fruit for 1s. 5d. per case—*i.e.*, eleven dozen oranges for 1s. This fruit was not especially dark-skinned. There can be little doubt, again, but that the fact of oranges being scale-infested considerably deteriorates their value in foreign markets, even when by reason of this condition they are not absolutely refused admission, or this only is granted on their being suitably disinfected at a cost which has ultimately to be borne by the producers. This restriction on the importation of fruit into other countries has been imposed, as has already been pointed out, out of regard to the interests of growers in these countries, and, as it is becoming general in these colonies, is a consideration which Maryborough fruit-growers—whose prosperity is becoming more and more independent of the returns from their home markets—can scarcely afford to ignore. Whilst at Maryborough an opportunity was afforded me of seeing oranges being packed for the trade, and these in many instances were observed to be the carriers of living scale insects. In remarking upon the Circular Black Scale it has been shown how this may happen in spite of careful attention to the fruit after this has been gathered. Already the Victorian Press has adverted to the fact that oranges from Maryborough arrive in that colony in an "unclean" condition—a statement having all the more significance, seeing that in Victoria special legislation to deal with such importations has for some time past been contemplated. A similar intimation has been received from another quarter, as appears from the following incident:—On the 6th May of the present year a fruit-grower residing in the Wide Bay district had some oranges carefully cut from the tree whereon they grew. These were rubbed with flannel to remove any scale insects that might be upon them. The oranges, then appearing entirely free from their presence, were packed in tissue paper, filling three ordinary fruit cases, and shipped to San Francisco. They arrived at their destination on the 8th June. Messrs. Gould and Jandin, the well-known firm of fruit purveyors, to whom they were consigned, in announcing their receipt and sale, in a letter dated 27th June, write as follows:—

One case, they state, "was used by the Inspector of Insects and Fruit Pests for examination as to scale and other insects, and his report to us was that this fruit could not be offered for sale on the market owing to its being covered with a new Black Scale, which was the first seen in the country, and he would positively refuse to have the fruit distributed for fear of spreading the scale throughout our local orchards, and only on condition of our cleaning this fruit thoroughly before presenting it for sale did he allow us to receive the other two cases from the steamship company. We probably could have done better in the disposal of it had it not been for these facts. It should have sold at $3.50 and $4.00 per case instead of $2.00. If you have any oranges that are perfectly clean and free from scale or other pests that you can ship here, it will be a profitable venture for you; but if your fruit has any scale upon it whatever, we would not advise exporting to this country, as the laws here are very strict, and the Inspector examines all the packages of fruit imported into this country very thoroughly. We are sorry that the result of your first shipment was not more encouraging." The sender of this fruit to California submitted for inspection three oranges, similar to those sent and from the same source, as evidence of their freedom from the presence of scale insects. It was, however, at once pointed out to him that young scale insects were upon them all, which after the interval of at most a few weeks would have become quite conspicuous objects. The importance of the Californian market to Maryborough orange-growers resides in the fact that all the late fruit sent there will arrive when the Florida oranges are gone by, and the local yield of this great orange-producing State—*i.e.*, California itself—is already rapidly failing. The price, $4.00 per case, quoted for Maryborough oranges is that of the best Washington Navels at San Francisco.

By Authority: Edmund Gregory, Government Printer, William street, Brisbane.

Queensland.

DEPARTMENT OF AGRICULTURE, BRISBANE.

BOTANY BULLETIN No. VIII.

DECEMBER, 1893.

CONTRIBUTIONS TO THE QUEENSLAND FLORA.

BY

F. M. BAILEY, F.L.S.,

COLONIAL BOTANIST.

The Bulletins of this Department will be sent free to such Individuals interested as may request them. Address all applications to "The Under Secretary for Agriculture, Brisbane."

BRISBANE:
BY AUTHORITY: EDMUND GREGORY, GOVERNMENT PRINTER, WILLIAM STREET.

1893.

NOTICE.

It was my intention to delay the publication of a part of the matter contained in the present Bulletin until I was in possession of further detail, but certain matters have occurred which make it imperative that, so far as possible, all phytologic matter at all available be issued in the present publication.

I particularly regret that this has to be done, for it was my hope that I should have been enabled to carry out the plan adopted with the Freshwater Algæ, of publishing all similar Families in separate Bulletins; and for this purpose the large number of Lichens determined for us by the eminent specialist, Professor J. Muller, have been kept back from a few of the previous Bulletins, but have now to be given.

Those descriptions, of which printed slips have been issued, and those added during the progress of the printing, are dated.

F. M. B.

30th December, 1893.

CONTENTS.

BOTANY:

CONTRIBUTIONS TO QUEENSLAND FLORA.

Order MALVACEÆ.

PLAGIANTHUS, Forst.

P. microphyllus, *F. v. M.*, Fragm. i. 29.; Fl. Austr. i. 190; *Halothamnus microphyllus*, F. v. M., Pl. Vict. i. 159. A dwarf rigid shrub, clothed with scurfy scales, very tortuous and branchy, the smaller branches slender and often spinescent. Leaves from linear to oblong-cuneate, rarely exceeding ½-in. and usually much smaller, obtuse or 3-toothed at the end, more or less tapering at the base. Flowers small, sessile or nearly so, 1 to 3 together in the axils, not spicate. Calyx when in flower not above 1½ line long. Carpel usually single, enclosed in the calyx and membranous.—Fl. Austr. l.c.

Hab.: Queensland, *F. v. M.**

* When these initials are thus given, I am indebted to Baron Mueller for the information of its having been received by him from Queensland, but he has not given me the locality.

Order RUTACEÆ.

ERIOSTEMON, Sm.

E. salicifolius, *Sm.*, Fl. Austr. i. 331; *E. lanceolatus*, Gærtn. f. Fr. iii. 154 t. 210; *Crowea scabra*, Grah. in Edinb. Phil. Journ. 1827, 174. An erect shrub, the branches rigid and often angular, glabrous or minutely hoary. Leaves linear or linear-lanceolate, mostly 1 to 2 in. long, rather thick and rigid, glabrous when full-grown, obscurely 1-nerved. Peduncle axillary, short and 1-flowered, with a few broad scale-like imbricate bracts at the base, hoary, with a minute tomentum, as well as the calyx and petals. Sepals short, orbicular, rigid. Petals pink, attaining about ½ inch. Filaments flattened, densely fringed with woolly hairs, clavate and glandular at the top, bearing the anthers on a short stipes as in *Boronia*; anthers tipped with a very short, broad recurved appendage. Ovary glabrous; style slightly pubescent below the middle. Cocci truncate at the top, but not beaked, transversely wrinkled. Seeds smooth and shining.—Fl. Austr. l.c.

Hab.: Queensland, *F. v. M.*

Order OLACINEÆ.

TRIBE ICACINEÆ.

GOMPHANDRA, Wall.

Calyx minute, cup-shaped, 4 or 5-lobed. Corolla campanulate, 4 or 5-lobed; lobes acuminate, inflexed, rarely free, midrib prominent within. Stamens 5, hypogynous, alternate with the petals, filaments thick, dilated above, hairy at the back (in most species), hollowed in front to receive the anthers. Anthers pendulous from the filiform apex of the filament, 2-lobed, dehiscing lengthwise; pollen-grains triangular. Hypogynous disk thick, annular or none Ovary sterile in the male, oblong in the female flower, 1-celled; style conic, stigma minute or style crowned by a stigmatiferous disk; ovules 2, collateral, pendulous, funicle dilated into an "obturator." Fruit drupaceous, surmounted by the remains of the disk (stigma?), stone crustaceous. Seed pendulous, surrounded by the raphe, albumen fleshy bipartite; embryo minute. Tree with alternate leaves, simple 1-nerved and petiolated. Flowers in axillary, terminal or leaf-opposed cymes; dichlamydeous, hermaphrodite or polygamo-diœcious.—*Hook.*, Fl. British India i. 585.

(This genus is briefly noticed in the Syn. Ql. Fl. p. 65, but it has been thought advisable to give a fuller description here, as a second species has been met with in Queensland.)

G. polymorpha, *Wight.* **var. 6.** A handsome tree of about 60 ft.in height, the infloresence and young shoots puberulent, otherwise glabrous. Leaves alternate 3 to 5 in. long, ovate-lanceolate, with a more or less elongated blunt apex and cuneate base, petioles about 4 or 5 lines long, dark-green on the upper, pale on the under surface; the primary veins distant, only 3 or 4 on each side of the midrib, reticulate veinlets obscure, margins entire. Flowers in short axillary, dichotomous cymes. Calyx very short and cup-shaped, with almost entire edge. Corolla-tube about 2 lines long with minute teeth, the tips inflexed, from which proceeds down the inside of the corolla-tube a prominent rib. Stamens glabrous, 5, at length exserted and widely spreading, but incurved again near the anthers. Ovary glabrous, 4-angled, stigma sessile. Fruit not as yet been gathered. I cannot separate this plant from the East Indian species, of which several (5) varieties are named and described in Hook., Fl. of Brit. India i. 586. From the fragmentary specimens which I have of *G. australiana*, F. v. M., the present plant seems to differ considerably both in foliage and inflorescence.

Hab.: Scrubs of the Barron River, *E. Cowley.*

September, 1893.

Order RHAMNEÆ.

EMMENOSPERMUM, F. v. M.

E. Cunninghamii, *Benth.*, Fl. Austr. i. 415. Leaves alternate, similar to those of *E. alphitonioides*, except that the petioles are longer. Flowers not seen. Umbel-like symes, apparently not numerous, in a terminal corymbose panicle. Fruit rather larger than *E. alphitonioides*, 3 or 4-celled; epicarp scarcely any; cocci 2-valved. Seeds red and shining as in that species, but not persistent on the torns, and the funicle very small.—Fl. Austr. l.c.

Hab.: Queensland, *F. v. M.*

CRYPTANDRA, Sm.

C. spinescens, *Sieb.*, Fl. Austr. i. 439; *C. pyramidalis*, R. Br., in Ann. Sc. Nat. x. 373. Nearly allied to *C. amara*, and with nearly the same foliage; but the branches are usually more twiggy, and the spinous branchlets more densely crowded. Leaves usually linear or linear-oblong, 2 or rarely 3 lines long, but occasionally small and obovate. Flowers smaller than in *C. amara*, and more distinctly, although very shortly, pedicellate. Calyx 1½ to 2 lines long, narrow-companulate, the adnate base glabrous and suddenly contracted into a little stipes about the length of the imbricate, brown bracts, the free part white-tomentose outside. Ovary almost entirely inferior, the pubescent summit slightly prominent above the adnate part, and obscurely grooved opposite the stamens, but without any distinct disk. Capsule oblong, 1½ to 2 lines long, almost included in the glabrous, elongated, adnate base of the calyx-tube, shortly free in the upper part. Cocci thinly crustaceous.—Fl. Austr. l.c.

Hab.: Queensland, *F. v. M.*

Order SAPINDACEÆ.

SUB-ORDER SAPINDEÆ.

CUPANIA, Linn.

C. flagelliformis (n. sp.) (So named from the thong-like branches of panicle.) Aboriginal name at the Barron River, "Maraguigi." A shrub or small tree, the branches angular, dark-coloured except in a young state, when, like the young foliage, they are clothed by a ferruginous or grey tomentum. Leaves, the petiole and rhachis together, measuring from 1 ft. to 16 in. in length, the leaflets scattered, 13 or more, size very irregular, some attaining 6 in. in length, and a width of 1¾ in., the point often much elongated, the base shortly cuneate to a petiolule of about ½ in., margins dentate with large teeth, the primary nerves prominent and parallel, with strongly-marked reticulations between, all more or less hairy on the under side, upper surface of leaflet glabrous, and the reticulations not prominent. Panicles velvety, near the ends of the branches, of few (3 to 5) slender thong-like branches, some of which being about 2 ft. in length; flowers in distant sessile clusters, expanded flower about 4 lines in diameter. Sepals orbicular, much imbricate, silky on the back, irregular as to size. Petals buff-coloured, broad cuneate, undulately lobed at the top, much shorter than the sepals, and bearing at the base of each 2 incurved, hairy, scale-like appendages, much shorter than the petal. Stamens 8, included, filaments hairy, anthers slightly longer than the filaments, oblong, angular, hairy between the blunt angles. Ovary hairy, but probably abortive in the flowers examined. Capsules not as yet obtained.

Hab.: Scrub about the Barron River, *E. Cowley.*

September, 1893.

SUB-ORDER DODONEÆ.

DODONÆA, Linn.

SERIES CYCLOPTERÆ.

D. lobulata, *F. v. M.*, in Linnæa xxv. 372; Fl. Austr. i. 479. Closely allied on the one hand to *D. attenuata*, and on the other to *D. ptarmicifolia*, glabrous and viscid, the branchlets scarcely angular. Leaves linear or linear-cuneate, obtuse, mostly 1 to 2 in. long; obtusely serrate or pinnatifid, with short, obtuse, callous lobes, coriaceous and rigid, the midrib scarcely conspicuous. Flowers few, in short racemes, the pedicels rather slender. Sepals thin, broadly ovate. Capsule of the smaller forms of *D. viscosa*, the wings not very broad. Seeds smooth and shining.—Fl. Austr. l.c.

Hab.: Queensland, *F. v. M.*

SERIES PINNATÆ.

D. oxyptera, *F. v. M.*, Fragm. i. 74; Fl. Austr. i. 484. A shrub of several feet, the branches virgate, terete, pubescent, as well as the leaves, and more or less viscid. Leaves pinnate, the rhachis angular, but scarcely dilated; leaflets usually 5 to 11, narrow-oblong or oblong-cuneate, obtuse, 2 to 4 lines or rarely ½ in. long, the margins recurved. Flowers small, sessile, or very shortly pedicellate. Sepals broad, acute, about 1 line long. Anthers obtuse, not exceeding the calyx, often hirsute. Capsule small, slightly hairy, the axis 2 or three lines long, the wings rigid, divergent, almost triangular, and acute.—Fl. Austr. l.c.

Hab.: Islands of the Gulf of Carpentaria, *Flora Australiensis.*

Order LEGUMINOSÆ.

TRIBE TRIFOLIEÆ.

MELILOTUS, Tournef.

M. alba, *Lam.* The common white Melilot. An erect, wiry-stemmed plant of 2, 3, or more ft. high. Stipules linear acuminate. Leaves pinnately 3-foliolate; leaflets narrow, sharply toothed. Racemes slender, attaining the length of 5 or 6 in. Flowers small white. Calyx-teeth lanceolate, shorter than the tube. Corolla 2 or 3 times the length of the calyx. Pod 1 to 1½ lines, obtuse, and marked with transverse wrinkles.

Hab.: A weed on the cultivation paddocks about Pittsworth. This plant is recorded as a troublesome weed in the fields and vineyards of Southern Europe.

TRIBE GALEGEÆ.

INDIGOFERA, Linn.

I. saxicola, *F. v. M.*, Fl. Austr. ii. 199. A shrub of 3 or 4 ft., with spreading branches, slightly hoary, with a minute pubescence. Leaflets 5 or rarely 7, obovate or orbicular, and very obtuse, mostly about 1 in. long, on petiolules of 1 to 2 lines, the pinnate veins scarcely prominent. Racemes pedunculate, rather slender, longer than the leaves. Calyx-teeth shorter than the tube, the upper ones broad and distant. Standard sessile, 3 lines long or rather more; keel acute. Pod terete, spreading, ½ to ¾ in. long, straight.—Fl. Austr. l. c.

Hab.: Queensland, *F. v. M.*

TRIBE INGEÆ.

PITHECOLOBIUM, Mart.

P. Lovellæ (n. sp.) A small tree, 20 to 30 ft. high, with a brown smooth bark, the young shoots and inflorescence clothed with dense glossy light-brown hairs, becoming of lighter colour on the older parts. Leaves velvety pubescent, usually with 3 pairs of pinnæ. The common petiole short in the leaves examined, about 1½ in. in length, with a sessile gland near the base; rhachis about 3½ in. long, bearing a sessile gland between the two upper pairs of pinnæ; rhachis of pinnæ from 1 to 2½ in. long, the uppermost pairs of pinnæ and leaflets much the largest. Leaflets 2 pairs each on the lowest and 4 on the terminal pinnæ, nearly sessile, ovate to nearly oblong, from under 1 in. to 2½ in. long, upper surface sparingly hairy, the under surface densely tomentose, margins revolute. Panicle terminal, rather short (judging from the specimen to hand); the sessile flowers in irregular head-like clusters. Bracts ovate to linear-lanceolate, minute, very hairy. Calyx campanulate, thick, coriaceous, the outside densely clothed with glossy, somewhat bronzed-coloured hairs, inside glabrous and purplish or dark coloured, about 5 lines long, teeth 5, blunt. Corolla-tube exceeding the calyx by 2 or 3 lines, then expanding and funnel-shaped, and deeply divided into 5 linear lobes, clothed on the outside with pale yellowish velvety hairs, the tube and lobes glabrous on the inner surface. Stamens filiform and very numerous, the tubular portion nearly as long as the corolla-tube, and of a deep crimson, free portions exserted beyond the corolla about 1 in. shading from light to deep crimson. Anthers light coloured, minute; style filiform, longer than the stamens.

Hab.: Fraser's Island, *Hon. Miss Lovell.*

This additional Pithecolobium in many respects resembles *P. Tozerii*, but differs from that species in the form of glands and foliage, as well also as in the indumentum.

May 1st, 1893.

Order ROSACEÆ.

Tribe PRUNEÆ.

PYGEUM, Gærtn.

Calyx-tube obconic, urceolate, or campanulate, deciduous; limb 5 to 15-toothed, often unequally. Petals minute, 5 to 6 in the 5 to 6-toothed calyx, none in the 10 to 15-toothed, villous or tomentose, rarely glabrous, often undistinguishable from the calyx lobes. Stamens 10 to 50, in one or more series at the orifice of the calyx-tube, filaments slender, incurved; anthers small. Carpel 1, basal in the calyx-tube, ovoid or subglobose; style terminal, slender, exserted from the bud; stigma capitate; ovules 2, collateral, pendulous. Fruit a transversely oblong, obscurely didymous, rarely subglobose drupe, pericarp thin, dry, or juicy. Cotyledons very thick, hemispheric; radicle minute, superior. Evergreen trees or shrubs. Leaves alternate, persistent, usually quite entire; stipules minute, fugacious, basal glands 2 or none. Flowers small, racemose, sometimes unisexual by want of ovary.—*Hook.*, Fl. Brit. Ind., ii. 318.

Differs from *Prunus* chiefly in the minute villous petals (when present) and form of the fruit. The often conspicuous basal pair of glands on the leaf are very variable, a few species have scattered glands, and one has bullate glands on the tip of the petiole, formed by a prolongation of the leaf-blade.—*Hook. l.c.*

The genus contained previously about twenty species all of Tropical Asia, except one Tropical African species.

P. Turnerianum (n. sp.) (After F. Turner, Botanist to Agricultural Department of New South Wales, who has done so much to bring before the public of that colony the economic value of Australian fodder plants.) Aboriginal name, "Abill." Mr. Cowley says that this name applies to both tree and fruit. A small tree, with small flanges at the base of trunk. The leafy part of the branches densely clothed with ferruginous hairs. Leaves, upper surface bright glossy green, the under surface pale, entire, lanceolate or oblong-lanceolate, 4 to 6½ in. long, 1½ to 2¼ in. broad, primary veins rather distant, very oblique, and looping near the margin, prominent on the underside; upper surface rather glossy, with short appressed hairs along the midrib, and sometimes on other parts of the surface;

the underside more or less hairy, with rather rigid appressed hair of a somewhat yellowish tinge, tapering to a slender petiole of 3 to 5 lines; basal glands irregular as to position, and number 1, 2, or 3, sometimes a marginal one on each side of the midrib below the lowest pair of lateral nerves, sometimes above on the one side and below on the other, or with a gland below the second pair of nerves, oval, dark coloured. Racemes numerous, lateral, 1 or 2 in. long, slender, and softly ferruginous tomentose flowers, male, nearly sessile, calyx-tube widely campanulate, about 2 lines diameter, glabrous, and probably purplish inside, except for a tuft of ferruginous hairs in place of ovary; lobes about 12, narrow, very hairy, the hairs longer at the apex, nearly as long as the tube. Stamens between 30 and 40, filaments coloured, glabrous, a little longer or about as long as the lobes of calyx. Anthers oblong. Female flowers wanting. Drupe of a rich plum colour, transversely slightly exceeding 1 in. in diameter.

Fruit stones of a Pygeum were picked up in the scrubs of tropical Queensland by Mr. Christie Palmerston, and others near Mount Sophia by Mr. A. Meston. The former are blunt-cordate, much compressed, about 1 in. long and nearly as broad, and about ½ in. thick. Putamen of a light brown colour, somewhat smooth like the shell of a hard-shelled almond, marked with prominent, arching, branched veins or ribs, and reticulate between. Those found by Mr. A. Meston at Mount Sophia are more spherical, but broader than long, 11 lines broad and 9 lines long, the reticulation more prominent and closer than in C. Palmerston's examples. From the fruit now to hand from Mr. E. Cowley there can be no doubt but what all belong to one species.

Hab.: For shoot, bearing male flowers, and later branches with ripe fruit, Barron River, *E. Cowley*. Stones of fruit, *Christie Palmerston* and *A. Meston*.

May 1st, 1893.

Order SAXIFRAGEÆ.

Tribe CUNONIEÆ.

WEINMANNIA, Linn.

W. apetala (n. sp.) A tall tree, glabrous except the inflorescence. Leaves opposite, digitately compound, leaflets 3, sessile, lanceolate and bluntly or glandularly serrate, 2 or 3 in. long, the petiole usually under 2 in. long, texture membranaceous. Inflorescence hoary-pubescent, racemose, at the nodes below the leaves of the branchlets. Some of the smaller branchlets are destitute of leaves and then change the inflorescence to a peduncle bearing at its end an umbel of three racemes, the common peduncle 6 to 8 lines, the secondary peduncles about 6 to 8 lines, bearing racemes of from 1½ to 3 in. long; flowers numerous, scattered. Bracts narrow-lanceolate, petiolate, about as long as the pedicels. Pedicels very slender about 2 or 3 lines long. Flowers when expanded 2 lines diameter; calyx-lobes 5. Petals none. Stamens 12 or more, much exserted, the filaments of unequal length, and often somewhat flattened; anthers some much larger than the others, didymous. Styles 2 free; spreading, glabrous. Ovary hirsute except at the very base. Fruit as yet unknown. Flowering in December and January.

The present species approaches near to *W. lachnocarpa* F. v. M., but differs in its more lax slender inflorescence, more membranous leaves, which are not so prominently reticulate; its longer stamens, as well as probably the flower lobes to the calyx.

Hab.: Kamerunga, *E. Cowley*.

September, 1893.

Order MYRTACEÆ.

Tribe CHAMÆLANCIEÆ.

DARWINIA, Rudge.

D. fascicularis, *Rudge*, Trans. Linn. Soc. xi. 299 t. 22; Fl. Austr. iii. 13. An erect much-branched heath-like shrub. Leaves scattered, often crowded, linear, slender, semiterete or obscurely triquetrous, subulate-pointed, mostly 4 to 5 lines long, shortly petiolate, the floral ones not different or slightly longer. Flowers about 6 to 12 together in terminal heads within the last leaves. Bracteoles narrow and short. Calyx slender, not 3 lines long, the adnate part prominently 5-ribbed, otherwise smooth. Lobes very small and scale-like. Petals broad, about ½-line long. Staminodia short and filiform. Style long and slender.—Fl. Austr. l.c.

Hab.: Queensland, *F. v. M.*

Tribe MYRTEÆ.

MYRTUS, Linn.

M. exaltata (n. sp.) (So named from its lofty growth.) A tree of from 80 to 100 ft. in height, furnishing a good timber. Bark on the branchlets loose, brownish. Leaves glossy, irregularly opposite or alternate, ovate with often long tail-like points, 2 to 3 in. long 1½ inch. broad, on rather slender petioles of about 3 lines, the primary veins very slender, numerous, parallel, oblique, joining in an intramarginal one more or less distant from the edge, the intermediate veinlets few and distant. Oil-dots minute. (No flowers seen.) Fruit in short, stout racemes in the upper axils, globular, about 5 lines diameter, of a pink colour aud fleshy consistence, containing, so far as could be observed (the fruit being in bad condition), but a solitary seed.

Hab.: Scrubs about the Barron River, the fruit used for jam-making, *E. Cowley.*

September, 1893.

Order COMPOSITÆ.

Tribe ASTEROIDEÆ.

OLEARIA, Mœnch.

O. ramosissima, *Benth.*, Fl. Austr. iii. 479. (*Eurybia ramosissima*, DC.; *Aster cyanodiscus*, F. v. M.; or *Olearia cyanodiscalis*, F. v. M., Fragm. v. 82.) A shrub of 2 or 3 ft., with numerous rather slender branches, scabrous-pubescent, mixed with a little loose wool. Leaves minute, reflexed, clustered in the axils, lanceolate or linear, entire, with revolute margins, all under 1 line long or rarely the larger ones narrow and nearly 2 lines long, glabrous and smooth or scabrous above, with a thin loose wool underneath. Flower-heads solitary at the ends of the branchlets, forming an oblong or rarely corymbose leafy panicle. Involucre broadly turbinate, about 3 lines long, the bracts often coloured and jagged at the edge. Florets blue, those of the rays 12 to 15, more numerous in the disk and longer than the involucre. Achenes more or less villous. Pappus white, with a few short outer bristles.—Fl. Austr. l.c.

Hab.: Queensland, *F. v. M.*

CONYZA, Linn.

C. elata (n. sp.). A tall rambling shrub, often attaining the height of 9 or more ft. Stems prominently striate. Leaves alternate, lanceolate, sharply toothed and accuminate, 3 to 5 in. long, the petioles short and slender, the primary veins few and distant, the young growth and inflorescence hoary tomentose, otherwise nearly glabrous. Flower-heads in small corymbs, terminating the lateral branches, clustered or on elongated peduncles. Involucral bracts narrow linear, in 2 or 3 series, the inner ones about 3 lines long, the outer ones broader and only 1 or 2 lines long. Receptacle densely hairy. Outer florets female, with very slender tubes, the lobes setaceous, the long exserted style-branches very narrow and glabrous; the disk or central florets few, male (or hermaphrodite) florets with much wider tubes enclosing the anthers, corolla-lobes as in the males, bearing prominent white bristles; style-branches flattened and echinate, but not so far exserted, but much broader than those of the female florets. Pappus slightly exceeding the involucre, 1-seriate, white. Achenes silky, and flattened, angular, or more or less ribbed.

Hab.: Abounding in the scrubs of the Russell River, and attaining the height of 12 or 14 ft., *Bellenden-Ker Expedition*; Barron River Scrubs, *E. Cowley*.

Tribe INULOIDES.

COLEOCOMA, F. v. M.

Involucre ovoid, the bracts imbricate in several rows, dry, with slightly scarious tips. Receptacle flat, without scales. Florets all tubular, those of the circumference slender, female, 3- to 5-toothed; disk-florets several, hermaphrodite, sterile, 5-toothed. Anthers tailed. Style of the disk-florets usually undivided. Achenes striate, somewhat compressed, those of the disk abortive. Pappus of linear rigid scale-like bristles, those of the female florets united in a long tube, jagged at the end, those of the disk-florets free almost to the base. Low, rigid herb. Leaves alternate, usually toothed. Flower-heads terminal or lateral.—*Benth.* in Fl. Austr. iii. 533.

C. centaurea, *F. v. M.*, Fl. Austr. iii. 533. A low, rigid, erect, branching herb, almost woody at the base, glabrous except for a little wooliness at base of involucre. Leaves linear or lanceolate, acute, with a few acute teeth, contracted at the base, but the upper ones sessile or slightly decurrent. Flower-heads terminal and sessile within the last leaves or at the base of the lateral branches. Involucre 4 or 5 lines long, the bracts very broad, the inner ones with short broad scarious tips, jagged almost as in *Centaurea*. Florets yellow. Achenes rather long, but much shorter than the involucre, the tips of the pappus of the sterile florets slightly protruding.—*Benth. l.c.*

Hab.: St. George, *Jos. Wedd.*

November, 1893.

Order GOODENOVIEÆ.

VELLEIA, Sm.

V. connata, *F. v. M.*, Fl. Austr. iv. 46. Glabrous and glaucous. Radical leaves petiolate, obovate-oblong and toothed or oblong-spathulate and entire, 2 to 3 in. long. Stems tall, dichotomous, with large, broad, connate entire or toothed bracts at the forks. Sepals 5, ovate or ovate-lanceolate, acuminate, the outer one fully 4 lines long, the others smaller, usually connate at the base. Corolla 7 to 8 lines long, the lower lobes not winged (or the wings destroyed in the specimens seen?), the upper ones winged on one side and slightly ciliate. Capsule about 3 lines diameter. Seeds about 1 line diameter, including the wing.—Fl. Austr. l.c.

Hab.: Queensland, *F. v. M.*

GOODENIA, Sm.

G. heterochila, *F. v. M.*, Fragm. iii. 142.; Fl. Austr. iv. 71. Herbaceous, softly pubescent or villous. Leaves oval-oblong or lanceolate, entire or toothed, 1 to 2 in. long, contracted at the base, the lower ones not seen. Peduncles 1-flowered, axillary, slender, shorter than the leaves, articulate under the flower. Bracteoles none or very minute. Calyx-lobes linear or setaceous. Corolla under ½ in. long, the 3 lower lobes winged and truncate, the 2 upper winged, but with an auricle on the outer side below the middle. Dissepiment of the ovary very short; ovules 4 or 5, large and flat.—Fl. Austr. l.c.

Hab.: I have at times received fragments from the Gulf country, which may probably belong to one or other of the forms of this species.

Order EPACRIDEÆ.

Tribe STYPHELIEÆ.

LEUCOPOGON, R. Br.

L. microphyllus, *R. Br.*, Fl. Austr. iv. 192. (*Perojoa microphylla*, Cav. Ic. iv. 29. t. 349. *Peroa microphylla*, Pers. *Styphelia microphylla*, Spreng. *Leucopogon denudatus*, Sieb. *Styphelia denudata*, Spreng. *Leucopogon fraternus*, DC.) An erect or straggling shrub, with rather slender, often twiggy, branches, more or less pubescent. Leaves ovate-oblong, lanceolate or almost linear, obtuse, flat, erect or recurved, 1 to 2 lines long, or sometimes all under 1 line, very rarely a few exceeding 2 lines. Spikes terminal, very short, dense, and few-flowered, clustered so as to form little leafy heads at the ends of the branches. Lower bracts leaf-like, acuminate; bracteoles half as long as the calyx. Sepals about 1 line long, narrow, acuminate and acute or rarely almost obtuse. Corolla under 1½ lines long, the lobes as long as the tube. Anthers attached below the short sterile tips. Hypogynous disk truncate or shortly lobed. Ovary 2-celled, tapering into the style. Fruit small, oblong, usually 1-seeded.—Fl. Austr. l.c.

Hab.: Queensland, *F. v. M.*

Order ASCLEPIADEÆ.

Tribe CYNANCHEÆ.

VINCETOXICUM, Mœnch.

V. pachylepis (n. sp.) A stout ferruginous climber. Leaves rotund-ovate, apiculate, the base prominently cordate, 3 to 5 in. long, 2½ to 4 in. broad; petioles slender, 1 to 1½ in. long, clothed as well as the principal veins with short brown hairs, the lamina nearly or quite glabrous on both sides. Flowers cream-coloured, fragrant, in pubescent, axillary umbels; peduncle about 1 in. long, the pedicels not exceeding 3 lines. Calyx-segments much overlapping, very broad, nearly orbicular, 2½ lines long, glabrous inside, margins ciliate. Corolla 4 or 5 lines long, contorted in the bud, the lobes twice as long as the tube, thick, and more or less hairy on the inside. Corona composed of 5 free, oblong apiculate, glossy, thick scales, about 1½ lines long; anthers somewhat shorter, but the terminal membrane held in the little point of the corona scale at its back. Pollen masses oblong, glossy. Stigma minutely 2-lobed. Fruit not seen.

Hab.: Kamerunga, *E. Cowley.*

Order CONVOLVULACEÆ.

Tribe CONVOLVULEÆ.

ERYCIBE, Roxb.

E. paniculata, *Roxb.* Flora Austr. iv. 411.; **var. coccinea,** *Bail.* Native name, "Nangbro." Bentham l.c. says berry in the Indian specimens ovoid, above ½ in. long, not seen in the Australian ones. De Candolle Prod. ix. 464. The berry is said to be black, the size of a small cherry. In Brandis's Florist Flora, p. 344, the berry is also said to be black. The colour of berry is very seldom recorded in the descriptions given of the species or varieties of this genus; but in all cases where the berries of P. paniculata are spoken of they are said to be black, thus differing from the Australian plant, in which they are, when fresh, described as of a pleasing cardinal red colour; and they were quite red when they reached my hands. In form oval, about ½ to nearly ¾ in. long; rather fleshy, containing a single seed.

Hab.: I am indebted to Miss Cowley, of Kamerunga, for the ripe fruit of the above plant, which she says is of a pleasing cardinal red in February. The above name is recommended to distinguish the Australian from any of the Indian forms.

IPOMÆA, Linn.

Series Speciosæ.

J. Muelleri, *Benth.*, Fl. Austr. iv. 423. A glabrous, rather slender twiner. Leaves on rather long petioles, very broadly cordate-ovate, obtuse, with rounded basal auricles, entire, 1 to 2 in. long. Peduncles shorter or at length longer than the petioles, bearing 1 to 3 flowers on very short pedicels. Bracts very small. Sepals broad, obtuse, or scarcely acuminate, 4 to 5 lines long. Corolla apparently pink, rather above 1 in. long. Capsule globular, smooth, as long as the calyx. Seeds villous, nearly allied to *I. sepiaria*, but the flowers are smaller and the seeds villous.—Fl. Austr. l.c.

Hab.: Queensland, *F. v. M.*

Order SOLANACEÆ.

SOLANUM, Linn.

S. macoorai (n. sp.) Aboriginal name for South Peak of Bellenden Ker Range. A shrub of straggling habit, attaining from 5 to 7 feet in height, the young shoots purplish, appearing glabrous, but with the aid of a lens seen to be more or less covered with minute stellate hairs. Prickles straw-coloured, straight, on the branches, petioles, midrib, and principal veins on both sides of leaf. Leaves ovate, acuminate, unequal sided at the base and tapering to a petiole of about 2 in.; the margins repandly lobed. No flowers seen. Fruit solitary, on a peduncle of about 1 in., globular, yellow, about ¾-in. diameter. Calyx-tube (as seen at base of fruit) with 5 blunt prominent ribs, lobes 2 or 3 lines long with recurved points.

Hab.: Summit of south peak Bellenden-Ker, June, 1889. From the seeds I brought to Brisbane plants were raised at Bowen Park. These grew luxuriantly, but have all died before producing flowers. The above fragmentary description has been kept back from publication in the hope that flowers would have been obtained from the plants in cultivation. These having been lost, an account is now given of the plant with the hope that some person visiting the locality may collect and forward to the writer a few shoots bearing flowers, or fresh fruits for cultivation.

Order VERBENACEÆ.

Tribe VITICEÆ.

CALLICARPA, Linn.

C. longifolia, *Linn.* From Dr. T. G. White, of Geraldton, I hear that the Javanese living in the Johnstone River district make use of the bark of this shrub as a substitute for the Betel-leaf, when chewing the areca-nut with lime. The species has a wide range, being met with in many parts of India and the Malay Peninsula, besides Australia, and therefore it may be put to the above purpose in Java. Dr. Dymock gives the following quotation, when referring to *C. lanata*, Linn.:—"Ainslie says that the bark has a peculiar sub-aromatic and slightly bitter taste, and is chewed by the Cingalese when they cannot obtain Betel-leaves." From the above it is probable that the bark of any species of the genus obtainable is used.

It is strange that the Javanese do not make use of the leaves of one or other of our indigenous Pipers, which, in form of leaf and habit of growth, rather closely resemble the Betel-leaf plant—*Piper Betle.* (P. Mestoni, of the Russell River, belongs to the same tribe of the genus..) Dr. Dymock, in his excellent work "The Vegetable Materia Medica of Western India," gives the following concise notice, extracted verbatim from "Dutt's Hindu Materia Medica":—"The leaves of this creeper are, as is well known, masticated by the natives of India. The poorer classes make their packets of betel with the addition of lime, catechu, and betel-nuts." The rich add cardamoms, nutmegs, cloves, camphor, and other aromatics. Betel-leaf thus chewed acts as a gentle stimulant and exhilarant. Those accustomed to its use feel a sense of langour when deprived of it. The ancient Hindu writers recommend that betel-leaf should be taken early in the morning, after meals, and at bedtime." According to Susruta, it is aromatic, carminative, stimulant, and astringent. It sweetens the breath, improves the voice, and removes all foulness from the mouth. According to other writers, it acts as an aphrodisiac. Medicinally, it is said to be useful in diseases supposed to be caused by deranged phlegm, and its juice is much used as an adjunct to pills administered in these diseases, the pills being rubbed into an emulsion with the juice of the betel-leaf and licked up. Being always at hand, betel-leaves are used as a domestic remedy in various ways. The stalk of the leaf, smeared with oil, is introduced into the rectum in constipation and tympanitis of children, with the object of inducing the bowels to act. The leaves are applied to the temples in headache for relieving pain; to painful and swollen glands for promoting absorption, and to the mammary gland with the object of checking the secretion of milk. Betel-leaves, known in India by the name Pan, are used as a ready dressing for foul ulcers, which seem to improve under them. In the Concan, the fruit with honey has a reputation as a remedy for cough. Sir James Emerson Tennent says in his account of the island of Ceylon, I., Page 113:—"Every Singhalese carries in his waistcloth an ornamented box of silver or brass, according to his means, enclosing a smaller one to hold a portion of chunam (lime obtained by the calcination of shells), whilst the larger contains the nuts of the Areca and a few fresh leaves of the betel-pepper. As inclination or habit impels, he scrapes down the nut, which abounds in catechu, and, rolling it up with a little of the lime in a betel-leaf, the whole is chewed and finally swallowed, after provoking an extreme salivation. No medical prescription could be more judiciously compounded to effect the desired object than this practical combination of antacid, the tonic, and carminative."

Order CHENOPODIACEÆ.

Tribe CHENOLEEÆ.

KOCHIA, Schrad.

K. planifolia, *F. v. M.*, Fragm. i. 213; Fl. Austr. v. 187. An erect divaricately branched shrub of 2 or 3 ft., the branches and young foliage covered with a soft and dense woolly tomentum, which wears off from the older leaves. Leaves oblong or oblanceolate, obtuse, contracted into a distinct petiole, $\frac{1}{4}$ to $\frac{1}{2}$ in. long, rather thick but flat. Fruiting perianth precisely that of *K. villosa*, glabrous or tomentose, the wing generally entire, membranous and attaining 5 to 6 lines diameter.—Fl. Austr. l. c.

Hab.: Queensland, *F. v. M.*

Order LAURINEÆ.

Tribe PERSEACEÆ.

ENDIANDRA, R. Br.

E. Sankeyana (n. sp.) Aboriginal name at Barron River, "Goolaway." A tree attaining the height of about 70 ft.; the young branches often 4-angular and more or less densely ferruginous velvety-tomentose. Leaves alternate or subopposite at the ends of the branchlets, from elliptical oblong to lanceolate, the larger ones 5 in. long and $2\frac{1}{2}$ in. broad in the widest part, shortly petiolate, the upper surface glabrous, the primary veins sunk, under surface pale, with the primary and reticulate veins very prominent, of a reddish-brown, and more or less velvety. Flowers not seen. Fruit racemes lateral or axillary, erect near the ends of the branchlets, rather slender, about $2\frac{1}{2}$ in. long, with one or two fruit at the end. Fruit black, globose, often compressed, 1 to $1\frac{1}{2}$ in. diameter, resting upon a star-like perianth, not exceeding 2 lines diameter.

Hab.: Scrubs about the Barron River, *E. Cowley*.

Note.—Following my plan of attaching to new native plants from time to time the names of those members of our Royal Society who have evinced an interest in the botany of the colony, to the present new Endiandra is given that of J. R. Sankey, the treasurer of the society and an active member of the Field Naturalist Section. September, 1893.

Order PROTEACEÆ.

BANKSIA, Linn. f.

B. ericifolia, *Linn. f.*, Suppl. 127; Fl. Austr. v. 547. A tall shrub or small tree of 12 to 14 ft.; glabrous except the inflorescence. Leaves crowded, narrow-linear, truncate or notched at the end, and sometimes with an intermediate point, otherwise entire with closely revolute margins, rarely exceeding $\frac{1}{2}$ in. Spikes cylindrical, 6 to 10 in. long. Bracts with broad shortly acuminate silky-pubescent tips. Perianth yellow, silky, the tube about $\frac{3}{4}$ in. long, the limb ovoid. Style about 1 in. long, hooked, with a very short, thick, stigmatic end. Fruiting cones long and cylindrical. Capsules scarcely protruding, villous but often becoming glabrous, the flat-top $\frac{3}{4}$ to 1 in. broad and 4 or 5 lines thick.—Fl. Austr. l.c.

Hab.: Queensland, *F. v. M.*

Order SANTALACEÆ.

CHORETRUM, R. Br.

C. glomeratum, *R. Br.*, Fl. Austr. vi. 218. An erect shrub, sometimes scarcely 1 ft. high, sometimes almost arborescent, with numerous erect, slender, wiry, angular branches. Leaves reduced to minute, subulate, deciduous scales. Flowers small, in clusters of from 2 to 5 on very short common peduncles not exceeding 1 line, each cluster surrounded by 3 or 4 minute almost orbicular bracts. Perianth about $\frac{3}{4}$ line long, the broadly turbinate adnate tube not above half the length of the lobes, the external margin very slightly prominent. Drupe when dry 2 to 4 lines long, globular or slightly ovoid.—*Benth.*, *l.c.*

Hab.: Near Dalby, *Dr. Thos. L. Bancroft.* The specimens submitted to me were in early bud and flower.

Order CUPULIFERÆ.

Flowers monœcious. Males in spikes or catkins. Perianth of 1 or several usually unequal scales, segments or lobes. Stamens 1 or more, with or without a central rudimentary pistil; filaments slender; anthers 2-celled. Female flowers solitary or few together, surrounded by scales or bracts either remaining free or more frequently united in an entire or lobed involucre often enclosing the fruits, and sometimes growing out into setæ or prickles. Perianth-tube adnate to the ovary, the limb usually 6-toothed. Ovary inferior, 1-celled or more or less perfectly 3 or more celled. Styles as many as cells, simple, stigmatic in the upper portion. Ovules 1 or 2 in each cell, erect or pendulous. Fruit consisting of one or more nuts placed upon, or more or less enclosed in, the usually enlarged persistent involucre. Seeds usually solitary in each nut, without albumen. Embryo various, the radicle usually superior. Trees or shrubs. Leaves alternate, penniveined, with or without stipules. Male catkins usually falling off entire.—*Benth.*, in Fl. Austr. vi. 209.

FAGUS, Linn.

(So called from *Phago* to eat; because the nuts were used as food in the early ages.)

Male flowers in globular pendulous catkins within small scales, falling off very early, or rarely solitary. Perianths shortly stalked within each catkin-scale, campanulate, 4 to 6-lobed, containing 8 to 16 stamens, with protruding filaments. Female catkins globular, almost sessile, the scales linear, with numerous closely-packed filiform inner scales, all empty except the innermost and forming an involucre round 2 to 4 sessile flowers in the centre of the catkin. Perianth-limb of

4 or 5 short lobes. Ovary 3-celled, with 2 pendulous ovules in each cell. Styles 3. Nuts 2 to 4, angled or winged, enclosed in a hard prickly involucre, composed of the combined scales of the catkin, and opening in 4 valves. Trees or rarely shrubs. Leaves alternate, coriaceous, penniveined, frequently plicate and toothed. Stipules usually deciduous. Male catkins usually in the lower axils, the females in the upper ones.—*Benth.*, Fl. Austr. l.c.

F. Moorei, *F. v. M.*, Fragm. v. 109; Fl. Austr. vi. 211. (*F. Carronii*, C. Moore, Negro Head of N.S. Wales.) (After C. Moore, Director of Sydney Botanic Garden.) A tree attaining the height of 150 ft. Leaves 1 to 2 in. long on the barren shoots, ¾ to 1 in. on the flowering branches, ovate or ovate-lanceolate, crenate, acute or a few only of the lowest obtuse, flat and coriaceous as in *F. Cunninghamii*, but with more numerous and rather more prominent primary veins. Male catkins in the lower axils on short recurved peduncles. Involucre irregularly 8 to 12-lobed, and mostly splitting. Stamens about 20. Female catkins in the upper axils on erect short peduncles, ovoid, glandular, containing 3 flowers each. Ovary of the 2 outer flowers 3-angled and 3-winged, of the inner flower flattened and 2-winged. Fruiting involucre about 5 lines long.—*Benth.*, Fl. Austr. in part; *Moore's* Fl. of N.S. Wales in part.

Hab.: Baron Mueller writes me that he has received specimens of this tree, which were gathered by Mr. R. Collins on high mountains towards Tamrookam. Found in New South Wales, at the head of Bellinger River, and head of Macleay River.

Order ARISTOLOCHIACEÆ.

ARISTOLOCHIA, Linn.

A. prævenosa, *F. v. M.*, Fragm. ii. 166; Fl. Austr. vi. 208. A tall climber, the young branches and principal veins of the underside of the leaves ferruginous-pubescent or nearly glabrous. Leaves petiolate, from ovate-oblong and 3 to 4 in. long, to narrow-oblong and 8 to 10 in., obtuse or obtusely acuminate, rounded or slightly cordate at the base, coriaceous, shining above, penniveined and more or less distinctly 3 or 5-nerved, with numerous prominent transverse and reticulate veinlets underneath. Flowers unknown. Fruit of a rich yellow colour, somewhat succulent, oblong somewhat narrowed towards the base, and the apex with a short point, fully 1½ in. long, and 10 lines in diameter, with 6 prominent ribs. Seeds compressed, triangular, the upper angles rounded, resembling in shape the pods of the Shepherd's purse, the sides slightly tubercular-rugose.

Hab.: Macpherson Range, *J. F. Shirley;* Nerang Creek, *H. Schneider.* Specimens from both localities in fruit only. First met with at the Clarence River, New South Wales.

Order COMMELYNACEÆ.

Tribe TRADESCANTIEÆ.

CARTONEMA, R. Br.

C. spicatum, *R. Br.*, Fl. Austr. vii. 91. Stems branching at the base, usually hairy, 6 in. high below the spike. Leaves linear, tapering from a base of 1½ to 3 lines broad just above the sheath to a long point, the longer ones usually exceeding the spike. Spike 1 to 3, sometimes very compact and only 2 in. long, rarely elongated to 6 in., and rather loose. Bracts linear-subulate, shorter than the perianth. Outer perianth segments subulate-acuminate, 5 to 6 lines long, very hairy; inner segments obovate, nearly as long, often but not always spotted. Filaments slightly flattened, at first shorter, but at length rather longer than the oblong-linear anthers, which open in terminal pores, rarely splitting down the sides of the cells. Ovary and capsule glabrous.—*Benth.*, *l.c.*

Hab.: Thursday Island, *E. Cowley*. Not previously met with in Queensland, but has been found in several localities of North Australia.

Order CENTROLEPIDEÆ.

CENTROLEPIS, Labill.

C. aristata, *Rœm. et Schult.*, Fl. Austr. vii. 206. (*Desvauxia aristata*, R. Br.) Leaves linear, sometimes very short and fine, but often a few of them nearly $\frac{1}{2}$ line broad and above 1 in. long. Scapes 1 to 2 in. high, or in luxuriant specimens twice that height, flattened under the spike. Floral bracts close together, glabrous, ovate erect, 2 to near 3 lines long, with long leafy points, that of the lower bract often $\frac{1}{2}$ in. and sometimes 1 in. long, the other one shorter. Flowers in each bract from 6 to about 20, intermixed with hyaline scales, some very narrow and entire, others broader and jagged at the end, always 1 under each stamen, and 1 under or by the side of each ovary, with a few apparently additional ones. Carpels of the ovary few, varying from 3 or 4 to 6 or 7.—Fl. Austr. l.c.

Hab.: Queensland, *F. v. M.*

Order CYPERACEÆ.

CYPERUS, Linn.

C. platystylis, *R. Br.*, Fl. Austr. vii. 264. Stems tufted, rather stout, not above 1 ft. high. Leaves rather broad, shorter and mostly much shorter than the stem, with flattened acutely-keeled sheaths. Umbel very compact, of about 6 rays, the longest under 1 in. Spikelets 6 to 12 in the clusters. Involucral bracts, 1 or 2 longer than the inflorescence, and one or two short. Spikelets brown, flat, but rather thick, 4 to 6 lines long, $1\frac{1}{2}$ lines broad, acute, the rhachis not winged. Glumes very regularly distichous and imbricate, broadly concave, the lower ones obtuse, the upper ones acute, the keel slightly prominent, sometimes produced into a short point, the nerves very faint. Style 2 or 3-cleft, flattened or triquetrous in the upper part, the angles ciliate. Nut oblong or oval-oblong, as long as the glume, the flat face next the rhachis, the back convex. The style is quite that of *Fimbristylis*, all the other characters those of *Cyperus*.—Fl. Austr. l.c.

Hab.: Queensland, *F. v. M.*

CAREX, Linn.

C. chlorantha, *R. Br.*, Fl. Austr. vii. 440. Stems usually under 6 in., but sometimes above 1 ft. high. Leaves much shorter. Spikelets 6 to 12, sessile in a dense terminal spike of $\frac{1}{2}$ to 1 in., or rarely rather longer and interrupted at the base, and then slightly compound with more numerous spikelets, the spikelets all or mostly androgynous, ovoid-oblong, 2 to 3 lines long, usually brown. Outer bracts glume-like, or rarely the lowest with a subulate lamina nearly as long as the inflorescence. Glumes ovate, 1 to $1\frac{1}{4}$ lines long, acute or mucronate, the keel usually green. Male flowers few at the top of the spikelet. Utricle as long as the glume, much flattened, the edges ciliate, tapering into a short 2-toothed beak. Style-branches 2. Nut flat.—Fl. Austr. l.c.

Hab.: Queensland, *F. v. M.*

Order GRAMINEÆ.

Tribe PANICEÆ.

PANICUM, Linn.

P. cœnicolum, *F. v. M.*, Austr. vii. 467. Stems from a knotty branching base ascending to 1 ft. or more. Leaves flat, usually softly pubescent or villous. Panicle of rather numerous slender simple branches, 3 to 4 in. long, at first erect, at length spreading, the lower ones verticillate, the upper ones alternate and distant or rarely in pairs. Spikelets in pairs, 1 sessile, the other pedicellate, oblong, $1\frac{1}{2}$ to 2 lines long. Outer glume not exceeding $\frac{1}{2}$ line, the 2nd rather shorter than the spikelet, 5 or 7-nerved: the 3rd 7 to 11-nerved, both more or less silky-hairy and empty. Fruiting glume smooth, acute.—Fl. Austr. l.c.

Hab.: Queensland, *F. v. M.*

Tribe ANDROPOGONEÆ.

ROTTBOELLIA, Linn. f.

R. rariflora (n. sp.) A decumbent pubescent grass, probably annual, shortly creeping and rooting at the base, the stems slender intricate and leafy throughout their whole length. Leaves with loose sheaths, the lamina from $\frac{3}{4}$ to $1\frac{1}{2}$ in. long, narrow-lanceolate; ligula very short and jagged, hidden by the long hairs on the face of the lamina near the base. Peduncles solitary or two or more together in the axils, articulate near the middle, and there bearing a rather long obtuse close sheathing bract, peduncle terminated by a subulate bract about 2 lines long, green, 3-nerved, with nerve-like margins, half enclosing a spikelet of usually a single flower. Outer glume about 1 or $1\frac{1}{2}$ line long, nearly white, smooth and hard, faintly 3-nerved; 2nd glume hyaline and faintly 1-nerved, the 3rd and 4th glume or palea hyaline. Stamens 3. Grain enclosed in the hyaline glume and palea, but free from them. The above name is given provisionally.

Hab.: Batavia River, *Hugh Millman.* Cape York Peninsula, *Geo. Jacobson.*

Order FILICES.

ASPLENIUM, Linn.

A. flaccidum, *Forst.*, Fl. Austr. vii. 749. Rhizome stout, erect, crowned with large, subulate-lanceolate membranous scales. Stipes stout, rather short, compressed or somewhat 3-angular. Fronds under 1 ft. to 2 ft., or, in New Zealand, twice that length; pinnate or bi-pinnate, with winged rhachis; polymorphous, coriaceous, pendulous, glabrous, and from a deep to a pale-green colour; lanceolate, acuminate in outline, pinnæ narrow, 3 to 6 or more in. long, the barren ones toothed, the fertile divided into linear lobes of 2 to 6 lines, each bearing a single, rather large, sorus attached to the central vein ; but the conspicuous indusium thrown over to the upper side so as to appear marginal.

Hab. : Spring Creek, Killarney, *M. E. Milward.* This fern is also met with in New South Wales, Victoria, Tasmania, and New Zealand. Dr. Robt. Brown named *A. odontites.*

Order MUSCI.

ARCHIDIUM, Bridel.

A. brisbanicum, *Broth.*, in Bail. Contrib. Queensl. Fl. Bull. n. 7, p. 23 (name only). Monœcious, gregarious, small, green ; stems very short, erect, destitute of stolons ; lower leaves minute, remote, rather reflexed ; foliage leaves much larger, crowded, erecto-patent, from the base lanceolate-subulate, shortly aristate by the longer vein, margins erect, above denticulate, vein at the base about ·05 mm. wide, produced into a short, denticulate awn ; cells loosely parenchymatous, rhomboid, wholly pellucid, dilutely chlorophyllose ; perichætial bracts similar to the leaves, but longer, exceeded by the much longer vein ; thecæ globose minute, soft, thinly clothed ; spores ·1-·12 mm., brown, papillose. Perigonia in the branches, very short, basilar, terminal with lanceolate bracts sparingly denticulate and veinless, antheridia few, without paraphyses.

Hab. : Ipswich road, near Brisbane, *H. Tryon.*

LEUCOLOMA, Bridel.

L. clavinerve, *C. Mull.*, in Lett. Second Suppl. Qd. Fl. p. 68 (name only). Diœcious, cæspitose in dense tufts, glaucous green, not at all shining ; stems procumbent, very densely branched stems erect, straight, short, terete, acute, very densely foliaged, usually divided above, branchlets fastigiate, very short, erect ; leaves when dry closely imbricate, when moist erect, canaliculato-concave, from the base oblong acuminate, terminated by the projecting club-shaped vein, the terminal point of the apex hyaline, margins erect, apex incurved, entire, limbate, border hyaline, very narrow, composed of elongated very narrow cellules, but obsolete at the base and apex, vein hyaline, at the base about ·05 mm. wide, very smooth, green, protracted into a club-shaped deciduous appendix, with hyaline tip, basilar cells very smooth, sparingly chlorophyllose, elongated and narrowly rectangular, the lower ones golden, with quadrate cellules in the margins ; in the blade of the leaf there are many series of quadrate, hyaline cellules, the superior ones of which are verrucose, pellucid, minute, quadrate, incrassate, and chlorophyllose. The other parts are unknown.

Hab. : Petrie's Quarries, Brisbane, *H. Tryon.*

FISSIDENS, Bridel.

F. (Conomitrium) splachnoides, *Broth.*, in Bail. Contrib. Queensl. Fl. Bull. n. 13, p. 21 (name only). Diœcious, cæspitose with densish tufts, lowly, fragile, pale-green, somewhat polished ; stems very short, scarcely more than 3 mm. high, rather thick, beneath red, above pale, in the lower parts of the base radiculose, with long radicles, brownish-red, above sparingly foliaged, simple ; leaves 3-4-jugate, alternate, very flaccid, for the plant large, oblong, shortly acuminate, with oblique apex, 1·4-1·5 x ·4-·5 mm., entire everywhere limbate, border very narrow, whitish, lamina nerveless, with large splachnoids, lax, oval-hexagonal cellules, ·04-·05 x ·02-·025 mm., the basal cellules larger, sparingly chlorophyllose, very smooth; perichætia terminal, with few very small bracts. Other parts unknown. Male plants similar to the female, and growing in the same tuft; perigonia terminal, with few, very small bracts, widely vaginate, acuminate, and numerous antheridia.

Hab.: Indooroopilly, Queensland, *Field Naturalists.*

BRYUM, Linn.

B. (Eubryum) Tryoni, *Broth.*, in Bail. Bot. Bull. No. 7, p. 24 (name only). Diœcious, cæspitose, in laxish tufts, lowly, deep green, shining; stems to 4 mm. high, erect, very densely radiculose, above densely foliaged, varying little, erect, straight, very short, crowded together; stem and foliage when dry appressed, when moist erecto-patent, carinato-concave, not at all decurrent, oblong-lanceolate, cuspidate by the shortly excerted vein, margins revolute, above denticulate, bordered, border narrow, indistinct, vein viridi-rufescent, shortly exserted, denticulate, with oblong-hexagonal cellules in the centre of the leaf, ·05-·075 x ·015 mm., basilar cellules subquadrate, purple; perichætial bracts smaller than the leaves, lanceolate, including numerous archegonia and short paraphyses; setæ to 2 cm. high, base geniculate-ascendant, apex arcuate, thin, red, scarcely shining, when dry not at all twisted; thecæ pendulous, of short cells (·75 mm.), when dry rugulose-subcylindrical, with neck about 3 mm. long and ·75 mm. wide, not at all constricted beneath the mouth, at length purple, not shining; annulus wide, double, in part seceding; peristome duplex; exostome whether moist or dry with teeth connivent, about ·475 mm. by ·075 mm., very dense and trabeculate above, pallid, with hyaline apex and border, everywhere minutely papillose; endostome perfectly free, hyaline, very densely papillose with carinate processes, strongly perforate, slightly shorter than the teeth, cilia 2, lengthily appendiculate; spores ·008-·01 mm., ochraceous, very smooth; operculum tall, convex, with very distinct apex, obtuse. The male plant is unknown.

Hab.: West End, South Brisbane, *H. Tryon.*

B. (Eubryum) immarginatum, *Broth.*, in Bail. Cont. Queensl. Fl. Bull. n. 13, p. 21 (name only). Diœcious, cæspitose, in dense lowly tufts, fragile, green. Stems scarcely 2-3 mm. high, red, with long brown radicles, densely foliaged, rarely becoming 3-5 mm. high, erect, red, loosely, from base to apex subcomose-foliose; leaves when dry a little contorted, when moist erecto-patent, concave, not at all decurrent, oblong or oblong-oval, shortly aristate by the exserted vein, 1-3-1-5 x ·57 mm., entire, not at all limbate, the margin more or less revolute, apex erect, vein thick, rufescent, ending in a short awn, rigid, slightly reflexed, very acute, of lax cells, with fine cell coat, oval-hexagonal in the centre of the leaf, ·03-·045 x ·017-·02 mm., the basilar ones subrectangular, purple; perichætial bracts lanceolate with entire margins, revolute, the vein considerably exserted; setæ to 15 mm. in length, flexuose, thin, red, apex pale; thecæ horizontal, subcylindrical, thin-walled, with short neck 4 mm. long and ·75 mm. thick, symmetrical, large-mouthed, pallid, not at all shining; annulus broad, in part seceding; the peristome resembles that of B. capillare;

spores ·01-·012 mm., lutescent-greenish, very smooth; operculum hemispherical, lengthily apiculate, pallid. The male plant is unknown.

Hab.: Mount Perry, Queensland, *James Keys.*

HOOKERIA, Sm.

H. (Euhookeria) Karsteniana, *Broth. Geh.* Synœcious, creeping, flaccid, complanate, pale-green, densely branched, with decumbent branches, the leaves about 2 mm. wide, obtuse; leaves delicate, hyaline, lateral, when humid, patent, asymetrical, widely oblong, rather obtuse, terminating in a very short apex, limbate, the border very narrow, hyaline, produced to the summit of the apex, with margins erect, above minutely denticulate, with two veins, pallid, slender, and diverging from the base, abrupt beneath the apex, very smooth; cellules everywhere lax, hyaline, above shortly hexagonal ·05-·06 x ·04-·045 mm., the basilar ones longer, all very smooth; perichætial bracts ovate-lanceolate, very acuminate, apex denticulate, nerveless; setæ to 1·5 cm., erect, purple, very fine and smooth; thecæ minute, oval, horizontal, atropurpureous; peristome normal; spores ·01-·012 mm., obscurely green, very smooth. Other parts unknown.

Hab.: Bellenden-Ker Range, *Karsten.*

PTEROBRYUM, Hornsch.

P. (Trachyloma) recurvulum *C. Mull.*, Bail. Syn. Queensl. Fl. 3rd Supp., p. 98 (name only). Diœcious (?), cæspitose, deep green, shining; stems creeping, branches 7-13 cm. long, flexuose, more or less densely pinnate, apex usually simple and recurved, sparingly complanate, turgid, obtuse, with short branchlets, 1-1·5 cm. long, outspread, straitish, somewhat complanate, turgid, obtuse; leaves densely crowded, prettily embossed, when moist outspread, cymbiform-concave, from the base cordate, with circinate, auricles undulate, the stems amplectent, ovate-ligulate, abruptly and shortly acuminate, the margins everywhere erect, very minutely serrulate, the vein very slender, green, scarcely produced beyond the middle of the leaf, somewhat bifurcate, cellules narrow, at both ends acuminate, replete with chlorophyll, scarcely distinct in the wiugs, the basilar and deeper ones more lax, in all parts smooth.

Hab.: Bellenden-Ker, *Expedition* 1889.

Of this Dr. V. F. Brotherus says "This pretty species resembles, in habit and structure of leaves, species of the genus *Calyptothecium* much more than any of those hitherto known of the genus or sub-genus *Trachyloma*, and should, I think, rather be referred to the former than the latter. As, however, fructiferous specimens are unknown, this matter must be left undecided for the present.

THUIDIUM, Schimp.

T. nano-delicatulum *Hampe* (*Cyrto-Hypnum nano-delicatulum, Hampe*) *S. pennula* C. Mull., in Bail. Syn. Queen. Bot., 3rd Supp. p. 98 (name only). Female plant robust, rigid, green, when old brown; stems stout, elongate, creeping, frequently divided, interruptedly rooted to the ground and alternately and arcuately rising from it, the divisions strikingly regular and densely bipinnate, pinnæ 1·5-2 cm. long, arcuate, with subequal pinnules, 2-5 mm. long, the higher ones shorter, simple, or rarely indistinctly ramulose; cauline leaves distant, squarrose, plicate, from the base dilatate, subcordate, suddenly alternate, aristate by the very lengthily exserted vein, with margins from base to centre more or less revolute, minutely crenulate, apex serrulate, vein thick, lutescent, ending in a stout awn, very long and serrulate; cellules incrassate, papillose, pellucid, oval, the basilar ones larger, the marginal subrotund, leaves in the branchlets minute, when dry adpressed, when humid erect, concave, ovate-lanceolate, with serrulate margins, vein pallid, beneath the apex vanishing, the back distantly spinulose, with stout papillose cells, subrotund, the apex truncate, crowned with acute papillæ, paraphyllia numerous, confervoid, ramose, papillose, perichætial bracts fuscescent-lutescent, from the base delatate, towards the apex piliform, long, flexuose, margins erect, lengthily and beautifully fimbriate with filiform cilia, simple, apex denticulate, vein slender, cellules longer, narrower, and smoother; other parts unknown.

Hab.: Near Brisbane, *Bail.*; North Pine River, *G. T. Musson.*

Order HEPATICÆ.

DENDROCEROS, Nees.

Fronds broad, linear, primately branched, remarkably crisped; lobes thin, and of a single stratum, occasionally divided into laciniæ that simulate leaves; cellules quadrate, strengthened at the angles, gonidia none; costa well defined, slender, of more than one stratum. Reproductive organs monœcious; females rising from beneath the costa; capsules pedunculate, with exserted involucre; elaters of a single spire, perfectly helicoidal; antheridia biseriate in the costa.

D. crispatus (*Hook ?*), *Nees. Trans. and Proceedings of the Bot. Soc. Edinb. xv. Part II.* (*Monoclea, crispata*, Hook. Bot. Misc. ii. 117 t. 27.) Fronds of a beautiful green, cæspitose-procumbent, 2 cm. long, ascending, bipinnatifid, laciniæ short, broadly linear, contiguous or subimbricate, strikingly sinuate-crisped, and plainly but slenderly costate; apex truncate-rotundate, often furcate; costa in section semilanceolate or oblong, in the middle 8 cellules thick, beneath slightly radicellose, at the interstices of the branches geniculate-subflexuose; cellulus of the fronds in a single stratum, moderate, quadrate-hexagonal, strengthened and thickened at the angles, within flexuose, and with a copious endochrome. Flowers monœcious; females showing above the frond, arising from the costa near the forks of the branches. Involucre at first short, with slender apex, clothing the base of the solitary obclavate oogonium, when mature linear-coroniform, erecto-incurved, the mouth protracted into a linguiform lip, papillose, carnose, 6-striate. Peduncles short, almost wholly immersed, base hidden within the oblong carnose involucel pallid of 3 layers of cells (6 in diameter), the central ones filled with chlorophyll. Capsule semiemersed, longer than the involucre, linear-cylindrical, rufous, bivalved, with filiform persistent collumella. Elaters medium, obtuse, furnished with spiral fibres. Spores rather large and rough. Antheridia uniseriate on both sides of the costa, solitary, subglobose, emerging from the apices of mamillæ.

Hab.: On bark of trees Tambourine Mountain, *C. J. Wild*, 1893.

First found on trees at the Island of St. Vincent. I believe Mr. Wild's specimens belong to the above, but until they have been examined by a specialist some doubts will remain.

D. Muelleri, *Stephani, Hedw.* 1889, page 6. Frond 3 cm. long, furcately divided, slender, deep green, base brownish; costa pallid, broad, thick, cavernose (cavities broadly tri-quadriseriate), the superficies therefore laxly reticulate, passing abruptly into the wings. Wings of a single stratum, crispate, scarcely broader than the costa, very deeply lobate, almost to the end of the frond separated into parts or segments; lobules repando-dentate, alternate, and simulating true leaves. Cellules ·035 mm., with thickened nodulose angles, towards the margin ·017 mm., the wings of the fronds perforate with intercellular interstices. Female flowers at the base of the bifurcations, surrounded by the large and strongly crispate lobules; involucre narrowly cylindrical, 4 mm. long. the cellules of the base 5-6 series thick. Andrœcia approximating to the margin of the costa, 2-3 seriate, filled with large, obovate solitary anthers, the pedicels equalling them in length. Capsules 2 cm. long, ·05 mm. in diameter, involucre about twice as long, fuciform, the. base deep green (spores immature), above beautifully golden; cellules convex, ·035 x ·017 mm., walls unequally thick; columella stout, spores green, 10-cellular, ·06 mm. in diameter, cuticle granulate, florescent. Elaters ·5 x ·008 mm., twisted into a single lax spiral.

Hab.: Bellenden-Ker Range, *Sayer*, 1886.

Order LICHENES.

The information given concerning the following lichens, reported for the first time as natives of Queensland, together with the notes and remarks on species whose descriptions have not been hitherto fully supplied, or which have been reported by other authors under incorrect or obsolete synonyms, is compiled for this Bulletin by Mr. John Shirley, B.Sc.

Family I.—COLLEMACEÆ, *Mull. Arg.* Enum. Lich. Gen. p. 18.

Tribe I.—COLLEMEÆ, *Korb.* Par. p. 408.

LEPTOGIUM, Fr., pro. p.

L. tremelloides, v. isidiosa *Mull. Arg.* Upper surface of thalline laciniæ, and the margins, in places, provided with cæspitose subfoliaceous isidiellæ.—Lich. Beit. 374.

Hab.: Main Range, near Toowoomba.

Family II.—EPICONIACEÆ, *Mull. Arg.* Enum. Lich. Gen. p. 18.

Tribe II.—CALICIEÆ, *Mull. Arg.* Enum. Lich. Genéve p. 19.

CALICIUM, Ach.

C. trachelinum, *Ach.* Thallus cinerascent, thin, granulose, or frequently obsolete; apothecia medium or large, the capitulum turbinate-globose and red or reddish below, sporal mass black; spores blackish, ellipsoid, in the centre moderately constricted, 1-septate, ·008-·013 x ·004-·007 mm.—*Nyl.* Syn. I. 154.

Syn.—*C. glebosum v. concinnum*, Wilson, and *C. hymenosporum*, Wilson.

C. victoriæ v. jejunum, *Wilson*. Botany Bulletin No. 2, p. 30.
Rev. F. R. M. Wilson says: "*C. jejunum*, reported by me (Trans. Lin. Soc. 1890), is now judged by me to be a *not clearly marked* form of *C. victoriæ*."—Proc. Roy. Soc. Vict. 1893 p. 163.

PYRGILLUS, Nyl.

P. javanicus, *Nyl.* The following are synonyms of this lichen :—*Calicium stenosporum*, Wilson, Botany Bulletin No. 2, p. 29; and *Pyrgillus australiensis*, Wilson, Bot. Bull. No. 2, p. 31.

TYLOPHORON, Nyl. Prod. Lich. Nov. Gran. p. 430.

Thallus crustaceous, apothecia (at first wholly enclosed in whitish, or white, subglobose verrucæ, or thalline tubercles) with shortly cylindrical or cupular innate thalline receptacle. The sporal mass protruding; spermagonia colourless, innate; sterigmata cylindrical, somewhat branched; spermatia acicular, straight. This genus differs from Calicium and Trachylia, as Lecanora differs from Lecidea.

T. triloculare, *Mull. Arg.* (nov. sp.) Thallus argillaceous or whitish, thinly tartareous, diffracto-areolate, and the whole surface crowdedly sub-granular; apothecia $\frac{1}{3}$-mm. wide or less, much wider than high, the base thalline-girdled, elsewhere free; perithecium outwardly nigro-fuscous, the true margin obtuse, not truncate-acute; disk plane or sub-concave, and above nigro-fuscous; hypothecium nigro-fuscous; lamina hyaline and above usually evanescent, covered with a thick stratum of spores; spores in narrow asci, or free, ellipsoid, brown, ·011-·013 x ·0065 mm.

Hab.: Main Range, near Toowoomba.

ACOLIUM (Fee) D.N.

Apothecia crateriform, or now urn-shaped, sessile; a black proper excipulum, which is either naked or margined by an accessory thalline one. Spores spherical and simple, or 2-4 locular, or even muriform, brown. Thallus crustaceous, rarely lobulate, mostly uniform.—*Willey* Int. St. Lich. p. 40.

A. buelliaceum, *J. Mull.* (nov. sp.) Thallus white, very thin, rather smooth, continuous or slightly rimulose, margin effuse; apothecia when evolute 1 mm. wide, sessile, three times broader than high, truncate-plane, and girdled with a thick entire, pulverulent border. Between the proper black margin and the white thalline one there is a vestige of a third integument. The junior apothecia are enclosed in small hemispherical verrucæ; disk plane, black, slightly albo-pulverulent; spores brown, bilocular or 3-locular, ·01-·011 x 006-·0065 mm.

Hab.: Main Range, near Toowoomba.

Family III.—LICHENACEÆ, *J. Mull.*, Lich. Socot. and Enum. Lich. Gen. p. 18.

Tribe III.—CLADONIEÆ, *J. Mull.* Enum. Lich. Gen. p. 22.

CLADONIA, Hffm.

Phæocarpæ Scyphophoræ.

C. fimbriata v. antilopæa, *J. Mull.*, s. *Cladonia delicata,* Wilson (non. Flk.); Lich. Fl. Queensl. p. 17.

C. degenerans, *Ach.*; **v. pleolepis,** *Flk.* Podetia short, cinereo-fuscescent, rigid, foliaceous-squamulose; scyphi irregular, lacerate-crisped, here and there at the margins ramose, proliferous, substerile.—*Acharius*, Syn. Lich. p. 259.

Hab.: Main Range, near Toowoomba.

PHÆOCARPÆ ASCYPHÆ.

C. furcata v. foliolosa, *J. Mull.* Podetia ½ in., nigrescent, rigid, squamose-granulose, sparingly foliolose; apices cylindrical right up to the apothecia, and not at all scyphose-incrassate.

Syn.—C. pityrea v. foliolosa, J. Mull., Lich. Beit. 1005.

Hab.: Mount Perry.

ERYTHROCARPÆ SCYPHOPHORÆ.

C. macilenta, v. flabellulata, *J. Mull.* (var. nov.) Podetia 9-12 mm. long, below 2-3 mm. thick or thinner, from the centre or higher copiously and finely flabellose-ramose, wholly granulose-pulverulent and destitute of scales.

Hab.: Wickham Terrace, on moist earth.

TRIBE IV.—RAMALINEÆ, *Th. M. Fries*, Gen. Heterolich p. 50.

RAMALINA, Ach.

R. Ecklonii, *Mnt.*; **v. tenuissima,** *Mey. et Flot.* Frond ⅓-½ in. long, laciniæ at the base about 1 mm. wide or narrower, gradually becoming finely acuminate, slightly canaliculate-concave or subplane. Spores ·012-·014 x ·005-·0055 mm., slightly curved or wholly straight. Rev. Lich. Mey. p. 311, Lich. Beit. 1478.

Hab.: Main Range, near Toowoomba.

R. inflata, v. olivacea, *J. Mull.* Thallus olivaceous-obscure; apothecia obsoletely æruginose-pruinose. In all other respects wholly agreeing with the type. Thallus here and there perforate. Spores straight, ·01-·014 x ·004-·005 mm. Lich. Beit. 128.

Hab.: Main Range, near Toowoomba.

ALECTORIA, Ach.

A. australiensis, *C. Knight.* Possesses no gonidia, and is now known to be nothing more than an undeveloped form of the fungus *Marasmius equicrinis.*

TRIBE V.—USNEEÆ, *Th. M. Fries*, Gen. Heter. p. 47.

USNEA, Hffm.

U. barbata, v. asperrima, *J.M.*, is a synonym of *Eumitria Baileyi*, Stirton. Lich. Fl. Queens. p. 26.

TRIBE VI.—PELTIGEREÆ, *J. Mull.*, Lich. Gen. p. 29.

PELTIGERA, Hffm.

P. polydactyla, v. dissecta, *J. Mull.* Thallus as in the type, but the thalline laciniæ at the margins are undulate, minutely and crowdedly microphylline-dissect. Apothecia resemble those of *v. microcarpa*, Ach., of this species. Lich. Beit. 1624.

Hab.: Main Range, near Toowoomba.

TRIBE VII.—PARMELIEÆ, *J. Mull.*, Lich. Gen. p. 31.

STICTINA, Nyl.

S. crocata, v. esorediata, *J. Mull.* s. *S. intricata*, Stirton (non *Del.*). Lich. Fl. Queens. p. 50.

S. brevipes, *J. Mull.* s. *S. marginifera*, Tayl. Lich. Fl. Qd. p. 55.

S. fuliginosa, *Nyl.*, Syn. i. 347. Thallus cervine or cinereo-fuscescent, moderate or small (2-4 inches), stiff, either rather smooth or unequal or sparingly scrobiculate-rugose, slightly shining or almost opaque, monophyllous, variously lobed, lobes rotundate ; above somewhat efflorescent with brown or blackish coralloid isidia, beneath pallid ; tomentum moderate or little ; cyphellæ whitish or pallid ; apothecia fusco-rufescent, about 1 m.m., scattered, often when young with margin whitish pilose-ciliate ; spores colourless, fusiform, 1-3 septate ·027-·04 x ·007-·008 mm.

Hab. : Mount Mistake.

S. quercizans, *Ach.* s. *S. tomentella*, Leighton (non Humb.) Lich., Fl. Queens. p. 54.

S. suborbicularis, *J. Mull.* s. *S. subtomentella*, Knight, and *S. macrophylla*, Auct. Lich. Fl. Queens. p. 54.

S. Freycinetii, v. isidiosula, *J. Mull.* Thallus roughened over with coarse isidiose granules.

Hab. : Main Range, near Toowoomba.

STICTA, Ach.

S. endochrysea, v. Urvillei, *J. Mull.*, Lich. Hariot e Feuer. s. *S. Urvillei*, Nyl, Lich. Fl. Queens. p. 60. *Fide* J. Mull. L.B. 1303.

S. endochrysea, v. flavicans, *J. Mull.*, Lich. Hariot e Feuer. s. *S. flavicans*, Hook. et. Tayl. Lich. Fl. Queens. p. 61. *Fide* J. Mull. L.B. 1300.

S. variabilis, v. papyracea, *J. Mull.*

Hab. : Main Range, near Toowoomba.

S. Seemanni, *Bab.* Strikingly resembles *S. dichotomoides*, Nyl. in colour of upper and lower surfaces, in laciniation, and in the shape and position of the apothecia ; it can, however, be readily separated from its ally by its glabrous under surface, which, in *S. dichotomoides*, Nyl., is tomentose.

Hab. : Main Range, near Toowoomba.

S. impressa, *H. et Tayl.*, s. *S. physciospora*, Nyl., and *S. Bornetii*, J. Mull., Lich. Fl. Queens. p. 63.

PARMELIA, Ach.

GLAUCESCENTES.

P. cetrata, *Ach.*; **v. sorediifera,** *Wainio.* A soredioid form of the lichen thus described by Acharius :—Thallus suborbicular, helvolo-pallescent, nude ; beneath black, hispid, lobes sinuate-laciniate, pedate, rather narrow, with broader apex, inciso-crenate, rotundate, ultimate segments retuse, subciliate ; apothecia at length dilatate, plane, large, fusco-atrous, imperforate. Syn.—*P. cristulata*, Fee, *P. perforata*, Nyl. (non Ach.), *fide* J. Mull., Lich. Cath. No. 38 ; *P. macrocarpoides*, Wn., *P. homotoma*, Nyl.

Hab. : Main Range, near Toowoomba.

P. perlata, v. ciliata, *DC.* Differs from the type in the thallus being strikingly nude below, and the margin nigro-ciliate. Spores ·025-·028 x ·014-·017 mm. Spermatia bifusiform ·005 x ·0006 mm. Nyl. Syn. i. 380, and Lich. Ins. Guin. p. 10.

Hab.: Main Range, near Toowoomba.

P. tiliacea, v. sulphurosa, *Tuck.*, s. *P. tiliacea f. asperata*, J. Mull. L.B. 570. Thallus densely and finely isidiose-asperate on the upper surface, strongly resembling *P. tiliacea f. scortea*, but within sulphureous.

Hab.: Main Range, near Toowoomba.

P. tiliacea, v. rugulata, *J. Mull.*, s. *P. caperatula*, Stir. (non Nyl.). Lich. Flor. Queens. p. 45.

P. meizospora, *Nyl.* s. *P. tiliacea, v. meizospora*, Nyl. Lich. Fl. Queens. p. 42.

P. Hookeri, *Tayl.*, resembles *P. tiliacea*, Ach., and *P. lævigata*, Ach., but thalline laciniæ discrete, sinuate incised, and strongly atro-rhizinose. Spores ·008-011 x ·006-·008 mm. Syn.—*P. sublævigata* Nyl., and *P. tiliacea v. sublævigata*, Nyl.

Hab.: Main Range, near Toowoomba.

P. prætervisa, *J. Mull.* s. *P. tinctorum*, Despr. Lich. Fl. Queens. p. 43, and *P. perlata, v. prætervisa*, J.M.

P. tenuissima, *Tayl.* Thallus suborbicular, inciso-lobate, pallid castaneous, margin with undulate lobes, crenate, subelevate, when old rugose, when young unequal; soredia white, filling very short, almost simple furrows; apothecia large, very concave, with thin margin, at length fractured, disk pallid castaneous. Spores ·014-·016 mm. long, ellipsoid or ovoid.

Hab.: Main Range, near Toowoomba.

OCHROLEUCÆ.

P. adpressa, *Kremp.* s. *P. amplexula*, Stirton Lich. Fl. Queens. p. 44.

P. rutidota f. sorediosa, *J.M.* Thallus above everywhere sprinkled over with isidiose soredia, ½ mm. broad or less, hemispherical. Syn.—*P. ochroleuca f. sorediosa*, J. Mull. L.B. 574.

Hab.: Main Range, near Toowoomba.

P. limbata, *Lam.* s. *P. insinuata*, Knight (non. Nyl.). Lich. Fl. Queens. p. 47.

HYPOGYMNIÆ.

P. physodes, v. pulverata, *J.M.* Thallus very variable, above usually leprose-pulverulent, beneath always in part whitish or pallid, laciniæ unequal, narrow and broad mixed, the latter 4-6 mm. broad, the former 1½-2 mm. Very nearly approaching *P. physodes, v. mundata.* Syn.—*P. mundata, v. pulverata*, Nyl., *P. subphysodes*, Kremp. Lich. Beit. 577.

Hab.: Main Range, near Toowoomba.

ANAPTYCHIA, Trev.

Separated from Physcia, which it resembles in the structure of the apothecia, by the nature of the cortical stratum, in this genus consisting of a double layer.

A. leucomelæna, *Trev.*, s. *Physcia leucomela*, Lich. Fl. Queens. p. 70.

A. comosa, *Trev.*, s. *Physcia comosa*, *v. alata*, Wilson, and *Theoloschistes chrysophthalmus*, *v. alata*, Shirley. See Bot. Bull. No. 2, p. 32, No. 5, p. 32.

A. speciosa, v. sorediosa, *J.M.* Thallus as in the normal form of this species, but the margins of the laciniæ furnished with large subregular or confluent, subfarinose soredia, cilia white; margins of apothecium subentire, smooth. L.B. 582.

Hab.: On bark, Main Range, near Toowoomba.

A. speciosa, v. hypoleuca f.orediifera, *J.M.*

Hab.: Main Range, near Toowoomba.

PHYSCIA, Fr. pro p.

P. stellaris, v. acrita, *Nyl.* Laciniæ contiguous, in the margin sparingly discrete, the centre often rugose; rhizinæ cinerascent; apothecia with entire margin. Lich. Scand. p. 139.

Hab.: Main Range, near Toowoomba.

TRIBE VIII.—PYXINEÆ, *J. Mull.*, Lich. Parag. p. 6.

PYXINE, Fr.

P. endochrysina, *Nyl.* Thallus glaucescent, resting on a black hypothallus, which is more or less revealed between the laciniæ, laciniæ short, sparingly pinnatifid, terminations rounded, bilobate; margins albo-sorediate; under surface blackened; fracture and medulla florescent. Sterile.

Hab.: Main Range, near Toowoomba.

P. Meissneri v. endoleuca, *J.M.* Thallus white within, or whitish, agreeing with *P. Meissneri* in all other respects, the apothecia, when young, being plane and lecanorine, and spores ·017-·021 mm. long. L.B. 118.

Hab.: Mount Gravatt, on rocks.

P. Meissneri f. sorediosa, *J. Mull.* Thallus particularly at the margins of the lobes flavidulo-sorediose. L.B. 118.

Hab.: Main Range, near Toowoomba.

TRIBE IX.—PANNARIEÆ, *Korb.* Lyst. p. 105.

PANNARIA, Del.

P. mariana f. isidiosa, *J. M.* L. B. 1159, s. *P. pannosa f. isidioidea*, J. M.

Hab.: Main Range, near Toowoomba.

ERIODERMA, Fée.

Apothecia scutellæform, marginal on the now extended lobes; spores simple, at length colourless. Thallus villous and now veiny beneath, with a pannose hypothallus, the cortical layer there wanting. —*Willey*, Lich. Sp. p. 33.

E. Knightii, *Shirley*, s. *Platysma eriophyllum*, C. K. Lich. Fl. Queens. p. 32.

Tribe X.—COCCOCARPIEÆ, *J. Mull*, Lich. Schenke.

COCCOCARPIA, Pers.

C. aurantiaca, *Mnt. et v. d. Bosch.* s. *Leptogium cærulum*, Wilson Bot. Bull. No. 2, p. 28.

C. pellita, v. incisa, *J. Mull.* Thallus firm; laciniæ deeply and radiately incised, in outline narrower than in the type; the centre isidiophorous; apothecia badio-fuscous. Syn.—*C. molybdæa v. incisa*, Nyl.; *Obryzum myriopus f. isidiosum*, Wilson Lich. Fl. Queens. p. 9.

C. pellita, v. smaragdina, *J. Mull*, s. *C. smaragdina*, Pers. Lich. Fl. Queens. p. 82.

Tribe XI.—PSOREÆ, *J. Mull.* (Psorei, *Th. M. Freis.* Gen. Het. p. 79), Lich. Parag. p. 8.

PSORA, *J. Mull*, pro p.

P. parvifolia, v. subgranulosa, *J. M.* Thalline laciniæ, granuliform exiguous, angulose or digitately crenate, incised, cinereo-virescent, beneath very minutely albido-hirsute; apothecia pallid, marginate, within whitish, lamina and hypothecium hyaline or subhyaline. Spores ·011-·012 x ·0025-·003 mm. Differs from v. *granulosa*, Tuck., in the narrow spores, and hyaline hypothecium.

Hab.: Main Range, near Toowoomba.

THALLOIDIMA, J. M.

T. cæruleo-nigricans, *J. Mull*, s. *Lecidea cæruleo-nigricans*, Lghtf. Bot. Bull. No. iv. p. 26.

Tribe XII.—LECANOREÆ, *J. Mull*, Lich. Socot. p. 359.

LECANORA, Ach.

L. subimmersa, *J. Mull.* (Sp. nov.) Thallus white, medium, granulose-rugulose, surface firm; apothecia ½-2½ mm. wide, the junior ones wholly immersed, plane, outwardly and inwardly black, rather shining and sublecideine, finally slightly emergent and then showing an entire or slightly undulate thalline margin; in other respects this species resembles *L. atra*. The lamina is mostly violet-brown. The spores 8, ·01 x ·006-·0065 mm.

Hab.: Rosewood Scrub.

L. lacteola, *J. Mull.* (Sp. nov.)

Hab.: Main Range, near Toowoomba.

L. subfusca, v. distans, *Nyl.* Thallus whitish, rugulose unequal, determinate; apothecia rufo-pallescent, to 1 mm. or somewhat less, thalline margin entire or obsoletely crenulate; spores 8, ellipsoid, simple, ·015-·018 x ·007-·008 mm.; paraphyses slender.

Hab.: Main Range, near Toowoomba.

L. subfusca, v. testaceo-pallida, *J. Mull.* Wholly resembles *v. chlarona*, but apothecia when moist exhibit a testaceo-pallid colour. L.B. 200.

Hab.: Main Range, near Toowoomba.

L. subfusca, v. cinereo-carnea, *Tuck.* Very similar to the preceding variety, but differs in the colour of the apothecia when moistened; spores ·009-·014 x ·005-·006 mm. Syn.—*Parmelia varia v. cinereo-carnea*, Eschw, *Lecanora leprosa*, Fée.

Hab.: Main Range, near Toowoomba.

L. atra, v. virens, *J. Mull.* Thallus greenish olivaceous, when moist intensely or obscurely green. L.B. 495.

Hab.: Main Range, near Toowoomba.

L. interjecta, *J. Mull*, s. *L. umbrina*, Stirton (non *Nyl.*) Lich. Fl. Queens. p. 89.

CALLOPISMA, De Not.

C. cinnabarinum, v. opacum, *J. Mull.* Thallus ferrugineous, opaque. L.B. 333.

Hab.: On rocks, Mount Perry.

C. conjungens, *J. Mull.* Thallus white, thin; apothecia ferrugineo-rufous, or rubenti-ferrugineous, 1-1·5 mm., girdled by a depressed or almost obsolete thalline margin; spores ·011-·016 x ·007-·009 mm. Differs from *L. russeola* in the entire thalline margin. Lich. Nov. Gran. p. 442.

Hab.: Sandgate.

PERTUSARIA, DC.

Lecanorastrum.

P. sulphurata, *J. Mull.* Thallus sulphureo-stramineous or stramineo-pallid, slightly granose-rugose, rugulæ crowdedly subdiscrete; verrucæ ·7-1 mm.; as very small hemispheres, slightly convex, when sterile usually truncate and sulphureo-pulverulent. Apothecia unknown.

Hab.: On rocks near Brisbane.

P. globulifera, *Nyl.* Thallus greyish, cartilagineo-membranaceous, verrucose-rugose, albo-sorediate, smooth, zonate and brown at the circumference; verrucæ large, globular, closed, slightly depressed, lycoperdoid, eventually lacerato-dehiscent, and pseudo-scutelliform, albo-sorediate; spores 1 or 2, colourless, ellipsoid, simple, large.

Hab.: Main Range, near Toowoomba.

P. commutata, *J. Mull.* Closely resembles *P. multipunctata*, but the disk of the apothecium is carneous or rosellate, as in *P. velata.* It differs from *P. subvaginata*, Nyl., in the smaller verrucæ, which are neither shortly cylindrical nor distinctly constricted. The thallus is commonly rimose-diffract, and often more or less papillose-exasperate; when young it is olivaceous, but afterwards strongly albescent. At all stages it is less white and less smooth than *P. velata.*

Syn.—*Variolaria amara*, Fee; and *v. fulva* Fee is v. *variolosa*, *J. Mull.* L.B. 706, and Rev. Lich. Fee. p. 4.

Hab.: Main Range, near Toowoomba.

Porophora.

P. (Pustulatæ) lactea, *Nyl.*, s. *P. sorediata*, C.K. Lich. Fl. Queens. p. 99.

P. (Depressæ) depressa, v. octomera, *J. Mull.* Thallus albido-cinereous, thin, smooth or smoothish; verrucæ hemispherical, solitary or 2-3-confluent, outline often regularly orbicular and the base clearly circumscripto-distinct, and not gradually passing into the thallus, smooth or smoothish, apex depressed, in the depression crowdedly 1-many-ostiolate; ostiola nigricant or atro-olivaceous, finally often maculari-confluent, stoutish; spores 6-8, ·07-·085 x ·055-·06 mm., within smooth.

Syn.—*Porina depressa*, Fée.

Hab.: Main Range, near Toowoomba.

P. (Depressæ) undulata, *J. Mull.* Thallus and verrucæ slightly florescent-albid, in places thin, rugulose, finally rimose; verrucæ 1 mm. wide, depresso-hemispherical, in base undulate, 3-5-gibbose, surface smooth, towards the base merging into the thallus; vertex at first obtuse, then subexcavate-depressed and adorned with brownish or colourless ostiola; spores 8, ·06-75 x ·027-3 mm., within smooth.

Hab.: Toowoomba, on bark.

DIPLOSCHISTES, Norm. Mag. naturvid. vii. 1853 p. 232.

D. actinostomus, *Zahl.*, s. *Urceolaria actinostoma*, Sch.; *U. novæ-zealandiæ*, C. K.; *U. plumbata*, Wilson (in lit.); *Lecidea clausa*, C. K., Lich. Fl. Queens. p. 123.

Tribe XIII.—GYALECTEÆ, *J. Mull.*, Lich. Parag. p. 12.

GYALECTIDIUM, J. Mull.

Thallus crustaceous; gonidia globose, green; apothecia lecanorine, margin simple, outwardly thalline. Paraphyses clathrately connected. Spores hyaline, parenchymatous. Differs from Gyalecta in the structure of the paraphyses.

G. phyllocharis, *J. Mull.*, s. *Lecidea phyllocharis*, Mnt. Lich. Fl. Queens. p. 115.

G. filicinum, *J. Mull.* Thallus suborbicular, small, very thin, cinereo-virescent, rather shining, more or less granulate, margin sub-effused or concolorous; gonidia globose, 5-8 μ wide; apothecia $\frac{1}{2}$ mm. or slightly larger, crowded, slightly depressed, thickly marginate, and at first innate-lecanorine, margin outwardly somewhat gibbose-unequal, and gradually disappearing in the thallus, within white, disk pallid fuscescent, nude; lamina wholly hyaline, tough; paraphyses strikingly slender; asci 1-spored; spores ·03-·035 x ·012-·016 mm., transversely about 12-septate, longitudinally 3-5-septate. L. B. 253.

Hab.: Main Range, near Toowoomba.

Tribe XIV. LECIDEÆ, *J. Mull.*, Enum. Lich. Genéve p. 50.

LECIDEA, Ach.

Eulecidea.

L. albo-cærulescens, *Wulf.*, s. *L. subnubila*, Stirton. Lich. Fl. Queens. p. 108.

Biatora.

L. impressa, *Kremp.*, s. *L. plumbeella*, J. Mull., and *Lecanora (Aspicilia) lævissima*, C. K. Lich. Fl. Queens. p. 91.

L. piperis, *Spreng.*; **v. melanocarpa,** *J. Mull.* Thallus fuscescent; apothecia from the first black or blackish; hypothecium thick, rufo-fuscous. Rev. Eschw. p. 16. Syn.—*L. sabuletorum* v. *brasiliensis*, Eschw.

Hab.: Mount Mistake and Rosewood Scrub.

PATELLARIA, J. Mull.

Sect. Psorothecium.

P. melaclina, (Nyl.) *J. Mull.*

Hab.: Main Range, near Toowoomba.

Sect. Catillaria.

P. alboflavicans, *J. Mull* (sp. nov.). Thallus thin, rimulose or at length diffracto-areolate, at first, however, continuous, outline effuse; apothecia ·7-1·5 mm., appressed-sessile, at first plane and thinly margined, then finally convex and immarginate, rather thin, wholly black and nude, opaque; epithecium olive black; hypothecium atro-fuscous; spores ellipsoid-fusiform, rather incurved, equally bilocular, ·012-5 x ·005-7 mm.

Hab.: On rocks near Brisbane; and Mount Mistake.

Sect. Bacidia.

P. intermixta, *J. Mull.* Thallus thin, white, effuse, soon scurfy and granulate, and now sorediiferous, ashy green and fuscescent or evanescent; apothecia small, adnate, brownish, flattish, pale within; border obtuse or wanting; spores ellipsoid, 1-septate, ·012-·023 x ·004-·008 mm. Tuck. North Am. Lich. pp. 30, 31.

Hab.: Helidon, on bark.

P. millegrana, *J. Mull.* Thallus whitish, subdeterminate, granulate-rugose; apothecia pallid, carneous, or carneo-fuscescent, to about 1 mm., plane or rather convex, marginate, margin commonly pallid or pallid whitish; spores 9-27 septate, ·06-114 x ·0045-·005 mm.; paraphyses slender. s. *P. heterochroa*, J. Mull.

Hab.: Main Range, near Toowoomba.

P. millegrana, v. fusco-nigrescens, *J. Mull.* Apothecia with fuscous or fusco-nigrous epithecium, and spores ·08-·087 x ·0045-·0055 mm. s. L. fusco-nigrescens, *Kremp.*

Hab.: Main Range, near Toowoomba.

BUELLIA, De Not.

B. lactea, *Korb.*, s. *Lecidea saxatilis*, Stirton (non *Schaer.*) Lich. Fl. Queens. p. 121.

B. subareolata, *J. Mull*, Lich. Parag. 130. Thallus rather thin, cinereo-flavicant, margin effuse, in other parts continuous, finally towards the margin rimose-areolate or spuriously areolate, surface sub-unequal; spurious areolæ plane, not at all polished; apothecia appressed-sessile, black, nude, ·05-·08 mm. wide; plane, thickly margined, margin somewhat atro-fuscous; epithecium, rufo-fuscous; hypothecium, a deep brown; spores 8, biseriate, 2-locular, ·016-8 x ·007-8 mm.

Hab.: Mount Mistake.

B. subarenaria, *J. Mull.* (sp. nov.).

Hab.: Hill End, on rocks.

B. rimulosa, *J.M.*, Lich. Beit. 1442. Thallus white, limitate, thin, smooth, continuous, usually crowdedly areolate-rimulose, not diffract; areolæ contiguous, very small; apothecia ·3 mm. wide, at first immersed and often spuriously thalline margined; epithecium fusco-nigrous; hypothecium above fusco-subhyaline, below in thick stratum rufo-nigricant; paraphyses at the apex strongly clavate; spores 8, 2-locular, ·009-11 x ·0045-5 mm., the centre scarcely constricted.

Hab.: Main Range, near Toowoomba.

HETEROTHECIUM, Flot. (pro p. Mass.).

Thallus crustaceous, gonidia commonly globose; apothecia (biatorine) lecideine, paraphyses not connexo-ramose; spores muriform and hyaline. Lich. Beit. 260.

H. vulpina, *Tuck.*, s. *L. domingensis v. gyrosa*, Stirton Lich. Fl. Queens. p. 117.

H. fusco-luteum, *J. M.*, s. *L. fusco-lutea*, Dicks, Lich. Fl. Queens. p. 115.

Tribe XV.—CŒNOGONIEÆ, *J. Mull.*, Lich. Parag. p. 18.

Gonidia confervaceous; apothecia lecideine-biatorine.

CŒNOGONIUM, Ehrenb.

C. confervoides, *Nyl.*, s. *C. interpositum*, Nyl. Lich. Exot. p. 259. Thalline filaments ·012-8 mm. thick. Prod. Lich. Nov. Gran. p. 456.

Hab.: Mount Mistake.

Tribe XVI.—THELOTREMEÆ, *J. Mull.*, Graph. Fée p. 5.

OCELLULARIA, J. Mull.

O. leucotylia, *J. Mull.* Thallus whitish, rather shining, rugulose, thin or very thin, indeterminate, apothecia colourless, enclosed in white, opaque, subglobose, finally rotundate-difform thalline tubercles; ·9-1·4 mm.; above unequal, the corneo-nigricant epithecium showing; spores 8, colourless, oblong, 4-6 locular, ·014-8x ·006-7 mm. Lich. Andam. p. 7.

Hab.: Bellenden-Ker.

O. phlyctioides, *J. Mull.* Thallus somewhat clayey whitish, thin, smooth and opaque, continuous; apothecia 1 mm. in outline undulate-irregular, slightly emergent; margin rather thick, patent, stellately aperient, then incomplete or obliterate, the interior one white, at first connivent, then radiately dehiscent, finally wide open; disk depressed, plane, albo-pulveraceous; lamina aquose-hyaline; hypothecium florescent-hyaline; spores 5-8, hyaline, ·013-7 x ·005-6 mm., elongate-ellipsoid, 4-6 locular.

Hab.: On bark, Brisbane.

O. endomelæna, *J. Mull.* Thallus chalky-white, thin, smooth, rather powdery; apothecia ·3-·7 mm., innate-emergent, concolorous with thallus, the emergent part depressed, hemispherical, towards the base disappearing in the thallus; margin obtuse, within subangulose, apex white, elsewhere fusco-nigrous; disk very little disclosed, nearly black; spores 8, ·03-34 x ·008-9 mm., 8-9 locular.

Hab.: On bark, near Brisbane.

PHÆOTREMA, J. Mull.

P. cricotum, *J. Mull.*, s. *Ocellularia cricota,* Wilson, *fide* Mull. Arg.

LEPTOTREMA, J. Mull.

L. compactum, *Nyl.* Given in L.B. 1184, as a Queensland lichen, with reference to *Nyl.* Prod. Nov. Gran., p. 46. No such plant is named in the Prodromus, and *L. compunctum* is evidently intended.

THELOTREMA, Ach.

T. inturgescens, *J. Mull.* Thallus stramineo-cinerascent, thin, from continuous and smooth, usually areolate-rimose; areolæ strongly inturgescent, and as if bullate-multigibbose; surface smooth, many fruited; apothecia profoundly innate, globose, to ·4 mm., apex with very narrow, ·05, ostiolum; perithecium within fulvescent; spores hyaline, solitary, ·27 x ·04, closely parenchymatous.

Hab.: On bark, near Brisbane.

T. cupulare, *J. Mull.* Thallus obscurely olivaceous, very unequal, firm, cartilaginous, shining; apothecia erumpent, usually wide, cupular, deeply concave; margin opening widely, at first stellate-patent or recurved, then subobsolete, and with the disk albo-farinose, the interior wholly albo-hyaline; spores 8, ·015-7 x ·005-6 mm., 6- locular, middle loculi, 2-locellate.

Hab.: On bark, Brisbane.

Tribe XVII.—GRAPHIDEÆ, *J. Mull.*, Graph. Fée pp. 4 and 13.

Sub-Tribe I.—Eugraphideæ, *J. Mull.*

OPEGRAPHA, Nyl.

O. Bonplandi, v. abbreviata, *J. Mull.*, Graph. Fée p. 17. Lirellæ much abbreviated; spores ·03-·045 x ·0035-·0045 mm., narrow fusiform, 7-9 septate, often from hyaline finally olivaceo-obscure.

Hab.: Main Range, near Toowoomba.

O. varia, v. diaphora, *Nyl.* Thallus white, pulverulent; lirellæ elongate, attenuate at both extremities, epithecium plane; proper margin persistent, flexuose; spores 8, colourless, irregularly obovate or obovate-fusiform, 5-septate, ·024-6 x ·007 m.m. Leighton Lich. Fl. Gt. Brit. pp. 404-5.

Hab.: Mount Mistake.

O. vulgata, v. subsiderella, *Nyl.* Thallus greenish-white, cartilagineo-membranaceous, cracked and scaly, effuse; lirellæ prominent and sessile, radiate-ramose, wavy and shining or greasy; epithecium rimiform, uniform; proper margin thick, very round and inflexed; spores 8, colourless, fusiform, 5-septate, ·015-·02 x ·003-4 mm. Leighton Lich. Fl. Gt. Brit. p. 407.

Hab.: Rosewood Scrub.

O. (Lecanactis) platygraphoides, *J. Mull.* Thallus cinerascent-whitish, thin, closely areolate-rimose; gonidia chroolepoid, with elliptical joints; apothecia 1-2 mm., sessile, orbicular, thick, obtusely crasso-marginate, more or less provided with a thalline coating, and in part girded with a thin, white fugaceous thalline margin, beneath which it is brown; at length undulate, irregular, and accrescent, 2·5-3 mm., proper margin as if an elongation of the periphery of the thick nigro-fuscous hypothecium; disk plane, when young albido-pruinose; spores 8, hyaline, subclavate, narrow below, ·03-35 x ·004-5 mm., 4-locular.

Hab.: On bark, near Brisbane.

GRAPHIS, J. Mull.

G. emersa, *J. Mull.* (sp. nov.). Thallus indicated by a white halo; lirellæ sessile-emergent, 1-2·5 mm. long and ·2 mm. wide, wholly simple and straight, differing in direction, wholly black and nude, linear, thickish, constricted towards the base; lips closely connivent, not at all sulcate; perithecium at the base complete, everywhere black; spores 8, hyaline, ·03 x ·008 mm., fusiform, 9-10 locular.

Hab.: Mount Mistake.

G. (Eugraphis) Lineola, *Ach.*, Syn. p. 80. Thallus rather soft, smooth, whitish, subpruinose; apothecia scattered, very slender, long, straitish, simple, bordered by a tumid spurious thalline margin, at length emergent, sessile, cylindrical, disk subrimiform. Syn.—*G. comma*, Mass., and Nylander in Prod. Nov. Gran. p. 73.

Hab.: Cleveland.

G. (Aulacographa) duplicata, *Ach.*, Syn. p. 81. Thallus thin, white, subdeterminate; apothecia rather prominent, elongate, straight, and flexuose; disk rimiform, margin of perithecium at length duplicate; thalline margin nearly wanting; spores ·02-5 x ·007-·01 mm.

Hab.: Main Range, near Toowoomba.

G. duplicata, v. sublævis, *J. Mull.*, Graph. Fée. p. 35. Lirellæ entire, or a few with lips longitudinally 1-sulcate. *Syn.—G. striatula v. sublævis*, Nyl., *Opegrapha peruviana*, Fée.

Hab.: Rosewood Scrub.

G. (Fissurina) insidiosa, *J. Mull.* Thallus thick, uneven, warty, dull green, brownish when dry; apothecia crowded, deeply immersed in warts of the thallus, simple or branched, closed; lips paler; spores 1-seriate, ovoid or obovate, yellow, ·017 x ·0075 mm., 3-septate.

Hab.: Main Range, near Toowoomba.

G. Baileyana, *J. Mull.* (sp. nov.). Thallus ochroleuco-albid, thin, smoothish or obsoletely rugulose, at length rimulose, widely effuse; lirellæ linear, branched and subflexuose, at length wide, varying much in outline, attaining 5 mm. by 1 mm., broadly or narrowly elliptical, when young thalline marginate, finally subimmarginate and plane, thin; disk when dry clothed with a pruinose leaden-white stratum, when moist obscurely fleshy; within hyaline; spores 3-4, ·045-75 x ·008-·01 mm., 12-18 locular.

Hab.: Main Range, near Toowoomba.

GRAPHINA, J. Mull.

G. pyelodes, *Wilson*, Bot. Bull. 7 p. 32, is *Phæographina quassiæcola*, J. Mull., s. *Graphis exserta*, Nyl.

TREMOTYLIUM, J. Mull.

T. nitidulum, *J. Mull.* Thallus whitish, thin, rimulose, rather smooth and shining, with numerous stromatiform verrucæ, elongate but irregular and deplanate, gradually uniting with the thallus; verrucæ smooth and finely verruculose, furnished with very small, not at all numerous, non-emergent ostiola; perithecium olivaceous within the apex, elsewhere hyaline; spores solitary, hyaline, ·2 x ·04 mm., linear ellipsoid, parenchymatous.

Hab.: Brookfield, on bark.

ARTHOTHELIUM, J. Mull.

A genus differing from *Arthonia* in its parenchymatous spores.

A. puniceum, *J. Mull.* Thallus obsolete; apothecia stellately erumpent from the epidermis, to 1 mm. wide, blood red, nude, flat, orbicular or slightly angulose, often faintly powdery, when evolute superficial, and girdled with the torn, purplish epidermis; perithecium wanting; hypothecium olive-brown, thin; lamina hyaline, paraphyses rigid, not separable, sparingly connected; spores 8, hyaline, ·023-6 x ·009-·01 mm., 6-locular, the four central ones 2-3-locellate.

Hab.: Brookfield, on bark.

Sub-Tribe II.—Glyphideæ, *J. Mull.*, Graph. Fée pp. 4 and 61.

CHIODECTON, Ach.

C. sphærale, *Ach.* s. *C. stromaticum*, C.K. Lich. Fl. Queens., p. 157.

C. (Enterographa) endoleucum, *J. Mull.* Thallus whitish, thin, usually closely rimulose, and finally rimose-granular, outline effuse, neither zonate nor byssoid, but at length albo-farinulent; stromata in the part emerging either suboblong and irregular or convex and hemispherical, white mealy, within white, above with many scattered perithecia; ostiola 2, orbicular or elliptical, black and nude; perithecium above and at the sides thinly browned; spores 8, ·026-35 x ·0035-5 mm., arcuate, at both ends obtuse, 4-locular.

Hab.: Toowoomba, on bark.

SARCOGRAPHA, J. Mull.

S. actinota, *Wilson*, is *Sarcographa subtricosa*, J. Mull., Bot. Bull. 7 p. 33.

Tribe XVIII.—STRIGULEÆ, *J. Mull.*, Pyr. Cub. p. 378.

STRIGULA, Fries.

S. elegans, v. eumorpha, *J. Mull.*, L.B. 919. Plagulæ $1\frac{1}{2}$-2 mm. in diameter, formed of 3-5 rays connate in the centre, discrete beneath, each composed of branchlets by 2-3-dichotomous division, the whole of the lacinulæ shortly linear, convex, glabrous. from florescent to whitish-green; pycnides $\frac{1}{10}$ mm. wide, nude; stylospores ·017 mm. long, baculiform, bilocular.

Hab.: North Pine River.

S. elegans, v. pertenuis, *J. Mull.* (var. nov.). Lacimæ subflabellately branched, here and there, in spaces, simple or only rudimentarily branched, branchlets ·04-·05 mm. wide, vesiculose-cellulose and here and there rudimentarily provided with cilia.

Hab.: North Pine River.

TRIBE XIX.—PYRENULÆ, *J. Mull.*, Pyr. Cub. p. 381.

SUB-TRIBE I.—ASTROTHELIEÆ, *Trev.*, Syn. Gen. Try. p. 22.

PARMENTARIA, Fée.

P. astroidea, *Fée.* Thallus hypophlœodal, the epidermis olivaceo-pallid, very thin; apothecia emergent but closely clothed by the thin cortex, when they are impurely nigricant, 2-3-4 in little heaps, or often 5-6 connate in stars, resting on a common black base, each hemispherical prominent, 1-5 fruited with common ostiolum; nucleus somewhat flavicant or pallid; paraphyses crowded, capillary; asci linear 2-4-8-spored; spores hyaline or olivaceous, at length brown, ·024-35 x ·011-6 mm., murali-locular in 8 x 4 ranks. Syn.—*Heufleria pentagastrica*, J. Mull., *Verrucaria astroidea*, Fée, *Pyrenastrum Americanum*, Sp.

Hab.: Main Range, near Toowoomba.

SUB-TRIBE II.—PLEUROTHELIEÆ, *J. Mull.*, Pyr. Cub. p. 387.

PARATHELIUM, Nyl., Bot. Leit. 1862 p. 279.

P. decumbens, *J. Mull.* (sp. nov.). Thallus whitish, at first smoothish, then only a mere vestige, finally evanescent; apothecia black, long-necked, decumbent-adnate and rather innate, at first thalline-subvelate, usually the emergent part nude; perithecium with thin neck, globose, ·7 mm., wanting beneath; spores 8, oblong-ellipsoid, 4-locular, ·02 x ·01 mm.

Hab.: On bark, Toowoomba.

SUB-TRIBE III.—VERRUCARIEÆ, *J. Mull.*, Pyr. Cub. p. 398.

PORINA, J. Mull., L.B. 644.

P. phæophthalma, *Shirley*, Lich. Fl. Qd., June, 1889; s. *P. brisbanensis*, J. Mull., Lich. Brisb. 1891.

CLATHROPORINA, J. Mull., L.B. 541.

C. olivacea, *J. Mull.*, s. *Porina enteroxantha* C.K. Lich. Fl. Queens. p. 171.

C. desquamans f. servediosa, *J. Mull.* (var. nov.). Soredia rather numerous, patelliform, ·5-·7 mm., evenly truncate, margin acute, the disk covered with a very pale golden dust.

Hab.: On bark, Brisbane and Toowoomba.

ARTHOPYRENIA, J. Mull., L.B. 612.

A. Cinchonæ, *J. Mull.* Thallus effuse, very thin, whitish, flavidulous or alboglaucescent, evanescent; apothecia convex-conoid, rugulose, papillate, ostiolate-impressed; the nucleus from albicant when dry to nigro-fuscescent when moist; perithecium dimidiate, base spreading; spores ·01-·025 x ·006-7 mm., 2-locular.

Hab.: Main Range, near Toowoomba.

POLYBLASTIA, J. Mull., L.B. 490.

P. nudata, *J. Mull.* (sp. nov.) Thallus white-spotted, very thin, rather smooth, shining; apothecia ·5 mm., almost equal in every diameter, hemispherical-convex, at first whitish clouded, usually at length nude and rather polished, almost wholly emersed; perithecium incomplete beneath; asci broad; spores 8, broadly or narrowly ellipsoid, ·03-35 x ·02 mm., 8-locular, with 4 transverse locelli in each loculus.

Hab.: On bark, near Brisbane.

PYRENULA, Fée Ess. Supp. p. 76.

P. bicuspidata, *J. Mull.* (sp. nov.). Thallus nigrescent-olivaceous, smooth; apothecia ·7 mm., black, twice as broad as high, semi-emergent, but thalline velate, and finally blackish, thickly scattered, regular; perithecium flat below, very thin at the base, but complete, the sides curving to the base; spores 8, ·04-47 x ·01-12 mm., 4-6 locular, at both ends cuspidate-acuminate.

Hab.: On bark, near Brisbane.

P. marginata, *Trev.* Thallus as in *P. convexa*, J. Mull., greenish-yellow, membranaceous, desquamescent, subverruculose, margin shining, undulate broad, fuscescent, limitate; apothecia globose, depressed, as if alato-marginate; perithecium sub-globose, complete, everywhere equally thick; ostiolum large, solitary, papilliform, brownish-red; spores fuscescent, 4-locular, ellipsoid, ·027-·04 x ·01-·018 mm.

Hab.: Rosewood Scrub.

P. Kunthii, *Fée.* Differs from *P. marginata*, Trev., in the slightly smaller apothecia, and the narrower spores, ·007-·011 wide.

Hab.: North Pine River.

P. pinguis, *Fée.* Thallus from pallid olivaceous, usually albicant, smooth, very thin; apothecia innate, revealed by the black punctiform ostiolum, the vertex widely denudate, but only slightly emergent; perithecium globose, complete, black, everywhere thickish, ·6 mm. wide; spores in linear asci, 8, 1-seriate, brown, 4-locular, ·035-·04 x ·015-8 mm., oblong-ellipsoid. *Verrucaria punctella*, Nyl.

Hab.: Main Range, near Toowoomba.

P. nitida, *Ach.* Thallus cartilagineo-membranaceous, levigate, from pallid fusco-cinerascent; apothecia in glabrous-closed verrucæ, which are prominent, nude, rugulose, perforate with depressed ostiola; spores 4-locular, ·018-·032 x ·009-·015 mm.

Hab.: Main Range, near Toowoomba.

ANTHRACOTHECIUM, Mass. Esam. Comp. p. 49.

A. confine, *J. Mull.* Thallus white or whitish, opaque, thin, bordered by an obscure line; apothecia mastoid, rather prominent, clothed by the thallus; ostiolum punctiform, black, at length denudate; perithecium thin, entire, black; spores 8, fuscescent, ellipsoid, murali-locular in 8 x 4 rows, ·011-·02 x ·007-·011 mm.

Hab.: Main Range, near Toowoomba.

A. Doleschalii, *Mass.* Thallus cinerascent, as a thin frosting; apothecia large, 1·5 m.m., ovate, black, cinereo-suffused, flattened, little emergent, fixed singly in areolate plates of bark; ostiola large, black, at length delapsed; spores ·02-·028 x ·009-·012 mm.

Hab.: Main Range, near Toowoomba.

Order FUNGI.

AGARICUS, Linn.

A. (Lepiota) membranaceus, *Cke. and Mass.*, Grev. xxi. 36. Pileus thin, membraneous, pale cream colour, convex, then expanded, umbonate, a little darker at the disc (1 to 2 cm.). Stem slender, slightly bulbous at the base, hollow; ring distant, small, rather fugacious. Gills free, ventricose, scarcely crowded. Spores very minute, 3 x 2 μ.—*Dr. M. C. Cooke, l.c.*

Hab.: On wood, Brisbane River, *Field Naturalists.*

Noticed in Botany Bulletin V., but wanting description.

A. (Collybia) muscipula, *Cke. and Mass.* (n. sp.).

Hab.: A solitary specimen received from Dr. Joseph Bancroft. The description has not yet come to hand; but Dr. Cooke, in letter, remarks that this new species is very similar to *Ag. radicatus*, Relb. It will be seen by referring to the 3rd Supplement to Syn. Queens. Fl., p. 114, that this latter species was met with a few years ago near Brisbane.

A. (Collybia) nummularis, *Fries.*, Cooke's Austr. Fung. 20. Pileus rather fleshy, almost plane, obsoletely depressed around the umbo, even, pallid; stem stuffed, then hollow, smooth, pallid, incrassated above; gills free, rather distant, white.—*Cooke, l.c.*

Hab.: Gladfield, on wood, *C. J. Gwyther*; also in Victoria.

A. (Collybia) dryophilus, *Bull.*, Cooke's Austr. Fung. 20. Pileus somewhat fleshy, nearly plane, obtuse, rather depressed, even, smooth, turning pale (1-2 in. diameter); stem fistulose, smooth, reddish-brown or yellowish (2 to 3 in. high, ½ in. thick); gills sinuate, adnexed, at length with a decurrent tooth, nearly free, crowded, narrow, white or pallid; spores 6 x 4 μ. *Cooke, l.c.* (but no *habitat* given).

Hab.: On the earth, Gladfield, *C. J. Gwyther.*

A. (Mycena) epipterygius, *Fries.* Cooke Illust. t. 208 a. Pileus membranaceous, campanulate, then expanded, rather obtuse, striate, cuticle viscid, separable; stem elongated, tough, rooting, smooth, viscid, yellowish; gills adnate, with a decurrent tooth, variable in colour.—*Cooke, l.c.*

Hab.: Gladfield, *C. J. Gwyther.*

Found amongst moss and leaves in Europe.

A. (Pleurotus) cyphellæformis, *Berk.*, Mag. Zool. and Bot. i. t. 15 f. 3; *Cooke*, Ill. t. 244 b.; *Sacc.*, Syll v. 379. (From *cyphellæformis*—shaped like the hollows of the ears, *cyphellai.*) Pileus cup-shaped, then dependent; upper stratum gelatinous, cinereous, very minutely strigose, especially at the base; margin paler, sprinkled with a few meal-like scales; gills pure white, rather distant, narrow, linear. A weak, gregarious species about 4 mm. high.

Hab.: On moss, Gladfield, *C. J. Gwyther.*

Found in Europe on the dead stems of herbaceous plants.

MARASMIUS, Fries.

M. pilopus, *Kalch.*, Grev. viii. t. 143, f. 13; *Sacc.* Syll. v. 2014; *Cke.*, Austr. Fungi 83. Pileus between coriaceous and membranaceous, almost diaphanous, convex, obtuse, or with the centre depressed (scarcely 1 in. broad), wholly radiately striate, gilvous, becoming pale; stem stuffed, then hollow (1 to 2 in. long, 1 line and more thick), somewhat bulbous at the base, invested wholly with a powdery ochraceous brown tomentum; gills adnate, very broad behind, narrower towards the margin, distant, branched, edge entire, red flesh colour when dry; spores oval ($2\frac{1}{2}$ x $1\frac{1}{2}$ μ).—*Cooke, l.c.*

Hab.: Near Warwick, *C. J. Gwyther.*

First found on wood in N.S.W.

M. putredinis, *Berk.*, Cooke in Austr. Fung. 86. Pileus plane, thin, smooth, reddish-yellow or grey ($1\frac{1}{2}$-$2\frac{1}{2}$ c.m. diam.); stem of the same colour (18 mm. long, 1 mm. thick), solid, equal, smooth; gills narrow, adnate, white, then turning yellowish.—*Cooke, l.c.*

Hab.: Gladfield, on wood, *C. J. Gwyther;* also found in Victoria.

M. badius, *Berk. and Curtis*, Cuban Fung. in Journ. Linn. Soc. x 294. Pileus reddish when fresh, convex, striate; glabrous, the margin incurved, stem primose glabrescent, gills ventricose, distant, smooth, adnate, thick rounded at the back, interstices smooth.

Hab.: On wood, Gladfield, *C. J. Gwyther.*

First found on bark amongst moss at the Island of Cuba.

M. rhyssophyllus, *Mont.* in Berk. and Curtis, Cuban Fung. Journ. Linn. Soc. x. 294. Pileus fibrous, glabrous pale yellow, stem same colour, glabrous, with a strigose base, gills distant, interstices trabeculate, yellow.

Hab.: Gladfield, on wood, *C. J. Gwyther.*

First found at Guiana.

ARRHENIA, Fries.

Membranaceous tender fungi. Hymenium inferior, lamellæ consisting of a few slender slightly raised veins in simple straight striæ. Spores pale, minute, fairly persistent, various in shape. Striæ not decurrent.—*Sacc.*, Syll. v. 498.

A. (Apus) cupularis, *Fries.*, *Sacc.*, Syll. v. 499. (*Cantharellus cupularis*, Fries.) Resupinate, soft, orbicular, exterior smooth villose, grey with simple centrifugal folds.—*Sacc.*, Syll. l.c.

Hab.: On a young pinnate leaf received from E. Cowley, Kamerunga.

This species is met with on rotten wood in Europe.

POLYPORUS, Fries.

(Ovini.)

P. Mylittæ, *Cke and Mass.*, Grev. xxi. 37. Pileus fleshy, tough, elastic, pulvinate, single or two or three together, and then deformed, convex, minutely velvety, white (10 cm. diam.) Stem short (2 cm. long), deformed like the pileus, solid, flesh white. Tubes rather long (7 mm.). Pores white, adnate ($\frac{1}{2}$ mm.), somewhat angular, edge acute, smaller towards the margin. Spores elliptical, with an oblique basal apiculus, smooth, 8 x 4 μ. The ultimate development of the *Sclerotium—Mylitta australis.*

Hab.: The *Sclerotium* has often been met with in Queensland, but the fully developed plant has not as yet been observed. *P. (Ovini) tumulosus*, Cke., found by Dr. J. Bancroft, near Burpengary, is a closely allied plant, having similar habit.

(PETALOIDES.)

P. grammocephalus, *Berk.;* **var. minor,** *Cooke.* (Description of this variety not to hand.)

Hab.: On wood, Eumundi, *Field Naturalists.*

P. infernalis, *Berk.*, Hook. Journ. 1843; Sacc. Syll. Fung. vi. 83; Cooke's Austr. Fung. 116. Pileus flabelliform, entire or rather lobed, depressed behind, thin, acute, at length corky, coriaceous, quite smooth, even, striately rugulose except at the base, blackish liver coloured (8-9 c.m. broad), stem short, lateral, black, thickened upwards, punctate, pulverulent (1-2½ c.m. long, 1 c.m. thick), hymenium brownish; pores minute, round, very short; margin sterile.—*Cooke, l.c.*

Hab.: Gladfield, *C. J Gwyther.*

This species was first met with in Brazil; since it has been found in Victoria, now in Queensland.

P. phlebophorus, *Berk.*, Fl. N. Zeal.; Sacc. Syll. Fung. vi. 91. Small, white, pileus flabellate, about 25 mm. broad and long, stem short, glabrous, veined, undulate, cuticle gelatinous; pores minute, subirregular, with thin toothed dissepiments.

Hab.: On stems of *Eucalyptus hemiphloia*, at Port Curtis, *Hon. A. Norton.* Only before known from New Zealand.

FOMES, Fries.

F. cryptarum, *Bull.*, as *Boletus cryptarum*, *Polyporus undata*, *Pers.*; Sacc. Syll. Fung. vi. 205. Pileus suberoso-stupose, effuso-reflexed, appressed-silky, colour reddish-ferruginous, but variable both in colour and form; pores minute, pale, rounded.

Hab.: On log in Bowen Park bush-house.

Found on rotten pinewood in Europe.

CYPHELLA, Fries.

C. longipes, *Cke. and Mass.*, Grev. xxi. 38. Tobacco-pipe Fungus, Gregarious, membranaceous, white. Pileus narrowly infundibuliform, 2 mm. broad, 4 mm. long, attenuated downwards into a long thin curved stem, 5 mm. to 1 cm. long, wholly smooth, thickest above, as it passes imperceptibly into the pileus. Spores pip-shaped, 7 x 6 μ.—*C. and M. l.c.*

Hab.: Brisbane River scrubs, on the rough bark of living trees, *Field Naturalists.*

The description wanting in Bot. Bulletin V.

CYATHUS, Hall.

C. Baileyi, *Massee.*, Grev. xxi. 3. Peridium obconic or campanulate, at maturity widely open above, and with the margin slightly revolute, thin, and cartilaginous, minutely tomentose externally, cinnamon-colour, glabrous and greyish-cinnamon inside, ⅔ to 1 cm. high; sporangiola 8 to 12 in number, biconvex, very smooth, grey, then black and shining, about 2 to 2·5 mm. diameter; spores subglobose, colourless, 18 to 20 x 15 to 16 μ. More or less gregarious. Basidia bisporous, clavate, apex truncate, sterigmata elongated, slender.—*Mass. l.c.*

Hab.: On dung, Brisbane.

PHYSARUM, Pers.

P. didermoides, *Ach.*, Rost. Mon. Sacc. Syll. Fung. vii. 338; *Spumaria didermoides*, Fries; *Didymium congestum*, B. and Br. Forming crowded patches very much resembling those of *Diachæa elegans*; Peridia obovate-oblong, cinereous, with a white mealy coat; stems hyaline, membranaceous, generally distinct, though crowded, springing from a thin subjacent membrane. Spores black, variegated with the white coarse, irregular, here and there lacunose flocci. The globose spores appear at first sight to be granulated, but on closer inspection the granules are found to arise from the disintegrated outer peridium.—*Berk.*, in Cooke's Handbook of Brit. Fung.

Hab.: Gladfield, on scales of onions and bracts of maize, *C. J. Gwyther.*

GEASTER, Mich.

G. Archeri, *Berk.*, Fl. Tasm. ii. 264, t. 88, f. 9; *Sacc.*, Syll. 1590, Cooke's Austr. Fungi 231. Outer peridium cut to the middle into 6 to 7 lobes; laciniæ flaccid, acuminate, revolute; inner peridium globose, purplish umber; peristome elongated, conical, sulcate-plicate, indistinctly marginate; capillitium umber; spores globose, rufous-olive, even, 5 μ diam.—*Cke.*, *l.c.*

Hab.: Gladfield, *C. J. Gwyther.*
First met with in Tasmania.

LYCOPERDON, Tourn.

L. Gunnii, *Berk.*, Fl. Tasm. ii., 265; *Sacc.*, Syll. vii. 341; *Cke.* Austr. Fungi. 239. Sessile, sub-globose (1 to 2 in. diam.), with very minute stellate warts. Columella short; spores bright olive, globose with long pedicels ($\frac{1}{6000}$ in.).—*Cooke l.c.*

Hab.: Near Warwick, *C. J. Gwyther.*
Also in the pastures of Tasmania and Victoria.

SPHACELOTHECA, De Bary.

(From *sphacelos*, rottenness; and *theca*, capsule.)

Part of the mycelium converted into a central fleshy columella, surrounded by the mass of spores; spores solitary, sporidiola acrogenous, on a septulate promycelium.—Cooke's Austr. Fung.

S. hydropiperis, *Schum.*; Sacc. Syll. Fung. vii. 499, and Cooke's Austr. Fung. 327; *Ustilago Hydropiperis*, Schret.; *Uredo Hydropiperis*, Schum.; *U. Bistortarum var. ustilaginea*, Dl.; *Cæoma Bistortarum*, Link.; *Ustilago Candollei*, Tul. Horn-shaped, evolved in the more or less swollen ovaries, replete with dark violet powder, opening at the apex and emitting the spores; spores solitary, globose, or ellipsoid or rounded, angular, 9-20 x 8-12 μ, or 8-17 μ; epispore even, dark violet, delicately granulose.—*Cooke*, *l.c.*

Hab.: Gladfield, in the ovaries of a *Polygonum*, *C. J. Gwyther.*
The same fungus infests the ovaries of many species of *Polygonums* in Europe and America.

PUCCINIA, Pers.

P. carissæ, *Cke. and Mass.* (n. sp.).

Hab.: Gladfield, on leaves of *Carissa ovata*, *C. J. Gwyther.*
The author's description not yet to hand.

UREDO, Pers.

U. pallidula, *Cke. and Mass.* (n. sp.).

Hab.: Gladfield, on the pods and leaves of a Cassia, *C. J. Gwyther.*
The author's description of this new species not yet to hand.

ASCOBOLUS, Pers.

A. Phillipsii, *Berk.*, Cooke's Austr. Fung. 268. Cups concave, with an elevated margin (3-5 mm.), externally wax-colour, then tawny, smooth; disc cinereous; asci clavate; sporidia elliptical, smooth, without striæ or reticulations, becoming brown (21-28 x 11-13 μ); paraphyses clavate.

Hab.: Gladfield, on dung, *C. J. Gwyther.*

CALONECTRIA, De Not.

(Literally, beautiful Nectria.)

Perithecia free or cæspitose, superficially-erumpent, somewhat soft, bright-coloured, globose, papillate afterwards bissoid or pilose; sporidia oblong or fusoid, 2 or more septate, hyaline.

C. otagensis, *(Lind.)*, *Sacc.*; *Nectria otagensis*, Lind.; Sacc. Syll. Fung. ii. Add. 68. Perithecia densely cæspitose, pale-yellow; sporidia distichous, fusoid, obtuse at both ends, 1 to 3 septate hyaline.

Hab.: Gladfield, on twigs of the native Pomegranate, *Capparis Mitchelli, C. J. Gwyther,*

This fungus was first met with at Otago, New Zealand, on decayed branches of *Sophora tetraptera.*

XYLARIA, Schr.

X. scopiformis, (*Kunze*) *Mont.* Cke.; Austr. Fungi 285; *Sacc.*, Syll. i. 340. (*Hypoxylon scopiforme*, Kunze.) Simple, slender, often fasciculate, 2 to 3 cm. long, clubs (1 to 1½ cm. long, 1 mm. thick) cylindrical, acute at the apex, black; stem about as long as the club, smooth, often compressed; perithecia few, large, inflated the clubs so as to appear nodulose. Sporidia unequal sided, dark brown (10 to 12 x 3½μ.)—*Cke. l.c.*

Hab.: On decaying fruit of *Flindersia australis* (Crow's Ash), Bunya Mountains, *H. Tryon.*

A tall variety is met with at Ceylon. The species has been also collected in Guiana, Surinam, Brazil, and Cuba.

X. rhizophila, *Cke. and Mass.* (n. sp.).

Hab.: Gladfield, on roots of herbaceous plants, *C. J. Gwyther.*
The description of this new *Xylaria* is not yet to hand.

USTULINA, Tul.

Stroma superficial, somewhat effused, rather thick, determinate; hymenium bearing conidia, pulverulent, whitish, becoming cinereous, then rigid, carbonaceous, black, naked, often becoming hollow; perithecia immersed, large horny; asci pedicellate; sporidia ovoid-fusiform, continuous, sooty-brown.—*Cke.* Austr. Fungi 290.

U. vulgaris, *Tul. Cke.;* Austr. Fungi 290, Sacc.; Syll. 1328. Stroma superficial, rather effused, repand, pulvinate, large, thick, undulated, at length quite black, carbonaceous, fragile, hollow within; perithecia large, ovate, densely crowded, peripherical, with a prominent ostiolum; asci cylindrical, 250 x 8 to 10 μ; sporidia fusiform, unequal sided, curved, turning black, 32 to 40 x 8 to 13 μ.—*Cke. l.c.*

Hab.: On logs, Eumundi, *Field Naturalist.*

Also found on the stems of *Fagus* (Beech), *Tilia* (Lime-tree), and *Carpinus* (Hornbeam), in Europe, Cuba, Guyana, &c., North America and Ceylon.

HYPOXYLON, Bull.

H. atrosphæricum, *Cke. and Mass.* (n. sp.) Description not to hand.

Hab.: On logs, Eumundi, *Field Naturalists.*

ROSELLINIA, Not.

R. seriata, *Cke. and Mass.* (n. sp.) Description not to hand.

Hab.: On rotten wood, Gladfield, *C. J. Gwyther.*

UROMYCES, Link.

U. puccinioides, *Berk. and Muell.*, Linn. Journ. xiii. 173; Sacc. Syll. 2100. Æcidia aggregate, on brown orbicular spots, opposite; pseudoperidia scattered, not circinate, margin short; æcidiospores orange (*Æcidium goodeniacearum*, Berk.); sori bullate; teleutospores brown, apiculate, sometimes with the apex, oblique or dentate, pedicellate.—Cooke's Handbook of Austr. Fung. 332.

Hab.: On *Scævola* and *Goodenia* at St. George, *Jos. Wedd.*

HAMASPORA, Korn.

Teleutospores multiseptate, sometimes uniseptate, free; pedicels coalesced in a prominent cylindrical gelatinous body.—*Cooke's* Austr. Fungi, 340.

H. longissima, (*Korn. Phragmidium longissimum*, Thum.) *Sacc.* Syll. vii. 2630; *Cke.* Austr. Fungi, 340. Uredosporiferous sori on the lower surface, scattered, or gregarious, or confluent, clear-orange; uredospores globose, or ovoid, even, reticulate (16μ. diam), pale yellow, epispore thick; teleutospore sori gregarious, pale ochre, tendril-like; teleutospores very long, linear-lanceolate, 4 septate (or more), yellowish, apex acute, hyaline, 200 to 240 x 13 to 14μ, pedicels very long, hyaline.—*Cke. l.c.*

Hab.: On Rubus leaves at Eudlo. Description wanting in Botany Bulletin, No. V.

First found on the living leaves of *Rubus rigidus* at the Cape of Good Hope.

ÆCIDIUM, Pers.

Æ. Goodeniacearum, *Berk.*, Linn. Journ. xiii. 173. (See *Uromyces puccinioides*, B.) Spots orbicular, brown beneath, or obsolete; pseudoperidia scattered (or circinate), with an abbreviated margin; spores orange.—Cooke's Handbook of Austr. Fung. 342.

Hab.: On *Scævola* and *Goodenia* at St. George, *Jos. Wedd.*

Æ. compositarum, *Mart.* Cooke's Austr. Fungi 340; Sacc. Syll. vii. 2815. Spots purplish, subrotund, and confluent; pseudoperidia crowded on the spots, in orbicular patches, or circinating;

margin white, revolute, laciniate; æcidiospores oval or subglobose, 15 to 20 μ diam. (Numerous varieties which have received names from the plants they infest.)—*Cooke l.c.*

Hab.: Gladfield, on compositæ, *C. J. Gwyther.*

Æ. deeringiæ, *Cke. and Mass.* (n. sp.) (Description not to hand.)

Hab.: On leaves of Deeringia celosioides, Gladfield, *C. J. Gwyther.*

ASTERINA, Lev.

A. hoveafolia, *Cke. and Mass.* (n. sp.).

Hab.: On leaves of *Hovea longifolia* at Gladfield, *C. J. Gwyther.*

The author's description of this new species is not yet to hand.

PHYLLOSTICTA, Pers.

P. fragaricola, *Desm.* Cooke Austr. Fungi. 346; Sacc. Syll. iii. 40 No. 219. The strawberry-leaf blight. Spots straggling, becoming bleached, with a red margin; perithecia punctiform, remotely scattered; sporules oblong-ovoid, 5 x $1\frac{1}{2}$ to 2 μ, straight, without nuclei, hyaline.—*Cooke l.c.*

Hab.: On strawberry leaves, Brisbane. Found also on strawberry plants in many parts of Europe.

PHOMA, Fries.

P. folliculorum (*Lév.*) Sacc., *Sphæropsis folliculorum,* Lév. Erumpent; perithecia gregarious, immersed, glabrous, black, conical, depressed, and papillate about the ostiolum, surrounded by whitish spots; sporules ovoid, continuous, hyaline.

Hab.: Near Townsville, on follicles of a *Marsdenia, E. J. Banfield;* on the same follicles Dr. Cooke found a new species of *Diplodia, D. Marsdeniæ.*

When first met with it was parasitic on follicles of *Asclepias curassavica* in the herbarium of Joseph Decaisne, for a long time Director of the Paris Jardin des Plantes.

DIPLODIA, Fries.

D. Marsdeniæ, *Cke. and Mass.* Grev. xxi. 75. Gregarious, perithecia, obturbinate, black, erumpent above, with a short ostiolum; sporides elliptical, for a long time continuous, and hyaline, with a granular plasma, at length uniseptate, not constricted, dark brown, 22 x 10 μ, on basidia of the same length.—*C. and M. l.c.*

Hab.: In company with *Phoma folliculorum,* Lev., on follicles of a *Marsdenia,* near Townsville, *E. J. Banfield.*

VERMICULARIA, Fries.

(So named from the supposed resemblance of the spores to little worms.)

Perithecium thin, mouthless, generally bristly; spores vermiculate.—*Berk.,* Outl.

Hab.: Gladfield, on some leaflets of *Flindersia.*

Dr. Cooke observed what appeared a species of the above genus, but finding no spores nothing further could be determined.

DARLUCA, Cast.

(After M. Darluc.)

Perithecia delicate; spores containing a row of sporidiola, oozing out and forming a tendril.—*Berk.,* Outl.; Cooke's Handb. of Brit. Fung.

D. filum, *Cast.* "Parasitic Darluca." *Sphæria Filum*, Biv.; *Darluca vagans*, Cast.; *Diplodia uredinicola*, Desm. Gregarious, very minute; perithecia globose, black, shining, pierced; spores hyaline, oblong, straight, containing four minute sporidioles.—*Cooke*, *l.c.*

Hab.: Gladfield, on leaves of Sorghum and Muchlenbeckia infested with *Uredo sorghi* and *U. rumicis*, *C. J. Gwyther.*

MELASMIA, Lev.

M. tecomatis, *Cke. and Mass.* (n. sp.).

Hab.: On leaves of *Tecoma jasminoides*, at Gladfield, *C. J. Gwyther.* Author's description of this new species not yet to hand.

GLŒOSPORIUM, Mont.

G. Alphitoniæ, *Cke. and Mass.* (n. sp.).

Hab.: Gladfield, on leaves of *Alphitonia excelsa, C. J. Gwyther.* Author's description of this new species not yet to hand.

PENICILLIUM, Link.

Sterile hyphæ creeping, septate; fertile threads at the apex unequally verticillately branched or penicillate; conidia sphæroid, produced in chains, hyaline, or brightly coloured.—*Cooke*, Austr. Fungi, 369.

P. glaucum, *Link*, Cooke, Austr. Fungi 369; Sacc. Syll. iv. 78. *Aspergillus simplex*, Pers., *Botrytis glauca*, Spreng., *Mucor crustaceus*, Linn. (?), *Penicillium crustaceum*, Fries, *P. expansum*, Link. Mycelium effused, creeping, white, sterile hyphæ creeping, intricate, septate; fertile hyphæ erect, branched in a penicillate manner at the apex, branches solitary or in pairs, erect, once or twice forked at the apex; branchlets erect; conidia seated at the apices in chains, sphærical or broadly elliptic, smooth, verdigris-green, hyaline, 4 μ diam.—*Cooke l.c.*

Hab.: Found on fruit, leaves, stems, &c., almost everywhere. The mycelioid condition of this species constitutes what is known as "the vinegar plant." A short time ago it was observed in brine used for meat-pickle at a Brisbane establishment.

MICROCOCCUS, Hall.

Cocci globose or ovoid, entire, single or crowded, or accumulated in colonies, or zooglœa, a colony embedded in a gelatinous substance. These gelatinous masses are also known by the name of Palmella. Sacc. Syll. viii. 1076.

M. crepusculum, *Ehrenb.*, Sacc. Syll. viii. 1082, No. 4284. Invested by a thick tegmen, viscid mucous, liquescent, of a whitish or becoming a pale-brown colour; cocci globose, 2 μ diam., single or congregated in colonies. Sacc. Syll. l. c.

Hab.: Taken from a bottle of Brisbane hop beer. This species is frequently found in putrescent liquids.

By Authority: Edmund Gregory, Government Printer, William street, Brisbane.

Queensland.

DEPARTMENT OF AGRICULTURE, BRISBANE.

BOTANY BULLETIN No. IX.

SEPTEMBER, 1894.

CONTRIBUTIONS TO THE QUEENSLAND FLORA.

BY

F. M. BAILEY, F.L.S.,

COLONIAL BOTANIST.

The Bulletins of this Department will be sent free to such Individuals interested as may request them. Address all applications to "The Under Secretary for Agriculture, Brisbane."

BRISBANE:
BY AUTHORITY: EDMUND GREGORY, GOVERNMENT PRINTER, WILLIAM STREET.

1894.

NOTICES.

THE present Bulletin brings the record of the Queensland Flora to September, 1894, and the author takes the opportunity of thanking the many persons who continue the work of collecting and forwarding their specimens to him for determination. By this means the range of species becomes known, and fresh species are brought to our knowledge.

The aboriginal and local names attached to some of the specimens forwarded have proved of great interest, and it is to be hoped that correspondents will continue to attach such names to their specimens, and also notes of any economic properties which the plants are supposed to possess.

Specimens of the indigenous plants of all parts of the colony are acceptable, and, if numbered, their names and any other information required will be returned to the senders.

Botanic specimens of the timber trees of the Johnstone and Daintree Rivers, and also of the Herberton district, are particularly desired for the purpose of adjusting the nomenclature; this has become necessary from the same local name in very many instances having been given to so many quite distinct trees as to have rendered local names useless, or at least confusing. Persons engaged in the timber trade should see that it would be to their advantage to assist in this matter, and the author hopes, therefore, to receive their assistance in his endeavour to adjust the timber nomenclature. It will be observed that in recording fresh Fungi advantage is taken to give descriptions of other species which may be wanting in earlier publications.

30th September, 1894. F. M. B.

CONTENTS.

BOTANY:

CONTRIBUTIONS TO QUEENSLAND FLORA.

Order MAGNOLIACEÆ.

TRIBE WINTEREÆ.

GALBULIMIMA (n.g.)

(Named from the resemblance of the fruit to a galbulus.)

Sepals 2, deciduous, at first entire but at length opening on one side down to the base, 2-seriate. Petals none, except the single outer series of staminodia be regarded as such. Stamens numerous in many series, on a raised torus; filaments much flattened, linear, bearing on the back, nearer the base than the apex; 2 adnate oblong anthers. Ovary glandular hirsute with about 7 or 8 prominent angles; stigmas purplish, more or less recurved and papillose. Berry globose, 8 or more celled, 5 usually with matured seed. Seeds with a loose outer ragged coat; testa smooth, cartilaginous; albumen copious, oily. Embryo not particularly small near the hilum, apical with reference to the position of the seed in the berry. An evergreen tree of about 50 ft., foliage and fruit possessing a strong resinous odour. The nearest ally of this new genus seems to be *Illicium.*

G. baccata (n. sp.). An evergreen tree of about 50 ft. in height, having a stem diameter of about $1\frac{1}{2}$ ft.; the young branchlets with a bronzed appearance from numerous bright ferruginous scales. Leaves alternate, margins entire, oblong-lanceolate, attaining the length of $4\frac{1}{2}$ in. on petioles of about $\frac{3}{4}$-in.; the upper face dark green, glossy; under side covered with minute scurfy glands or scales, pellucidly-dotted. Flowers axillary, solitary, on peduncles of about $\frac{1}{2}$-in., bearing near the top 2 or 3 thick angular bracts; pedicel short; bud ovoid; sepals 2, one entirely overcovering the other; petals wanting; stamens numerous, the outer series without anthers; filaments much flattened, linear, bearing in the lower half; 2 parallel, oblong, sessile anthers. Ovary angular, sessile, clothed with ferruginous bright hairs. Fruit globose, crimson, resembling a fleshy *Callitris* fruit in its form and markings. Seeds compressed, embedded in the substance of the fruit.

Hab.: Eumundi, *E. H. Arundell.*

Order STERCULIACEÆ.

TARRIETIA, Blume.

T. argyrodendron, var. macrophylla (n. var.) This variety forms a large tree, and differs considerably from all others in its timber, which is strong, hard, and durable. The wood is close in grain, and the dark-coloured zones add to its beauty and make it worthy of the attention of the cabinetmaker. On the flowering branchlets sent with the sample of timber the leaflets are three, silvery on the under-side, and much larger than those of the normal form. The flower panicles are large; but the flowers on those examined were only in the early bud state.

Hab.: Barron River, *E. Cowley*.

Order TILIACEÆ.

Tribe SLOANEÆ.

ELÆOCARPUS, Linn.

E. eumundi, *Bail.*, Proc. Roy. Soc. of Ql., April, 1894. A tree of considerable size and erect growth. Leaves more coriaceous than most other Australian species, mostly oblong-lanceolate, 3 to 5 in. long, and 1 to $1\frac{1}{2}$ in. broad near the middle; on somewhat slender petioles of $1\frac{1}{2}$ to 2 in. in length; the margins entire or with distant rather prominent blunt teeth in the upper part; apex often elongated, but blunt. The young growth, petioles, and midrib more or less clothed with appressed, short, grey hairs, which are also sometimes found sparsely scattered over the lamina on the under surface. Inflorescence lateral on the two-year-old wood. Racemes seldom exceeding 2 in. in length, pedicels about $\frac{1}{2}$-in. Flowers not seen. Drupe (not quite ripe) oval, $\frac{3}{4}$-in. long; pericarp juicy, sharply acid; putamen deeply pitted, containing 1 or 2 seed. The fruit structure reminds of the Indian species, *E. oblonga*.

Hab.: Eumundi, *Field Naturalists*, March, 1894.

Order BURSERACEÆ.

BURSERA, Linn.

B. australasica, *Bail.* The diagnosis of this tree given in Botany Bulletin V. was drawn up from a few fragmentary shoots picked up in the Eumundi scrubs, but the trees were not identified until met with by the Field Naturalists when botanising in the same locality during the last Easter holidays. I am now, therefore, enabled to correct and add to the former description, as follows:—Tree of considerable size, the bark shedding somewhat similar to the red cedar in hard woody scales. Leaflets 3 to 7, from $1\frac{1}{2}$ to 4 in. long; common petiole from $1\frac{1}{2}$ to $2\frac{1}{2}$ in. long, and the petiolule varying from 3 to 9 lines long. Drupe, when ripe, with a very juicy epicarp. I have received foliage specimens from near the same locality of a tree said to be known there as Red Carrot-wood and White Carrot-wood, which I believe identical with the above *Bursera*. These local names, however, in some instances, are only known to a few persons, and therefore are of little use for identification.—Proc. Roy. Soc. of Ql., April, 1894.

Order OLACINEÆ.

Tribe PHYTOCRENEÆ.

CARDIOPTERIS, Wall.

(This genus is given in Hooker's Flora of British India in the above order, but as a genus of doubtful affinity.)

Calyx 4 or 5-parted; lobes imbricate, persistent, but not or only slightly accrescent. Corolla deciduous, between rotate and funnel-shaped, 4 or 5-lobed; stamens 4 or 5, inserted on the base of the tube of the corolla, alternate with its lobes; filaments short, glabrous; anthers 2-celled, introrse, dehiscing longitudinally; pollen-grains 4-angular. Ovary free, surrounded at the base by a thick fleshy annular disk, oblong, compressed, 1-celled; ovules 1 (rarely 2), pendulous, naked, micropyle ultimately superior. Style 2-branched, one branch deciduous, curved, capitate at the apex; the other accrescent, ultimately deciduous, divided at the apex into 2 unequal, ovate, rather obtuse divisions. Fruit ovate-orbicular, emarginate or obcordate, compressed, very broadly winged, 1-celled, indehiscent. Seed solitary, linear, furrowed; embryo minute, in hard fleshy albumen. A climbing herb with milky juice. Leaves alternate, long-petioled, simple or lobed, cordate, palminerved. Flowers ebracteate, in axillary racemose or paniculate cymes, bisexual, dichlamydeous.—*Masters* in Hook. Fl. Brit. Ind.

C. lobata, *R. Br.* Stem terete, striate. Leaves 3 to 5 in. by 3 to $4\frac{1}{2}$ in., glabrous, membranous, polymorphous, usually more or less angular and slighty lobed; base 7 to 9-nerved, cordate; lobes acute or acuminate, widely divergent; petiole 3 to 5 in. Peduncles $2\frac{1}{2}$ to 4 in., solitary, axillary, dichotomous; pedicels puberulous, erect, ultimately spreading or recurved. Flowers rather crowded, secund, ebracteate. Calyx puberulous. Corolla slightly exceeding the calyx, whitish, deciduous. Fruit 1 to $1\frac{1}{2}$ in. by $1\frac{1}{4}$ in. The plant varies much in the consistence and form of the leaves, occasionally even on the same specimen; hence, by some writers, several species have been proposed.—*Hook. l.c.* The Australian form is that known as var. *moluccana.* The plant has some resemblance to a yam, *Dioscorea;* and by some has been mistaken for a species of that genus.

Hab.: Barron River, *E. Cowley*, 1892.

Order SAPINDACEÆ.

RATONIA, DC.

R. Lessertiana, *Benth. and Hook. f.*, Gen. Pl. i. 400. A large shrub or small tree. The branchlets, leaf-petioles, rhachis, and inflorescence puberulent, but the dark-reddish colour of the bark plainly visible. Leaflets 4 or 5 (on the specimens examined), opposite or alternate, usually lanceolate, 4 to 7 in. long, and from $1\frac{1}{4}$ to 2 in. broad in the widest part; the apex obtuse, but often elongated; base cuneate to the short slender petiole; texture thin; primary veins distant, and the reticulation delicate. Inflorescence a racemose panicle, slender and drooping, 4 to 8 in. long; the branches very short, or one $1\frac{1}{2}$ or 2 in. long; flowers minute, only seen at base of fruit. Capsule red, $\frac{3}{4}$-in. long, globose-pyriform, glabrous, stipitate, triquetrous towards the base. All examined 1-seeded.

Hab.: Daintree River, *E. Cowley*.

The above species, with which I believe our Australian to agree, and under which I place it, enjoys a wide range, being, according to Sir J. D. Hooker, met with in Tenasserim, South Andaman Islands, Malacca.

Order ONAGRARIEÆ.

ŒNOTHERA, Linn.

Œ. longiflora, *Jacq.* The long-flowered Evening Primrose. Plant with erect stem, pilose. Leaves oblong to lanceolate, denticulate. Flowers large, bud erect; free part of the calyx-tube 3 to 4 times as long as the ovary, filiform; petals yellow, nocturnal, bilobed. Stigma 4-parted; divisions elongated. Stamens included. Capsule linear. Seeds minute, scrobiculate.

Hab.: A plant belonging to Buenos Ayres, which has become naturalised at the Warrego River, from whence my first specimens were received in 1887 from Mr. A. P. Jones. It is also found about Toowoomba.

Order MYRTACEÆ.

EUGENIA, Linn.

E. hemilampra, *F. v. M.*, Fragm. ix. 145 (name proposed). In Moore and Betche's Handb. of the Fl. of N.S.W., 207, it is also referred to as a probable form of *E. Smithii*, but no description seems ever to have been published of the flowers or fruit. A tree of large size, having a stem diameter of from $1\frac{1}{2}$ in. to 3 ft.; the branchlets frequently flattened and dark-coloured. Leaves lanceolate or elliptical, obtusely acuminate or almost pungent, 3 in. to 5 in. long; veins fine, numerous, parallel, very oblique, joining in an intramarginal one near the edge; under side more or less light-coloured; upper side dark-green. Oil-dots only visible before a strong light; much more obscure and very minute in the southern plant, larger but still somewhat obscure in the northern specimens. Flowers very small and numerous, in a terminal trichotomous panicle, which is more developed in the northern than in the southern examples. Calyx-border prominent; teeth very minute and obscure in the flower. Petals mostly cohering and falling off together, tomentose; the whole calyptra about $\frac{1}{2}$ line diameter. Stamens twice as long as the petals; filaments flexuose. Anthers with globular divaricate cells, as in *E. Smithii*. Fruit crimson, globular, $1\frac{1}{4}$ in. diameter, crowned by the small circular scar of the calyx-rim and the minute calyx-teeth, and often with a few stamens. Cotyledons as in *E. Smithii*.

Hab: Johnstone River (flowering specimens), *Dr. Thos. L. Bancroft*; Eumundi (fruiting specimens), *W. Munro Hull*.

Fruit useful for preserving, being fleshy and of a sharp acid flavour.

Order LYTHRARIEÆ.

PUNICA, Linn.

Calyx-tube funnel-shaped, coriaceous, adnate to the ovary below, enlarged above the ovary; lobes 5 to 7, persistent on the fruit. Petals 5 to 7, lanceolete, wrinkled, inserted between the calyx-lobes. Stamens numerous, inserted round the mouth of the calyx. Ovary inferior with many cells in two whorls; style long, bent, stigma capitate; ovules numerous, placentas in some cells axile, in others parietal. Berry inferior, globose, many-celled. Seeds very many, angular, testa coriaceous with a watery outer coat; cotyledons convolute. Large shrubs; branches often armed. Leaves opposite, subopposited, or clustered, oblong, obovate, obtuse, entire. Flowers shortly pedicellate, axillary, solitary or clustered, large, orange-red or creamy-white.

P. Granatum, *Linn.* Pomegranate. A dense shrub or small tree, often spinous, deciduous. Leaves about 2 in. long and $\frac{1}{2}$-in. broad, narrowed towards both ends, with the intramarginal nerve distinct or obscure. Calyx-lobes about 1 in. long, the petals longer. Fruit globose, often large, the numerous seeds covered with a very juicy pulp, which is sharply acid or sweet.

Hab.: This common plant of India and Persia has strayed from cultivation and become naturalised about Bundaberg.—*J. Keys.*

NOTE.—Dr. W. Dymock, Veg. Mat. Med. of W. India, says that the Arabs recommend the root-bark as being the most astringent part of the plant, and a perfect specific in cases of tapeworm; it is given in decoction, prepared with two ounces of fresh bark, boiled in a pint and a-half of water till but three-quarters of a pint remain; of this when cold a wineglassful may be drunk every half-hour till the whole is taken. This dose sometimes sickens the stomach a little, but seldom fails to destroy the worm, which is soon after passed.

The seeds of the pomegranate are considered to be stomachic, the pulp cardiacal and stomachic. The root, bark, and rind of the fruit are officinal in the Pharmacopæia of India.

Order SAPOTACEÆ.

SIDEROXYLUM, Linn.

S. eerwah, *Bail.* Proc. Roy. Soc. of Ql., April, 1894. A medium or large-sized tree. I have only leaves, young fruit (probably not more than two or three weeks old), and fully ripe fruit, scarcely enough to establish a species, only that, these being so very distinct from all the other Australian species, it is better for it to bear a distinctive name, and the description can be filled up at some future time. The leaves closely approach those of *S. obovata*, being obovate or broadly elliptical, obtuse, decurrent upon the petiole, including the latter, about 5 in. long, with a breadth of 2½ in. at the broadest part. Pedicels glabrous, 3 or 4 lines long. Calyx-segments obtuse, nearly orbicular, glabrous except for the ragged membranous ciliate margins, about 1 line in diameter. Ovary with a dense ring of glossy brown hairs at the base, the rest part glabrous. Ripe fruit of a reddish purple, oval, but often tapering towards the base so as to become somewhat pear-shaped, 2 to 2½ in. long, containing 1 or 2 seeds, the 2-seeded fruits much compressed. Seeds when 2 in a fruit shaped like a cowrie shell, from ¾ to 1¼ in. long; hilum broad, the length of the seed.

Hab.: Near Mount Eerwah, *Field Naturalists*, 24th March, 1894.

Order APOCYNACEÆ.

CARISSA, Linn.

C. ovata, *R.Br.*, **var. stolonifera,** *Bail.* Referred to in Dr. Thos. L. Bancroft's paper in Proc. Roy. Soc., June, 1894. This form is of a dwarf spreading habit, the branches, bending down, take root when they touch the soil and form fresh plants, thus one plant will soon cover with a low bushy growth a large space. The stems are more slender and the leaves smaller than in the coastal or normal form. Another and more remarkable distinction is that while the normal form Dr. Thos. L. Bancroft found to contain little or no poisonous properties, the bark of this inland plant he found to possess an exceedingly bitter poisonous principle.

Hab.: Near Dalby, *Dr. Thos. L. Bancroft.*

Order ASCLEPIADEÆ.

Tribe CYNANCHEÆ.

ARAUJIA, Brot.

(Named after Antonio de Araujo, a great promoter of botany in Portugal.)

Calyx 5-parted, eglandulous inside, segments foliaceous; corolla hypocrateriform or almost infundibuliform, with 5 swellings outside at the base and a corresponding number of cavities inside; limb slightly spreading and 5-lobed. Corona adnate to the base of the corolla; anthers terminated by a membrane; pollen-masses pendulous, fixed by their tapering tops. Stigma ovate, 2-horned at the apex. Follicles ovate, ventricose, bent downwards, semi-bilocular, thick, coriaceous, smooth or at length tuberculose-muricate. Seeds comose, adhering to the lamellæ of the dissepiment. Twining plants, hoary or hirsute. Leaves opposite. Cymes few-flowered. Flowers whitish or rose-coloured.

A. albens, *G. Don.* (*Physianthus albens*, Mart.) A twiner, with ovate or lanceolate leaves 2 or 3 in. long, truncate or cordate at the base, and acute at the apex, white underneath as well as the young shoots. Flowers in subdichotomously branched cymes; pedicels about 7 lines long, calyx-segments broad, leafy. Corolla with a broad tube and a 5-lobed limb. Corona of 5 fleshy segments attached to the corolla-tube at the base, the upper portion hood-shaped or convex with revolute margins. Pollen-masses pendulous. Follicle glaucous, thick, oval, 2½ to 3 in. long, and 2 in. in diameter.

Hab.: A native of South Brazil, naturalised about the Brisbane River and Darling Downs.

Order VERBENACEÆ.

Tribe VERBENEÆ.

STACHYTARPHETA, Vahl.

S. mutabilis, *Vahl.* A rather dense shrub of 4 or 5 ft., scabrous-pubescent. Leaves ovate, serrate, contracted into the petiole, scabrous above, pubescent beneath; spikes elongated, 12 to 18 in. long, erect, furrows at length narrower than the thickened rhachis; bracts lanceolate-subulate, spreading above the middle; calyx 5 to 6 lines long, 4-toothed, hispid; corolla large red or rosy-red, the limb 6 to 8 lines in diameter at times.

Hab.: This South American shrub has become naturalised near Port Douglas, *E. Cowley*. The plant is also naturalised in the Seychelles.

Tribe CHLOANTHEÆ.

NEWCASTLIA, F. v. M.

Calyx campanulate, 5-lobed, valvate in the bud. Corolla-tube campanulate, the limb of 5 nearly equal lobes. Stamens 5; anthers without appendages. Ovary small, completely 2-celled, with 2 ovules in each cell laterally above the middle. Style slender, entire, or minutely 2-lobed. Fruit not exceeding the calyx, not succulent, apparently separating into 4 nuts. Densely woolly or cottony shrubs. Leaves opposite, undivided. Flowers opposite and sessile, in dense terminal woolly spikes, or forming an elongated panicle with spike-like branches. Bracts often prominent upon the growing points of inflorescence, but with the bracteoles usually very deciduous.—Flora Austr. v. 39.

N. cladotricha, *F. v M.* in Hook Kew Journ. ix. 22; Fragm. i. 184, t. i. and iii. 21; Flora Austr. v. 40. The name referring to the branched hairs of the indumentum. An erect shrub, attaining 2 to 3 ft., densely clothed with white or rust-coloured woolly branching hairs, and strongly scented. Leaves sessile, narrow-oblong to ovate-lanceolate, obtuse, rounded at the base, the margins slightly recurved, $\frac{3}{4}$ to over 1 in. long, thick, very rugose, reticulate underneath, loosely hirsute or tomentose on both sides with branched hairs. Inflorescence in elongated panicles with spike-like branches, or in spikes at first short and dense, but lengthning sometimes to several inches and interrupted. Bracts ovate or ovate-lanceolate, densely covered with a dark-brown tomentum, imbricate in the very young spike and at the growing end, but falling off early. Calyx about $1\frac{1}{2}$ lines long, very woolly, the lobes rather shorter than the tube. Corolla glabrous outside, the tube broad, about as long as the calyx, lobes short and broad, with blue points. Stamens about as long as the tube, inserted above a woolly ring near the base, alternating with the corolla-lobes; filaments very short, anthers ovate dorsally attached. Pollen bright-yellow. Style scarcely exserted, stigma minutely emarginate. Ovary glabrous. Ovules attached near the top, but the seed enlarges upwards so as to be attached near the base.

Hab.: St. George, *J. Wedd.*

Order LAURINEÆ.

Tribe PERSEACEÆ.

CRYPTOCARYA, R. Br.

C. oblata (n. sp.) This is said to be a tree of considerable size. The young growth and inflorescence covered with a more or less dense clothing of short bright ferruginous hairs, but soon becoming perfectly glabrous; branchlets very angular, nearly black, with numerous light-coloured lenticelles; leaves broadly lanceolate with elongated points, attaining 5 or more inches in length, the primary veins few, distant, and not very prominent, and the reticulation somewhat faint; texture membranous; petioles short; fruit oblate and laterally compressed, the broadest diameter about $1\frac{3}{4}$ in., marked by prominent ribs, the fleshy covering softer and more juicy than usual in the genus. The perianth is more persistent in this fresh species than in any other Australian plants of the genus; but I could find none perfect enough to describe any of its parts, except, I might observe, that the staminodia seemed large and to resemble those of *C. Wightiana*, Thwaites.

Hab.: Daintree River, *E. Cowley.*

Order LILIACEÆ.

CORDYLINE, Comm.

C. terminalis, var. Baileyi. This is a very beautiful variegated form, which was found a few years ago by Mr. W. T. Bailey, on Holham Creek, Pimpama. The plant has since been propagated from cuttings, and all the plants thus obtained have retained the variegated foliage.

Order ORCHIDEÆ.

DENDROBIUM, Swartz.

D. linguiforme, var. Nugentii (n. var.) This species differs considerably in the form and size of its tongue-like, thick leaves, but until I received Mr. Nugent's specimens I have never observed any marked variation in the flowers. These, however, at first sight strike one as being distinct, and differ from the more commonly known plant in the following particulars:—Smaller flowers, shorter pedicels, segments scarcely exceeding 4 lines in length; white, except for a tinge of yellow near the pouch; the labellum not half the length of the other segments, the lateral lobes being of a lilac colour; in other respects this Northern plant agrees with the normal form.

Hab.: Eungella Range, *L. J. Nugent.*

Order GRAMINEÆ.

PASPALUM, Linn.

P. Galmarra (sp. nov.) In my report upon the Botany of the Bellenden-Ker Expedition, 1889, I referred to this grass, which I had gathered along Harvey's Creek, a tributary of the Russell River, thinking it probably the one Dr. Robt. Brown had given in his "Prodromus Floræ Novæ Hollandiæ" as *Paspalum pubescens.* It proves, however, not to be Brown's grass, but a new species. The name *pubescens* might stand under my authority, but there having been several grasses to which the name *Paspalum pubescens* has been given, I consider it better that the present species should be known under another distinctive specific name, and therefore give to it the aboriginal name of "Jacky Jacky"—Galmarra, explorer Kennedy's faithful attendant—and recommend for a common name that of "Russell River Grass." Lately I have heard from Mr. P. R. Gordon that this grass is considered excellent for stock by settlers at the Russell River. I am indebted to Mr. A Meston for the name "Galmarra."

It may have been observed that, in making use of the aboriginal name of a person or place for the specific name of a new plant, I have simply used the word without in any way latinising it. Some botanists may not approve of this, but we must remember how few are the instances where native names or words are preserved, and also how frequently the latinising of such would destroy the euphony.

Order FUNGI.

AGARICUS, Linn.

A. (Collybia) muscipula, *Cke. and Mass.*, Grev. xxii. 36. Pileus fleshy, umbonate, smooth, mouse-grey or brown, wrinkled, 3-4 in. broad; substance thin, tough; margin shortly incurved; stem elongated, stuffed, 8-9 in. long, ½-in. thick, tapering downwards and rooting, longitudinally striate, often twisted; gills broadly adnate, very broad, scarcely crowded; spores whitish, subglobose, 14 μ diameter, with a minute apiculus. Much resembling *A. radicatus*, but with very different spores. *A. (Collybia) radicatus*, var. *superbiens*, Berk., has large elliptical spores.—*Cooke l.c.*

Hab.: Near Brisbane, *Dr. J. Bancroft.*

The description of this new species was not to hand when Botany Bulletin viii. was published.

BATTARREA, Pers.

(Named in honour of Antonia Battarra, who published a work upon Fungi in 1759.)

Peridium composed of two membranes, volviform, dehiscing in lobes, distinct from the ascending receptacle, which is stipitate, pileate, pulverulent above, membrane of the interior peridium when broken calyptrate, subterranean peridium rooting.—Cooke's Austr. Fungi, 225.

B. phalloides, *Dicks.*, Pers. Syn. 139, t. 31 f. 1; Sacc. Syll. vii. 195; Cke. Austr. Fungi, 225. (So named from its resemblance to the genus *Phallus.*) Volva ovate, bicorticate, whitish, replete with mucus; stem cylindrical, a little attenuated towards each end, straight, fleshy, replete with mucilage, at first short, afterwards quickly elongated upwards; peridium campanulate, smooth and even below, above covered with a thick, powdery, brown stratum which is a portion of the ruptured volva, like a calyptra. Spores brown (6 μ, minutely warted).—*Cooke l.c.*

Hab.: Gladfield, *C. J. Gwyther.* Other Australian habitat: Murchison River, Lake Albacutya. The foreign habitats are England and various other European countries, and North America.

MORCHELLA, Dill.

(From the German *morchel.*)

Fungi between waxy and fleshy, clavately pileate, confluent with the central hollow stem; plicately or reticulately lacunose above, bearing the hymenium effused over the whole surface. Sporidia continuous, hyaline.—Cooke's Austr. Fungi, 249.

M. deliciosa, *Fries.*, Cke. Myco. f. 320; Sacc. Syll. viii. 13. The delicious Morel. Capitulum subcylindrical ($2\frac{1}{2}$ to 3 cm. long), acute, livid yellowish, base adnate; ribs longitudinal, firm, connected by transverse folds; stem even; asci cylindrical. Sporidia broadly ellipsoid, 20 x 10-11 μ.

Hab.: Amongst rotten bark near stem of gum-tree, Charley's Gully, Gladfield, *C. J. Gwyther.* This species of esculent fungus is met with in many parts of Europe, India, and Java.

HELOTIUM, Fries.

Cups waxy, rather thick; disc flattened, at first punctiform, then dilated, always open, sessile or shortly stipitate; sporidia continuous or spuriously septate, hyaline.—Cooke's Austr. Fungi, 263.

H. terrestre, *Berk. and Broome*, Linn. Trans. Cups stipitate, small, nearly plane, horn-colour, lurid, externally smooth and naked (4–5 mm. broad). Asci elongated; sporidia elliptic, shortly appendiculate at each end, uniguttulate, 10 μ long; paraphyses filiform, clavate at the tips.—*Cooke* in Austr. Fungi, and Grev. xxii. 36. In this latter he remarks:—"By some error, apparently, this species was originally described as externally *villous*, and hence was transferred by Saccardo to *Dasyscypha*, and as such was recorded in 'Handbook of Austr. Fungi'; but the specimens now received (from Gladfield), as well as those in Herb. Kew (Taylor's Range), are externally smooth and naked; hence it should be restored to its original genus *Helotium.*"

Hab.: On damp earth, Taylor's Range, *Bail.*; at Gladfield, *C. J. Gwyther.*

H. citrinum, *Hedw.*, Sacc. Syll. 910; Austr. Fungi, 263. Crowded, lemon yellow, cups flattened, concave, with the short, thick, paler stem obconical (2 mm.); asci clavate, 90-100 by 8-9 μ; sporidia oblong, obtuse, hyaline, biguttulate, 10-12 by 4 μ; paraphyses filiform, not clavate at the tips.—*Cooke*, Austr. Fungi, 263.

Hab.: Mount Mistake, on wood.

No description given in 2nd Suppl. to Syn. Ql. Flora, where it was previously noticed.

BELONIDIUM, Mont.

Cups subsessile or shortly stipitate, scutellate, or infundibuliform, waxy, smooth or downy; asci elongated; sporidia elongated, multi-septate.—Cooke's Austr. Fungi, 267.

B. parasiticum, *Cke. and Mass.*, Grev. xxii. 68. Parasitic, white. Cups very minute, glabrous, concave or nearly plane, attached by a central papilla scarcely visible to the naked eye. Asci clavate; sporidia 8, subfusoid, straight, triseptate, scarcely constricted, hyaline, 22 x 4 μ. Paraphyses filiform. Near *B. minutissimum*, but cups much smaller, sessile; and sporidia different.—*C. and M. l.c.*

Hab.: On the subiculum of *Asterina*, growing upon the leaflets of *Tarrietia trifoliata*, Barron River.

XYLARIA, Hill.

X. fulvella, *Berk. and Curtis*, Cuban Fungi; Sacc. Syll. i. 1166. Clavate, rubiginose, papillate. Perithecia half-exserted, ostiola black; stipes cylindrical, pale tawny-coloured, lineato-rugose. Sporidia oblong, 7, 6 μ long.

Hab.: Eumundi, at base of dead stump in scrub, *Field Naturalists*; first met with on rotten wood at Cuba.

X. ianthino-velutina, *Mont.*, Syll. Crypt.; Sacc. Syll. i. 1282. Simple or branched, terete, apex acutely compressed. All parts clothed with long violet-brown hair. Perithecia superficial, somewhat free, depressed, ovoid at lengths opening between the hairs. Sporidia monostichous, navicular-subpyriform, 12-13 μ long.

Hab.: Barron River scrubs, on old fruit of a *Flindersia*, *E. Cowley*; found on the rotting woody legumes of *Hymenæa Courbaril* in Brazil.

X. rhizophila, *Cke. and Mass.*, Grev. xxii. 37. Stroma clavate, divided nearly to the base into 2 to 6 clubs, which are spathulate, flattened, mostly rounded at the apex, 3 to 5 c.m. long, 5-7 mm. broad, bright-brown, base rugose, smooth, rooting. Perithecia prominent; ostiola papillate, black. Asci cylindrical. Sporidia uniseriate, subfusiform, obtuse, straight or curved, uninucleate, brown, 8-10 x 2-3 μ.—*C. and M. l.c.*

Noticed in Botany Bulletin viii., but then description not to hand.

RHOPALOPSIS, Cooke.

Very densely cæspitose, clubs abbreviated, shortly stipitate or crowded together on an intricate stroma; perithecia peripherical; sporidia continuous, brown.—Cooke's Austr. Fungi, 289.

R. cetrarioides, *Well. and Curr.* (*Kretschmaria cetrarioides* in Sacc. Syll. 1489.) Given under *Hypoxylon* in Syn. Ql. Fl. 780. Stroma decumbent, laciniate, resembling in habit and mode of growth *Cetraria tristis;* lacinia dilated, multifid, passing into perithecia at the apices; perithecia densely aggregated, sometimes compressed, irregular; sporidia lanceolate, continuous, brown.—*Cooke* in Austr. Fungi, l.c.

Hab.: Trinity Bay, on wood.

R. angolense, *Well. and Currey.* (*Kretschmaria angolense* in Sacc. Syll. 1519; Cooke's Austr. Fungi, 290.) Given under *Hypoxylon* in Syn. Ql. Flora, 780. Clavate, black, bright and shining; perithecia densely aggregated; ostiola minute, a little prominent; sporidia dark-brown, ovate or slightly curved, 12-15 μ long.—*Cooke l.c.*

Hab.: Trinity Bay.

R. confusum, *Berk. and Cooke*, Grev. xii. 2. Gregarious, stipitate, simple. Heads depressed, globose, glaucous; at length black on attenuated flexuous stipes. Perithecia innate, globose; ostiole punctiform.

Hab.: Eumundi, on bark of a dead log, *Field Naturalists;* also on wood, Brazil.

HYPOXYLON, Bull.

H. (Sphæroxylon) atrosphæricum, *Cke. and Mass.*, Grev xxii. 68. Stroma erumpent-superficial, subglobose, 2 mm. diameter, separate, rarely connate, gregarious, black, externally papillate; perithecia peripherical, in one series, ovate, mamillate; asci cylindrical; sporidia fusiform, straight or curved, unequal-sided, rather acute at the ends, narrow, clear brown, 22 x 6 μ (rarely 8 μ). Externally somewhat resembling *H. coharens;* but the stroma are seldom connate, smaller than *H. argillaceum*, and black; the sporidia also are about equal in length, much narrower, and acute at the ends. There is no other species amongst the black series of *Sphæroxylon* with which the sporidia could be confounded, and no form of *H. multiforme* or *H. majusculum* to which it could be referred.—*C. and M. l.c.*

This species was noticed in Botany Bulletin viii.; but the author's description was not then to hand.

ASTERINA, Lév.

A. hoveafolia, *Cke. and Mass.*, Grev. xxii. 36. Epiphyllous. Spots black or with a brown centre, suborbicular, velvety (1-2 mm.). Perithecia usually arranged in a ring or part of a ring at the circumference, black, scutellate, fimbriate. Asci large, pyriform. Sporidia subelliptical, uniseptate, brown, the upper cell the broadest (16 x 7 μ).—*C. and M. l.c.*

This species was noticed in Botany Bulletin viii.; but the description was not then to hand.

DIMEROSPORIUM, Fuckel.

D. Tarrietiæ, *Cke. and Mass.*

Hab.: Eumundi, on leaflets of *Tarrietia trifoliolata*, *Field Naturalists.*

PUCCINIA, Pers.

P. Carissæ, *Cke. and Mass.*, Grev. xxii. 37. Hypophyllous. Uredospores not seen. Teleutospores. Sori small, gregarious or orbicular spots forming rings which are at length confluent, rather compact, dark-brown; spores elliptic, constricted in the centre, rounded at the ends, smooth, brown (20-22 x 16 μ), on short peduncles. Quite distinct from *P. Alyxiæ.*—*C. and M. l.c.*

Hab.: Gladfield, *C. J. Gwyther;* Dalby, *Dr. Thos. L. Bancroft.* Noticed in Botany Bulletin viii.; but the description was not then to hand.

P. heterospora, *Berk. and Curtis.* (*Uromyces Thwaitesii*, B. and Br.; *U. pulcherrimus*, B. and C.) Spots determinate, purplish or yellow; sori minute, hypophyllous, soon naked, crowded in orbicular glomerules, brown; teleutospores elongated or subglobose, even, 15-27 μ diameter; incrassated about the apex, at first continuous, at length biseptate; pedicels hyaline, slender, narrowed downwards, 3-4 times as long as the spores.—*Cke.*, Austr. Fungi, 338.

Hab.: On the leaves of a native *Hibiscus* received from *Mr. J. Wedd*, St. George. This fungus has also been found on *Abutilon crispum* received from the Gulf of Carpentaria; and on *Abutilon avicennæ* from New South Wales.—*Cooke*, Austr. Fungi.

UREDO, Pers.

U. pallidula, *Cke. and Mass.*, Grev. xxii. 37. Pustules pallid, convex, gregarious, splitting irregularly, and then girt by the ruptured epidermis on both surfaces. Uredospores tawny in the mass, pulverulent, elliptical, smooth (12-14 x 8-10 μ), nearly colourless.—*C. and M. l.c.*

Hab.: Gladfield, on pods and leaves of *Cassia.* Noticed in Botany Bulletin viii., but description not then to hand.

U. Sorghi, *Fuckel.* Sori linear, erumpent, ferruginous; uredospores obovate, olive-brown, 40-24 μ.

Hab.: On sorghum, Gladfield, *C. J. Gwyther;* on sugar-cane, Nerang, *J. F. Shirley;* from both localities, bearing *Darluca filum.*

U. Rumicis, *Schum.* Sori hypophyllous or amphigenous, surrounded by the torn epidermis, scattered or gregarious, suborbicular, smooth, of a cinnamon or pale fuscous brown; uredospores sphæroid or elliptic-sphæroid, subspinulose, yellowish, 24-33 x 18-26 μ.

Hab.: On leaves of *Muehlenbeckia*, Gladfield, *C. J. Gwyther.*

U. leguminum, *Desm.*, Cooke's Austr. Fungi 344. Pustules rounded, solitary, rather large, girt by the ruptured epidermis; uredospores ovoid, pedicellate, rough, pale-brown (20 x 18 μ). —*Cooke l.c.*

Hab.: On *Acacia* pods, *Cooke l.c.*

U. cichoracearum, *DC.*, Cooke's Austr. Fungi 344; recorded in 2nd Suppl. Syn. Ql. Flora 127. Spots obliterated or very minute, sori on both surfaces, scattered, small, orbicular, rarely confluent, often girt by the remains of the ruptured epidermis; uredospores subglobose or oblong, with short, hyaline, deciduous pedicels. —*Cooke l.c.*

Hab.: On *Bidens* and other Compositæ, near Brisbane.

U. clematidis, *Berk.*, Hook Journ. Bot. vi. 205; Sacc. Syll. 3139; *Cooke* in Austr. Fungi 344. Sori on the under surface, solitary or gregarious, pale yellow, more or less rounded, flattened; spores irregular, ovoid, clavate, quadrangular, or polygonal, epispore thin minutely granular, very pale yellowish, hyaline, 24-28 x 66-20 μ (sometimes 30 x 35 μ).—*Cooke l.c.*

Hab.: On *Clematis aristata, Cooke l.c.*

MELASMIA, Lév.

Perithecia dimidiate, plane, almost without a mouth, or cracking, membranaceous, black, innate in a blackened, effused stroma, often on leaves; sporules elongated, continuous, subhyaline.—*Cooke*, Austr. Fungi 359.

M. eucalypti, *Cke. and Mass.*, Grev. xvi. 75; *Cooke*, Austr. Fungi 359. Spots orbicular or confluent (2 mm. diam.), black; perithecia few, somewhat gregarious, elliptical, or lanceolate, dehiscing by a fissure, then hysterium-like; sporules lanceolate, acute at each end, continuous, hyaline (15 x 5 μ), on rather long simple basidia. —*C. and M. l.c.*

Hab.: On leaves of *Eucalyptus*, Nerang Creek.

This species is noticed in the 2nd Suppl. Syn. Ql. Flora, without description.

M. Tecomatis, *Cke. and Mass.*, Grev. xxii. 37. Perithecia on both surfaces, superficial, orbicular, rugose, black (1-2 mm.), then deficient above, and marginate, disk brownish, sporules elongated, fusoid, continuous, hyaline, 16 x 2 μ.—*C. and M. l.c.*

Hab.: On leaves of *Tecoma jasminoides* at Gladfield.

Noticed without description in Botany Bulletin viii.

GLÆOSPORIUM, Mont.

Pustules nestling beneath the epidermis, discoid or pulvinate, at length sometimes erumpent, pale or brown; conidia ovate-oblong, rarely oblong, continuous, hyaline, often conglutinate and erumpent in a globule or tendril; basidia thread-like, fasciculate.—*Cooke*, Austr. Fungi.

The following species are wanting description in my former publications:—

G. Alphitoniæ, *Cke. and Mass.*, Grev. xxii. 37; recorded in Botany Bulletin viii. Epiphyllous. Spots irregular or confluent, pallid, pustules erumpent, small, gregarious on the spots, chiefly towards the centre, darker, splitting above. Conidia cylindrical, roundish at the ends, 18-22 x 4 μ, hyaline, binucleate, mostly straight. —*C. and M. l.c.*

Hab.: Gladfield.

G. intermedium, *Sacc.*, Cooke's Austr. Fungi 361; recorded in 1st Suppl. Syn. Ql. Flora 86. Pustules gregarious, punctiform, black, then erumpent ($\frac{1}{6}$-$\frac{1}{5}$ mm. diam.); conidia elongated, rounded at the ends, straight, hyaline (14-18 x 4-6 μ).—*Cooke l.c.*

Hab.: On *Hoya australis*, Tambourine Mountain, *Rev. B. Scortechini.*

G. citricolum, *Cke. and Mass.*, Grev. xvi. 3; Cooke's Austr. Fungi 361; recorded in 2nd Suppl. Syn. Ql. Flora 139. Spots dark-brown, small, rather discoid, often confluent; pustules immersed; conidia oval, continuous, hyaline, 8 x 6 μ.—*C. and M. l.c.*

Hab.: On Orange-trees, Toowoomba, *H. Tryon.*

G. glaucum, *Cke. and Mass.*, Grev. xvi. 75; Cooke's Austr. Fungi 362; recorded in 2nd Suppl. Syn. Ql. Flora 139. Spots rather orbicular on one or both surfaces, becoming glaucous, rather mealy, pustules minute, conidia profuse, soon oozing out, forming an effused mealy stratum, globose, hyaline, 6-7 μ diam.—*C. and M. l.c.*

Hab.: On foliage of indigenous shrubs at Nerang Creek.

G. Denisonii, *Sacc. and Berl.*, Sacc. Syll. 4593; Cooke's Austr. Fungi 362; recorded in 1st Suppl. Syn. Ql. Flora 86. Pustules gregarious, minutely pustulate, covered by the scarcely perforate epidermis, yellowish within; conidia oblong-cylindrical, obtuse, slightly curved, 6-8 x 1-5 μ, hyaline; basidia simple, rod-like.—*Cooke l.c.*

Hab.: On leaves of *Macrozamia Denisonii*, Tambourine Mountain, *Rev. B. Scortechini.*

G. fructigenum, *Berk.*, Gard. Chron. 1856; Sacc. Syll. 3751; Cooke's Austr. Fungi 363; recorded in 2nd Suppl. Syn. Ql. Flora 139. Pustules concentric, dull rose-colour, erumpent, with a single pore or a fringed mouth, pulvinate; conidia oblong or cylindrical, often curved, 20-30 x 5-6 μ, glandular, hyaline; basidia simple, rarely forked.—*Cooke l.c.*

Hab.: On pear-fruit, Toowoomba, *H. Tryon.*

G. musarum, *Cke. and Mass.*, Grev. xvi. 3; Cooke's Austr. Fungi 363; recorded in 2nd Suppl. Syn. Ql. Flora 139. Pustules innate-erumpent, gregarious, rather rosy; conidia elongated, ellipsoid, rounded at the ends, continuous, hyaline, 10-12 x 4 μ, glandular within.—*C. and M. l.c.*

Hab.: On bananas exposed for sale in Brisbane.

G. lagenarium, *Pass.*, Sacc. Syll. 3757; Cooke's Australian Flora 363; recorded in 3rd Suppl. Syn. Ql. Flora 126. Pustules seated beneath the cuticle, erumpent, often circinating, minute, pulvinate, somewhat rosy; conidia ovate-oblong, sometimes unequal-sided, 16-18 x 5-6 μ, continuous, cloudy, hyaline; basidia fasciculate, rather fusoid, 15-20 x 3-5 μ.—Cooke's Austr. Fungi l.c.

Hab.: On mango-fruit grown in Brisbane.

G. cucurbitarum, *Berk and Broome*, Trans. Linn. Soc. ii. p. 68; Sacc. Syll. 3758; Cooke's Austr. Fungi 363; recorded Syn. Ql. Flora 779, and 1st Suppl. 86. Spots bright-orange, depressed; conidia clavate, shortly stipitate, 10-22 μ long.—Cooke's Austr. Fungi l.c. Dr. Cooke says of this that it is scarcely more than a variety of *G. lagenarium.*

Hab.: On water-melon fruit exposed for sale in Brisbane; also on bananas in Brisbane fruitshop and on pie-melons growing at Eight-mile Plains. Specimens from each locality determined by the *Rev M. J. Berkeley* and *Mr. C. E. Broome.*

For description of *G. Lindemuthianum* (S. and M.), the French bean, *Glæosporium*, see Botany Bulletin v. 35; and *G. pestiferum* (Cke. and Mass.), the vine, *Glæosporium*, see Botany Bulletin iii. 32.

ASPERGILLUS, Mich.

A. entomophilus, *Cooke.*

Hab.: On various kinds of insects at Queensland Museum.

A. glaucus, *Link.*, Sacc. Syll. 304; Cooke's Austr. Fungi 360; recorded in Syn. Ql. Flora 777. Creeping threads floccose, branched, indistinctly septate, uncoloured; fertile threads erect, simple, nearly continuous, hyaline or glaucous, apex inflated into a spherical vesicle; conidia congregated in chains about the vesicle, seated on cylindrical hyaline basidia, 15 x 4 μ diam. Conidia globose, muriculate, at first hyaline, then glaucous, 8-10 μ diam.

Hab.: On putrescent organic matter everywhere. Has been found on living palm-leaves at times, at other times on old *Boletus.*

A. Cookei, *Sacc.* Syll.=*A mucoroideus*, Cooke, Grev. xii. 9; Cooke's Austr. Fungi 369; recorded in 2nd Suppl. Syn. Ql. Flora 141. Gregarious; mycelium white, intricately interwoven; fertile threads erect, hyaline, continuous, crowned with a large globose vesicle; basidia short, cylindrical; conidia for a long time persistent, globose, brown, 4 μ diam., produced in chains, forming a globose black capitulum.—*Cooke l.c.*

Hab.: On dead plants and leaves received from the Johnstone River.

STACHYBOTRYS, Corda.

(From *stachys*, a spike, and *botrys*, a bunch.)

Flocci septate, free; branches bearing short verticillate ramuli at their apices, forming a little head, and each terminated by a spore.

S. lobulata, *Berk.* Black, threads branching proliferously; ramuli subalternate, attenuated; apices 4 to 5-lobed; spores elliptic, echinulate, or smooth, binucleate.—Cooke's British Fungi. From the articulated creeping mycelium spring slender very minutely scabrous threads, branched proliferously; ramuli often alternate, attenuated, their apices swelling into a pyriform 4-5-lobed receptacle, from which spring elliptic spores, some of which are echinulate, others smooth, with two nuclei. The lobes are not mamillate as in *S. atra*, and the spores have no true septum.—*Berk. and Cke. l.c.*

Hab.: On the wall-paper of a Brisbane office, the wall having become damp from long-continued wet weather. The fungus is met with in several parts of Europe and North America on damp decomposing paper and linen.

By Authority: Edmund Gregory, Government Printer, William street, Brisbane.

ASPERGILLUS, Mich.

A. entomophilus, *Cooke.*

Hab.: On various kinds of insects at Queensland Museum.

A. glaucus, *Link*, Sacc. Syll. 394; Cooke's Austr. Fungi 330; recorded in Syn. Ql. Flora 777. Creeping threads floccose, branched, indistinctly septate, uncoloured; fertile threads erect, simple, nearly continuous, hyaline or glaucous, apex inflated into a spherical vesicle; conidia congregated in chains about the vesicle, seated on cylindrical hyaline basidia, 15 × 4 μ diam.; conidia globose, [illegible], at first hyaline, then glaucous, 8-10 μ diam.

Hab.: On putrescent organic matter everywhere. Has been found on living palm-leaves at times, at other times on old leather.

A. Cookei, *Sacc.* Syll. = *Aspergillus* [illegible], Cooke, Grevillea [illegible]; Cooke's Austr. Fungi 330; recorded in the Suppl. Syn. Ql. Flora 110. Gregarious; mycelium white, intricately interwoven; fertile threads erect, hyaline, continuous, crowned with a large globose vesicle; basidia short, cylindrical; conidia for a long time persistent, globose, brown, 5 μ diam., produced in chains, forming a globose black capitulum.—Cooke l.c.

Hab.: On dead plants and fence received from the Johnstone River.

STACHYBOTRYS, Corda.

(From *stachys*, a spike, and *botrys*, a bunch.)

Fertile threads septate, free; branches bearing short verticillate ramuli at their apex, forming a little head, and each terminated by a spore.

S. lobulata, *Berk.* Black, threads loosely and sparingly branched, [illegible]; apices 4 to 5-lobed; spores elliptical, tuberculated or smooth, binucleate.—Cooke's Brit. Fungi. "From the articulated creeping mycelium spring slender very minutely asperate threads, branched proliferously; usually often alternate, attenuated, their apices swelling into a pyriform 4-5-lobed receptacle, from which spring elliptical spores, some of which are echinulate, others smooth, with two nuclei. The lobes are not unfrequently [illegible] some have no true septum."—Berk. and Cke. l.c.

Hab.: On the wall-paper of a Brisbane office, the wall having become damp from long continued wet weather. The fungus is not unfrequent in several parts of Europe and North America on damp decomposing paper and linen.

By Authority: Edmund Gregory, Government Printer, William street, Brisbane.

Queensland.

DEPARTMENT OF AGRICULTURE, BRISBANE.

BOTANY ABRIDGED,

OR

HOW TO READILY DISTINGUISH SOME OF OUR COMMON PLANTS;

TO WHICH ARE APPENDED A FEW ADDITIONS TO THE

COMPANION FOR THE QUEENSLAND STUDENT OF PLANT LIFE.

BY

F. M. BAILEY, F.L.S.,

COLONIAL BOTANIST.

Copies can be obtained free, on application to The Under Secretary for Agriculture.

BRISBANE:

BY AUTHORITY: EDMUND GREGORY, GOVERNMENT PRINTER, WILLIAM STREET.

1894.

NOTICE.

The only object the writer has in issuing these few pages is that they may be the means of assisting school teachers to readily name some of the more common plants which may be brought to them by their pupils; and if they in their turn would point out their distinguishing marks to the young, a habit of observation would be thus engendered which could not fail to be of service to them in after life. The work claims no botanic merit, and is only intended as a ready means of distinguishing, by one or two prominent marks, some of the more common plants or families of plants with which we are daily coming in contact.

Should the name by which a plant is known sound discordant to one's ear, one must remember that the science of botany is of world-wide importance; indeed, the more highly the state of civilisation the more encouragement we find given to this branch of scientific research. It is simultaneously being worked up by persons of very different nationalities, and thus it may easily be seen that names euphonious to one may be quite the reverse to another; but that which may be termed the scientific or technic language used in describing is common to all, be they Russian, Japanese, German, French, or English. In conclusion it may be stated that any Queenslander requiring to become acquainted with the science of botany would find all the information required in the writer's "Companion for the Queensland Student of Plant Life," the present pamphlet and bulletins, the "Synopsis of Queensland Flora," &c., to be obtained from the Department of Agriculture and the Government Printer.

31st September, 1894. F. M. B.

BOTANY ABRIDGED.

THESE few pages are published with a view to assist school teachers, and particularly those residing in the country districts, to some of the more prominent distinctive characteristics of common plants. I am not advocating the teaching of botany, but it would be a comparatively easy matter for the teacher, when the opportunity occurs, to point out to his pupils one or more of the marks by which one plant is known from another, and thus in a simple way encourage the young to observe and thus obtain some slight knowledge of plant life. There is no other branch of natural history of equal importance to man as botany; it aids the medical man, the artisan, and the tiller of the ground; without it we should not be able to publish to the world the various vegetable products of a country in an intelligent manner. I would ask, therefore, the school teacher to observe the common plants of the field, garden, forest, scrub, and waters near to the school ground, and encourage his pupils to do likewise. Then in after years none of them would be found using the words of Carlyle, "For many years it has been one of my constant regrets that no schoolmaster of mine had a knowledge of natural history, so far at least as to have taught me the grasses that grew by the wayside," &c. See that you do not cast words of ridicule and contempt upon the nomenclature used by the botanist. Use the local names locally, but remember that a plant may be known by a very different local name only a few miles from you; therefore become acquainted with the scientific. Point out to the young that the scientific name is often characteristic, and derived from some peculiar feature of the species or genus. Take, say, for example, the gum-tree, ironbark, and stringybark; the botanist places these under the name *Eucalyptus*, by which they are known all over the world. The youngest pupil will see at once, if pointed out to him, how admirably this name is suited to these trees. Show a flower-bud or half-expanded flower, and explain that the word used, *Eucalyptus*, was so given to these plants because the organs of reproduction, the anthers and stigma, are well covered, and thus protected until they come to maturity by the extinguisher-like lid by which they are covered in the early stage of their existence. Botanic names are also, in some instances, commemorative, and hand down from age to age the name of some worker in, or benefactor to, the science. As an example of this class, the name *Banksia* may be quoted, as it is called after Sir Joseph Banks, one of the earliest collectors of Australian plants. There are instances where the names will be considered, and justly so, as far-fetched; and others in which it was a prostitution of a noble science to attach the name to the plant; but there have been, and unfortunately are still, sycophants amongst botanists as in other professions.

It would seem our bounden duty, besides the pleasure we derive from the pursuit, to study plant life. Plants act a most important part in the economy of nature, as in their act of feeding they are fitting the air for the respiration of animals, and in like manner the animal world is useful to plant life; thus we see that the one is essential to the well-being of the other. All plants are of use, be they considered by us ever so mean; and this alone, one might think, answers enough to that constant query put to a lover of plants when he has just met with some new or rare treasure of Flora's Kingdom—"What's the good of it? What's the use of it?" Those persons who are in the habit of asking these questions are the people whose one only object in the world is to amass money; gold is their god, and they are blind to the beauties of nature around them. If, then, plants are essential to animal life, how thankful we should feel to the Great Creator who caused them to spring forth so abundantly over the face of the earth, and gave to man intellect to, as it were, carry on the creation. The wild man certainly has not used his intellect to improve the natural plants, but has been usually content to gather the products which grew spontaneously from the soil for his food and clothing. But how far different has been the behaviour of the civilised portion of mankind! By judicious selection, cultivation, and other means they have produced, from a grass bearing a grain which at the present time we should consider very inferior, those excellent cereals of which we are so justly proud, and from which we make our bread and other necessary articles of food. And from the Wild Crab the numerous excellent Apples, and doubtless from the Almond or some far inferior fruit the luscious Peach and Nectarine; and not only have the fruits, grains, and roots, under the directing care of the cultivator, been greatly improved, but kinds have been obtained which produce their crop at different times of the year. Thus by planting various kinds one may gather from his garden the same kind of fruit through several months of the year. Amongst the indigenous plants are many which we may anticipate, at probably an early date, being taken in hand by the cultivator and made to produce some of the necessaries or luxuries of life. At the present it may be thought unnecessary to trouble ourselves with the work of obtaining fresh useful fruits, &c., considering the vast number now in cultivation; but we should bear in mind that we might obtain strong healthy kinds which would be found more suitable to our variable climate. The subject is one that a teacher might at times point out to his pupils. He could point out that the grain of some of our grasses is little inferior to wheat; that some of the native *Ipomœas* nearly equal their ally the sweet potato; that a large number of the indigenous fruits, even in their wild state, are used by the settler, and are undoubtedly wholesome and agreeable; and that some are more or less closely allied to the highly prized fruits of cultivation. Attention might also be directed to the valuable or useful properties of some of our native plants. This the children themselves in some instances have observed, and put their knowledge to a practical use, for at times we find them gathering the leaves of the Red Ash (*Alphitonia excelsa*) to use as soap to take from their hands the stains of ink.

Seeing, then, how useful and necessary plants are to our well-being, surely it will be allowed that some little knowledge of this most important branch of natural history should be possessed by all. They are probably the first natural objects which delight our children; so one might easily imagine that little labour would be required to induce the young to take a further interest and to acquire some little knowledge of their names and the characteristics which distinguish species from species, genus from genus, order from order, and class from class. Teachers must not fancy for a moment that I am advocating that some additional subject be taught, for really too many things are attempted already. I am not asking for Botany to be added to the long list of subjects now taught. I am rather asking, particularly the country teachers, to look around them upon the wonders of the Vegetable Kingdom, to make themselves conversant with the plant life of their district, so that when the scholars bring flower or fruiting shoots of the plants to the school they may be able to give some information regarding the same in a casual way, which may have the effect of awakening in the young mind a desire to know more of plant life. Now let us imagine a case or two by way of example: Suppose, for instance, a shoot be brought of the native Rosella (*Hibiscus heterophyllus*). The botanist places this plant in an order or family of plants agreeing in general characteristics with the Mallow (*Malva*), whence the name Malvaceæ. It would be well to explain all these words whenever used, as by so doing it would make the subject more attractive. Thus it might be pointed out that the name *Malva* was given because of the soft mucilaginous qualities of the plants; that this property was more or less present in all plants of the family; that the principal economic value of the plants was as producers of material for the manufacture of fabrics, as cotton, which is the hairy covering of the seed of species of *Gossypium*. The leaves of some furnish dye, as, for instance, those of the Hollyhock are said to yield a blue dye like indigo. From the seeds oil is obtained, particularly cotton-seed; the seeds of others are used as culinary vegetables. The outer envelopes of the flowers are in some cases fleshy and sharply acid, and then they are utilised for jam, as the well-known Rosella (*Hibiscus sabdariffa*). Very many of the plants of this order yield from their bark valuable fibre, and the wood of several is useful and not without beauty. The medical man finds in this order also some properties to aid him. A few of the uses of the plants of the order might be stated to the children to obtain their attention, after which one or two of the characteristics of the order might be mentioned, as: that it consists of herbs, shrubs, and trees; that the leaves are alternately placed upon the stem or branches; that they are for the most part toothed, lobed, or much divided; that the hairs are most frequently stellate—that is to say, that they resemble little stars; that the flowers usually contain both sexes; that it is seldom that the male (stamens) are met with in one bloom and the female (style) in another; that the stamens are often numerous and more or less united in a column, the filaments becoming free towards the top, and each bearing a 1-celled anther, which contains the pollen or impregnating substance; that the style, simple at the base, branches at the top into as many branches or stigmas as there are cells in the fruit; that this latter may be dry or even berry-like, may separate into little fruitlets or keep entire. Having said these few words about the order, it may be well to revert to the plant of which it was supposed a specimen had been brought to the teacher—namely, *Hibiscus heterophyllus*. The pupil might be told that the name *Hibiscus* was called the generic name, and in botanic language agreed with his or her name of Jones or Smith, as the case might be; and that the second name was called the specific name, and agreed with the christian name of William, John Mary, &c.; that the name *Hibiscus* was an ancient name of the Mallow; that this genus is distinguishable from its allies by the style, bearing 5 branches at the top, or having 5 radiating stigmas, corresponding to the 5 cells of the ovary or young fruit. The bracteoles or circle of appendages at the base of the flowers are also 5 or more; these are either free from each other or are united, and form a sort of cup. The species which is supposed to have been brought for examination—namely, *H. heterophyllus*—it may be well to now dissect or notice more particularly. It will be observed that upon the young growth, besides the conical prickles with which the whole plant is covered, there is a close cottony covering of hair; and upon more closely observing this it will be found to be composed of minute stars. Thus the botanist speaks of this matter as a stellate tomentum. Now observe the leaves; they will be found to be of various shapes: some much lobed, others not lobed at all. This feature suggested the name *heterophyllus*, various-leaved. It will be observed that the edge is uneven; they are said to be serrulate, or resembling the teeth of a fine saw, or crenulate, with rounded, not sharp, teeth. Notice the position of the flowers; they are axillary—that is, they are situated in the upper angle formed by the attachment of the leaf to the stem; the pedicels are said to be short. The pedicel is the stem of the flower. The bracteoles are about 10, are linear (having parallel margins) rigid, not ciliate (without fine hairs) along the margin, as in some other species of *Hibiscus*. The calyx or cup of the flower will be found to be deeply divided into lance-shaped lobes, and covered with starry hairs, or, as it is called, stellate tomentum. The corolla is composed of 5 petals, white, with a purple base. The capsule is ovoid-globular and densely setose—bristly or silky-hairy. The seeds will be found glabrous, or without any woolly or hairy covering. If it is required to say more about this plant, it may be pointed out as a producer of strong fibre, which at one time was employed by the aborigines for making twine for their nets, and thus is now often known as the "Kurrajong." The tender shoots have also a pleasant acid flavour, and are much relished by stock.

As in the first, we have supposed a plant of the Mallow Family to have been brought to the teacher for explanation; and these plants are placed in the first class, Dicotyledons, so called because the young plants have two or more seed-leaves or seed-lobes, which are called cotyledons, from their frequent form being cup-shaped. We will now suppose that a grass is the plant to be examined, say one most frequently to be met with in our pastures and of simple construction—a *Paspalum*. It may be pointed out that the family of Grasses, or the order Gramineæ, as it is termed by the botanist, will be found placed in the second class, Monocotyledons, the young plants having but a single seed-leaf. The flowers of grasses are, like many other plants, hermaphrodite, that is to say, the two sexes, stamens and styles, are both in the same flower; or they are unisexual, that is to say, the sexual organs are in separate flowers. The number of stamens in a flower is usually 3, but are sometimes reduced to 2 or 1; and in others there are found 6 or more. The anthers at the end of the thread-like stalk are said to be versatile, because being so slightly attached to the top of the filament or thread they readily swing to and fro. The styles are 2 or rarely 3, and are free or united at the base into a 2 or 3-branched style, the stigmatic portion being usually feathery. The fruit is a small seed-like nut, or utricle. The outer envelopes of these flowers are called glumes, the inner scales are the palea and lodicules; but in some grasses one or both of these two last-mentioned organs may be wanting. Grass-stems are usually hollow between the nodes or joints. The leaves sheath the stem at the base, and these sheaths are split open from the base opposite the blade, and often end within the blade in a scarious (thin, dry) or ciliate—that is, eyelash-like—appendage. This appendage is called the ligula. Probably no order of plants is of equal value to man; some of the products are grains, fodders, oils, material for furniture and building, &c., &c.

As we began by supposing that a specimen of *Paspalum* had been brought, we will consider the species was *P. scrobiculatum*, and a few of the characteristics of both genus and species may as well be noticed. It is not always possible to give the meaning or derivation of botanic names, but whenever this is convenient I would advise its being done. In the present instance it is considered that the name *Paspalum* was one used by the Greeks for the Millet, and *scrobiculatum* was given to the species because of the furrowed uneven surface of the outer glumes. The spikelets of this genus are 1-flowered and are not awned, and are arranged in one or two rows on the spikes of the panicle; but sometimes these spikes are solitary; the glumes are but 3. The styles will be found distinct. The grain will be found enclosed in the palea and third or flowering glume, but free from them. The species under notice is a tall coarse grass, usually having some rather long hairs about the base of the leaf-blade. The spikes number from 2 to 5, are distant from each other, and 2 or more inches long, flat and sometimes downy near the base, the spikelets with very short or no stalklets—thus said to be shortly pedicellate or sessile, in 2 rows; but in some countries the rows are as many as 4, and then they are much crowded; in shape they are ovoid-orbicular-oval or nearly round. The outer glume or scale will be found to have a prominent midrib, and sometimes minutely pubescent—that is to say, slightly downy. All these characters may be observed by the unassisted eye, but to examine further the aid of a lens—magnifying glass—is required.

The plants of the third class are called Acotyledons, because they are without cotyledons or seed-leaves; or cryptogams, because the sexual organs are obscure or wanting. They have no real flowers—that is, with the usual stamens and pistils—or true seeds, the reproduction being carried on by means of minute often highly microscopic granules called spores. Ferns and their allies are termed the vascular cryptogams. They have true stems enclosing bundles of vascular tissue, and spores enclosed in capsule-like cases called spore-cases or sporangia. Of these beautiful forms of vegetation so much has been written that it is almost superfluous to mention anything about them; but, as the few natural orders composing the vascular cryptogams of Queensland are at times misunderstood, it may be well to give a few of the leading distinguishing characters of three of them—viz., Lycopodiaceæ, Marsileaceæ, and Filices. In Lycopodiaceæ the spore-cases are sessile—that is to say, stalkless—and situated in the upper angle formed by the leaf or bract and the stem. Leaves radical, proceeding from the root or rhizome, or placed upon the stems or branches. The best known of these plants by Queenslanders are the *Lycopodiums*, whose spore-cases are all similar; and the *Selaginellas*, whose spore-cases are of two kinds—the small ones are filled with minute powdery spores called microspores, the larger contain from 1 to 6 large spores called macrospores. The floating red moss so often seen upon still water, *Azolla rubra*, belongs to this order; and so does that leafless epiphyte, *Psilotum triquetrum*, which has pendulous forked branches and numerous globular spore-cases. Marsileaceæ has no true leaves. The fronds are circinate in vernation—that is, in the young state they are rolled inward, the barren ones often open at the top into leaflets resembling those of the Clover plant. The fertile ones are on much shorter stalks or the stalks are wanting, and the leaflets are recurved, their margins united, and thus form the so-called involucre spore-cases of two kinds, as in some Lycopodiaceæ, but arranged, as in ferns, in sori inside the involucre (*i.e.*, on the under surface of the recurved frond). The Nardoo is a good example. Now we come to Filices, or the Ferns. These have no true leaves; their leaf-like expansions are termed fronds, and consist of the stalk or stipes, in the young state; except in one tribe these are rolled inwards—circinate. The leafy expansion is simple or more or less compound. The spore-cases are usually small and collected into clusters or patches, called sori, on the under surface or margins of the fertile fronds, which are either nearly similar to the barren ones or very narrow, resembling simple or branched spikes. The sori is either naked or covered by a membrane called the indusium or involucre. The Australian tribes of these plants are—

Tribe Ophioglosseæ.—Fronds not circinate. The fertile portion spikelike or more or less branched. The spore-cases globular, opening by a transverse slit, in 2 rows or small clusters on the spike or its branches without any ring. Examples: Adder-tongue, Grape Fern, &c.

Tribe Marattieæ.—Fronds circinate. The spore-cases also without any perfect ring, opening by a longitudinal slit, distinct, sessile or united in 2 rows, in sori forming marginal lobes to the rhachis or segment, or placed on their under surface. Examples: Snake Ferns.

Tribe Osmundeæ.—Spore-cases globular or nearly so, without any or with an imperfect or transverse ring, opening in 2 valves or irregularly, few or solitary, rarely numerous and clustered in sori on the under surface of the segments or pinnules. Examples: Water Fern, Braid Fern, Parasol Fern, Swamp Tree Fern, &c.

Tribe Hymenophylleæ.—Spore-cases depressed, with a transverse ring on a columnar receptacle within a cup-shaped or 2-lobed indusium, embedded in or protruding from the frond's margin. Examples: The Bristle and Film Ferns.

Tribe Cyatheeæ.—Tree fern. With large fronds; the spore-cases with a more or less oblique ring, in globular sori on the under surface of the fronds. For an example see the common tree ferns, *Alsophila*.

Tribe Polypodieæ.—Spore-cases with a longitudinal or scarcely oblique ring, numerous and stipitate (stalked) in sori or patches on the under side or rarely the margins of the fronds. This tribe is divided into two divisions:—(A.) Sori covered, at least when young, with an indusium. Examples: Woolly Tree Fern, Hare's-foot Fern, Grass-leaved Fern, Maidenhair Fern, Bracken, &c. (B.) No indusium. Examples: The *Polypodiums*, Stag's-horn, and Elk's-horn Ferns.

With the object of assisting the matter advocated, the following notes are given, in which the observer is directed to some few of the most easily to be remembered distinctive characteristics which distinguish some of the most common orders of Queensland plants, as well as a few marks by which some genera and species may be readily recognised. These brief notes should be particularly acceptable to persons so situated as not to be able to consult works of reference upon the subject, or who have not the leisure for botanic work in a more extended form. The marks which distinguish one plant from another are at times more prominent than the unobservant may imagine. Take, for example, three of our cultivated Passion-fruits; the number of those glandular processes at or near the top of the leaf-stalk is alone sufficient to determine or distinguish one of these from the other, even without the flower or fruit. Examine a leaf of the small Passion-fruit (*Passiflora edulis*), and it will be found to have but two of these processes. Another species, *Passiflora Decaisneana*, known by usually requiring to be fertilised by hand; on this will be found four of these processes, while on the leaf-stalks of the two large kinds of Granadillas—*Passiflora quadrangularis* and *Passiflora quadrangularis*, var. *macrocarpa*—will be found six of these glandular processes. Or take for another example the two Cruciferous plants so common in our gardens, *Alyssum* and *Iberis*. These are, by those just beginning to take an interest in flowers, thought to be plants of the same genus; but one distinctive feature a child will quickly perceive, and that is, that the flower of the former (which is known in England as Madwort) has all its four petals equal-sized, while the latter plant, called Candytuft, has petals of unequal size, the two exterior ones being much larger than the others.

It will not be found a difficult matter to remember those prominent marks which separate in many instances genera and species, and thus avoid confusion in speaking of plants. In the order Pittosporeæ we have two genera separated only, one might say, by the form of seed; the seed of *Pittosporum* being thick or nearly globose, while in *Hymenosporum* it is flat, kidney-shaped, and surrounded by a membranous wing. Of the first, numerous examples are to be met with both in the wild state and in garden culture; but the latter genus is confined to Australia, and is limited to a single species, and commonly met with in South Queensland. Take, for instance, the orders Malvaceæ, Sterculiaceæ, and Tiliaceæ. Isolated genera of these orders are distinct enough: no one would imagine that the common Sida-weed, the Bottle-tree, and the Brisbane Quandong belong to the same order; but all the plants composing the above three orders have not the same marked distinctions, and we find that with the orders named, like many others, the distinctive marks which separate them are but small, as may be pointed out in a few words. They in common are composed of trees, shrubs, and herbs; the leaves of all are placed alternately upon the stem or branches, and stipules are usually present. In the stamens a distinction occurs. In Malvaceæ they are monadelphous; in Sterculiaceæ they are monadelphous, or, if free, definite and alternating with the petals; in Tiliaceæ they are indefinite, free, or scarcely united at the base. With regard to the anthers they are 1-celled in the first order, and 2-celled in the second and third.

It will be found in the Vegetable Kingdom, as in the Animal World, that as we descend to lower forms their construction becomes more and more simple until we meet with organisms of a single cell, and that so minute as to be undiscernible by the naked eye; the study of which are only difficult by their vast numbers, and from having to be detected and examined by the microscope's aid. These instruments now, however, are by no means costly, and it would be advisable for every teacher to possess one, so that, whenever time would allow, those pupils found taking an interest in plant life might be further encouraged by the teacher giving them a glimpse of those exquisite forms to be met with in the still water-pools, and known as fresh-water Algæ; also the forms of pollen-grains, stomata, hairs, scales, and other portions of a plant which might prove instructive and attractive to the young mind.

Geraniaceæ.—The common garden plants of this order are, *Geranium*, *Pelargonium*, *Tropæolum*, *Oxalis*, and the Balsam. The name *Geranium* is so often given in popular language to the *Pelargoniums* in cultivation, that a word or so may here be given on the subject. The flowers of *Geranium* are regular, that is to say they are symmetrical in their arrangement, while those of the *Pelargonium* are irregular, that is, they are wanting in symmetry. In the *Geranium*, all the 10 stamens usually bear anthers, but in *Pelargonium*, 5 to 7, or sometimes only 2 or 3, are found bearing anthers, and adnate to the pedicels of these flowers will be found a linear adnate spur or tube. The flowers are also produced in umbels, while in *Geranium* the peduncles bear but 1 or 2 flowers.

The Order Rutaceæ is of so much importance that I should be glad to give some short notes to enable these plants to be at once detected, but so varied are the forms that it would be unsafe to attempt anything of the kind. It may, however, be remarked that the leaves are always marked with pellucid glandular dots, such being oil-cells, from which cause they are strongly scented; that there are no stipules, that the disk is within the stamens, that the ovules are 2 in each cell, and the seeds usually solitary in each cell. Some idea of the diversity of the form assumed by plants of this order may be obtained when we remember that in it are contained the lovely *Boronia* and luscious Orange.

The Order Olacineæ contains plants differing so much in appearance, both in regard to growth and fruits, that one need not be surprised to find plants of the family being mistaken for those of very distinct orders. I, however, shall only refer to one case, viz., the climber *Cardiopteris lobata*, var. *moluccana*, which grows about the Barron River, and may readily be mistaken, if seen in fruit only, for a *Dioscorea* or Yam. The mistake may be found out by remembering that the fruit of *Cardiopteris* is superior, while that of *Dioscorea* is inferior.

Leguminosæ.—This is one of the most important orders of the Australian flora. I feel it would be impossible to describe in a few words those distinctive marks by which the whole of the plants may be known, yet a little information may be given. As the name of this order has reference to the fruit, which is termed a legume or pod, it may be pointed out that this is very variable in form, the usual being flattish and opening round the margin in 2 valves, but sometimes the fruit is follicular, or opening by one suture, or indehiscent. The order is divided into 3 sub-orders, the first being called Papilionaceæ, from the supposed resemblance of the flowers to a butterfly. The common Sweet Pea is a good example; the corolla will be observed to be of very irregular form, and this has caused the petals of which it is composed to have different names given to them, the upper one being called the standard or vexillum, the two lateral ones the wings or alæ, and the two lower or inferior ones the keel or carina. The petals are imbricate, and in the bud the standard is always outside. The second sub-order is called Cæsalpinieæ, taking its name from the genus *Cæsalpinia*, a genus often containing very prickly plants, one of which has become naturalised in the scrubs about Brisbane (*C. sepiaria*). The corolla of the flowers in this sub-order is regular or nearly regular, imbricate in the bud, with the upper petal inside. The third sub-order is called Mimoseæ, from *Mimosa*, a common name for all the *Acacia* and many allied plants. The flowers are small, regular, sessile (stalkless), in spikes or heads, or rarely shortly pedicellate (on pedicels). The sepals are valvate—that is, their edges do not overlap each other, but are often united. Petals valvate with few exceptions, often united. The stamens are equal to or double the number of the petals, or are very numerous. It may here be remarked that the true perfect leaf of *Acacia* is always twice pinnate, and that which serves as the leaf of the greater number of our Wattles, &c., is only the flattened foot-stalk of the leaf, which from its resemblance, and from its performing the functions of a leaf, is called a phyllodium, but in the young seedling state the true twice-pinnate leaf is always present. The *Acacia* pods are very various as to form. The seed, however, are peculiar; they are more or less flattened, and usually marked in the centre of each face with an oval or horseshoe-shaped depression, or opaque ring or spot. The funicle, or cord by which the seed is attached to the placenta, is usually thickened into a fleshy aril either under or round the seed.

To some not well acquainted with the plants, the indigenous Sensitive-plant (*Neptunia gracilis*) may be mistaken for the true Sensitive-plant (*Mimosa pudica*). These plants, however, belong to distinct tribes of the order. A few words will point out distinctions enough to distinguish them. *Neptunia gracilis*, even before the flowers have opened, may be known by the two little heart-shaped leaves—or, as the botanist would say, cordate bracteoles—at about the middle of the flower-stalk (peduncle), and if the flowers are open it will be observed that usually each anther is tipped by a minute gland; the pod also does not break up into articles. *Mimosa pudica* is a prickly plant, has no bracteoles or glands upon the anthers, and the seed-pod breaks up into articles.

Hamamelideæ.—This is a small order of plants not represented in the Australian flora. Some fine specimens of one species may be seen in some of the plantations about Brisbane; and as this, the Sweet Gum of America (*Liquidambar styraciflua*), may be taken by some for a Maple, which it resembles in foliage, it may be pointed out that the Maple has opposite and the Sweet Gum alternate leaves; this, without other characteristics, will serve to distinguish the trees.

The Order MYRTACEÆ is too important in Australia to be passed over, but it is quite impossible to point to a few characters by which its plants may be at once recognised, yet some features may be mentioned by which some of the genera may be known, or at least distinguished, from allies. Thus some of the *Angophoras* (Apple-trees) are so like Eucalypts that it may be found difficult at first sight to distinguish one from the other; but if the flowers be examined, the petals of *Angophora* will be found to be all free, while those of the Eucalypts are united or consolidated into an operculum. In the flowers of the Box (*Tristania*), the stamens are united in 5 bundles. In *Syncarpia* the calyxes are connate in some, but in one species free; but the flowers are gathered together in globular heads on axillary peduncles. All these plants belong to a tribe of the order whose fruit is a capsule opening at maturity at the summit in as many valves as there are cells. But in another tribe the fruit is a berry or drupe, and here belong such trees as the Rose Apple, Brazilian Cherry, and the Guavas. The leaves of Myrtaceous plants are all more or less dotted with small resinous glands; these may be scarcely visible if the leaf be of a thick texture. In the tribe which contains the *Barringtonias* these resinous or oil dots are wanting.

RUBIACEÆ, as at present understood, is a most important family of plants. From it are obtained many drugs, dyes, fruits, coffee, besides some excellent timber. Its plants have always opposite or whorled leaves, and stipules of various form, sometimes mere bristles and at other times large and leafy. The corolla is gamopetalous (for example see the flowers of *Gardenia* and *Bouvardia*), and the stamens are equal in number to its lobes, and alternate with them. The fruit will be found to differ considerably—it may be a capsule, drupe, or berry; and the plants may be minute herbs or gigantic trees.

COMPOSITÆ.—This is a large and difficult family to understand. The flowers or florets are collected together in heads, each of which is surrounded by a calyx-like involucre, the true calyx of each floret being absent or reduced to a pappus. The stamens are the same in number as the corolla-lobes and alternate with them. The ovary is inferior, and the fruit, or seed as it is usually termed, is called an achene. The flower-heads are said to be discoid, when wanting the ligulate or strap-like florets which form the rays of the circumference of the flower-head, or flower as it is popularly called; and radiate when having strap-like florets at the circumference.

STYLIDIEÆ.—The plants of this order are often objects of interest from the column being so frequently elastic as to have caused children in some localities to name these flowers Jack-in-a-box. The stamens are 2, having their filaments connate with the style in a column free from the corolla; the anthers are sessile at the top of the column, 2-celled, the cells at length divaricate; the style or stigma entire or 2-lobed, concealed between the anthers or protruding from them. The sudden movement of the column in many of the above plants on being touched is of so interesting a nature that it may be well to mention a few other plants to be found in our gardens, or indigenous, in which this phenomenon also occurs:—The leaves of the Sensitive-plant (*Mimosa pudica*) and the native species (*Neptunia* *gracilis*); stamens of the Prickly Pear (*Opuntia*) and the English Berberry; the labellum of the flowers of *Pterostylis*, *Caleana*, and *Drakæa*, three genera of Orchids. But the spontaneous movement of the lateral leaflets of *Desmodium gyrans* will be found the most interesting. At one time this plant was common in most Brisbane gardens.

GOODENOVIEÆ.—This is an almost exclusively Australian order, and may be known pretty well by the beautiful cup-shaped or 2-lipped dilatation, called an indusium, at the top of the style which encloses the stigma. The style is undivided, except in the one genus *Calogyne*.

In the order of true Heaths, ERICACEÆ, and that of the Australian Heaths, EPACRIDEÆ, the same distinction occurs as in Malvaceæ and Sterculiaceæ, the first having 2-celled and the last 1-celled anthers, only, it will be seen, reversed in order. Our garden *Azaleas* may be taken as examples of Ericaceæ, and that common little heath-like plant, with sharp prickly leaves, and small white tubular flowers with dense white hairs in the throat, called *Leucopogon juniperina*, as an example of Epacrideæ.

Many ornamental shrubs, both indigenous and cultivated, belonging to the Olive family, are met with in this colony; for instance, the Jasmines, Lilacs, Ash, *Notelæas*, Olives, and *Ligustrums*. That these are closely allied will at once be seen upon examining the various flowers and fruits. It may be some advantage, however, to know that the stems and branches are usually thickly studded with more or less prominent lenticelles.

Persons often are found to confuse plants of the orders *Apocynaceæ* and *Asclepiadeæ*; but if flowers are obtainable, and their anthers observed, the doubts are at once solved, for in the first-named the anthers are connivent—their tips being close together—round the stigma, while in the latter they are united to, or, as the botanist would say, connate around, that organ. For the first order the *Allamanda* may be taken, and the Redhead (*Asclepias curassavica*) for the latter.

There is often a doubt in the minds of some as to which of the two prickly *Solanums*, so common about Brisbane, the name of Apple of Sodom belongs. This may simply be decided even without seeing the fruit. Only take a lens and examine the hairs which cover the surface of each plant; in one these will be found simple, and in the other like little stars. This latter is *Solanum sodomæum*, or the Apple of Sodom; the other with simple hairs being *Solanum aculeatissimum*, and bearing the brighter coloured fruit.

BIGNONIACEÆ.—Of this order the two genera *Bignonia* and *Tecoma* are frequently mistaken one for the other by amateur gardeners and others, as one may observe from the labelling seen in gardens, and, as many of our showy garden plants belong to the genera, a few of the distinguishing marks may be stated. The *Bignonias* are usually furnished with tendrils, and the partition in the capsule is parallel with the valves, or, as it is termed, septicidal; while the *Tecomas* have no tendrils, and the partition in the capsule is placed in a contrary direction—that is to say, transverse with relation to the valves—loculicidal.

I find that persons with some knowledge of plants often get confused over three common Queensland plants, two of which are naturalised, the other indigenous. I refer to *Rivina lævis* and *Phytolacca octandra* belonging to the order Phytolaccaceæ, and the Amarantaceous plant *Deeringia celasioides*. Each bear what are called red berries in racemes. The following one or two distinguishing marks may assist in identifying one from the other, viz. :—The *Rivina* has a perianth of 4 segments, also 4 stamens, and the fruit is 1-seeded. The *Phytolacca* has a perianth of 5 divisions, and usually 8 stamens; the berry is composed of 8 united carpels. The *Deeringia* has a perianth of 5 segments, 5 stamens shortly united in a ring at the base, and several seed in each fruit or berry.

LAURINEÆ.—The leaves of this order are usually alternate, but they will be found also nearly or quite opposite, and in the Laurel Dodders wanting. The anthers will be found the readiest guide to plants of this order, therefore a description of these organs may here be given. They are adnate, with 2 collateral cells or 2 superposed pairs of cells, each cell opening in a valve from the base upwards, or in the genus *Hernandia*, of which our "Cudgerie" or grease-nut is a species, from the inner to the outer side.

PROTEACEÆ.—Plants of this order have 4 valvate perianth-segments, with a stamen inserted upon the inside of each. Some idea of the great diversity in the fruit may be gathered when it is pointed out that the Geebung, the Queensland Nut, the Silky Oak, and the *Banksia* are all members of this family.

The Spurge Family—EUPHORBIACEÆ—is a very large and important order of plants; but the following are the characteristics of the whole:—Ovary 3-celled, rarely 1-2 or several-celled, with 1 or 2 pendulous ovules in each cell, and as many styles or stigmatic branches as cells. Albumen usually copious. This order is largely represented in Queensland, and among the plants will be found some of the smallest weeds and largest timbers. Many of the latter will be found described in the Catalogue of Queensland Woods.

It may not be out of place here to say that the many showy plants cultivated in our gardens and bush-houses under the popular name of *Crotons* belong to the genus *Codiæum*, of which there are but few species, say 3 or 4; but these have produced the large number of varieties that adorn our gardens. Of the genus *Croton* 500 or more species are known. The following may be noted as a few of the distinguishing marks in the genera:—In *Croton* the leaves are furnished with 2 or more glands at the top end of the leaf-stalk or on the base of the leaf-blade; the calyx-segments imbricate or almost or quite valvate in the bud.

The Nettle Family—URTICACEÆ—like the Spurge Family, to the casual observer might appear to contain too widely dissimilar plants to be classed in one order, especially when he is told that the botanist places here the Elm, Hop, Hemp, Mulberry, Fig, and Breadfruit and Jack-fruit, as well as the lowly Stinging Nettles of Europe, and our gigantic Stinging-trees. Yet when one looks into the matter there will be seen much that is common to all, and that when these various plants are separated into tribes the arrangement will be acknowledged all that could be desired. In the following particulars, all plants of this order will agree:—Ovary 1-celled, with 1 ovule, and 1 or 2 oblique styles or unilateral stigmas; albumen usually scanty; stamens opposite the perianth-lobes.

Order CASUARINEÆ—the family of Australian Oaks.—A few notes to assist in identifying our so-called Oaks (*Casuarinas*). The Horsetail Oak (*C. equisetifolia*) is a coast tree, and the Moreton Bay variety (var. *incana*) is distinguishable from other Oaks by its soft cottony covering. The teeth at the joints of the branchlets are usually 7, but may be from 6 to 8, and the cones are nearly globular.

C. suberosa.—This name would lead one to suppose that the stem-bark was of a corky character, but it is less so than some others. The teeth at joints are also 7, or from 6 to 8, but the cones are oblong and about 1 in. long.

The Threadybark Oak (*C. inophloia*) is at once known by the loose thready character of its bark, resembling in this respect no other species.

The Scrub Oak (*C. Cunninghamiana*) has the same number of teeth as the preceding species. The cones, however, are nearly globular, smaller, and the tree is larger.

The "Billa" or Swamp Oak (*C. glauca*) may at once be known by its greater number of teeth in the whorl around the joints (which number 10 to 12), its short dense male spikes, and small flat-topped cones. The form of this species met with inland, however, has larger cones, which, as stated by Mr. Bentham, resemble the cones of *Casuarina equisetifolia*.

The Forest Oak (*C. torulosa*) may be readily known by its corky bark; teeth at the nodes are usually only 4, the cones rather large, oblong-globular, hairy, and tuberculose.

In the Order CYCADEÆ, persons are frequently found confusing the plants of *Cycas* with *Macrozamia*. They would not do so if they could only remember that species of *Cycas* have a prominent midrib to the leaflet, while the leaflets of *Macrozamia* have no midrib, but a number of parallel nerves.

ORCHIDEÆ.—This is the name of probably the most beautiful order of plants; in species it outnumbers the grasses, and their forms are innumerable. The structure of the flowers is peculiar, and one might imagine that no difficulty would be experienced in at once detecting any plant of the order if a flower were to be seen, although to allot the plant to its particular genus or species might be very difficult. However, as flowers of this beautiful and curious family may frequently be brought to the teacher, it might be well on such occasions to explain to the child bringing the flower, that, like the pea-flower, the orchid flower has received peculiar names for its parts. The flowers are said to be hermaphrodite, which is, each flower contains both male and female organs; that the flower is superior, above the ovary; that the petal-like parts—segments—are 6; the three outer are spoken of as the sepals, one known as the dorsal, and the two side ones as the lateral. The two lateral inner ones are the petals; these are similar to each other; the third petal is usually very dissimilar from the others, and called the labellum; this is frequently lobed, and upon its face will often be found beautiful glandular appendages, which are spoken of as fringe, plates, or calli. In the centre of the flower is what is called the column, consisting of the combined andræcium and pistil; on this column, near the top, may be seen the stigma, and at the summit, under a cap which is easily removed, will be seen the pollen-masses—this is the anther. To describe thus far would probably cause the child to take more interest in these flowers, and the above explanations could be given in a few minutes; but to go further in dissecting the flower would require the aid of magnifying glasses, probably not possessed by the young folks. Still, it might be pointed out to them that plants of this large family are of variable habit; that those found growing in the soil are said to be terrestrial, and when found growing upon the branches or trunks of trees, epiphytal. Some others might be termed saprophytal. A good illustration of this kind will be found in that large climbing orchid *Galeola foliata;* this is never found except growing in old rotten stumps or roots.

Plants belonging to AMARYLLIDEÆ, the *Hippeastrums* and *Crinums,* for instance, are often spoken of as Lilies, a mistake which need never occur if persons would observe the position of the ovary alone, for in Amaryllideæ this organ is always inferior or below the perianth, while in Liliaceæ it is superior or above the perianth. We find some persons who have forgotten, and others who know no better, calling by the name of *Crocus* that pretty Amaryllidaceous plant so frequently used in our gardens for edgings (*Zephyranthes candida*), and whose pure white flowers, we are told, suggested the name "La Plata" for the American river. That this plant could not be allied to the *Crocus* might be at once known by counting the stamens, of which organs there are 6, while in the *Crocus,* which belongs to Irideæ, there are but 3. In our gardens it is not infrequent that we find plants of *Cordyline* labelled *Dracæna.* It may therefore be stated that, while there is much similarity in the foliage of the two genera, the fruit differs considerably; in the cells of the fruit of *Dracæna* there being but a solitary ovule, while they are found numerous in each cell of the *Cordyline* fruit. Both genera belong to Liliaceæ.

TYPHACEÆ is the name of the order containing the Bullrush or Reed Mace, and Bur-reed, and is only referred to here to correct a mistake. Thus when persons are collecting bullrush-rods for decorative purposes, one may often hear the expression that all the rods seem to have blighted tops. This is, however, not the case, for what appears a blighted portion of the spike is in reality only the portion which bore the male flowers.

CYPERACEÆ and GRAMINEÆ.—These two orders of Sedges and Grasses are often confused by persons having but little knowledge of botany. This, however, might be avoided by paying attention to the leaf-sheath. In the Sedges this portion has its margins connate—that is, united on the opposite side of the stem to the blade; whereas in the Grasses these margins are free to the base.

It might be interesting if the teacher, after pointing out which are the male and female organs of Grasses—that is, the stamens and styles—were also to mention that these often vary both in position and number in different Grasses. A few examples of this might be mentioned, only to use species of common occurrence. The most frequent number of stamens in the flowers of grass will be found to be 3. (*See* Summer Grass, Blue Grass, &c.) A pretty little grass often seen on hillsides, with graceful, drooping panicle, has received no local name in Queensland, but to the botanist it is known as *Microlæna stipoides*. The number of stamens in the flowers will be found to be 4. *Sporobolus diander*, a tufty grass often met with on the border of creeks, is named, it will be seen, from its being usually found to have but 2 stamens in each flower; while in the flowers of the Rice Grass, which is most frequently met with in swampy land, will be found 6 stamens in each flower, and in some of the Bamboos this number is exceeded. In the Maize plant the sexes are separated; we find the male flowers forming a terminal panicle to the plant, while the female form a spike at the joints of the stem below; but, as if to prove that there is no rule without an exception, many female flowers producing fruit are at times found in the male panicle, and male flowers at times also may be met with at the apex of the female spike or cob. There are many other modifications of these organs, but enough is stated, it is hoped, to create an interest in the matter. The styles will be found to vary much in form, but the number is rarely more than 2, and frequently a single style with 2 or 3 branches.

ERRATA.

THE following ERRATA occur in the "Companion for the Queensland Student of Plant Life." Will persons having that work kindly correct same with pen.—F.M.B.

Page 18—For "AMADON" read "AMADOU."

" 21—In ATER, for "ATRO-PURPURENS" read "ATRO-PURPUREUS."

" 25—In CORNIGERA, for "*Datura cornigery*" read "*Datura cornigera.*"

" 29—First line, for "round" read "ground."

" 33—In FEMINEUS, for "Sir Thos. Mellington" read "Sir Thos. Millington."

" 35—For "GABULUS" read "GALBULUS."

" 37—In HISTOLOGY, for "*Islos*" read "*Istos.*"

" 41—In LEPIS, for "stillate" read "stellate."

" 48—In PARTHENOGENESIS, for "*Alcornea*" read "*Alchornea.*"

" 55—In PURPLE, for "PURPURASCEUS" read "PURPURASCENS."

" 57—For "RRSPIRATION" read "RESPIRATION."

" 62—In SIALAGOGUE, for "*Zingeber*" read "*Zingiber.*"

" 62—For "SILIGUA" read "SILIQUA."

" 69—For "TELENTOSPORE" read "TELEUTOSPORE."

" 100—Third line after "BANKSIA," read "the very few Australian plants," &c.

ADDITIONS

TO THE

COMPANION FOR THE QUEENSLAND STUDENT OF PLANT LIFE.

AMPHIGENUS, AMPHIGENOUS—Growing all round an object.

APOSTAXIS—A term applied to unusual discharges of the juices of plants. This may arise merely from an extreme abundance of fluid, which is in consequence discharged, as in the Vine, from the serrations of the leavés. If, however, it is elaborated sap which flows out, either from injury or weakness of the tissues, the effect may be injurious. And this is exactly the case in what is called gumming—a condition which may be induced artificially by allowing water to drop constantly over a branch. This always proceeds from injured or diseased tissues, and is with difficulty arrested when once set up, and, if so, is the certain forerunner of fatal canker. In some cases, as in the Tragacanth plant, the gum is organised, and is derived apparently from the medullary rays. In Conifers, a flow of resin is often attended with the same fatal results as gumming in Plums and other allied plants. In this case it seems to arise generally from root confinement and a consequent check of circulation.—*Rev. M. J. Berkeley.*

ARCUATUS—That has the jaundice; turning colour; or it may refer to some part being bent like a bow (*arcus*).

AZYGOSPORE — Spore produced without copulation.

BAST or BASS—The inner fibrous bark of dicotyledonous plants. (*See* Bark.)

BIFARIAM—In two rows. TRIFARIAM—In three rows.

BULB—An underground bud covered with scales.

BULBIT or BULBLET—Separable buds in the axil of leaves, as in some Lilies, also in the inflorescence of *Furcrœa.*

BUTYRACEUS — Buttery, from *butyrum*, butter.

BYRSINUS, BYRSA—Supposed resemblance to oxhide, as *Polystictus byrsinus.*

BYSSISEDUS (from *byssus*, cotton, and *sedeo*, I sit)—As if sitting in a cottony mass.

CÆSARIATUS — Covered with long hair (*cæsaries*).

CARCINOMALIS—Resembling a *carcinoma*, a canker or cancer, as the Ant-hill Fungus, *Podaxis carcinomalis.*

CATERVARIUS — Pertaining to companies, as *Lentinus catervarius*, or the Blight Fungus, which attacks the leaves of Figs, *Dothidea catervaria.*

CELSISSIMA—Noble, eminent, as *Buckinghamia celsissima.*

CHARTACEOUS, CHARTACEUS (*Charta*, paper) —Thin, flexible, and membranous, resembling paper or parchment, as the pericarp of Pimpernel.

CIBARIUS—Suitable for food (*cibus*), as *Clathrus cibarius.*

CORONARIUS—Forming or adapted to form a crown or garland.

CRISPA—Crisp, curled, as *Clathrus crispus.*

DEVEXUS—Shelving downwards, as *Trametes devexa.*

DIOICA—Diœcious, as *Phytolacca dioica*, the Bella Sombra tree.

DECIPIENS—Deceptive; resembling others.

DEFORMIS, DEFORMED—As the leaves of the Peach, by *Exoascus deformans.*

DISEASES OF PLANTS—This one writer well defines as that state of the organism in which all the organs are not performing their functions in accordance with nature. The causes of these diseased conditions in plants may be classed as follow:—

1. Parasitic fungi and other plants, such as the Dodder, Mistletoe, and including that curious root parasite *Balanophora fungosa*, which attacks the roots of the scrub trees in Tropical Queensland.

2. Insects causing galls and fissures in the leaves and bark, as well as wounds of any description.

3. Poisonous gases in the air or soil, as well as any poisonous material so placed as to affect the nutrition.

4. Atmospheric or other conditions so affecting the plant as to alter the conditions of nutrition by giving a redundancy or deficiency of air, light, moisture, warmth, &c.

Under these heads most of the so-called diseases of plants find a place.

EDIBLE FUNGI.

The question being frequently put—"How are we to distinguish the edible from poisonous or deleterious species?" I take the opportunity of extracting from Dr. M. C. Cooke's "British Edible Fungi" that great authority's answer to the same question:—"The question is often propounded—'Is there no general rule by which good or harmless fungi can be distinguished from those which are deleterious?' Many attempts have been made to answer this question, but none of them are satisfactory except the negative one, to the effect that no rule can be laid down which shall be of universal application in the discrimination of dangerous fungi. The only safeguard is to become acquainted, by means of well-defined features, with some of the best of the esculent species, and by no means to experiment with those which are unknown. It is true that this process will entail the trouble of learning something, but better far to acquire the necessary elementary information than run the risk of mishaps. We have always protested against foolish risk, and cautioned would-be fungus-eaters against cooking and eating any kinds which they do not know unmistakably. There is no difficulty in recognising all the best kinds by means of ordinary intelligence and care, and, when once known, so as to be distinguished from others somewhat like them, or from all the rest, then there is no fear of error. Good fungi have usually a pleasant mushroomy odour, a smell of new meal, a faint scent resembling anise, or no particular odour at all. Then, again, a fragment broken off from the freshly gathered fungus, if tasted, should possess an agreeable nutty flavour, with no acidity, sharpness, or tingling upon the tongue. And, further, it is a most suspicious indication of bad qualities if a fungus when broken, cut, or bruised speedily turns of a deep blue or greenish colour. Avoid, therefore, all fungi with a disagreeable odour, a pungency of flavour, and a tendency to become blue when bruised."

The following paragraph is extracted from the Grevilleæ for March, 1894:—

"*Artificial Production of Mushroom Spawn.*—In a very interesting pamphlet entitled 'Sur un noveau procédé de culture du Champignon de couche,' by MM. J. Costantin and L. Matruchot, we have an account of the method by which the spawn of the edible mushroom can be produced wholesale. The pure spores are collected and sown in a special sterilised nutrient solution, and forms a pure white cord-like mycelium. This mycelium is placed on sterilised dung, where it develops abundantly for some weeks. At this stage it has the appearance and odour characteristic of natural spawn, and when placed in a mushroom bed grows and produces mushrooms normally. The advantages of this method are:—

"I. *The production of a pure mycelium*, free from the many diseases, the germs of which are introduced along with the spawn as at present produced.

"II. *Choice of varieties.* It is well known that certain varieties, especially the one having the cap entirely white, is most esteemed in the market. By the method described it is alone possible to perpetuate any variety in a pure state.

"III. *Permanent production of spawn.* At present the production of spawn is intermittent; by the culture process spawn can be produced throughout the year, an evident advantage."

The authors hope to apply the same method of cultivation to other edible species of fungus, as the *Morel*, *Boletus*, &c.

Believing that the method could be adopted with advantage in Queensland, the above extract is given in full.

As this is a matter of some importance, the notice may be extended so as to mention the known wholesome fungi, which at certain seasons, or under special conditions, abound in Queensland. Doubtless many of those kinds which, so far as at present known, are peculiar to Queensland or Australia, are esculent; but with one exception all those here mentioned are given as esculent in Dr. M. C. Cooke's "British Edible Fungi." After each name is given the locality where specimens of the species have been obtained, either by the writer or his friends.

Agaricus (*Amanitopsis*) *vaginatus*, Bull. The Sheathed Mushroom; Indooroopilly and Rockhampton.

A. (*Lepiota*) *procerus*, Scop. Parasol Mushroom; Brisbane district.

A. (*Lepiota*) *excoriatus*, Scheff. The Fawn-coloured Parasol Mushroom.

A. (*Lepiota*) *naucinus*, Fries. The Nut-tree Mushroom; in a Brisbane garden.

A. (*Amillaria*) *melleus*, Vahl. Stump Mushroom; Enoggera Creek.

A. (*Clitocybe*) *cerussatus*, Fries. The White-lead Coloured Mushroom; Albert Park, Brisbane.

A. (*Collybia*) *fusipes*, Bull. The Spindle-stemmed Mushroom; Eight-mile Plains.

A. (*Pleurotus*) *ostreatus*, Jacq. The Oyster Mushroom.

A. (*Psalliota*) *campestris*, Linn. Common Mushroom.

Lactarius piperatus, Scop. The Peppery *Lactarius*; Endeavour River. This is eaten on the continent of Europe and in America, but rejected in England, probably from prejudice.

Cantharellus cibarius, Fries. The Chantarelle; about Oxley Creek. This is eaten in many parts of Europe, but seems not to be a general favourite.

Panus torulosus, Fries. Islands of Moreton Bay. This species is eaten upon the continent of Europe, but is only fit for food when very young.

Boletus luteus, Fries. The Yellow *Boletus*; about Brisbane.

B. elegans, Fries. The Bright Yellow *Boletus*; Oxley Creek.

B. granulatus, Linn. The Granular *Boletus*; Eight-mile Plains.

Boletus badius, Fries. The Bay *Boletus;* about Brisbane.
B. edulis, Bull. The Edible *Boletus;* about Brisbane.
B. æreus, Bull. (*B. æneus*, Fries.) About Brisbane.
B. æstivalis, Fries. The Summer *Boletus;* about Brisbane.

Dr. Cooke says that species of this genus are amongst the most common of the dried fungi. The stem is discarded, the pores cleared away from the underside of the cap, and then the white fleshy cap is cut in slices about the thickness of a penny-piece, and thoroughly dried in the air.

Polyporus turnulosus, Cooke. This species is used for food by the aborigines at Burpengary. Specimens of this fungus have also been gathered near Brisbane.

P. intybaceus, Fries. Near Brisbane.

Hydnum coralloides, Scop. The Cauliflower Spring Cap; Mount Mistake. All writers recommend stewing as the best method of cooking *Hydnums.*

Craterellus cornucopioides, Linn. Horn of Plenty; Petrie's Quarries, Brisbane River. This fungus is by no means plentiful in Queensland, which is to be regretted, for Dr. Cooke speaks highly of it, and says that he knew a fungus-eater who would think nothing of a walk of six or eight miles with the prospect of a dish of *Craterellus.*

Clavaria flava, Schæff. The Yellow Fairy Club; Brisbane.
C. botrytes, Pers. The Branched Fairy Club; Taylor's Range.
C. fastigiata, Linn. The Branched Fairy Club; near Brisbane.
C. cristata, Pers. The Crested Fairy Club; near O'Connelltown.
C. rugosa, Bull. The Rough Fairy Club; near Brisbane.
C. aurea, Schæff. The Golden Fairy Club; near Brisbane.

Hirneola auricula-judaæ, Linn., Jew's Ear; and *H. polytricha*, Mont., Jew's Ear. On the logs in damp scrubs throughout the colony this fungus, which is so plentiful during some seasons, seems never gathered in this colony, although it has for years formed an important export in New Zealand.

Tremella lutescens, Pers., and *T. mesenterica*, Retz. Brain Fungus. These two are esculent, but not plentiful, and too small usually to be worth the trouble of gathering. Like the *Hirneola*, this is found on the logs in damp scrubs.

Clathrus cibarius, Fischer. The odour of this and allied species is of such a disagreeable character as to cause it to be rejected by most persons.

Lycoperdon lilacinum, Berk. (*Bovista lilacina*, Berk.) This Puff-ball is common to many parts of Queensland. It is used for food in India, but only in a young state.

Lycoperdon gemmatum, Batsch. Warted Puff-ball, Logan.

L. bovista, Linn. (*L. giganteum*, Batsch.) The Giant Puff-ball; very abundant about Milora. This species when properly prepared is said to be universally relished. The mode recommended by Dr. Cooke is this: Cut the ball in slices less than half-an-inch thick, cover them with egg beaten up, and sprinkle with bread-crumbs; fry them until the surface is browned, and then serve. Of course pepper and salt are better sprinkled over before frying.

Morchella deliciosa, Fries. The delicious Morel, found at Gladfield. This and others of the genus are dried both in Europe and India, and sold as articles of food.

Peziza cochleata, Linn. Earth-cups; Brisbane. These are prepared for food by simply stewing, but Dr. Cooke does not speak very highly of them.

In addition to the above, the following of our Fungi are considered edible in the United States of America:—

Agaricus (*Lepiota*) *cepæstipes*, Sow. This and the var. *cretaceus* are often plentiful on garden borders about Brisbane.

Agaricus (*Collybia*) *radicatus*, Relh. Specimens have been gathered near South Brisbane.

Hygrophorus miniatus, Fries. During some seasons this is very abundant on pasture land, but too small, one would think, to be worth gathering for use.

Polyporus picipes, Fries. On logs in scrubs of Southern Queensland.

Polyporus sulfureus, Bull. On living trunks of trees, Bunya Mountains; a very large fragile species.

Hydnum lævigatum, Swartz. Eight-mile Plains.

Hydnum coralloides, Scop. Recorded by Baron Mueller as from Queensland, without locality.

Clavaria formosa, Pers. Reported as from Queensland.

Leotia lubrica, Pers. The locality forgotten; plant rare in Queensland.

Before closing this paragraph a few more extracts may be given from Dr. Cooke's works, but all who are interested in Fungi should possess the works of this great authority upon this useful and interesting family of plants.

Mushrooms of all kinds pass rapidly into decay, and consequently suffer rapid chemical change, so that even innocuous species should always be eaten as soon after they are gathered as conveniently may be. Not even the common mushroom is so delicate or so excellent at any other period as it is within an hour or two of its being gathered. Certainly no fungus should be cooked as food after it has exhibited any symptoms of decay.

Although not used as food by Europeans, surely an article which could be obtained in such quantities as the Jew's Ear Fungus (*Hirneola polytricha*) in Queensland is worthy the attention of settlers living near scrub land. The preparation for market is of the simplest kind, as it merely requires drying in the open air. The only market for the article is China, and Dr. Cooke tells us that from 1872 to 1883 the export from New Zealand of this article amounted in value to £79,752. I have before drawn attention to the value of this fungus for export, but think the subject of sufficient importance to again refer to it. The plant is cultivated in China, but not in sufficient quantities to meet the demand.

EXANTHEMATA—A name given to skin diseases, blotches of leaves, &c.

EXOTIC—Foreign, as *Murraya exotica.*

FIMETARIUS—Pertaining to dung, as the *Agaricus fimetarius*, which grows upon dung.

FRUIT BLIGHTS—Dr. M. C. Cooke, in Gardeners' Chronicle, July, 1893, recommends a solution of 2 lb. of sulphate of iron in five gallons of water in preference to the sulphate of copper, so commonly used, to check the growth of *Glœosporium* and similar blights which attack fruits.

FORMICA—An ant. FORMICARIUM—The dwelling of ants, as *Hydophytum formicarium.*

GLACIALES—Having the appearance of being frozen.

GLÆOSPORIUM FRUCTIGENUM, B., or G. LÆTICOLOR, B.—It is stated in the Gardeners' Chronicle of 21st October, 1893, that these can be kept well under control by two or three sprayings of potassic sulphide (½ oz. to a gallon of water), but it must be applied at an early stage of the fungus growth.

GALBULUS—This differs from the *Strobilus* only in being round, and having the heads of the carpella much enlarged. Example: Fruit of Juniper.

GERONTOGÆOUS — Belonging to the Old World.

HÆDINUS—Of a kid, as *Boletus hædinus.*

HIRNEOLUS — A little jug or pitcher. Applied to some fungi.

HOMOMALLOUS (from *homo*, whole, and *mallos*, a lock of wool, uniformly bending or curving to one side)—Secund; turning to one side. HETEROMALLOUS—Spreading in all directions.

ILLINITUS—Besmeared, anointed. Applied to some fungi.

INTRICATUS—Entangled, as *Sida intricata.*

LUCIFUGUS—Shunning the light; growing in shady places.

MAMMOSUS — Resembling a breast, or *mamma*, as the fungus *Tylostoma mammosum.*

MAPPA (from *mappa*, a napkin).

MATH—An old term for "crop"; as aftermath, the second mowing, and lattermath, the last mown crop.

MEROS—A part of anything, in connection with some numeral; as pentamerous, if a flower consists of organs in fives; tetramerous, if in fours, and so on.

MITIS—Mild, soft, as *Agaricus mitis.*

MUSCARIUS — Pertaining to flies. (See *Agaricus muscarius.*)

MUSHROOMS—(See Edible Fungi.)

OBLATUM, OBLATA—A flattened sphere, as some fruits.

OPSIS—The appearance, as *Coreopsis*, from the seed resembling a bug.

PENETRALIS — Piercing, penetrating, as *Polyporus penetralis.*

PHYLLOXERA—Temporary flooding of the vineyards with water, or, where this is not practicable, treating the roots with sulphuretted carbon, is recommended in "Science Gossip" to check this pest of the vineyard.

PSITTACINUS — Parrot-coloured, *i.e.*, red and green, as *Gahnia psittacorum*, or *Alstrœmeria psittacina.*

PUDICUS—Bashful, as *Agaricus pudicus*, or *Mimosa pudica.*

RACHODES—Applied to plants whose stems have the cuticle broken into thin scales.

RELIGIOSUS, RELIGIOSA—Some plants are so named from being used in religious worship, as *Ficus religiosa*, the Sacred Fig of India.

RINGBARKING—This is performed by removing a ring of the bark, say 2 or 3 feet from the ground, in doing which cut well into the sapwood, and perform the operation only when the sap is well up in the trees.

ROBUSTA—Robust, as *Grevillea robusta*, the Silky Oak.

SEMITALIS—Belonging to or growing on waysides.

SIMULANS—Resembling; used for a specific name when the species closely resembles another, as in *Stereum simulans*, a fungus found on logs in dense scrubs.

SPECTABILIS, SPECTABILE—Good-looking.

SPHACELATE—Withered or dead.

SPISSUS — Crowded, thick, clammy, as *Agaricus spissus.*

SUDORUS—Full of moisture (*sudor*).

TERRIGENUS—Born on the ground—*i.e.*, not epiphytal.

VULPINUS—Of a fox, fox-coloured, as *Lentinus vulpinus.*

ZOOGLÆA—A colouring embedded in a gelatinous substance, as some Algæ.

By Authority: EDMUND GREGORY, Government Printer, William street, Brisbane.

Queensland.

REPORT OF THE PROCEEDINGS

OF THE

RUST IN WHEAT CONFERENCE.

FOURTH SESSION.

HELD IN BRISBANE, QUEENSLAND, 20th, 21st, 26th, 27th, and 28th MARCH, 1894.

CONVENED BY THE SECRETARY FOR LANDS AND AGRICULTURE.

TOGETHER WITH

DESCRIPTIONS OF PROMINENT VARIETIES OF WHEAT.

BRISBANE:
BY AUTHORITY: EDMUND GREGORY, GOVERNMENT PRINTER, WILLIAM STREET.

1894.

TABLE OF CONTENTS.

RUST IN WHEAT—FOURTH CONFERENCE.

DELEGATES.

New South Wales: W. S. CAMPBELL, Esq., Agricultural Department, Sydney.

Dr. N. A. COBB, B.Sc., Vegetable Pathologist, Agricultural Department, Sydney.

WM. FARRER, Esq., Lambrigg, Queanbeyan, N.S.W.

South Australia: G. INGLIS, Esq., Georgetown, S.A.

RICHARD MARSHALL, Esq., Templers, S.A.

Victoria: D. MCALPINE, Esq, Vegetable Pathologist, Agricultural Department, Melbourne.

Queensland: PETER MCLEAN, Esq., Under Secretary for Agriculture.

Professor E. M. SHELTON, M.Sc., Instructor in Agriculture.

FIRST DAY, TUESDAY, MARCH 20, 1894.

PRESENT:

Hon. A. H. BARLOW, M.L.A., Minister for Lands and Agriculture, in the chair.

SAMUEL GRIMES, Esq, M.L.A.

All the delegates with the exception of Mr. Farrer.

The CHAIRMAN, after extending a very cordial welcome to the delegates, said this colony has always been looked upon as a purely pastoral country, but the fact of this Conference meeting in the capital city to discuss so important a subject as rust in wheat, the great vegetable plague that has caused the loss of millions of money to these colonies, shows clearly that the farming industry has a foothold here as well as the pastoral industry. It is especially gratifying to know that since the growth of wheat has been entered upon here on anything like a large scale, Queensland has maintained an average equal to, if not exceeding, that of the other colonies. Since the first conference in Melbourne considerable light has been thrown upon this question, and without doubt considerable advances have been made in the direction of finding a remedy. While it is generally admitted that no such grain as rust-proof wheat exists, the line of action now being carried out of growing varieties constitutionally able to resist the attacks of the enemy is unanimously admitted to be the correct one. At one time it was thought a remedy would be found in spraying, and several machines have been invented and constructed for the purpose of applying fungicides. However efficacious these fungicides might be, the difficulty of application has been a serious drawback; and it is now satisfactory to be able to grow wheat that will not, under anything like favourable conditions, require such treatment. Owing to the system in operation here for collecting statistical information, no direct statement can be made as to the average of last year, but from a general knowledge of the state of our crops during the growing season and the harvesting operations it is fully safe to place the average at about 16 bushels to the acre. At the conference held in Adelaide two years ago a very formidable programme was prepared for experimental work between the time of that meeting and the present. Doubtless the reports from you will show that the work has been well and faithfully done, and that valuable results have been secured. Extensive experiments have been carried out in different portions of this colony, and as a result of these experiments the Department of Agriculture was able to exhibit a wheat trophy at several of our annual shows, such as had never before been seen in the colony, which gave clear and satisfactory evidence of the adaptability of the colony to the growth of that cereal. Upwards of 250 varieties have been experimented with, and valuable lessons have been learned by these experiments. Our Instructor in Agriculture, who has charge of that work, will submit to you his report. Replies from our farmers to the questions proposed at the last conference will also be placed before you. The knowledge gained by these replies will doubtless be of an interesting character, and may assist you in determining your further line of action. Whatever has been done in the past—and good work has been done—there is much work yet before us. But, what with your able experiments and investigations and the faithful co-operation of the farmers, this pest will be kept well under control; so that, given a fair season and anything like a fair price for the grain, they who are termed the backbone of a country will receive remuneration for their time and labour.

Mr. Samuel Grimes, M.L.A.: Gentlemen,—I am not here as one of the delegates to this Conference, but appear as a farmer and as a representative of the farming community in Queensland, on whose behalf I beg to offer you a hearty welcome. I fully endorse all that has been said by Mr. Barlow, and I think we cannot too highly appreciate the indefatigable labours of the members of these conferences. I have read with great interest the reports of your former meetings, and am convinced that they have been of most decided advantage to the wheat-growers, and, through the wheat-growers, to the general community. You perhaps have not been able to find out a specific for rust in wheat, but you have done much by your researches, and by obtaining information from various farmers in the colonies, to prevent rust, to ascertain the best varieties of wheat, introduce new, early, and hardy varieties, and to show the best and most suitable time for sowing. As all of this has been a great check to the contagion, I trust your labours, gentlemen, will be as successful here in Brisbane as they have been in the other colonies; and I feel certain that I shall read with pleasure and profit the report of what has been done at the present sitting.

The Hon. A. H. Barlow: Well, gentlemen, as I have at present two departments to look after, I think I shall have to leave you, and be with you again at 1 o'clock.

Dr. Cobb: I hope, Mr. Chairman, we shall not allow you to retire without first expressing our thanks for your courtesy, and for the excellent arrangements that have been made for the Conference.

On the motion of Mr. Campbell, seconded by Mr. Inglis, Mr. McLean was elected chairman.

Mr. Barlow then withdrew, and Mr. McLean took the chair.

Mr. McLean: I beg to thank the Conference for the honour they have now conferred upon me for the fourth time; and before we enter upon any formal business, I wish to invite the representatives to luncheon in this building at 1 o'clock, and to-morrow evening I hope they will do me the honour of dining with me at my own house at 6. Furthermore, if the gentlemen present are agreeable, and can spare the time, we can make arrangements to leave on Thursday morning for Bundaberg, visit some of the mills and canefields on the Friday, and return to Brisbane on the following day. I have here a telegram from Professor Lowrie, of Roseworthy, South Australia, in which he states that, owing to a fatal accident at the college, he cannot be present at the Conference, and also that his report on last year's work cannot be in Brisbane before Thursday. As we shall have to discuss this report, I think it will be best to meet again on Monday, and go on with the regular work of the Conference. The Nomenclature Committee will, I suppose, be working all to-day and to-morrow.

The various delegates expressed their approval of these arrangements.

Dr. Cobb: I must remind you that there are present only two members of the Nomenclature Committee, and this is an insufficient number to do the work, so I think that additional members should be now appointed. Professor Shelton has just suggested to me that the present Conference resolve itself into a Nomenclature Committee of the whole to go on with the work, so I accordingly move that that be done.

After a slight discussion, however, Dr. Cobb altered his motion, and it was decided that Messrs. Marshall and McAlpine should be added to the Committee; all the members who were appointed in 1892 also retaining their positions.

Election of Secretary.

Mr. McAlpine: Owing, unfortunately, to the economy at present practised in the Victorian Civil Service, I exceedingly regret to have to remind you that we cannot have Mr. Pearson as secretary again this year, and it is, therefore, necessary to appoint a new one. As I do not think we can find anybody to fill the position so well as Professor Shelton, I move that he be appointed secretary.

Mr. Inglis seconded.

Motion carried.

Professor Shelton: I have made it a rule never to dodge work, and so will do the best I can with the new duties proposed for me. But to tell the truth, there are many difficulties in the way of my doing the work thoroughly, among which is the pressure of other duties. I have to leave for the far North the week after next at the very latest to plant experimental wheats, which, by the way, is a part of the work recommended by this Conference, and which will take up a good deal of my time for some weeks to come. However, though my work, as compared with that of our former secretary, Mr. Pearson, will perhaps appear at a great disadvantage, still I will try and do the best I can.

The Chairman: Mr. Marshall has sent over a box of wheat in the straw for the Nomenclature Committee, but the Custom-house officers, evidently thinking it something of great value, have placed it in bond, and we now have to pass entries for a few wheat heads.

Just then notice came to hand that the wheat had arrived in the building.

On the motion of Dr. Cobb, seconded by Professor Shelton, the Conference adjourned till 10 o'clock on Wednesday morning.

The Nomenclature Committee then commenced their duties.

SECOND DAY, WEDNESDAY, MARCH 21, 1894.

10 o'clock.

All the delegates present.

Mr. P. McLean in the chair.

Dr. Cobb: Mr Chairman, I have to report that the Nomenclature Committee met yesterday, and although there is no written report, I can give a verbal progress report which I think will be satisfactory. We have gone through a list of wheats and determined which we shall describe, and have also finished the descriptions of eight wheats. We have discussed one point which we would like to submit to the full Conference, and it is this: What attention shall we give in the descriptions of wheats to the milling qualities?

The Chairman: That is a question we have given great attention to in Queensland, and at some expense too, as perhaps Professor Shelton has told you. I think it would be a very good thing if the Nomenclature Committee would make some reference to this subject. It has special bearing upon us here in Queensland, where our millers are very apt to put up their backs against certain varieties of wheat which make capital flour and bread. We have taken a great deal of interest in the subject, and gone to some expense in testing wheats which the millers objected to, and Professor Shelton will probably be able to submit to you the reports of millers and bakers on varieties which we have tested. You recollect at a previous conference we did give expression to an opinion with reference to the action of millers in their dealings with wheat.

Mr. CAMPBELL: The question seems to be, not what are the milling qualities of wheat, but what are the wheats that millers will buy.

The CHAIRMAN: That is a question that we may not be able to deal with. For instance, when we first introduced the Belotourka we submitted it to one of our principal millers, and in his report, which is now lying up in my office, he says he has tested it and found it a splendid milling wheat, and that he is prepared to give 4s. per bushel for unlimited quantities of it. Wheat was then selling at from 3s. 6d. to 4s. per bushel. Now this same man last year set his face against the Belotourka, and refused distinctly to purchase it, so the consequence is a lot of our farmers have been put out of their reckoning and are disheartened. In fact, it is a mystery to me how we are to deal with millers. I believe they frequently take advantage of the supply of wheat in the market to say one thing at one time and another thing at another, in order to get their grain at a reduced price from the grower,

Mr. FARRER then read the following paper on the milling of wheats :—

This matter of the millers and the extent to which we ought to meet their demands, or allow them to direct us in what we are doing, is very important. I hope we shall, at any rate, arrive at some definite conclusion at this Conference as to what position we ought to take up, and that we shall succeed in making it and our reasons for taking it up to be clearly understood.

I have given much thought to the subject of the kind of wheat I ought to take for my ideal and aim to make in working for our requirements; but, owing to the number of factors that enter into it, the problem has been rather a difficult one for me to solve. If I had thought that nothing more than the production of grain enough for our own requirements was to be the end of the wheat-growing industry of this country, I do not think my interest in the industry would ever have amounted to much, or that I should have taken up the matter of coping with the rust pest or of producing improved wheats. Before, however, I took the matter in hand, I had satisfied myself that the undeveloped resources for wheat-growing of my own colony alone were enormous, and that in their development lies the possibility of enormous wealth and of a prosperity more solid, certain, and enduring than there is in any other industry, if we except that of of wool-growing alone. If our wheat-producing resources are developed to anything like the extent to which I hope to live to see them developed, the requirements for local consumption, with which alone our millers are concerned, will for some time to come be little more than a mere bagatelle compared with what we shall send to England. It is for this reason that I am inclined to look ahead, and to try to make wheats of such a character as I believe will cause them to be more highly prized in England than are others that are received from any other part of the world—to be more highly prized not only on account of their intrinsic value and because they contain the nutritive elements and the qualities which are wanted the most in the home market, but also on account of the attractive appearance and the flavour which are associated with those qualities.

The wheats which are wanted most of all and are most highly valued in the English market are those which possess the qualities in which the home-grown wheats are most deficient; such wheats are wanted to mix with those that are produced at home, in order to enable good flour to be made from the latter. The principal defects of the home-grown wheats are two: (1) They are too starchy or deficient in gluten, and (2) they are too moist. The qualities, then, which are specially wanted in a wheat to mix with them are: (1) Relative richness in gluten, and (2) relative dryness. If these two qualities can be secured in a wheat and associated with good appearance and flavour, we have an ideal wheat for the English market. Such a wheat, I am convinced, can be produced in this country at least as well as in any other country in the world; and when I add that in trying to produce grain of this character we can grow varieties which best resist the rust-fungus, and far better than can the soft starchy kinds which are at present far too generally grown, it appears to be clear that we ought to set to work to try to get such types and to replace all others by them.

I may state that our Australian wheats (the South Australian wheats I am specially referring to) first gained their hold on the English market in consequence of their possessing qualities which they are acknowledged now to no longer possess. Richness in gluten was a quality for which they were remarkable in the early days, while the soils of that colony were still comparatively virgin and had not become deficient in vegetable matter; but, as soon as frequent tillage and exposure to the hot sun had caused the vegetable matter in them to be burnt up and exhausted, these soils could no longer supply nitrogen enough to varieties of wheat that wanted it for making much gluten in their grain. The consequence of this was that the good old sorts had to be replaced by inferior varieties which were less exacting of nitrogenous food in the soil and could win the bulk of the substance of their grain from the air alone. As the other colonies have received practically all their wheats from South Australia, it is in this way that it has come that we find ourselves growing wheats whose berries are little more than mere balls of starch—attractive, indeed, in the highest degree to the eye (as worthless things too often are), but far too deficient in the special element which gives to wheat its superior value as a food.

The difficulty we have now to face is that our millers have been used for so long a time to these degenerate sorts, and have become so accustomed to the routine work of dealing with soft starchy wheats, that they look aghast and are frightened by its hardness when they see a really good wheat given to them to deal with. Things have been made worse by the fact that until now the millers have always been able to have their own way so easily, and have had no trouble in getting out of the difficulty by pronouncing a hard wheat, whenever it has been submitted to them, to be of inferior milling quality. It is in this way that wheats which are in reality of superior milling quality, and possess additional value on account of being very fairly resistant of rust, have been brushed aside by the millers and kept out of cultivation. Little, as a rule, do the millers care whether the flour they make and sell is really good strength-sustaining food, so long as it is white and attractive and they can make plenty of it from a bushel of grain with the least call on their capacity or effort. Flour that is white and attractive can be made from wheats of any colour, for it is the bran which gives to a wheat its colour; if a flour made from a red wheat is less white in colour than that made from a white, it is only because the miller is wanting in skill.

The opinion I am giving in regard to millers and their attitude towards wheat-growers is not mere conjecture. I have now had a pretty large experience of millers' opinions of the milling qualities of different wheats; and, from the conflicting and inconsistent verdicts which have come under my notice, I have come to place very little value on a miller's opinion of a wheat, and have ceased to be disquieted when it is unfavourable. So often, in fact, has it happened that a wheat I have known to be in reality of first-rate milling quality has been pronounced by a miller, to whom it has been submitted, to be inferior for milling, that whenever I receive from a miller an unfavourable opinion of a wheat I feel inclined, unless I have good reasons for thinking the opinion to be a correct one, to suspect the capacity of the miller giving it. I am, also, in the habit of accepting favourable opinions of wheats far more readily than I do unfavourable ones. This is because so many illegitimate reasons exist for such opinions being made to be unfavourable. The above opinions in regard to millers and their ways of acting have been submitted to a gentleman who was brought up to their business and is familiar with it, and he assures me that facts entirely justify them.

I will give an illustration. The wheats which I find to be most consistently resistant of rust in my own district, and in my own colony generally, are the Fifes and varieties of the Fife type—such as the various Fifes, Horneblende, Blount's Lambrigg, Defiance, &c. These are the wheats which are most used for flour-making and are preferred before others at Minneapolis, which may fairly be considered to be the milling capital of the world. I have on several occasions received samples of these wheats which have been grown in America, and after planting part of these samples have compared the grain I have grown from them with the American-grown sample. From these comparisons—not made once or twice only, but on several occasions—I have become satisfied that we can grow, in my own district at any rate, as well as in many other parts of my colony, the Fife wheats as least as well as they are grown in America; and yet, in the face of the above facts, whenever I submit a sample of a Fife wheat to one of our millers, in nine cases out of ten he pronounces it to be inferior or even worthless for milling.

I think I have now said enough to show that I have reason for thinking it highly improbable that good can come from our seeking guidance or direction from our millers in our work. My own idea is that their unanimous demand, if we consult them, will be for large-berried soft starchy wheats, which cannot be rich in gluten, and which too dearly-bought experience has shown us to be highly rust-liable and unsafe to grow. I think, also, that apart from the object for which we are here—to rid the farmer of the rust-pest—a desire to see our own people furnished with a stronger and more strength-sustaining bread than can be made from the soft starchy wheats ought to be an important factor in determining us as to the position we should take up in this matter. The course I think we ought to follow is to find out to what extent resistance to rust (which I regard as being a quality that is essential to the true interests of the grower), high intrinsic food value, and superior milling quality are compatible; and then to seek to combine all these qualities in the highest degree in varieties, and associate these qualities with beauty of appearance and with such other qualities as are necessary to enable a variety possessing them to thrive under our conditions. I think, also, that we ought to seek to consult rather for the legitimate requirements of what must in the near future be our principal customer—viz., the English market—rather than for what I have attempted to show to be the less legitimate demands of our own millers.

Mr INGLIS: I understood that the duties of the Committee were to specify, name, and describe all the wheats they had to deal with, and that then it would be the work of the whole Conference to decide which wheats should be recommended or condemned. With regard to the milling qualities, could they not be described as hard, soft, &c.?

Dr. COBB: I agree with most of Mr. Farrer's remarks, and do not believe we should lay too much stress on the opinions of local millers; but could we not take into consideration the Minneapolis or English standards of excellence? If we have decided views about the milling qualities of any particular wheat, I think they ought to be given.

Mr. CAMPBELL: I should like to ask Mr. Farrer, Do we know positively that the English millers will take these red wheats?

Mr. FARRER: Yes; we know positively that they prefer them.

Professor SHELTON: They will take them by the millions of bushels.

Mr. CAMPBELL: Could we not mention that, and say these are good milling wheats for the English market?

Mr FARRER: I think we should confine ourselves to a mere technical description of a wheat.

Professor SHELTON: I have listened to Mr. Farrer's paper with sympathy. It is most apparent that progress in our particular line of work is out of the question with this milling difficulty staring us in the face, but I think this is an unfavourable time for forcing our views. When wheat is at 2s. per bushel, it is very difficult to induce a miller to buy wheat that he does not like, when he can get all he chooses of other sorts at this nominal price. In fact, the times are against us. Take our Department of Agriculture. We have imported two kinds—the Zimmermann and the Currell. I grew the former of these sorts in Kansas for several years, and there they command the highest price in the market. They are both small, plump, red wheats. Take any of the white starchy varieties, and put them on sale in America beside the Zimmermann or Currell, and they (the white) will command 5 to 10 cents less per bushel. In other words, the millers demand the red wheats Now, those two particular wheats, when introduced into Queensland, are pooh-poohed the whole length of the colony. This shows the utter inconsistency of millers, and I don't see how we are going to get over it. These red wheats make as white flour and as beautiful bread as any that can be produced here. However, I must say that many of the millers themselves object to many of these soft wheats. Only the other day I was talking to a mill-owner on the Downs, and he said he was disposed to discriminate against the Allora Spring, for the reason that it was too light and starchy—not "strong" enough, he said. Then said I, "Why don't you take the Belotourka and combine them?" But, of course, the hard wheats grind hard and require more machinery than the millers at present possess, and so there the difficulty lies. But, referring more directly to the question at issue, I should say we had better not condemn any particular sort by a description that may be only slightly at variance with the facts. Whatever we say under the head of milling qualities, let us be certain about it. If we know such a sort is a good milling wheat, let us say so. If another variety is known generally to be a hard milling wheat, we may possibly say that; but let us remain silent unless we are quite certain of the facts. For by our action we might put back the very thing we are trying to bring about, by encouraging the millers and farmers in their conservative opinions about wheats.

Mr. MCALPINE: I have listened with great interest to what Mr. Farrer has said; and while I agree with him on some points, there are others on which I differ. First, I agree with what he says about introducing wheats rich in gluten into the market, but he must know the millers are masters of the situation. It is evident, however, that a certain kind of wheat is required for the local market, and another kind for English or foreign consumption. I take it for granted that we ought to state milling qualities, because that is an important question to the grower, but we could note whether each wheat is of good milling qualities for the English market, or a good milling wheat for the Australian market, or whatever the case might be. Then the farmer would know, if he was growing for local use, the sorts the local millers would be likely to demand. There is another point on which I do not agree with Mr. Farrer. I do not think we ought to flout the millers. They, of course, are often inconsiderate in their demands and opinions, but I would recommend that a conference be held at some early date between representative millers and the present members of this Conference, or others on behalf of the wheat-growers, and great good would result if the matter was quietly talked over. I was speaking the other day to some millers in Melbourne; and as Mr. Farrer thinks he can teach the millers everything, so I believe the millers could teach us a good deal. One of the best pathological authorities in Europe and America has drawn attention in a recent article to the same subject, which shows the milling difficulty is as bad in other countries as it is here. He says that, notwithstanding the fact that red wheat makes an excellent and tasty bread, it fetches a lower price than the white starchy varieties. Still he advises farmers to grow the red sorts in preference to the white as they are likely to be more profitable by giving larger harvests, and then millers can mix the two sorts. Now I think, if we could arrange this meeting between the millers and the present conference, we could probably come to some common course of action, and then inform the farmers what sorts would most likely pay best.

Mr. Marshall: With regard to hard and soft wheats about which Mr. Farrer has spoken, Do not hard wheats exhaust the soil equally as much as soft wheats, and is it true that hard wheats are always the best resisters of rust? Rust resistance is not confined to hard wheats, and I have many soft wheats, which are by no means particularly liable to the disease. I do not think it is essential that we should grow hard wheats, but rather rust-resisting ones.

Mr. Inglis: Climate makes a lot of difference in the degree of softness of a wheat. Soft wheats in one place are hard ones in another.

Mr. Marshall: In South Australia throughout the whole colony the millers have been docking all the farmers 2d. and 3d. per bushel for Ward's Prolific. The farmers feel naturally annoyed, and have been holding meetings, &c., to protest against this reduction, but so far with no result.

Dr. Cobb moved, "That the Nomenclature Committee pay attention to the milling qualities of wheat, but that, in order to avoid prejudicing anyone against any particular wheat, great care be exercised in accepting evidence for or against the milling quality."

Mr. Inglis seconded the motion.

Mr. Farrer moved, as an amendment—"That all mention of the milling qualities of a wheat be omitted in the description of it." I think we should give a mere technical description, and say nothing about the milling qualities.

Dr. Cobb: What a technical description consists of will give rise to a lot of discussion. Shall we omit shelling?

Mr. Farrer: No.

Mr. Campbell: It is not so much a question of what the milling qualities are, but what the millers will take, and what they will not take.

The Chairman: I do not think millers are guided so much by the quality of the wheat as by the state of the market.

In reply to a question, Dr. Cobb said: I mean by the milling qualities the properties of wheat which make it suitable for grinding into flour that will sell, whether it be in Sydney, Melbourne, America, or anywhere else.

Mr. Marshall: I thoroughly agree with the suggestion previously made that we should have milling experts to assist us in this matter, for they would be of great assistance to us. One difficulty in South Australia is that the hard wheats require new machinery, and the mill-owners are not likely to go to that expense if they can avoid it.

Mr. CAMPBELL: But when new mills are erected, will they not be furnished with the latest appliances?

The CHAIRMAN: We have had new mills put up here, but they have not done much towards solving the difficulty.

Dr. Cobb's motion being then put to the meeting, was carried.

Mr. Farrer's amendment, being negative to the motion just carried, was not put.

The CHAIRMAN: I have just arranged with the Traffic Manager for a reserved carriage, which will leave the Central Station to-morrow morning at ten minutes to 8. We have lunch at Gympie at 1. and arrive at Bundaberg at five minutes past 7. The next day we examine as far as possible the sugar works and plantations about Bundaberg, and will finally reach Brisbane at five past 5 on Saturday evening To-night I hope you will do me the favour of dining with me at my own house.

Professor SHELTON moved—"That we do now adjourn till 10 o'clock on Monday morning, when the Conference shall proceed with the reports of the delegates from the several colonies upon their experiments made during the past year, after which we shall go into a committee of the whole upon resolutions."

Carried.

The Chairman then left the chair, and the Nomenclature Committee resumed their duties 10.55 a.m.

THIRD DAY, MONDAY, MARCH 26, 1894.

All the delegates present. Mr. McLEAN took the chair at 10·10 a.m.

Nomenclature Committee reported progress through their chairman, Dr. Cobb, and asked leave to sit again. Granted.

The CHAIRMAN: Before proceeding, I wish to say that a letter from the Hon. J. D. Macansh, of Canning Downs, addressed to Professor Shelton, has been received inviting members of the Conference to pay a visit to the Canning Downs Estate. If there are any of you gentlemen who can spare the time to accept this invitation, I will make arrangements accordingly. Professor Lowrie's report on the work done during the past year has just come to hand, and I will give it to Mr. Inglis to read. With regard to the order of business, I would suggest that we take the reports of the New South Wales representatives first, Victoria next, then South Australia, and Queensland last.

Members expressing their approval at this arrangement, the Chairman called on Mr. Campbell for his paper.

RUST IN WHEAT EXPERIMENTS.

With the view of further testing the suitability of certain varieties of wheats for cultivation in different parts of the colony, the Department distributed in May and June last year 2,763 packets of selected wheats to 451 applicants. These wheats, in all 61 bushels, were grown, with the exception of one bushel, in this colony by farmers who were supplied with the seed the previous year. The names of the varieties are as follows:——

Australian Glory
Australian Wonder
Amethyst
Allora Spring
Algerian
Bega
Belotourka
Bird-proof
Blount's Lambrigg
Blount's Fife
Broderick's
Brisbane
Cook's
Early Para
Egyptian Mummy
Farmer's Friend
Fillbag
Fluorspar
Flourball
Fountain
Frampton
Fultz
Galland's Hybrid
Goldsmith's Pedigree
Hornblende
Hundredfold
Improved Fife
Jacinth
Jordan's
King's Jubilee
Manitoba
Medeah
Niagara
Pride of the Market
Prince of Wales
Pringle's Defiance
Quartz
Rattling Tom
Red Californian
Saxon Fife
Smith's Nonpareil
Square-headed Sicilian
Stand-up
Steinwedel
Summer Club
Talavera
Thomas' Rust Proof
Tourmaline
Vermont
Victorian Defiance
Ward's Prolific
Ward's White
White Fife

It was found that the interest taken in these experiments had much increased, and he Department could with difficulty comply with the numerous applications for eed.

As soon as the wheats were harvested, the farmers were asked to reply in full to the following questions :—

1. Which of the wheats were new to your district?

2. Which have proved suitable to you?

3. Which, if any, do you consider to be better than the wheats already grown n your district?

4. Which of the wheats resist rust best?

And from the replies received, the following information has been collated :—

North Coast District.

(From the Hunter to the Richmond.)

1. Which of the wheats were new to your district? Very little wheat is grown n this district, and therefore in nearly every case the varieties were entirely new.

2. Which have proved suitable to you? The replies received indicate that Talavera is by far the most suitable variety for this district, next in order being Egyptian Mummy, Allora Spring, Medeah, Belotourka, Square-headed Sicilian, and Ward's Prolific.

3. Which, if any, do you consider better than the wheats already grown in your district? No wheats have previously been grown in the greater part of this district.

4. Which of the wheats resisted rust best? (1) Square-headed Sicilian; (2) Medeah; (3) Ward's Prolific; (4) Belotourka; (5) Egyptian Mummy; (6) Talavera; (7) Allora Spring.

South Coast District.

1. Which of the wheats were new to your district? Nearly all new.

2. Which have proved suitable to you? As was the case with the North Coast, Talavera proved to be by far the most suitable variety, next in order being Medeah, Egyptian Mummy, and Australian Wonder.

3. Which, if any, do you consider better than the wheats already grown in your district? Same as answer to question 2—viz., Talavera, &c.

4. Which of the wheats resisted rust best? (1) Medeah; (2) Belotourka; (3) Egyptian Mummy; (4) Talavera.

A half-bushel sample of Galland's Hybrid, sown at Pambula, gave a splendid return, and was entirely free from rust. Although this variety is said not to be a good milling wheat, it is a very useful variety for cultivation in this district for poultry feed, as it gives an enormous yield and is rarely affected by rust.

Northern Table-land.

(Tamworth, Armidale, Inverell, Glen Innes, Tenterfield, &c.)

1. Which of the wheats were new to your district? Nearly all new.

2. Which have proved suitable to you? Farmer's Friend and Talavera were considered to be by far the best, next in order being Steinwedel, Pringle's Defiance, Victorian Defiance, Blount's Lambrigg, and Smith's Nonpareil.

3. Which, if any, do you consider better than the wheats already grown in your district? Many of the farmers replied that the wheats which they had previously grown—viz., White Velvet, Purple Straw, White Lammas, and Steinwedel, were superior to the wheats sent out; but many others were in favour of Talavera and Farmer's Friend, and several in favour of Smith's Nonpareil and Pringle's Defiance.

4. Which of the wheats resisted rust best? (1) Square-headed Sicilian; (2) Talavera; (3) Smith's Nonpariel; (4) Medeah; (5) Australian Wonder; (6) Blount's Fife; (7) White Fife.

Southern Table-land.

(Albury, Tumut, Cooma, Wagga, Junee, Goulburn, &c.)

1. Which of the wheats were new to your district? Several of the varieties had been tried on a small scale; but, as a rule, they were new to the district.

2. Which have proved suitable to you? Steinwedel, Farmer's Friend, Talavera, Blount's Lambrigg, Smith's Nonpareil, Victorian Defiance, and Rattling Tom were all considered suitable. Allora Spring, Ward's Prolific, and Red Californian were also well spoken of in some parts of the district.

3. Which, if any, do you consider better than the wheats already grown in your district? Scarcely any of them were thought to be superior, but it was considered that Farmer's Friend, Blount's Lambrigg, Rattling Tom, Talavera, Red Californian, and Smith's Nonpareil were worthy of a trial on a larger scale, especially the first two varieties.

4. Which of the wheats resisted rust best? (1) Talavera; (2) Farmer's Friend; (3) Blount's Lambrigg; (4) Smith's Nonpareil; (5) Rattling Tom.

WESTERN DISTRICT.

(Bathurst, Orange, Forbes, Blayney, Mudgee, Molong, Wellington, Dubbo, Narramine, &c.)

1. Which of the wheats were new to your district? All but Steinwedel, Talavera, Farmer's Friend, and Blount's Lambrigg.

2. Which have proved suitable to you? Farmer's Friend, Talavera, and Steinwedel, were found to be the most suitable, next in order being Blount's Lambrigg, Smith's Nonpareil, Allora Spring, Rattling Tom, and Australian Wonder.

3. Which, if any, do you consider better than the wheats already grown in your district? Farmer's Friend, Talavera, Steinwedel, Blount's Lambrigg, and Allora Spring were said to be the best varieties, but only in a few instances did they prove superior to the wheats already grown.

4. Which of the wheats resisted rust best? The season was a very dry one, and but few of the crops suffered from rust. As far as could be ascertained, the following wheats were most rust-resistant:—(1) Blount's Lambrigg; (2) Talavera; (3) Allora Spring; (4) Smith's Nonpareil; (5) Farmer's Friend; (6) Ward's Prolific, Marshall's White. In the far West, at the artesian bore farms, some splendid returns were obtained from Allora Spring and Farmer's Friend wheats.

The experimenters were recommended to use the Jensen hot-water treatment for the prevention of smut, instead of bluestone and other solutions, with the result that they are unanimous in the opinion that it is superior to any treatment which they have previously tried, the crops being perfectly free from smut, and the percentage of germination increased.

At the end of which Mr. CAMPBELL said:

In conclusion, I may say that perhaps too much reliance is not to be placed on these reports from farmers. [Applause.]

DISCUSSION ON MR. CAMPBELL'S REPORT.

Professor SHELTON: What is the number of farmers involved in these replies? It may have been given at the outset, but I did not catch it.

Mr. CAMPBELL: 451 farmers.

Professor SHELTON: Did the number vary much in the different districts?

Mr. CAMPBELL: They were pretty evenly distributed.

Mr. FARRER: How many sorts did each farmer receive?

Mr. CAMPBELL: Each one got about ten or a dozen sorts. We had not enough to distribute every variety to each farmer.

Mr. MCALPINE: I would like to ask if anyone was sent to check these experiments? For instance, it is said that the hot-water treatment for smut increased germination in some cases and diminished it in others. Were these cases investigated?

Mr. CAMPBELL: I believe that in the majority of cases it increased germination; but Dr. Cobb will deal with the matter in his remarks.

Dr. COBB: There were no regular experiments made with the seed in this connection. It all came from Mr. Farrer's farm, and as there was very little smut last year we did not think it worth while to treat the seed, and so it was not treated at all.

MR. FARRER'S REPORT.

At the last Conference I had the privilege of indicating a line of action by means of which success in combating the rust pest can be secured—such a measure of success, at any rate, as is necessary to enable wheat-growing to become, as far as danger from rust is concerned, a fairly safe industry for farmers to take in hand in districts which are not too close to the coast. In order that this line of action might be entered upon, I offered to supply to such of the Governments of the different colonies as were in a position to take the matter in hand, seeds which had been produced by cross-bred wheats of the first generation from the cross, such cross-bred wheats having been made for the purpose of combining with ability to resist the rust pest suitability for our conditions and requirements. I pointed out that the diverse types which would be produced by such seeds would enable each colony to secure, by means of selection, individual plants that possess superior power of resisting rust, and fitness for its own climate and conditions, from which individual plants such varieties as we want could be made or fixed. From the, in most cases, rather meagre reports I have received in regard to the manner in which my cross-bred wheats have served the purpose for which they were distributed, I am led to think that I failed to point out sufficiently clearly what was to be expected from them, and in what manner they should be dealt with. It is my intention to endeavour to supply this omission in this paper, and to point out in detail the steps which ought to be taken for the purpose of getting such wheats as we want from my seeds. Before doing this I would wish it to be understood clearly that I myself went carefully through this work last summer, and that what I have to say has not merely been evolved from my own brain or imagination, but is the result of actual practical experience. The details I shall give, however, unfortunately do not represent the course I actually followed, but the routine I shall hope to go through next summer, when I shall endeavour to correct the mistakes and supply the omissions of last season.

Before I begin my description of the detail work of selecting the best plants for our purpose from the cross-breds, it will be well, I think, to dwell for a moment on the special difficulties that have to be overcome in making varieties which are both resistant of rust and suitable for our conditions and requirements. When, after some years of preliminary work, which I had been carrying on before these Conferences were instituted, I had become possessed of a number of varieties that were satisfactorily resistant of rust, I found they were all late sorts; and as our hot winds are apt to ripen late sorts prematurely, and before their grain has reached its full size and filled out, I saw that lateness of maturity was almost as serious a defect in a wheat for this country as its liability to rust. It became necessary, therefore, to make an attempt to combine earliness with the power of resisting rust. This, on the face of it, has the appearance of being a task which could be easily accomplished by crossing rust-resistant and early varieties; but when it is considered that it may be that earliness and resistance to rust are incompatible qualities, that early and late wheats are in bloom at different times, that early rust-liable and late rust-resisting sorts belong to different types, and that crosses between varieties which differ widely are on that account difficult and tedious to fix and uncertain as to the character of the types they will produce when they are crossed, it will be seen that the task is not entirely an easy one. I have found, as a matter of fact, that in breaking this new ground I have had to work largely in the dark, and to spend much time in doing such preliminary work as ascertaining accurately the different qualities possessed by the varieties I proposed making use of as parents, and the degrees in which they were able to transmit their respective qualities to their progeny. This work has now been sufficiently done with a few varieties for me to be able to feel some degree of certainty in regard to the outcome of many of the crosses I am making, but very much still remains to be done. The work I have already done, however, makes me confident that my work in the future will be more effective than it has been in the past, and that with a smaller expenditure of labour and time; while all doubts have now been removed in regard to the success which is to reward our efforts; but I can see that the full measure of success, which is necessary to satisfy me, will not come so quickly as I had at first hoped. Resistant wheats can only be made early gradually—step by step.

In order to combine the qualities of earliness of maturity and resistance to rust in one variety by means of cross-breeding, late rust-resistant and early rust-liable sorts, as I have already pointed out, have to be mated. It will be well to pause for a moment, and consider what we ought to expect from the union of types which differ so widely in these two qualities, as well as in others, such as the relative hardness, size, character of the grain, &c. What we generally see in the analogous case of the Animal Kingdom, with which we are more familiar, when parents, that are not closely similar, are united is that, if the progeny be numerous, certain individuals inherit some of their characteristics almost entirely from one parent, combined with other characteristics which they have inherited almost entirely from the other parent; while as regards the majority of their characteristics they are intermediate in various degrees between both parents; and when this happens in different degrees and in a different manner with all the progeny, it will be seen how it comes that no two individuals of the same parentage are ever exactly alike, and that the greater the dissimilarity of the parents the greater will be the difference between the offspring of the same union. I will attempt to illustrate briefly what I mean; and for this purpose will make the case as simple as I can, and apply it to the subject we are actually dealing with.

Suppose I have mated a rust-resistant late with a rust-liable early variety of wheat. The greatest diversity of types will be shown by the offspring which grows from seed of the first generation from the cross—from such seed as I am distributing. Suppose we have 100 plants growing from such seeds, which are of the same parentage. Out of this number I would expect there might be one or two—say one—which has inherited in a very high degree, possibly even in as high a degree as the parents themselves possess them, the qualities we are seeking to secure from both parents. A few more—say five—I would expect to inherit high rust-resistant power from one parent, associated with moderate earliness from the other; and five more to inherit a high degree of earliness with fair rust-resisting power. The remaining eighty-nine I would expect to inherit these qualities in various degrees intermediate between the two parents; and something of this sort is what I actually find to occur in most cases. The work, then, of the person whose business it is to make use of these 100 plants is essentially the work of selecting as many of these eleven plants as promise to fill our requirements; and that work, as I have found out from actual experience, requires for its successful performance the closest attention, care, patience, thoroughness, and system. With regard to the first four of these requirements I can, of course, give no help; I can only suggest that the work must be done in the field, and that it is impossible to do it anything like properly elsewhere. It is in connection with the last requirement that I hope to be able to give some help, and that I shall now endeavour to do.

As the principal quality we want to secure in the wheats we are aiming to get is that of offering resistance to rust, it is clearly important that we should seek to reject speedily and get rid of such plants as do not possess that quality; and as late planting is the means at our command by which rust-liability can be made to show itself with the greatest certainty, it is clearly advisable that we should plant our seed late. I do not think it advisable, however, to make this test an unnecessarily severe one, as it is not rust-liability under any conditions that we want to bring out, but rather to see what plants are rust-liable under the least favourable conditions to which they are likely to be exposed in ordinary farming. In recommending late planting, therefore, I do not think it ought to be made later than the middle of June; a most desirable time I would consider to be during the first half of June, and that the occurrence of rust will have been invited sufficiently for our purpose if the seeds are planted during that fortnight. As each plant has to be examined by itself for rust, closer planting in the rows than five inches from seed to seed will be found to be undesirable. A good distance between the drills is two links, or about sixteen inches. When they are that distance apart the work of examining the plants can be done with comfort.

After sowing, and until the plants begin to head, little work need be done beyond keeping down the weeds and occasionally breaking the surface of the ground with a Planet Junior or other hoe. A close study of the plants, however, during this period will often yield much that is of interest, and varieties can then often be separated by differences which cannot be seen at other times; but it is not until the plants begin to head that the work of selection begins.

The first thing to be noted in a drill of cross-breds is what plants are the first to come into ear. Such plants I am in the habit of marking with a black tie made from a strip of any cheap material that does not lose its colour from the weather and tears easily. The plants which show ears the first are not always the earliest to ripen or the most desirable; and in some cases in which the presence of a black tie shows that the time between heading and ripening has been long, the marked plant is rejected on that account. It would do at least equally well to mark the first plants that come into flower, instead of those that head the first; but in my own case it is more convenient to mark the latter. If any plant heads much earlier than any others in a drill, my custom is to mark it with two ties, and the next early ones with one tie. I generally mark about six plants in a drill for earliness in heading.

The time rust begins to appear is generally a few days after the plant has gone out of bloom. It is early enough, however, to make the first examination for rust about a fortnight after that time. It is probable that, in the first examination, only the lowest leaves will be found to be effected. If most of the plants in a drill are found to have rust on them, then those that are clean should be marked by a tie of a distinct colour. If instead of a few plants being clean, few are found to be rusty, then the rusty plants should be pulled up, and got rid of at once, and none marked.

Ties of different colours should be used for marking in each examination of a drill; but the same colour should be used for the same examination in all the drills—that is to say, if pink be used for the first and chocolate for the second examination for rust in a drill, these colours should be respectively used for the first and second examinations for rust in all the drills. In every case the date of examination, the number of plants marked, and all particulars which may be wanted, such as the degree of freedom from rust each particular colour is a record of in each drill, should be entered in a field-book at the time of examination. After this, until the plants begin to ripen, examinations for rust should be made at intervals of about a week. These examinations will disclose the fact that in general the first parts of the plant to be attacked are the lowest leaves, next the middle leaves, after that the upper leaves, next the leaf-sheaths, and last of all the stalk or the part of the straw between the highest leaf and the ear. Very few plants indeed, unless the season be one in which rust is remarkably scarce, escape having some rust on the lowest leaves; in a few more the middle leaves remain clean, while the number in which the upper leaves remain unaffected is comparatively large. It is for this reason that, in passing plants for freedom from rust, I draw the line above the leaves, and consider all plants which, in a season when rust is ordinarily prevalent, have the straw (leaf-sheaths and stalks) entirely free from rust to be satisfactorily clean. In selecting, however, the most desirable plants from which to fix varieties, I should, of course, give a decided preference to those with ties on them showing that their leaves had remained rust-free, as well as to those which appeared to possess the most desirable qualities in other respects. Periodic and fairly frequent examinations for rust, and coloured ties to mark the results of such examinations, are quite necessary, because rust that is on a plant one day may have been washed off by rain on the next, and because it is frequently impracticable, if not impossible, to tell with certainty after it is ripe whether a plant has been affected with rust or not.

The last examination for rust should be made when the earliest plants are beginning to show signs of ripening, or when the stalk is beginning to change its colour. In this examination two ties should be used, one—(dark-blue is the colour I use for this purpose) to mark those plants that have their straw entirely clean, and the other (red is my colour for this) to show those that are the first to ripen. If most of the plants in the drill have clean straw, I pull up the rusty plants, and enter in my field-book that all the plants left had their straw clean at this examination. If any of the plants are markedly earlier than all the other plants in the drill, I mark them by two red ties, and the next earliest ones by one. In all cases I mark about half a dozen of the earliest plants in a drill containing from eighty to 100. In selecting the earliest ripening plants, I mark those whose stalks change colour first. It is well, however, to be careful and to use discretion in this matter, as it frequently happens that plants ripen early because they are diseased. The appearance of the plant, and especially the manner in which the ears have filled, will show fairly well when this is the case. Plants that have ripened early because they are unhealthy should, of course, be rejected.

If the above system of marking has been carried out, the work of harvesting will be easy, and can be done quickly. One detail, however, which is essential, and should be continued in harvesting each generation until the variety is fixed, is that the plants be harvested separately, however much alike they may be outwardly, for I have frequently found that plants which were exactly alike, ard had for that reason been placed in the same bundle, have differed widely in the character of their grain. It is easy to keep the plants separate by tying each into a bundle by itself. Care, however, must be taken to place the tie which goes round the bundle below the coloured marking-ties; and for this purpose the marking-ties should be slipped up the stalks to which they are attached before the tie is placed around the bundle. The several bundles from the same drill should be made into a single large bundle, and a label on which are recorded the parentage of the plants, the number of the drill from which they were taken, the character of the straw, &c., attached to it. If any plant that is harvested differs widely from the other plants which were taken from the same drill in the character of its straw or in its habit of growth, the fact should be recorded on a special label which should be attached to its own bundle. In practice, however, it is not very often that I have had occasion to do this. The large bundles should be provided with a loop by which they may be hung up.

In dealing with each drill only a few of the most desirable plants are, of course, harvested. Some of the plants, which the coloured ties on them show to be desirable as far as resistance to rust and earliness are concerned, have now to be rejected on account of other faults. It may be because they have poor or bearded heads, or because their chaff is too thin or too loosely attached to hold the grain, or because the straw is brittle or weak. It will be well, also, in harvesting to look out for plants that appear only to have escaped rust because, from being unhealthy, they have been too deficient in sap for the parasite to thrive on them. Such plants, which are by no means uncommon, are betrayed by their pinched ears. They should either be rejected, or, if harvested, should be regarded with suspicion and the fact noted on a label attached to them. In regard to the time of harvesting it will be better not to do it too soon after the plants are ripe. If they are left for a week or two exposed to the wind and weather, faults in their straw become more apparent, and a better opinion can be formed of their ability to hold their grain.

If the process I have attempted to describe has been systematically and thoroughly carried out, and if the bundles can be put away in a place where mice cannot get at them, the thrashing may be deferred until shortly before the seeds are wanted for planting; for it is better, I believe, to allow the grain to remain in the ear for some time than to thrash it out at once. The history of the different bundles has been secured; for it is recorded on them by the coloured ties and by the labels attached to the large bundles, and can be transferred to the envelopes in which the seed is placed when bundles are thrashed.

There is another point to which I would like to draw your attention, because it seems to me to bear very directly on the work of selecting types to fix as varieties for our country. It is a matter in regard to which I am collecting data, and I hope to be able to throw more light on it at a future Conference; and it may be that, by now directing your attention to it, others will attend to it in the meantime. I have already suggested that plants which have matured early or resisted rust ought to be rejected at the time of harvesting, or, at any rate, if they are harvested, ought to be looked upon with suspicion, if they have many of their heads pinched. In harvesting plants separately it has become apparent to me that those which stool (tiller) the most very often have a large proportion of their heads pinched, and sometimes yield fewer ears that are filled with good grain than do scantily tillering sorts. This failure to satisfactorily fill their heads with grain often appears to be a fault which is attached to the variety; and as the plants which are in this way defective must have spent much of their strength, and have taken from the soil much of an already too scanty supply of available plant-food in forming the small worthless grains they have in their pinched heads, as well as in providing the heads themselves and the stalks which bear them, I am inclined to consider the habit of producing many pinched heads to be a serious fault in a variety. The improved English wheats seem to suffer more than others from this fault. In their case I think it arises from their having been improved or made for conditions that are widely different from our own—for moist land that is well furnished with available plant-food by manures; whereas our own wheat soils are in general comparatively poor and dry, and often too dry for manures to be available for the crop, even if our conditions were in other respects such as to cause the application of manures to be economical or even practicable. With us the English wheats which are so productive at home yield scantier crops than our own varieties, because they waste so much of their strength in forming useless material while they are preparing to produce a larger crop of grain than our land can furnish them food for. They have, in fact, too little root-force to collect food enough for our poorer and comparatively dry soils for all the heads they bear; for, in improving them, the proportion of foliage to root has been made to be too large. From the incomplete data I am as yet possessed of, I am inclined to think that varieties which do their work with us in the most satisfactory manner, and with the least waste of food and strength, are those which stool comparatively little. I notice, also, that those wheats which have a reputation in Europe of being the most suitable for poor soils are in general scanty stoolers, and little liable to produce pinched heads. I think this matter is worthy of our attention; and that for the present it will be safer, when we are selecting the most desirable plants from the drills of cross-breds, to reject those which have any or more than a very small proportion of their ears pinched.

A fact which recently came under my eyes is suggestive, and may be worth bringing before you. It is this: Shortly after I had finished harvesting the selected plants from my drills of cross-breds, we had four days of continuous warm rain. At the end of that time, when I went amongst my unharvested wheats I found that the grain in the heads had mostly sprouted, but in the plants which had pendant heads, and especially if the chaff was close-lying, very few, if any, of the grains had germinated. Certainly it is not often that there is danger in this country of grain sprouting in the ear before it is harvested; but I can see that the danger can be made very small by making our wheats to have pendant or drooping ears and close-lying chaff. I recollect, also, to have read somewhere that, when the chaff is close-lying and covers it well, the grain has thinner bran on that account.

I would like to say a few words on just one other subject. My plan of making a large number of crosses has been criticised; but I have reasons for it. I have already mentioned that, in consequence of its being new ground that I was breaking, much of what I have done has been to a great extent haphazard work. I have had to find out for myself the principles to follow in order to make my crosses successful. It would be useless for me to attempt to generalise for this purpose without having a large number of facts at my command. I have made my crosses numerous in order to become possessed of such facts. My plan has also been rational when it is viewed from another aspect. A Lord Rivers, who was remarkably successful with his greyhounds, when asked how he came to be so successful, answered: "I breed many and hang many." I am following Lord Rivers' example, and am breeding many cross-bred wheats; but I give them to others who can try them for themselves, and the large majority they find to be without value they can hang.

Discussion on Mr. Farrer's Report.

Mr. McAlpine: I would like to say that the paper just read by Mr. Farrer will be of very great use indeed. He has been generously supplying all the Australian Governments with cross-breds, which it is important we should use to the greatest advantage, and he has just now given us the best method to make the most use of them. Now, referring to this paper, there are one or two points on which I would like to speak. First, the examination of plants for rust. I think it is best, as far as is practicable, to inspect the wheat three times; first, just before heading; secondly, just after heading; and finally at ripening. I do this because you will find plants sometimes without any rust which were on a previous occasion considerably affected; and so although at harvest no rust may be found visible on a plant, yet it has been there and done its injury. Therefore the fact ought to be recorded against it. There is another point which is very important. What degree of rust are we to consider necessary to decide whether we are to retain or reject a variety? This is a critical point, and I am very pleased to find as a coincidence that Mr. Farrer has adopted the very same plan as myself. When the rust appears on the sheath or stalk, I think that the variety is one that should be rejected, and I am pleased to find that Mr. Farrer, with his large practical experience, adopts the same view.

Mr. INGLIS: I fully endorse all that Mr. McAlpine has said, and think that great praise ought to be given to Mr. Farrer for his valuable services, and for the encouragement he has given others to take up the work he has been so successfully carrying on. Now, with regard to one or two points in Mr. Farrer's address. He says you will very seldom see the rust appearing until after the bloom is off. But in South Australia we often see it before the wheat comes into head at all. In fact we frequently see it before the plants are 6 inches high. So it appears to me that rust appears earlier in South Australia than it does in New South Wales. Again, we have never experienced what Mr. Farrer has said about the rain washing off the rust. With regard to the proper time for sowing, as a rule I think May is the best month in South Australia.

The CHAIRMAN: We have had that statement at previous conferences about the rain washing off the rust.

Professor SHELTON: All that has been said by previous speakers, not only about this particular paper, but about Mr. Farrer's work in general, I can heartily endorse. I believe he is doing the greatest work of the kind in the world. I am sure this Conference is under deep obligations to him in this way, and now he crowns it all by taking us completely into his confidence and giving us his methods of work, the details of his industrious labours, and the means by which the work shall be continued to the end. I have not always shared his enthusiasm—that he knows as well as I—in respect to the outcome of cross-breds. In the experience of years as a stock-breeder, and in my reading on the subject, I have noticed that cross-breeding among animals, with a view to ensure certain definite results, is a long and tedious process, and the outcome of it is most uncertain. I am inclined to fear that such will be the case with many of these crosses. We may, perhaps, have to wait many years in order to get the results he hopes for. Nature seems to abhor crossing in the wheat plant. She has taken the precaution to enclose its organs of generation in receptacles which are impervious to outside influences. Though different sorts may be planted side by side, they rarely if ever cross. Nature seems to have made strenuous efforts to prevent this work which our friend is so busy in trying to carry out. I think there must be some reason for it. At any rate, I hope we may reach all the good results which are expected from the cross-breds. It appeared to me, in listening to Mr. Farrer's paper, that there is great need for the members of this Conference in their experiments to add and increase the number of signs by which the tendency to rustiness is detected in the plant at all its stages, so that the process of culling out may be done from the first. Now, we have done a good deal of this. Dr. Cobb has made out a number of such signs. He told us that the glaucousness is a most valuable token, and now Mr. Farrer tells us to steer clear of wheats that tiller much. This latter, I think, is a most valuable suggestion, and it occurs to me that what he says is true—namely, those sorts which tiller the most are not the most desirable, although, as a rule, it is reckoned a valuable quality. In fact, I think the most valuable wheats are those which tiller the least. This is all I have to say on this matter just now; but I can only state in conclusion that, as far as the cross-breds are concerned, many of those which I have handled have proved to be most promising. By pursuing the plan laid down in this paper of Mr. Farrer's, and by rigorous selection, by culling out to an ideal plant, our results will perhaps not be the same, as each of us will probably cull out to a different standard of excellence; but I sincerely hope Mr. Farrer will go on with his work, for I believe that the best results will be obtained when each follows his own plan, seeking to obtain those results to which he has been aiming from the start.

Dr. COBB: I have only one point to call attention to. Although Mr. Farrer has given us most detailed and perfect accounts of the crosses and crossings, and has, I am convinced, taken the right step in that direction, yet I am satisfied they will never reach the farmers to the extent we could desire. Some time ago Mr. Farrer wrote a short and very simple paper on this same subject for the former Director of Agriculture in New South Wales, and this paper was sent to the different farmers to whom the cross-breds were issued. I may say we have distributed Mr. Farrer's cross-breds to all those farmers whom we considered would be most likely to use them to the best advantage. Well, then, with these cross-breds we sent this statement of Mr. Farrer's as to how the selection was to be made, and although these directions could not have been simpler or more explicit, I found to my surprise that the attempts to carry them out were failures. Consequently, the second year they were only sent out to the best men, and last season I went to three of the places where it should have been done properly, and in those three cases the work would not have been carried out if I had not done it myself. After I did do it, one of the farmers said it was very easy when he saw what was wanted. My main idea in speaking is that, having worked this plan out ourselves, we should take particular pains to show farmers again and again what the plan really is. I wish to call the special attention of the members of this Conference, who, no doubt, will read and re-read this paper of Mr. Farrer's, to the necessity of their adopting this plan, and improving on it as circumstances suggest, for on the whole, I think it better to see what previous people have done, and try to improve on their results, rather than to make plans of one's own, which usually only waste time and breed confusion.

Mr. Marshall: There are one or two subjects with which I would like to deal. First about the late planting. In South Australia late planting is not always necessary in determining the most rust-resistant wheats. It frequently happens that the earliest planted are the most taken by rust. This was especially so in 1867. All the early sown wheats were first destroyed, in fact were the only crops that were absolute failures. Crops sown in August produced good grain. There was another thing which happened: On the 7th of October of the same year, a violent hailstorm passed over my district, cutting down all the wheat, so the result was that wherever the hailstorm occurred the wheat was taken off from plants which had sprung up in October, and in all cases these plants produced good grain. Again, in 1877—I am speaking from memory—the early sown crops were failures, and the late comparatively free. I remember similar instances in other years. I can agree with Mr. Farrer in reference to tillering. In our dry climate I think it is very undesirable that we should sow wheats which are heavy stoolers. Mr. Farrer says that rust generally appears about the time that wheat is in bloom. With that I agree thoroughly. Still, in 1877, I think that rust appeared very early, and in May could be seen anywhere. It continued throughout the whole year, but the late sown crops were not nearly so much attacked as the early. I have seen rust in our wheat fields in August; but by feeding the plants down we have found that they have been the better for it, thus showing again that early crops do not always escape rust the best. Next we come to the question of rain washing off rust. I have never noticed it. I can remember one year, somewhere about 1880, the rust was very bad in the beginning of October, and increased very rapidly. A little later on we had extremely heavy rains, but after they were over the rust was still plainly visible on the plants. A friend of mine once told me that the rust had been washed off his crop, and that the wheat from it afterwards got a prize at an agricultural show; but I myself have never been able to wash it off. I have tried to scrape it off with a knife, but could not. Mr. Farrer's paper is a most practical one, and he deserves the hearty thanks of every colonist. In fact, I hope his own will reward him substantially. It would give me the greatest pleasure to contribute myself towards a testimonial for Mr. Farrer.

Mr. Farrer: My paper was written for this Conference not for the general farmer, who has not time to go into its details. With reference to the point about rain washing off rust, I may mention that I had a man going through the wheats, and his plan was to mark each plant that was quite free from rust at a certain stage, and it was remarkable that whenever the weather had been wet, how often it happened we could not find traces of rust on plants which had been left unmarked. I afterwards gave some attention to this matter myself, and examined plants which I knew for a certainty to have been rusty, and found no rust upon them except the black rust and the rust under the cuticle. Sometimes having looked into some of these plants where the rust had been washed off, I took occasion to strip them, and found the rust in masses under the sheath. There is no doubt about this washing off.

Mr. MARSHALL: I have noticed that if you strip the sheath of a plant which appears to have very little rust, you will find some red powder, but I don't think the rain washed it there. I have frequently found it there when there has been no rain, and I regard it more as a natural consequence.

Mr. MCALPINE: Mr. Marshall has spoken about the time of the appearance of rust being usually about the time of bloom. Now, the question is, which is the best time to examine a variety of wheat for rust, so as to know whether you are to retain or reject it. I find that the time of rust appearance is very variable, so I have usually made it a rule to examine before heading, after heading, and finally when the plant is ripe. I think farmers are largely misled by appearances, and thus we often see that though rust is not externally visible on a wheat, yet it has been there, and done its damage. This makes me also think that the question of rain washing off rust is one of minor importance, for if the rust has been on the plant, it has injured it, whether it is washed off after or not. With regard to Dr. Cobb's remark that he does not believe there are many farmers who will carry out these ideas, I do not think Mr. Farrer intends or expects the farmers to do so, but rather certain trained individuals having special facilities; and this, I may here state, is a matter which all the colonies will have to attend to. To do this work properly, you must do it by yourself; and I have to say that there is a student, a prizeman at one of our agricultural colleges, who has helped me in this matter, and into whose hands I hope to be able to put this work on future occasions. But what I wish to point out is that such work as that proposed by Mr. Farrer can't be thrust into the hands of the ordinary farmer, but must be in the hands of someone specially trained. I have nothing to say against Professor Shelton's remarks about cross-breeding; but I would like to call attention to what he said about signs for rust. I think we should be very careful in coming to conclusions with reference to this matter. For instance, take some of these signs or qualities. Early maturity is reckoned a good quality, but, as Mr. Marshall has pointed out, it also has its exceptions. Then comes glaucousness, which is not always associated with the absence of rust; as a matter of fact, I do not consider it a desirable quality always to encourage. Then we have stooling. I think Professor Shelton said those sorts which tiller most are not the most rust-resistant.

Professor SHELTON: I would not go too far on that point. I say that I have found that those sorts which stool most are most inclined to be rust susceptible.

Mr. MCALPINE: The ten Swedish wheats I got from Sweden were sent to me because they were the most rust-resistant of wheats in that country. Now, these sorts are characterised by their wonderful stooling properties. In our colonies these wheats have been very liable to rust, but still in Sweden they stool well and are also rust-resistant. Thus while it is very desirable to have plenty of these tokens which show rust liability, yet we ought to be very careful in coming to definite conclusions, considering the imperfectness of the information at our command.

Mr. CAMPBELL: We all agree that it is very fortunate to have such enthusiasts as Mr. Farrer. Mr. McAlpine has just pointed out that it is almost impossible to get farmers able to carry out this work exactly, and as there is a great difference in localities, every district will require its experimental plots to determine the rust-resistant and other qualities, good or bad, in the various wheats. For instance, take glaucousness. Is wheat which is glaucous in one locality glaucous in another? So that, I think, unless we can find men of exceptional ability, like Mr. Farrer or Mr. Marshall, to carry out experiments in different districts, the various Governments will have to carry them out themselves. In New South Wales you may depend that Dr. Cobb will do his utmost to have this work thoroughly carried out as far as financial considerations will allow, and I believe it will result in the development of many other valuable qualities in addition to rust resistance. I would have liked Mr. Farrer to have spoken more fully on the application of manures, by which I mean more particularly artificial manures. These are often useful when there is plenty of moisture in the ground, but otherwise they will perhaps do more harm than good. This subject, I think, is an important one, and one on which farmers should be given information.

The CHAIRMAN: I was much interested in Mr. Farrer's paper, and it struck me as rather peculiar that in selecting a colour with which to mark his wheats he placed all his crops in mourning. I would have thought he would have wished his fields to look gay and joyous and so have used some other colour, say white, instead of black. However, with reference to the question when rust appears. Mr. Inglis says it is often seen in South Australia when the wheat is six inches high. We have it here when it is not three inches in height. Then about the time of planting. We must remember that the delegates here represent a vast deal of country, and that it is impossible to say which is the correct time. If we say you should sow in June, the people in the North, who reap their crops in September, would be a long way out of their reckoning if they adopted the suggestion. I have known wheat to be sown in August, and a good crop reaped from it, but I think here early sowing is the best. Climatic conditions are, however, important, and should be taken into consideration. We must have our seeding so as to have our crop in as full head as possible just at the season most favourable to the development of the rust contagion. It is comparatively easy to have the experiments spoken of in some of the southern colonies, but in Queensland it is a matter of great difficulty. At present we are about to enter upon a series of experiments extending over a region 800 miles in length, so you can appreciate some of the difficulties we have to contend with. Our experiments will reach from Warwick, on the borders of New South Wales, up to Herberton, in the very Northern portion of the colony.

Dr. COBB, on being called for his report, said: I have not a set paper to read, and so will only speak in reference to one or two points. There is no doubt that in New South Wales rust is washed off by rain. But there is also no doubt of the fact that you can tell whether it has been there. If it has been there and burst through the cuticle, it is gone; but it has left its mark. With regard to a previous question of Mr. Farrer's about rust under the cuticle, I think climatic differences have to be taken into consideration. I learn from Mr. McAlpine that the appearance of rust under the cuticle is very common in Victoria. The rust which gives the black appearance to the straw is not common in New South Wales, the red form being the one we chiefly have to deal with. The rust, however, does undoubtedly appear under the cuticle without breaking out. Should it appear after the time the crop is still growing and maturing its grain, it should have a direct bearing upon our selection.

Mr. McALPINE: We find the black rust in every case at the bottom of the stalk. The black rust, however, is, I think, only a stage of the red rust. This is a matter in which the use of trained specialists in examining the wheat plants for rust is a necessity.

ALLEGED HESSIAN FLY.

The CHAIRMAN: Mr. Henry Tryon has brought under the attention of Dr. Cobb an insect which he has captured in Queensland, and which he thinks closely resembles the Hessian fly. So far as I know, the Hessian fly has not yet been introduced into Queensland, but no doubt members who take an interest in such matters would like to examine this particular insect.

The fly, a live one in a box, was then handed round, Mr. CAMPBELL remarking that he believed the Hessian fly was in New Zealand.

MR. McALPINE'S REPORT ON RUST IN WHEAT EXPERIMENTS IN VICTORIA, 1893-94.

The report, for 1892-93, already published and placed in your hands, gives the results of experiments and investigations carried out as suggested by the last Rust Conference, held in Adelaide in March, 1892. A good deal of preliminary investigation was necessary to prepare the way for future definite and decided action, so that now the distinct course has been decided and acted on of finding out the varieties of wheat best adapted to different climatic districts by a process of careful selection, judicious crossing, and subsequent fixing. As I have put it in the published report: "The next best thing to having succeeded is to have discovered the road which leads to success, and this the Rust Conference has now done, and is following it up." We have succeeded in obtaining rust-resistant wheat as the sequel will show; that is, wheats which have successfully resisted the rust for several successive seasons under conditions favourable to its development. The main object of this Conference, as I take it, will be to devise the best and most practical measures for concerted action in this direction, and to show clearly to the wheat-grower that progress has been made in averting the loss due to rust. In the present report I will deal mainly with two leading lines of investigation: 1st. The experiments in wheat culture conducted at the School of Horticulture, Burnley; and 2nd, The wheat-testing experiments carried out by farmers in different districts of Victoria.

I. RUST IN WHEAT EXPERIMENTS AT SCHOOL OF HORTICULTURE, BURNLEY.

This is the third season in which experiments with different varieties of wheat and their greater or less liability to rust have been carried out at the School of Horticulture.

The soil of the experimental plots is not well adapted to wheat-growing, as it is a poor stiff clay and practically undrained. It is, therefore, a pretty severe test of the rust-resisting power of any variety of wheat, especially when sown so late as in this instance; but this locality was mainly chosen for temporary purposes, because it is convenient to Melbourne (between three and four miles distant), no small advantage in a matter requiring periodical and careful inspection.

Owing to circumstances over which I had no control, the time of sowing was very late—from 8th to 15th August. The ploughing was finished on 7th August; then two and a-half bags of bonedust were applied, and sowing commenced. To stimulate growth, a dressing of sulphate of ammonia was given on 26th October.

Plots.—The wheat plots are arranged in three longitudinal rows, designated I., II., and III., each row with six divisions, marked with plain numbers, and each division with a certain number of plots, as shown by the consecutive small numbers. In the first row the divisions are 40 feet x 12 feet; in the second, 40 feet x 9 feet; and in the third, 40 feet x 15 feet. Owing to imperfect drainage, in wet weather the water lodged round some of the plots. In these cases germination was retarded, growth stunted, and the yield poor. It is important to remember this in comparing the experimental results obtained. In Divisions 7 and 8 the growth was superior to any of the others, no doubt owing to a quantity of wood ashes which happened to be there. The working of the plots was entirely done by occasional student labour, my principal student assistant being Patrick O'Dea.

Source from which Varieties or Crosses were Obtained.—There were 285 plots altogether, containing 145 different varieties or crosses. These were obtained from the following sources, and to all who contributed samples the thanks of the colony are due:—

	Varieties or Crosses.
1. H. C. L. Anderson, Esq., M.A., late Director of Agriculture, Sydney	61
2. Wm. Farrer, Esq., Lambrigg, Queanbeyan, N.S.W.	34
3. Professor Blount, College of Agriculture, New Mexico	12
4. R. Marshall, Esq., Templers, S.A.	12
5. Professor Eriksson, Stockholm, Sweden	10
6. P. McLean, Esq., Under Secretary for Agriculture, Brisbane, Q.	7
7. Experimental Plots, School of Horticulture, Burnley, V.	7
8. Principal T. K. Dow, Longerenong Agricultural College, V.	3
9. From various sources—Purple Straw, White Tuscan, Frampton, Noe	4
	150

Of these 150 samples sent, there were 145 of them presumably distinct varieties or crosses.

Nature of Season.—The season showed 0·86 inches above the average rainfall, the total for the year being 26·81 inches, but very unequally distributed. The first quarter of 1893 was considerably below the average—viz., 3·84 inches, the other three being above it. The heaviest rainfall occurred during the month of May, when it was nearly twice the average. The rainfall for the months previous to sowing was practically the same as for the remainder of the year (Appendix A).

Naming of Cross-bred Wheats.—It is customary, in naming crosses, to give the male parent first, followed by the name of the female parent; but, as given by Mr. Farrer, the first name always indicates the female parent, and the × is used to indicate fertilised by the male parent, the name of which follows. Thus Anglo-Australian (crossed by) × Hornblende indicates that the pistil of Anglo-Australian was fertilised with pollen taken from Hornblende. Where a third name occurs, as follows: (Blount's Lambrigg × Hornblende) × Hornblende; then it denotes that the pistil of the cross-bred was fertilised by the pollen from Hornblende. It is desirable, however, to name all crosses according to the system generally adopted.

Degree of Rustiness.—I have already in the printed report for last year adopted a scale of rustiness which need not be repeated here. It is necessary, however, to explain that in the decimal notation employed, extending from absolutely rust-free or zero to rotten with rust or 10, the scale indicates that the rust is confined to the flag, moderate when on flag and sheath, and it is only reckoned bad when it attacks the stalk. All the slightly rusty wheats have been retained for further trial, because they are such as would be regarded as satisfactorily rust-resistant by the farmer. Those marked with an asterisk have been tried for at least two successive seasons with good results.

(*a.*) During the past season there were *three* varieties absolutely free from rust (that is, which showed no rust in any of the plots), viz.:—

1. D'Arblay's Hungarian
*2. Carter's Pride of the Market
*3. Sicilian Baart.

In the previous season, 1892, none were found absolutely rust-free in all the plots

(*b.*) Of those found rust-free in some of the plots, but not in all, there were *nine* kinds, viz.:—

*4. Blount's Fife × Ward's Prolific
5. Blount's Lambrigg × Ward's White
*6. Durum
7. Jock × Sicilian Square-headed Red
8. Jock × Ward's Prolific
*9. Medeah
*10. Polish
11. Sicilian Square-headed Red × Hornblende
12. Sicilian Square-headed Red × Ward's White.

In the previous season there were only three varieties, viz.:—Carter's Anglo-Australian, Medeah, and Summer Club; the latter, however, was not grown this season.

(*c.*) Of those practically free or very slightly rusty in all the plots, there were 39 kinds, viz.:—

13. Algerian
14. Allora Spring
15. Anglo-Australian × Hornblende
16. Bearded Centennial
17. Bega
18. Blount's Bancroft
19. Blount's Farrer's Durum
20. Blount's Fife × Saskatchewan Fife
21. Blount's Fife × Vermont
22. Blount's Hebron
*23. Blount's Lambrigg × Hornblende
24. Blount's Mexican Blanco
25. Buckby's Rust-resistant
26. Chatsbury × Hornblende
*27. Fultz
28. Fultz × Hornblende
29. (Hornblende × Blount's Lambrigg) × Hornblende
30. Hornblende × Indian D
31. Hornblende × Leak's
32. Hornblende × Sicilian Square-headed Red
33. Hornblende × Summer Club
34. Hornblende × Ward's White
35. Indian Pearl
36. Italian
37. Marshall's No. 8
38. Marshall's No. 10
39. Marshall's No. 15
40. Marshall's No. 17
41. Marshall's No. 34
42. Marshall's No. 1 × Ward's White
43. Mexican
44. Red Fife
45. Red Straw
*46. Russian
47. Saskatchewan Fife
*48. Tourmaline
49. (Vermont × Hornblende) × Hornblende
50. Victorian Defiance
*51. White Fife.

(*d.*) And of those slightly rusty in all or some of the plots, but bad in none, there were 31 kinds, viz. :—

52. Bearded Herrisson
53. Bega × Hornblende
54. Bestehorn
*55. Belatourka
56. Blount's Fife × Hornblende
57. Blount's Fife × Ward's White
*58. Blount's Lambrigg
59. (Blount's Lambrigg × Blount's Fife) × Hornblende
60. (Blount's Lambrigg × Hornblende) × Hornblende
61. Brown-eared Mummy
62. Canning Downs
*63. Carter's Anglo-Australian
64. Early Baart
65. Eldorado
66. Frampton
67. (Fultz × Blount's Lambrigg) × Hornblende
68. Hercules
69. (Jock × Blount's Lambrigg) × Hornblende
70. Judkin
71. Ladoga
72. Marshall's No. 9
73. Marshall's No. 33
74. McCaulay's Rust-resistant
75. Pride of the Market × Hornblende
76. Pringle's No. 5
*77. Robin's Rust-resistant
*78. Smith's Nonpareil
79. Summer Club × Hornblende
80. Thomas' Rust-resistant
81. Ward's Prolific
82. Ward's White × Hornblende.

During the past season there were thus 82 varieties or crosses out of a total of 145 different kinds, which were either free from rust or only slightly rusty, and therefore worthy of further trial. At least 15 of these have successfully resisted the rust for two years in succession, and some, such as Smith's Nonpareil, have a favourable record as regards rust for three years in succession. But perhaps the most remarkable feature of the list is the number of Mr. Farrer's cross-breds which figure there. Every one supplied by him during the past season is characterised by the possession of rust-resisting properties, and no words of mine could be a higher practical tribute to the rare skill and judgment and patience with which he has followed up *the* most promising line in connection with the solution of the rust problem than this fact.

Treatment of Seed.—Treatment of the seed for the prevention of rust is the favourite remedy with most persons who have turned their attention to the subject, and the periodical suggestions made to rid the country of this terrible pest usually take the form of some kind of treatment of the seed which in their experience is always efficacious. I have to deal with such persons, and a trial on a small scale usually convinces them of their folly. Thus one (a clergyman) soaked seed in kerosine; another (a chemist) treated the seed with a special preparation of carbolic acid; a third (a farmer) sent seed treated in some unknown way; a fourth recommended steeping the seed in a solution of bluestone and human urine, and so on. I considered it advisable, therefore, as an object lesson for farmers and others, to treat the seed in a variety of ways and see the effect as regard rust. The seed was treated in twenty different ways (including hot water), as detailed on page 26 of Report, and in every instance rust appeared. The treatment of the seed has not been found to prevent the rust in any one instance when the experiments are properly conducted and a number of different varieties grown together, so that I felt justified in stating—"These results bear out what has already been expressed, that the treatment of the seed for rust is a delusion, and farmers of an experimenting turn of mind will do well to direct their energies to some other mode of combating or practically preventing the rust." During the past season the hot-water treatment of the seed was the only one tried.

Hot-water Treatment of the Seed.—The hot-water treatment of the seed was carried out comparatively on 124 plots—that is to say, there were 124 plots untreated alongside of the same kinds treated. Unfortunately the comparison between the two kinds of treatment is not strictly fair, because a number of those plots, the seeds of which were treated with hot water, were on the outside row, where the water lodged, and so were at a disadvantage. The treated were often found more advanced than the untreated, and the treatment seemed to improve the germination, when the conditions were, as near as possible, similar. The experiments of last season, however, seemed to show that the treated were more backward in the early stages of growth, and that the ripening was somewhat retarded.

Taking the plots as they stand, there was a much larger relative proportion of the untreated grain which germinated than the treated. Out of an equal number of treated and untreated grain sown (5,400), 1,927 of the untreated germinated, while only 1,603 of the treated did so.

Smut only appeared in three of the plots—viz., Fillbag, White Essex, and Noe, the latter having been treated with hot-water.

Germination of Seeds.—It is shown that in none of the 285 plots did the seeds entirely fail to germinate, while in only a few was there full germination.

Five plots germinated 100 per cent., as follows :—

Untreated.—Thomas' Rust-resistant and White Essex, both from Sydney.

Hot-water Treatment.—Belotourka, Farrer's Durun, and the Blount.

The wheats in Division 7 were the first to appear, owing no doubt to the quantity of wood ashes upon it.

Time of Heading.—As regards the time of heading, the great majority came out in ear about the end of November, but Blount's Hudson and King's Jubilee headed as early as the middle of November. The Swedish wheats were all late, with the exception of Bestehorn's and Beseler's Brown Club-head, which headed about the end of November, the others not coming into ear till early in January.

Glaucousness.—While the waxy bloom on the flag, sheath, or stem of the wheat-plant will act in the direction of preventing the spores of the rust finding a lodgment there, still I do not consider it a desirable quality to encourage. It was noticeable in the plots that the poorer the plants the heavier was the coating of the waxy bloom, and indeed it seemed to be an indication of unhealthiness. Wherever any portion of the crop was subject to unfavourable conditions—such as a poorer soil, a surplus or a scarcity of water—there numbers of plants were found thickly covered with the bloom. Anything which tends to prevent the free and healthy action of the stomates or breathing pores will exercise an injurious influence on the plant; and while, on the one hand, this waxy bloom clogs up the entrance for the tube of the germinating spore, on the other hand, it will prevent the free play of gases inward and outward.

Kind of Rust.—This is a matter of little or no concern to the practical farmer. It is sufficient for him to know that it is rust, and that it injures his crop. But, apart from the scientific interest of determining the particular kind of rust, it has an important practical bearing. There are at least two kinds of rust which concern us—*Puccinia rubigo-vera* and *Puccinia graminis*, the former recognised in Britain as being much milder in its consequences than the other. In settling the host-plants subject to the rusts affecting our wheat crops, and which it is desirable to destroy, it is evidently advantageous to distinguish the actual kind of rust which is being propagated. Now, the so-called "black rust," which succeeds the red rust, is just another form of it; and the spores—teleutospores as they are technically called—enable us easily to distinguish the kind of rust from their distinctive characters. I have carefully gone over all the plots, taken specimens of black rust wherever found, and submitted it in each case to microscopic examination. In every case *Puccinia graminis* was the rust present, although in some instances it may have been intermixed with the other, or *Puccinia rubigo-vera.*

I have endeavoured in this Report to bring the results obtained to a focus and to show that there are certain varieties of wheat grown in certain districts absolutely free from rust. Twelve such wheats were grown during the past season in the experimental plots, and while it requires a longer trial to test their rust-resisting power and to test this power in different districts, still it may safely be affirmed, notwithstanding the assertions of some that rust is climatic, that it is a dispensation of Providence that it cannot be cured and must therefore be endured. It may be affirmed that by judicious selection and crossing and subsequent fixing, varieties can be obtained and have been obtained, as the members of this Conference can conclusively show, capable of resisting the rust even in a climate such as ours. Farmers are wanting such wheats, and the labours of the Intercolonial Rust in Wheat Conference ought to provide them.

But more is wanted than a rust-resisting wheat for the farmer; it must be a saleable wheat, one that the miller will buy on account of its suitable milling qualities. This is a matter which I leave to be settled by other members of the Conference, but it seems to me that the miller has become such an important factor in connection with the selection of wheats on account of their rust-resisting qualities, that he should be represented at any future Conference.

In these days of low prices, every wheat-grower must not only endeavour to improve the quality of his produce, but also to increase the yield, in order to make up for the deficiency in price, and therefore a good yielding wheat is another necessity.

Granted that all this can be done for the farmer, the question still remains how best can it be done. Speaking generally, I think it can best be done by having wheat-testing stations in representative districts of each colony working on a common plan and for a common end, and a head-quarters or distributing station, where tests are carried out and experiments made under conditions that render them absolutely reliable and serve as a check upon the outlying stations. Applying this to Victoria, I consider that by means of advanced students chosen as student-assistants at our two Agricultural Colleges—Dookie and Longerenog—and a well-chosen central station, this might be done, with the addition of subordinate test experiments carried out in the Mallee and elsewhere, as was done during the past season by farmers chosen on account of their skill by the agricultural societies or otherwise. This plan need not involve any considerable outlay, and should be capable of providing rust-resistant varieties suited to the different climatic districts of the colony. Self-supporting seed-farms might also be established, where the farmer could obtain the necessary seed of any required kind of wheat which had been proved to be satisfactorily rust-resistant for the district in which it was intended to be grown on a large scale. The necessity for testing wheats in different districts is indispensable for the complete success of our scheme.

II.—Farmers' Wheat-Testing Experiments.

During the past season the services of farmers were enlisted in testing promising varieties of wheat, and noting their suitability to their several districts as well as their behaviour towards rust. The accompanying circular, with form for replies to wheat-testing experiments, explains the nature and object of this work. The principal varieties experimented on for a start were ten Swedish wheats, having the reputation of being more or less rust-resisting there; the seed of which was kindly supplied by Professor Eriksson, of the Experimental Station, near Stockholm. He sent them as samples "of the most rust-resistant of our wheats for experimenting with in your country." It is generally recognised that one year's trial is not sufficient to test the practical value capabilities of a new variety, especially when it has to become acclimatised, and accordingly several farmers are giving the more promising of the Swedish wheats a second year's trial.

About twenty replies have been received up to date, and generally these varieties are found to be unsuitable to the colony, very late in ripening, and sometimes very rusty. They are all fairly good stoolers, Schiff yielding as many as fifty-seven stalks from one grain, and the late sown wheat stooled more than the early sown. Some of them are noted as heavy yielders, such as Urtoba, Schiff, Square-head, and Count Walderdorff, and the grain of the two former particularly is considered first class by experts.

The actual results obtained in a few cases are given with remarks upon them :—

In County Rodney some very careful experiments were carried out by Mr. A. Barron, Toolamba, under the auspices of the Tatura and Goulburn Valley Agricultural Association, and by Mr. Gerald H. Robinson, of Ardmona. The late sowing—about the middle of June—prevented the heads filling when the dry weather set in as much as they otherwise would, but the effect of earlier sowing will be tested this season. The soil in both cases was a red chocolate with clay bottom. Results show that at Toolamba no rust appeared, the yield was generally light, and Urtoba on the whole yielded the best. Mr. Barron believes that some of the wheats will be very good by the look of them.

At Ardmona the rust was slight or very slight on them all, but not sufficiently bad to do perceptible damage. The yield of Square-head was particularly good, and the stooling remarkably heavy. The grain of Schiff is of the kind desired by farmers—white, plump, and of good size, and therefore a desirable variety to cultivate. Mr. Robinson remarks that from the experience gained by this one season's experiments, a distinct advance has been made towards procuring a rust-resistingwheat which will answer the requirements of both millers and farmers.

In County Anglesey the samples were sown by Mr. J. Morison on a light loam, on 25th May. Heading took place about the middle of November, and the time of ripening was early in January. The best yielders were Schiff and Urtoba, with 2lb. 5oz. each; Ultuna Red-bearded, with 2lb. 1oz.,; Besthorn's and Beseler's Brown Club-head, with 2 lb. each. Dwarf only yielded 15 oz. Only one variety was free from rust, and noted for not being waxy—viz., Ultuna Red-bearded. The average number of stalks from each grain varied from twenty (Square-head), twenty-eight (Ultuna Red-bearded), to the highest, twenty-nine (Count Walderdorff).

In such a large wheat-growing country as the Mallee, it is very desirable to test a number of varieties in order to find out those best suited to the soil, climate, early, fairly rust resistant, good milling, and good yielding wheats. On applying to Mr. Lascelles, he willingly agreed to try any varieties I wished, and accordingly samples were sent to Lakeside Experimental Farm, near to Hopetoun, under the charge of Mr. Skelton Parks. The samples were rather late in being sent for sowing as early as the district requires, so that this season will be even a better test than the last. The soil is a sandy loam, and the rainfall during 1893 was 17·03 inches. The plots only received the natural rainfall. The drills were only 2 feet apart, and the land was only hoed once to clean out thistles. The ten Swedish varieties turned out a complete failure as far as rust was concerned, for all of them were rusty, and some very bad. However, another trial will be made this season, and they will be sown much earlier than 12th June, which was the time last season. Of the other eighteen selected varieties recorded in the table, only two showed rust—viz., Canning Downs and Ward's Prolific, but the late sowing—3rd July—rather favoured the rust. Some of these have a very good record, such as Robin's Rust-proof and Chrysolite, and if found suitable for the Mallee, they might ultimately prove very remunerative to grow.

Another interesting experiment was carried out at Rosebery, in Karkarooc County, in the Mallee, where the ten varieties of Swedish wheats were sown on 25th May, fifty gains of each. They all headed in November, and ripened towards the end of December. The soil was a red sand, with red clay bottom, where pines had previously grown. The yield varied from 2 lb. 2 oz. (Schiff) to 13½ oz. (Kaiser), and there was a general absence of rust, this being in striking contrast to the result at Hopetoun, where the Swedish wheats were a complete failure as far as rust is concerned.

This attempt at getting the farmers to undertake wheat-testing experiments for their district will be continued during the present season, and agricultural societies migh ely assist by selecting and appointing the very best farmers for this purpose.

APPENDIX A.

Description of Season 1893, by R. L. J. Ellery, C.M.G., F.R.S., Government Astronomer.

Rainfall for the first quarter very small, being 3·84 inches below the average. Second quarter: 2·80 inches above the average, being heaviest in May, when the rainfall was nearly twice the average. Third quarter: 1·31 inches above the average. Last quarter: 0·58 inches, also above the average. The total amount of rainfall for the year was 26·81 inches, being 0·86 inches above the average.

Temperature.—The mean temperature for the year was 57·9 degrees, being 0·5 degrees above the average. There were 44 days when the maximum temperature reached over 80 degrees, the average number of days being 48. There were 32 days when the minimum temperature was less than 40 degrees, the average number of days being 34. There were 2 days when the temperature was below 32 degrees, the average number of days being 2·7. The highest temperature recorded during the year was 105·5 degrees, and the lowest 31 degrees.

Mean Humidity for the year was 3 per cent. above the average; for the first quarter being 3 per cent. above; second quarter, 5 per cent. above; third quarter, 3 per cent. below, and last quarter 4 per cent. above the average.

Mean daily Sunshine for the year was 9 minutes above the average. For the first quarter 55 minutes above; second quarter, 39 minutes below; third quarter, 3 mintees above; and last quarter, 17 minutes above the daily average.

Melbourne Observatory, Year 1893.

Month.	Rainfall.		Temperature.		Humidity.		Sunshine.	
	1893.	Average.	1893.	Average.	1893.	Average.	1893.	Average.
	Inches.	Inches.	° ′	° ′			H. M.	H. M.
January ...	0·19	1·81	65 7	66 2	0·63	0·64	8 43	8 24
February ...	0·25	1·84	66 5	65 8	0·61	0·66	9 9	7 22
March ...	1·45	2·08	65 5	63 9	0·65	0·68	6 16	5 38
April... ...	2·07	2·38	58 0	58 7	0·78	0·72	3 42	4 42
May	4·00	2·11	56 3	53 2	0·78	0·78	3 22	3 34
June	3·21	1·99	48 6	49 8	0·85	0·80	2 4	2 48
July	2·32	1·88	48 3	47 6	0·83	0·80	3 57	3 22
August ...	1·71	1·81	51 4	50 3	0·77	0·75	4 46	4 21
September ...	3·27	2·30	53 5	53 2	0·76	0·72	4 7	4 59
October ...	3·42	2·87	57 3	56 6	0·75	0·70	6 10	5 30
November ...	2·37	2·55	60 1	60 1	0·74	0·67	6 55	7 8
December ...	2·55	2·34	64 1	63 3	0·68	0·65	8 4	7 41
Year ...	26·81	25·95	57 9	57 4	0·74	0·71	5 36	5 27

Discussion on Mr. McAlpine's Report.

Professor Shelton: I must compliment Mr. McAlpine on the work which he has carried out. I would like to refer to one matter referred to in this report—namely, the question of glaucousness. Mr. McAlpine cautioned us against hasty conclusions in respect to it, but I think his caution holds in respect to the statements contained in the paper regarding the colouring of wheats. He speaks of the blue colouring which he discovered in the peculiar bloom noticeable on many kinds of wheat.

Mr. McAlpine: Not generally; I only know what took place at Burnley.

Professor Shelton: But you implied that it was a sign of weakness. However, I want to say that in dry regions you will discern, as a drought progresses, this peculiar blue colour coming over the field, never mind what the sort is. I have noticed it particularly in Colorado. There you are often obliged to wait for irrigation water while the wheat gets bluer and bluer, but as soon as water was turned on there was a rapid change. The blue shade would be replaced by the delicate green which we all love to see in wheat. All of which indicates to my mind that the cells of the plant had, in the protracted drought, parted with their moisture, and were in a more or less collapsed condition. Hence the change in colour. But when the water came the leaf got gorged with moisture, and you had a return to the original green. I think there is much in this matter of glaucousness or otherwise. I have noticed this high bloom particularly in the best of Mr. Farrer's cross-breds. In fact, one could usually detect the rust-resistant sorts in the field by this sign alone. My impression is that proper glaucousness is in some way associated with the quality of rust resistance.

Mr. CAMPBELL: But I thought you pointed out that glaucousness is connected with dryness.

Professor SHELTON: I don't believe the blue tinge has anything to do with glaucousness. I think it is simply a collapsed condition of the wheat plants due to some character of the soil or quite likely dry weather.

Mr. MCALPINE: My conclusions this year are different from what they were the previous one. After Dr. Cobb's remarks on this subject, I observed the glaucousness of every plot. Generally speaking, those plants which were very glaucous were not so much attacked by rust. The varieties selected for their glaucousness were found to be slightly and moderately rusty, some of them being practically free. On the other hand, those which were absolutely free were only moderately glaucous. This shows that we cannot come to any general conclusion, but I thought it wise to record my experience, so as to warn us against recommending glaucousness as a desirable quality. The general opinion of farmers, and they are often right in these matters, is that glaucousness is a sign of weakness in a plant. I have put the question to a great number of wheat-growers, and that is usually their impression.

Mr. CAMPBELL: In relation to the treatment of seed by specifics as a preventive of rust, I may mention that we lately slightly assisted a person to test a specific of his, which he was positive would be most successful. Some treated and some untreated seed were sown side by side, and the result was an utter failure, the specific not being of the slightest use. A proposal I am greatly in favour of is that of seed farms, one of which we have started in New South Wales. It will test seeds, and then grow them for the purpose of distribution.

The CHAIRMAN: Do you mean that it will distribute samples, or sell in quantities for crop?

Mr. CAMPBELL: Sell in quantities.

Mr. MARSHALL remarked that there was evidently a difference of opinion about the character and effects of glaucousness.

REPORT OF PROFESSOR LOWRIE, OF SOUTH AUSTRALIA.

The CHAIRMAN, in the absence of Mr. Inglis, who had just been called away on important business, read Mr. Lowrie's report, as follows:—

To the Chairman of the Intercolonial Rust Conference.

Sir,—I have much pleasure, in accordance with instructions from the Hon. the Minister of Agriculture and Education in this colony, to submit to you in conference with intercolonial delegates a short report of the work that has been done here since the meeting of the Rust Conference in Adelaide, in 1892.

I do this the more gladly, in so far as I am well aware that much good, directly and indirectly, to the farming community here has resulted from former meetings. Keen attention is being given by leading farmers to the growth of rust-resisting varieties of wheat, though, generally speaking, farmers do not yet appreciate the full importance of the question. It can, however, be truly said that more interest is being taken in the choice of variety and selection of seed, and that much of this increased interest can be ascribed to the suggestive nature and awakening influence of the reports published after the three former sittings of the Rust Conference.

I am sorry that, as my time has been very fully occupied with departmental work and the direction of the Agricultural College, no opportunity has offered for taking up any special line of research among the many which former Conferences directly and indirectly suggested as likely to lead to further light. I have, however, been able to make a series of comparative tests of varieties of wheat in small hand plots, and also on blocks of land varying in area from one acre up to eighteen acres under ordinary farming conditions. I believe that these latter tests—field tests—prove more satisfactory than tests made on small hand plots. From one point of view small plots have much to recommend them, for it is possible to have the various wheats under almost exactly similar conditions as to quality and conditions of soil, and when a careful study of individual plants is required small plots are, of course, altogether necessary. I have noticed, however, frequently that wheats which, in small plots and under favourable conditions accordingly, have apparently had much to recommend them have failed sadly in the field, where the struggle is keener. These tests have been made on the College Farm, and on experimental blocks situated at different places from the north to the south of the colony, but all under my direction. The number of wheats so tried is, of course, very limited, but in selecting the varieties for the tests I was careful that some of these should be the more popular wheats, while others deserved a place on account of their rust-resisting or other qualities.

The following is a statement of the results, in bushels, per acre at the different places:—

Name of Wheat.	College Farm.			Gladstone.		Blackrock.		Maitland.		Eudunda.	Clare.	Average Yield.	Liability to rust: Max.=10. Min.=1.	Tendency to lodge: Max.=10. Min.=1.	Liability to be shaken out: Max.=10. Min.=1.
	Field IX. 1892.	Field VI. 1892.	Field IV. 1893.	1892.	1893.	1892.	1893.	1892.	1893.	1893.	1892.				
	bush. lb.	bush. lb.	bush. lb.	bush. lb.	bush. lb.	bush. lb.	bush. lb.	bush. lb.	bush. lb.	bush. lb.	bush. lb.	bush. lb.			
Baart	28 26	...	12 28	19 52	...	6 55	...	9 8	...	13 6	24 25	16 20	6	6	4
White Tuscan	26 53	29 36	11 33	16 54	...	...	...	7 57	...	...	21 8	19 0	4	1	4
Wheaton's Rust-proof	26 50	...	13 16	...	...	...	...	...	...	...	...	20 3	1	1	3
Early Para	26 45	21 28	11 25	14 24	...	4 15	...	...	...	...	19 23	16 17	3	2	1
Leake's Rust-proof ...	26 0	...	13 45	18 15	18 43	8 58	21 36	...	18 4	11 27	...	17 6	2	2	1
Nonpareil	26 1	...	...	...	...	...	...	...	...	...	...	26 0	3	1	1
Red Tuscan	25 41	...	...	...	...	...	...	...	...	...	...	25 41	4	3	3
Excelsior	25 40	...	13 40	...	...	...	...	...	...	...	...	19 40	5	5	2
Blount's Lambrigg ...	24 33	13 46	12 14	...	...	9 5	20 19	7 34	...	5 19	20 6	14 7	1	4	2
White Essex	24 14	...	13 30	...	...	7 20	...	11 30	...	6 13	...	12 33	5	1	2
Steinwedel	22 34	17 40	10 10	...	...	9 50	...	7 25	...	...	...	13 32	7	2	8
Summer Club	22 26	...	...	...	...	...	...	...	...	...	...	22 26	1	2	1
Velvet Pearl	22 25	...	13 0	...	...	13 15	...	...	...	...	...	16 13	6	5	2
King's Jubilee.. ...	22 14	...	13 25	14 36	...	4 10	...	6 21	...	...	...	12 9	6	10	2
Early Frames	20 33	14 9	...	...	...	10 21	...	...	...	...	...	15 1	3	1	1
Du Toit's	13 27	...	...	8 16	...	4 5	...	...	...	...	...	8 36	8	7	3
Talavera	...	26 47	10 40	...	...	...	...	10 44	...	...	...	16 4	2	2	2
Medeah	...	24 21	18 32	14 36	...	3 30	...	...	...	...	...	15 15	1	1	1
King's White	...	22 33	10 33	...	...	...	...	...	...	...	...	16 33	6	2	2
Ward's Prolific ...	...	19 50	15 6	16 33	...	7 32	...	7 53	...	...	10 0	12 49	2	6	1
Purple Straw	...	16 16	...	...	...	13 25	26 52	...	14 0	...	11 42	16 27	7	2	2
King's Rust-proof ...	...	12 33	...	...	...	...	...	...	...	...	...	12 33	1	2	1
Early Japan	...	...	9 2	...	...	...	20 12	...	...	...	...	14 37	4	1	3
Allora Spring	...	...	11 6	...	...	...	25 43	...	...	...	...	18 25	3	3	4
Xeres	...	...	21 18	...	...	...	...	...	...	...	...	21 18	1	1	1
Australian Wonder ...	...	...	15 56	...	...	...	...	...	...	...	...	15 56	1	2	1
Odessa	...	...	15 33	...	...	...	...	...	...	...	...	15 33	2	1	2
Saumur de Mars ...	...	...	14 25	...	...	...	...	...	...	5 55	...	10 10	3	2	5
Red Straw	...	...	14 1	...	...	...	...	...	...	...	26 35	20 18	9	2	3
Belotourka	...	...	13 40	...	...	...	...	...	...	...	...	13 40	1	2	1
Australian Glory ...	...	...	11 29	...	...	...	...	...	...	6 47	...	9 8	7	3	1

I have thought it well to state the above results in a tabular form. From it it will be seen that one of the most useful wheats in the list is Leake's Rust-proof. It is prolific, fairly rust-resistant, does not lodge nor shake out readily, and is with all a very good milling sample.

Wheaton's Rust Proof is also a most valuable wheat, is as prolific as Leake's Rust-proof, and withstands rust to an eminent degree; but the sample is scarcely so inviting as that of Leake's Rust-proof.

I should like to state here our very great indebtedness to Mr. Farrer for the supply of cross-bred wheats which he has so generously placed at our disposal, and to say further that I have watched with much interest the growth of these wheats. We cannot, of course, expect that they should all be suited to our climate, but I feel assured that a small proportion of them are likely to suit our conditions and likely to prove valuable wheats when, after continued selection, they have been brought to a fixity of type more or less definite and lasting.

The degree of rustiness, as indicated in the column by figures, is the general average of the plants in each plot; but in many of these plots particular plants were free from rust or had some other quality to recommend them, and these were selected for further work. From all the plots, in fact, the more rusty plants were culled, and it is our purpose to continue this selection still further in future seasons.

Speaking of these cross-breds generally, we would say that the sample of wheat, from the wheat-buyer's point of view, is only fair. A few—more notably the crosses in which Leake's Rust Proof forms one of the parents—gave good milling samples; but a large number also yielded, when harvested, samples which wheat-buyers would not accept.

WILLIAM LOWRIE.

On the motion of Professor SHELTON, seconded by Mr. FARRER, the Conference then adjourned till half-past 2 o'clock.

AFTERNOON SESSION, MONDAY, 26 *MARCH,* 1894.

The CHAIRMAN, having taken the chair at 2·30 p.m., called on Mr. Inglis to read his paper, adding "Now we shall have the practical part of the business."

MR. INGLIS' REPORT.

Mr. Chairman,—I would like to add, as a supplement to our South Australian Report, some facts that have come under my own observation.

I might state that since our last Conference, in Adelaide, our colony has had again to contend with the ravages of red rust, more especially in 1892. This season commenced with a very dry winter, which materially checked the growth of the early wheat, or rather early sown wheat. A great deal of it was turning a brown colour, but in August we had heavy rains, which caused a rapid growth, no doubt causing the wheat plant to be soft and succulent, and therefore more liable to rust.

Appended is the rainfall taken at my place, which is in the middle of a large agricultural country or district, for the year 1892.

The season of 1893 commenced with splendid rain and fine seasonable rain all through the season, and there was no check on the growth of the wheat plant whatever, unless it was through too much rain; but, notwithstanding these favourable conditions, many crops were very badly affected with red rust, but, although crops were badly affected, nearly the whole of the samples were good—only a few exceptions where the grain was shrivelled, thereby showing us that it is not always wise to cut for hay too early. One case that I know of I will mention. A farmer who had a very early crop, some of which he cut for hay, but it was so bad that the hay merchant refused to take it. He left off cutting, and reaped the crop, it being clean from rubbish, and from which he reaped ten bushels per acre. And the only way that I can account for it is that during the time the wheat was in bloom we were almost free from frost; and another thing in its favour was that there was plenty of moisture in the ground to bring the grain to perfection, which is not usually the case in that season of the year.

In reference to the difference of new land and worn-out soil, you know that I have always held the opinion that rusted wheats have been as bad on new lands as on worn-out soils. This year I had an instance of this on a farm close to me. There was a paddock of wheat grown on new soil. This wheat—Red Straw—was the worst shrivelled in the district; it was so badly shrivelled that the wheat merchant refused to buy it, and it was bought for seed, being thoroughly clean, grown on fallowed land, and the first crop.

Now, on the adjoining lands, where crops had been grown for the last twenty years, good crops were reaped. My opinion is that the ranker the growth the more liable to rust, and of course rich new land will always produce rank growth, and therefore are more liable to destruction by rust. I sowed thirty bags of the same seed stated above, and reaped eighteen bushels per acre of firm plump wheat.

On Change of Seed.—Although I am a firm believer in change of seed, I find that we cannot draw hard and fast conclusions on this point. I will give a few instances on this question. A farmer close to me wanted to change his seed. He was growing Purple Straw; and as he had two farms—one in the north, about 100 miles up—he sent for forty or fifty bags from the north, which sowed the half of one paddock, and sowed the other half with the Purple Straw that he had at home. The changed seed produced ten bushels, and was the same crop that I spoke of as being too rusty for hay; while the unchanged seed produced fourteen bushels per acre, and less rust, all under similar conditions as to sowing and treatment.

I know another farmer who does not believe in changing seed, and has grown the same wheat for the last twenty years; and his return this year from 600 acres was 20 bushels per acre; it was a red straw wheat. His farm is well managed, and has long rests, being fed for several years with sheep, without sowing wheat on it; so that we require to be careful in making definite statements on these difficult problems.

Early and Late Sowing.—I feel satisfied that, as a general rule, early sowing is by far the best; but in 1892 all the early-sown crops in the north were much worse than those sown later. There was plenty of moisture to cause the wheat to grow, but after it came up dry weather set in, and the wheat turned a sort of brown colour; it was checked so much that it never recovered, and the late-sown crops were by far the best.

I consider that drainage has a good deal to do with rust; in one of my own paddocks, about 250 acres, there are two hills, the crown of the hills running east and west, and in reaping north and south I found that both hills with a northerly aspect produced by far the best crop. You could distinctly hear the difference of the sound in the stripping machine as soon as the top of the hill was turned. I believe the cause to be through the ground being so fully saturated with water in the winter time, and no drainage on the south side, but on the north side the sun shining on it keeps it drier.

In our more northern country the rust is never so bad, having a drier atmosphere; this year, as far as I can learn, they had no rust at all.

Whilst recognising the fact that rust-resisting wheats are the best to sow, we must see that they are wheats of commercial value, for I am sorry to say that the millers are very particular on this question, even Ward's Prolific, which we count a very good milling quality, is bought at from 2d. to 3d. per bushel less than white soft wheat; so that unless some alteration is made between buyer and seller, we shall have to grow wheat that will sell at 2d. per bushel reduction, which on wheat at 2s. per bushel means a very serious loss to the grower.

Madcat is a wheat which, in its present state, is neither good for flour nor yet for hay; it used to sell best for hay, but now some chaff merchants refuse to buy it, owing to its long, stiff, black beard; and it is a wheat that cannot be thrashed with profit by the usual stripper used by us in South Australia; so that this wheat, which is highly rust-resisting, is of very little value; but by crossing it with some other softer wheat, I believe it would become a valuable wheat.

In reference to hybridising, I am pleased to think that so much has been done in this direction already—no doubt through the suggestions of the past conferences held; and I feel certain that by still continuing this important work—namely, careful selecting and crossing—we shall soon get wheats that will both resist red rust and be a marketable wheat as well.

We have wheats now, such as Blount's Lambrigg, Wheaton's Rust-proof, King's Rust-proof, and some others which are good rust-resisting wheats, but too small in the grain, so much being lost in winnowing or screening it for milling purposes; and they are flinty wheats as well. Leake's Rust-proof is a better wheat in this respect, being larger in the grain, and a softer wheat.

I might just mention here that, on a farm close to mine, three different wheats were sown—namely, Steinwedel, Purple Straw, and King's Rust-proof. The two first-named were sown about the middle of May, and averaged 16 bushels per acre; King's Jubilee was sown at the end of May, and averaged 28 bushels per acre. Another farmer sowed this wheat in the beginning of July, as it was too wet to work the land before, and his crop averaged 18 bushels per acre. This wheat does best on deep, loamy soil, but not good for hard red soils.

Gentlemen,—All those particulars that I have mentioned have come under my own personal observation, and I therefore can vouch for their accuracy; and I feel confident that we, as farmers, and the country at large, will gain great advantages by this work being still continued. Much has been done during the past four years, and much can be done still, to enable us to grow wheat at a profit instead of a loss.

Out of twenty-six varieties of wheat grown this past season, the following are the ones giving the best returns:—Wheaton's Rust-proof, 31 bushels per acre; King's Rust-proof, 28 bushels; Blount's Lambrigg, 26 bushels; Belotourka, 25 bushels; White Tuscan, 24 bushels; Leake's Rust-proof, 18 bushels; also, a wheat selected and grown by a Mr. King—I think, No. 2—is a good wheat to grow.

In conclusion, I would say that the colonies are greatly indebted to gentlemen like Messrs. Farrer and Marshall, who have given so much time and labour to this very important subject; and I do trust that, by combined effort, we shall be free from this terrible scourge in a very short period.

Discussion on Mr. Inglis' Report.

Mr. Campbell: Mr. Inglis has mentioned a farmer who had two farms which exchanged seed. I would like to know if the climate of the northern one is warmer than that of the southern one?

Mr. Inglis: Warmer and drier.

In reply to another question, Mr. Inglis said Medeah was a hard, flinty wheat, and consequently unsuitable for milling purposes.

Mr. Marshall: There is a great deal of diversity of opinion about the qualifications of Medeah as a hay wheat. It is not good for milling, but there are many who will grow nothing else but Medeah for hay. I do not grow it myself, as the beard is very annoying when the hay is being eaten by stock, but I believe if it is cut quite green the beards are not nearly so objectionable.

Mr. Farrer: Medeah wheat flour will fetch a very high price for making macaroni.

Professor Shelton: Mr. Pearson told us at Adelaide that he had taken pains to consult wheat dealers, and that they had given him the assurance that if the Medeah or similar wheats were grown in sufficient quantity they would command a high price for the purpose mentioned by Mr. Farrer.

Mr. Inglis: The highest price was once given in South Australia for Medeah hay; but afterwards, owing largely to the fact that the public refused it at Broken Hill, the chaff-dealers declined to purchase it.

The Chairman: I think it is pretty well understood that bearded wheats are objected to by chaff-dealers.

REPORT BY PROFESSOR SHELTON, OF QUEENSLAND.

At the last meeting of the Conference held in Adelaide, a general scheme, having for its object to test in all the colonies there represented a large number of varieties of wheat, was agreed to. The plan then adopted had for its essential features:—

1. That the different Governments should cultivate a large number of different varieties of wheat with the purpose of ascertaining their rust-resisting powers and other valuable qualities.

2. To give those of proved value a further and more extended trial at the hands of a few careful farmers.

3. Finally place in the hands of wheat-growers in general those sorts the superiority of which had been amply demonstrated in the course of these extended trials.

The adoption of this scheme marked an important change in the sentiment of the Convention. Hitherto, the Conference had devoted itself largely to the work of analysing the reports of practical men and formulating for the public ideas clearly deducible therefrom, while suggesting to its own members as well as the wheat-growing public the duty of carrying out various experiments, to test the efficacy of certain chemicals—fungicides—in destroying rust, and the influence of manure, cultivation, &c., to the same end. By this action of the Adelaide Conference we have virtually said that the chief, if not only, line of work which promises profitable results is the study of the wheat plant itself. Nothing has been brought out more clearly in the work of the Conference than this, that, independent of soils, seasons, and other surroundings, the wheat plant possesses inherent qualities capable of development to an extent which renders the plant, if not "proof" against the attacks of rust, at least strongly resistant thereto. That the line of work adopted by the last Conference is the true policy I have no doubt, although I see no reason to expect finality in the results of our work. Whether the opinion quite commonly held by farmers, that the most rust resistant of wheats do steadily lose their resistant capacity, deteriorating with greater or less rapidity with even a few years of cultivation, it is certain that the most vigorous sorts succumb to the rust contagion, often with small provocation in the shape of unfavourable seasons. The fact that sorts like the Defiance, Town and Country, Talavera, and others, once regarded as among the most valuable of wheats grown in the colony, are now rarely seen in cultivation implies a general failure of these sorts, if not a special deterioration in the line of rust resistance. During the past season, a considerable number of crops of Belatourka, hitherto the most resistant of varieties, have more or less completely fallen a prey to the rust disease. Further confirmation of this view is furnished by the pronounced tendency of red or dark skinned wheats, so far as I know, to assume lighter colours and a more pronounced starchy composition with lengthened cultivation in Queensland. Samples of the Belotourka, having originally a dark, horny grain, have this year been grown in Queensland which showed grain as white as Ward's Prolific or Steinwedel. The same may be said of the rust-resistant multiple-headed sort long grown in Queensland under the name of Mummy or Hen and Chickens. To me it is clear that the Agricultural Departments of the different colonies will, until private persons find it profitable to undertake the work, have for their special task the duty of maintaining the standard of rust resistance in the wheats of the several colonies. This will be accomplished by testing varieties new and old, and proving their value; afterwards giving them to wheat-growers to replace the degenerate sorts in general cultivation. The experiments undertaken in Queensland on the lines laid down by the Adelaide Conference have been carried out during the year past at two points—Warwick, near the southern boundary of the colony and inland 80 miles; and at Roma, west from Brisbane about 300 miles. These places are within the general limits of the Darling Downs region, and both are centres of considerable activity in wheat-growing. The soil upon which the experiment was conducted at Warwick is a rather light form of the black, volcanic soil, peculiar to this district. At Roma the experimental area consisted of a somewhat low-lying, heavy, clay loam, which in point of fertility is much above the average of the farm lands of the district. In both sections the general climatic conditions of the season have been very favourable to a full development of the wheat plants, albeit heavy rains early in the season wrought some damage at Roma, and later in October a violent hailstorm—just as the wheat had come in ear—did much damage to nearly every variety grown there. At Warwick rust appeared late in the season, and ultimately infected nearly every sort grown there, but the attack was of a peculiarly mild type, doing comparatively little damage. At Roma, on the other hand, although the district about does not ordinarily suffer greatly from rust, our experimental wheats were, almost from the time of their appearance above ground, subject to rust attacks of the most virulent character. Very many of the varieties which are elsewhere in excellent repute for their rust-resistant qualities, here succumbed more or less completely, the whole experiment making a record, for rustiness, that could hardly be surpassed. I need hardly say that this is precisely what we had hoped for, with small reason for expecting it, however. Every sort grown here was evidently put to a severe test, as will be seen by the fact that varieties like Leake's, Smith's Nonpariel, and Thomas Rust-proof, all accounted rust resistant to a greater or less degree, were all more or less completely ruined by the disease.

Our observations of these experiments have been confined to those matters that have a more or less complete bearing on the question of rust development. In the case of those sorts which suffered most from rust, the time of ripening could not be made out. The disease so completely possessed each plant that it never had an opportunity to reach its normal maturity. The degree of rustiness of the different sorts has been represented by the figures 1-5; the numeral 1 indicates leaf rust and occasional colonies upon the stalk; 3 refers to rustiness sufficient to perceptibly affect the grain, while 5 indicates the complete ruin of the crop.

The diagram following shows graphically the extent to which rust affected the different sorts grown. Here as before the gauge 1-5 is used in indicating rust effects. The full length line stands for "5," while two inches indicate "1" of the standard.

[*See* diagram opposite.]

Behaviour of Crossbreds.—The seed of these wheats was obtained wholly from Mr. W. J. Farrer, of New South Wales, by whom they were for the most part originated. Most of them are comparatively recent creations, and so are wanting in fixedness of type. In cultivation they assume many and often wide variations: certain plants resembling one or the other parent, while all gradations between the two are represented in nearly every plat. A like variableness in the time of ripening is seen in these sorts, on which account it is generally difficult to name accurately the date of their ripening and other facts in the history of their growth. With all these crossbreds, many years of persevering cultivation, with careful selection to a definite type, will be required before they can be dealt with as distinct varieties. I was interested in noticing that those, the seed of which had been selected for some special trait in character, reproduced this character with marked fidelity. The seed which came to us marked "from heads having four grains to the breast," developed plants which very generally bore an ear having four grains to the spikelet. Nearly as much may be said for the sort collected for its narrow leaves, although this latter character could not so satisfactorily be made out as when the variation affected the heads. This, I think, has been made out by these experiments, that the average rustiness was clearly lower than in the case of the established varieties, although none of the crossbreds, taking each plant as a whole, exhibited such complete immunity from rust as did certain established sorts like King's Jubilee, Ward's Prolific, 8M, 31M, Squared-headed Sicilian, Ward's White, and others that might be mentioned. The very variable characters exhibited by these newly-created varieties sufficiently explain the lack of high rust resistance among them; it also emphasises the need of rigorous selection to a truly rust-resistant type. Certain crosses deserve specific mention. The sorts having in their ancestry Quartz, Zimmerman, and particularly Early Japanese, generally fell an easy prey to the rust; while the crosses of Blount's Fife, Ward's White, Ward's Prolific, Blount's Lambrigg, and Horneblende were uniformly rust-resistant, though often late in reaching maturity. The Horneblende appears to be a particularly


37. Jacinth.
36. Talavera.
35. Marshall's No. 3.
34. Marshall's No. 8.
33. Marshall's No. 31.
32. Freeling.
31. Mexican Spring.
30. Canning Downs Rust-resistant.
29. Blount's Fife.
28. Summer Club.
27. Thomas Rust-proof.
26. Tourmaline.
25. Rattling Tom.
24. Manitoba.
23. Square-headed Sicilian.
22. Niagara.
21. Marshall's White.
20. Bega.
18. Fluorspar.
17. Belotourka.
16. White Naples.
15. Lazistan.
14. Quartz.
13B. Steinwedel × Horneblende.
13A. Horneblende × Indian C.
12B. Jacinth × Ladoga.
12A. Bellevue Talavera.
11B. Jacinth × Early Japanese.
11A. Horneblende × Indian B.
10. King's Jubilee × Tourmaline.
9. Blount's Lambrigg × Horneblende × Horneblende.
8. Ward's White × Horneblende.
7. Anglo-Australian.
6. Improved Fife.
5B. King's Jubilee × Indian G.
5A. The Blount × Early Japanese.
4B. Amethyst × Indian D.
4A. Jacinth × Ward's Prolific.
3B. King's Jubilee × Indian B.
3A. King's Jubilee × Early Japanese.
2. Blount's Fife × Vermont.
1B. Quartz × Leak's.
1A. King's Jubilee × Zimmermann.
FARRER'S CROSSBREDS
92. Early Japanese.
91. White Essex.
90. Red Provence.
89. Ward's Prolific.
83. Fultz.
82. Indian Pearl.
81. Australian Club.
80. Chrysolite.
79. Indian Pearl.
77. Frampton.
76. Blount's No. 10.
75. Polish.
74. Currell.
73. Algerian.
72. Defiance.
71. Queensland Defiance
70. Victorian Defiance
67. Fountain.
65. White Cythere.
64. Russian.
63. Town and Country.
62. Broderick.
61. Medeah.
59. White Hogan.
58. Leak's.
57. Sicilian Baart.
56. White Fife.
55. Gore's Indian, No. 2.
54. Gore's Indian, No. 1.
53. Northern Champion.
52. Brown-eared Mummy.
50. King's Jubilee.
49. Cook's.
48. Goldsmith's Pedigree.
47. Velvet Chaff.
46. Australian Wonder.
45. Australian Glory.
44. King's Jubilee.
43. Farmer's Friend.
42. Fillbag.
41. Red Californian.
39. Smith's Nonpareil.
38. Early Para.

prepotent sort, fixing its peculiar strong straw, covered with dense velvet-like bloom and square compact heads—nearly always rust free—upon its progeny, however, it may have been mated. Thanks to the indefatigable industry of experimenters, particularly Mr. Farrer, we now have available a large number of these crossbreds, quite likely as many as we shall need for years to come. What is now required is a careful study of tendencies in them, accompanied by a rigorous selection to a clearly apprehended standard of excellence.

Swedish Wheats.—Eleven varieties of Swedish wheats obtained from the Victorian Department of Agriculture were included in the Warwick experiment. Several of these were really beautiful wheats which, as grain, left little to be desired. In cultivation, however, they were a complete failure. Nearly all took the rust in it's most virulent form, and all were so late in coming to maturity as to make them quite worthless for any useful purpose in Queensland.

Rust-resistance in General.—All admit that, other things being equal, those sorts which ripen earliest are the least subject to the rust contagion. One not unfrequently hears the remark made by practical men that the quality of early ripening is the single quality required to make wheats resistant to rust. Valuable as the quality of early maturity is, it is possible to make too much of it, as of other good things. In our Roma experiment, the earliest wheat grown, so far as I can judge, was the Early Japanese—certainly in advance of King's Jubilee (ripe October 20); but this sort was absolutely "rotten with rust" in grain and straw. In like manner Jacinth, October 27; Fillbag, October 20; Australian Glory, October 25; Red Californian, October 25; and Farmer's Friend, October 26, all very early wheats, succumbed completely to the rust disease. Where we look the ground over, how many truly rust-resistant early wheats can be named? Ward's Prolific is truly one of this sort, but certainly the Steinwedel and King's Jubilee are not. On the other hand, in our experiments and generally, by far the greater number of wheats with proved powers of rust-resistance are somewhat late in bringing their seed to maturity. Among these are 8M, November 4; 31M, November 4; Ward's White, November 15; Square-headed Sicilian, November 7; Improved Fife, November 15; Anglo-Australian, November 10; to say nothing of Blount's Lambrigg, one of the latest and most rust-resistant of all. My belief is that a great and most useful work is possible to us all in taking these vigorous, disease conquering sorts, and by cultivation and useful selection, in ways known to you all, shorten the period of their growth, and make them early wheats. My impression is that this can be more easily done than by crossing with early varieties, thus introducing elements of weakness, to say nothing of variations toward and untoward.

The importance of a dense covering or bloom of stalk and flag as an indication of the ability of the plant, thus dowered, to ward off the disease has been so fully fought out by Dr. Cobb, that it remains only for me to say that our experiments fully confirm his view of the importance of the glaucous covering as a sign of rust-resistant power. The period in the history of the affected plant, when disease gets a foothold, and the portion of the plant most involved, are interesting, and not unlikely practical questions, that have not so far received much attention at the hands of this Conference. Some sorts, I have observed, take the disease very early, but rapidly grow away from it, showing at maturity only a few and feeble rust colonies, while with others conversely, the plant shows increasing susceptibility to rust as it approaches maturity. Thus King's Jubilee, which at four months old was a mass of rust, at harvest showed scarcely a trace of it. Others, again, as showed in the table of observations of the Warwick experiments, seemed progressively to increase in susceptibility as their maturity approached. In several sorts, particular parts of the plant seemed favorite seats of the disease. Often it was the leaf that suffered while the stork remained untouched, and *vice versâ*, while in some, notably White Cythera, the chaff and awns became a mass of rust colonies beyond anything that could be seen in other sorts.

To aid, as far as possible, in multiplying signs of rust liability is the undoubted duty of members of this Conference, and, I may add, wheat-growers in general. We need to know every indication of a predisposition to the disease in wheat to enable us successfully to practise the rigorous selection needed in bringing wheats to that condition of constitutional strength which will enable them under all circumstances to escape rust contamination.

Discussion on Professor Shelton's Paper.

Mr. Farrer: Professor Shelton's paper has suggested to me the great difference there is in the rust-resistant powers of different wheats in different colonies. It is quite remarkable that so many sorts not liable in our colonies are so liable in Queensland, and *vice versâ*. King's Jubilee, for instance, seems to have been at Roma freer from rust than any other sort. It was very unfortunate the Warwick experiment was unsuccessful.

Mr. Inglis: It seems to be a mystery how wheat changes in different countries. I have tried King's Jubilee twice, and it was a failure both times. It looked a splendid wheat at first, but when the rain came two-thirds of it were knocked down. King's Rust-proof is a very good wheat, however, and stands up well; it is also a good milling sort, and is practically rust-proof, although a late wheat.

Mr. Marshall: It struck me very forcibly too that there are many wheats which resist rust well in one place and not in another. At the Adelaide Conference, I think Blount's Lambrigg was recommended as a good wheat for inland districts. I distributed a lot of wheats last year, and sent a bag of Blount's Lambrigg to a farmer in York's Peninsula. I have just received a letter from him in which he says it was very free from rust. In communications from some other farmers, many of whom are in inland districts, Talavera is placed at the head of rust-resistant wheats, and Blount's Lambrigg at the bottom. As a general result, I have come to the conclusion that farmers' reports are not reliable. As to King's Jubilee, I can fully endorse all what Mr. Inglis has said about its liability to rust, and its inability to stand up well. Leake's Rust-proof is not a rust-resistant wheat, and often suffers from rust in South Australia.

Mr. Campbell: All this confirms my previously expressed opinion that there is an absolute necessity for experiments to be made in different localities. No matter what the resistant powers of a wheat may be, they are certain to vary in different districts.

Mr. McAlpine: Professor Shelton's paper, which bristles with points of practical importance, shows us how cautious we must be in commending wheats. King's Jubilee is a striking case. With us it was the rustiest of all. I would be glad to know something of the climate and rainfall of Roma.

Professor Shelton: The annual rainfall is somewhere between 26 and 30 inches.

The Chairman: The lowest rainfall for many years has been 12 inches.

Professor Shelton: Shortly after planting the wheat, which came up very well, we had a tremendous downpour of rain. From then the rains continued about as needed, up to near harvest, when the weather got rather dry, but the rain came on again shortly and ripened the wheat well.

Returning to the comparative merits of the different Roma wheats as illustrated by the diagram, Professor Shelton pointed out that most of the hitherto favourably regarded sorts had supported their reputations.

Mr. Marshall: The results of my experiments have pretty well coincided with those of Professor Shelton's, with the exception, however, of King's Jubilee. Blount's Lambrigg, Sicilian Baart, and others resisted rust as well with me as they did at Roma. I get all sorts of contradictory reports from farmers, though.

MR. McLEAN'S REPORT.

1. How many acres of your land were under wheat this season?—Replies received, 168; circulars sent out, 580. Area under wheat on farms from which replies received, 5,737 acres. Average area under wheat for each farm, $34\frac{1}{3}$ acres.

* Note.—The average is somewhat diminished by a few farms having under 5 acres in crop.

2. What portion of this was damaged by rust, and what was the loss per acre on that portion?—No damage reported, 110 farms; slight damage, 24; *much damage, 28; destroyed by flood or other causes, 6.

* Represents that rust was more or less all through the crop.

3. What kind of season have you had this year?—Season can be said to have been good, only twenty of the replies giving the season as *bad*. Sixty farmers complain that the season was too wet at planting, and too dry when wheat was coming into ear. One farmer says that "there are a plurality of applicable answers to this question."

4. Give the date when the first speck of rust was observed in your crop.—The earliest date was 20th June, at Greenmount, rust appearing in July, August, September, October, and November. Two cases only appeared in June, and four in July. The greater number of cases were observed in October.

5. Give the date when the rust spread throughout your crop so as to do damage.—From middle of October to middle of November appears to have been the principal time, with cases in August and September and towards end of November.

6. State the kind of weather at this time.—Hot and muggy.

7. What was the time of sowing the seed? Was this early or late for the district?—Sowing was principally done during May and June, the earliest date noted being the 20th March, the latest 15th August. The replies generally point to early sowing, the 1st June being taken as the dividing date between early and late sowing.

8. What kinds of wheat did you grow this year?—The varieties given as having been grown were:—Algerian, Allora Spring, Baltimore, Belotourka, Canning Downs, Carter's Hybrid, Currell, Defiance, Egyptian Mummy, Farmer's Friend, Fillbag, Golden Drop, Hugall's, Indian, Indian Pearl, Leake's, Medeah, Mexican, New Zealand, Polish, Pugh's Prolific, Purple Straw, Rattling Tom, Russian, Smith's Nonpareil, South Australian Spring, Steinwedel, Talavera, Tenterfield Spring, Town and Country, Twenty-week Spring, Velvet, Ward's Prolific, White Lammas, White Tuscan.

9. What varieties have you found this year most affected and least affected by rust?—*Most affected*: Steinwedel, Rattling Tom, Farmer's Friend, Fillbag, White Tuscan, White Lammas, Belotourka, Allora Spring, Defiance, Purple Straw, Mexican, Talavera, Indian Spring, Town and Country, Russian, Pugh's, Smith's Nonpareil, South Australian, Currell, Mummy. *Least affected*: Mummy, Baltimore, Algerian, Polish, Pugh's, Belotourka, Indian, Talavera, Smith's Nonpareil, Spring, Canning Downs, Allora Spring, White Tuscan, Town and Country, Ward's Prolific.

From the answers, the time of sowing is often charged with the cause of rust. It will be observed that some varieties are given as most and least affected.

10. Did the rusty crop stand thinly or thickly on the ground?—Thinly, the proportion reporting thus being about two to one as against thickly.

11. What has been your experience this season with rust-shrivelled seed as compared with plump seed?—This question has been answered by few. The majority of those answering have contented themselves with saying that they only used plump seed, and did not compare the rust-shrivelled with the plump seed. Of those that did make a comparison, three farmers, one of whom said he had fifty years' experience, preferred shrivelled seed. Two do not believe in it at all. One farmer says that if close, dry weather comes after planting shrivelled seed, it will not germinate; two consider that shrivelled seed produces pinched wheat; and seventeen think that shrivelled seed as good as plump.

12. Did you cut any of your rusted crop in the dough stage? If so, what were the results as to yield and character of grain?—Five farmers only cut in the dough stage, with the following results:—

S. and J. Holmes cut 28 acres, with good results.
H. Yesberg cut some, and if weather is fine it will give good results.
J. W. Armstrong cut some; yield, 8 bushels grain, pinched.
J. Ball cut in dough stage; better grain; yield much better.
W. Marriott: It thickened, but made no difference in the rust.

13. Does wheat from colder or warmer, wetter or drier, districts suffer most from rust with you?—The answers are not sufficiently clear to form an opinion. Those that have answered the question directly are divided about equally in their opinion. As a rule, it appears that the wheat seed grown is obtained in the neighbourhood by exchange.

14. Name any other plants, and especially grasses, upon which you have observed rust. If possible, send samples of such plants.—Oats, rye, barley, lucerne, corn, kangaroo grass, millet, prairie grass, natural grasses (the names of which were not given), and the nut grass, marsh-mallow, wild flax, wild oats, wild raspberry, wild cotton.

15. What results have you obtained from any measures of prevention you may have tried?—This question has been answered by few, but those that have, favour feeding down with sheep, early seeding, change of seed every second or third year, drilling in place of broadcasting, and drainage, which have been tried with good results.

16. What kind of soil and subsoil have you?—The soils are too varied to give a general reply to this question.

17. Is there any other information you would like to give?

At the conclusion, Mr. McLean added that it appeared Queensland had been the only colony which had carried out the recommendations of the Adelaide Conference in respect to the issue of questions to farmers.

Discussion on Mr. McLean's Report.

Mr. McAlpine: I would like to know if any of the farmers mention anything about sowing shrivelled seed that was a year old, because in my experiments I found that the rust-shrivelled seed seemed to have an advantage over the rest in germinating power; but a friend, who was looking over my wheats, suggested that it was owing to the fact that the shrivelled seed was a year old.

Mr. McLean: No, nothing was mentioned.

Dr. Cobb: During the reading of the several papers, I have noted a few points on which I would like to make one or two remarks. While listening to all that has passed, the thought that has chiefly occupied me is that we have still a great deal to learn. We have made mistakes—I think we all admit that—but I know that all the members have given this subject of rust their most earnest attention from year to year, that there has been no shirking, and that although we have made mistakes, they have been slight ones considering the advances we have made; but in spite of this advance, the thought is still uppermost in my mind, how very much we still have to learn. Mr. McAlpine said that his wheat was sown late, and Mr. Marshall mentions sowing wheats late in order to test their rust-resistant qualities, and one also often sees in newspapers and reports the statement that certain wheats were sown late in order to test them, in order to give them every chance to take the rust. Although all this is of some value, I don't think we want to know what plants will take the rust when sown late, but what plants will take it when sown early, because we are all pretty well agreed that early sowing is the best. There are exceptions, of course Now, in our experiments, it strikes me we ought to sow at two dates at least. We should put in a crop when the farmers are putting in t eirs, and to this give most attention, and another sowing later on. With regard to manuring, it must be remembered that manure is not employed in wheat-growing in these colonies, and while experimentally manures come within our province, because we may increase the vigour or earliness of a wheat by their aid, we should recollect that manures are seldom used in practice in Australia, and so carry out our experiments, bearing in mind this state of affairs before us. The only place in our New South Wales experiments where we used manure was at Wagga Wagga, and that was owing to special reasons. Then Mr. McAlpine mentions that his land was not adapted to wheat-growing, but was used because it was easily accessible. I can fully appreciate all Mr. McAlpine's reasons, but I think land for these experimental purposes should be suitable for wheat, and should be, if possible, in a wheat district. Otherwise the results are liable to be unsatisfactory, and we have to be very cautious in drawing conclusions about wheats grown under such circumstances. Another point is one that was not exactly suggested to me by any report read, but is one to which I think I should call attention and give my own experience. The idea occurred to me a couple of years ago, but what specially fixed it in my mind was the reading of the report of the American experiments on rust in wheat. These American experiments are carried out on precisely the same lines as, and were, I believe, suggested by, the Australian ones. Their results have so far confirmed our results, but attention is called to the fact that rust begins at particular points in the crop. It does not begin at once all over the crop, but begins, say, in the centre or at one side, and then spreads from there until all the crop is rusted. That requires a certain amount of time, say, two or three weeks, for I think the idea of sudden outbreaks of rust is a mistake. In fact these outbreakings are merely the simultaneous outbreakings of the spores; the rust has been there for some time previous. This suggested to me the idea of submitting all the wheats as evenly as possible to the influence of rust, and this I thought could be done by sowing notoriously rust-liable sorts in every other row. I modified that since, and now think that it would do as well if every third sort was a rust-liable variety. Of course, an objection to this plan will be that more ground will be required, but I may say that I tried it at Wagga Wagga last season, and I am so satisfied with it that, if my advice is taken, the experimental wheats will not be sown in any other way. With regard to glaucousness, I would point out that it is not colouration, but an actual coating of substance on the outside of the wheat, which you can rub off with your finger or with a knife. If you rub a knife along some of the wheat, you can scrape off the glaucousness, and you can often see the green showing through the wax. This is quite different from the bluishness which is caused by lack of moisture. It certainly is the case that very glaucous plants are strong growers, with strong straw and thick flags, and the remark of Mr. McAlpine that they seemed to be weaker plants, recalled to my mind some observations I made two years ago when I measured some wheats, and noticed that these glaucous wheats had very thick flags. However, I do not put this forward as anything but as an opinion. Professor Shelton has mentioned the marked tendency which wheats have to deteriorate. I think this points more strongly than anything else to the necessity of having wheat stations. If we get a wheat at our stations that will resist rust, and send it out into cultivation, it seems, from all the information that we can get, that it is very likely to deteriorate, and that in a few years, so as to be no longer rust-resistant. This shows that the Governments which have stations should keep wheats up to their standards. We should have from our stations a continual stream of wheats going out to the farmers, but the Government should see that the more intelligent class of cultivators also take the matter up. In New South Wales we have several farmers who do this in a very sensible and simple way. In particular one—who, by the way, gained one of the National prizes for farms—grows a considerable amount of seed wheat, and he tells me that his manner of raising the wheat is paying him. These wheats are sown at first from small quantities, of good quality, the variety used being one in general cultivation, such as the Defiance or Allora Spring. At the time the wheat is about to ripen, this farmer goes down through the crop with two men, each of which has a belt with two hooks, and on each hook is hung a bag. Each man makes a tour of the field as far as he can reach, going slowly down the drill and culling each plant there is any objection to. When they have finished they burn or otherwise destroy these objectionable plants. Then the crop is harvested and sells at from 5s. and upwards per bushel. It seems to me it does not require an extraordinary amount of intelligence to do this, and certainly the business is a success in New South Wales. Such a policy would guard against deterioration. If we can get rust-resistant wheats growing on these farms, and these men to realise the necessity of keeping up the standard, they will give them the necessary attention, and so at least check the deterioration. One thing that has struck me very forcibly is the variety of results we get from our different experiments. King's Jubilee in one place is very rusty, and in another practically free. Then here is another fact which seems to have escaped attention: Smith's Nonpariel has rusted in many instances, while Blount's Lambrigg is said to have had no rust at all; but I have satisfied myself that these two wheats are identical. With reference to the four grains to a spikelet, Professor Shelton mentioned a sort which transmitted this trait, but I think it is a matter of nutrition. A farmer in New South Wales last year, during the course of an experiment, took advantage of the wet weather, just while the wheats were coming into head, to give the crop a top dressing of manure got from the Colonial Sugar Refining Company. As a result the wheats did wonderfully, giving four and five heads to the breast, and this part which was top dressed returned a splendid yield. Professor Shelton has expressed the opinion that the ultimate outcome of cross-breeding is uncertain. I don't altogether look at it in that light, but I believe the key of the situation is selection, and I am not certain that the selection exercised on these cross-breds will give us results equal to the selection bestowed on the ordinary sorts. It is with regret that I say this, but it is the conclusion I have come to. For all that, there are two or three of Mr. Farrer's cross-breds which are very promising indeed. A few of the earlier sorts, particularly those made up of King's Jubilee crossed on some other sort, I have great hopes of. I do not know whether the attention of the Conference has been called in any particular manner to this small point: the difference that is exhibited by the flag and sheath or straw in taking the rust. Of course it is well known that the flag takes the rust first and easiest; but the reason for that has not yet taken up our attention. The reason is, I take it, that the surface of the sheath and the surface of one side of the flag are of quite a different construction, and this explains why the sheath and stem take the rust less freely than the flag. This points out the necessity of making a distinction between the flag and the other parts of the wheat plant. I have not made any particular observations with regard to long and short stalked wheats, but thinking the matter over, I come to an opposite conclusion to that of Professor Shelton. I think the short-stemmed sorts are the most rust-resistant.

Mr. Farrer: In the short-stalked varieties, parasites have less space to attack.

The Chairman: We investigated this subject particularly.

Dr. Cobb: Of course I am only speaking from memory. The fact that King's Jubilee acted in the way it did, as reported by Professor Shelton, leads me to revert to an idea I originally had from Mr. Pearson. He told me that Farmer's Friend, although it was a wheat particularly liable to rust, yet in some cases the grain itself did not seem to suffer much. My observations have since led me to believe that we should adopt some term to express this quality; and a term that has expressed itself to me as suitable is *Rust-enduring*. I think that those sorts which Mr. Marshall calls the fleshy-stalked sorts are the most rust-enduring. I would like to see something made of this idea. I am very glad the rust questions were issued to farmers in Queensland, and am somewhat sorry they were not sent out in the other colonies. At the same time, however, we in New South Wales did issue, with our wheat, questions, the answers to which gave us much useful information. With regard to Victorian Defiance, I wish Mr. Farrer would explain his reasons for thinking that it is not the same as Ward's Prolific, for it is a matter that would affect our Nomenclature Committee. I know that, according to Mr. Pearson, Victorian Defiance is very apt to vary, but Ward's Prolific is also known to do the same. Victorian Defiance this year with me was quite true.

Mr. Farrer: The two were quite distinct with me last season. The Victorian Defiance has a somewhat closer head and a somewhat less cup-shaped habit of growth than the Ward's Prolific.

Mr. Marshall: I have three distinct varieties of Victorian Defiance.

Mr. Farrer: Although I think much can be done by rigorous selection from old varieties, I do not agree with Dr. Cobb's opinion that we shall not get better varieties by selecting from cross-breeds than from old varieties; for I think we shall. One thing has struck me, and it is this: There is a good deal in the time at which rust affects varieties. Some sorts are exceedingly liable to take the rust, but are only so at a late stage of their growth. It is well known that in human beings some diseases, and the time of their attack, are hereditary, and I am not sure whether this is not also the case with the wheat plant. I often find that although a plant may be badly attacked by rust, yet the grain when harvested is in fairly good condition. I have noticed this particularly in the case of two rust-liable varieties, one belonging to the Golden Drop type, and the other the Australian Club, which is a form of Purple Straw. I have selected these two, and intend to plant them, to see if the tendency to take rust in this manner is hereditary. Also in Purple Straw, in exercising selection I always give the preference to the plants which rust late. As regards deterioration, I think that on Government farms a great deal of good could be done. Rust-resistant varieties certainly deteriorate if watchfulness is not exercised in the direction of getting rid of any plants which develop a tendency to take rust. On these Government farms care should be taken to cull out all the plants that are affected by rust, and in that way the standard of rust-resistance would be kept up. It would be a great advantage if the farmers themselves kept stud plots, growing the wheat in drills. Half an acre should be planted and cultivated, say, by a Planet Junior hoe, and all rusty plants should be pulled out by a man walking along the rows. It would also give the farmer a chance of destroying all plants that were bunted. Bunt is a disease which I think is spread by machinery, and one which could be largely prevented by disinfecting machinery. And so I think if the farmer, after culling out all bunted plants, harvested and threshed his seed with disinfected machinery, and then planted it in fallow ground where there was no likelihood of there being any self-sown bunted plants, we would be able to stamp bunt gradually out. Something ought to be done in the direction of legislation with regard to machinery, like threshing machines, which travel round from farm to farm. These machines are powerful agents in the spreading of diseases, and I think every one of them should be cleaned and disinfected before it leaves a farm.

Mr. McAlpine: I would like to make an explanation. You will understand that the Victorian experiments have been conducted for two years. Well, then, the report of one year's experiments have already been published, and I have the report of the second year's here beside me. So I think Mr. McLean is not able to crow over us about the circulars to farmers. In fact, the farmers had given us their replies, and they are printed in the book which I hold in my hand, but I did not think it necessary to refer to them. They have been issuing questions to farmers in Germany and the United States, and I have here the results, which I think ought to be given in our report. I notice that in Germany the farmers universally condemn the use of nitrate of soda. One of them says, "I have rust everywhere where I used Chili saltpetre." In the United States report on the experiments, wheat-growers are finally advised to keep up the promising work of breeding rust-resistant varieties on the lines which offered the most profitable results. I agree with most of Dr. Cobb's remarks, and hope that the subject of stud farms will be introduced into our resolutions. Glaucousness is a subject which I think is well worthy of careful consideration, and I intend to pay great attention to it in the future. With regard to King's Jubilee, I would like to record that while it was with me the rustiest, yet it yielded the best of all my wheats.

Dr. Cobb: There is a minor point to which I would like to refer, and that is the great variety of scales of rustiness which we have here. We are working here in a co-operative manner, and I think we should have one uniform scale for the purposes of comparison. I hope the matter will be thoroughly threshed out in committee, and that the best scale, in the opinion of the Conference, will be adopted.

Professor Shelton: I can hardly agree with Dr. Cobb. I myself used two scales or standards, on account of their simplicity, but I think all the scales referred to to-day practically amount to the same thing. With regard to the Doctor's recommendation to plant rusty wheats among the other sorts, I think a great objection to it is that it increases the labour and confusion of the work. I am also opposed to it for the same reason that Dr. Cobb objects to late sowing—that it is a practice too far removed from the practices of farmers.

Mr. Farrer: I think there is a great deal of philosophy in sowing wheats late. We have laid down that wheat should be sown early because it is less likely to be affected by rust, and our object is to find out the liability of varieties when they are sown under the ordinary conditions. Still I think we should also sow late in our experiments—not excessively late, because in that case fresh causes are brought to bear upon the plant but within the whole season in which wheat-sowing is usually carried on. A season or so ago I planted twice—first in the end of May, and secondly in the beginning of July. The July sown crop was the least affected by rust. There is objection against two sowings, and that is that you increase the labour necessary, and in consequence the whole work is liable to be done badly. There are such a number of matters to attend to. I was saying just now that I want to direct my attention to the matter of individual plants that contract the rust affection late in the season, and to keep them by themselves in order to see if the progeny would inherit the same quality, for I think that a variety which takes the disease late is almost as good as one that does not take it at all.

Mr. Inglis: I believe old seed is always preferable to new seed; and with reference to large or small heads, we always find a top dressing will produce a better head. Although Dr. Cobb said that instead of crossing wheats so much it would be better to go in for selection, I am inclined to think we can better plants by crossing. If we refer to live stock, look at sheep and see what excellent results we obtain from crossing there.

Professor SHELTON: All our best breeds of cattle are of pure origin, or have been so long bred in line as to be practically pure.

Mr. INGLIS: Crossing is well worth trying. With regard to the length of the joint, I may say that I have seen wheat badly affected with rust which did not come out of the sheath at all. Some wheats, such as the White Essex, are very liable to smuts, and smut is a thing which I think could and should be put down. On the subject of deep and shallow ploughing, I may mention that a neighbour of mine tried three ways of preparing the land one season, and arrived at the conclusion that it is best to plough 2 inches deep.

Mr. CAMPBELL: Yes, I believe that it has been found that 2 inches is the best depth for ploughing.

Mr. MARSHALL: Mr. Chairman, I have not been present at any previous conference, and had only very short notice to attend this one. Consequently, I have not had time to write out a paper; but I will take this opportunity of stating a few ideas that have occurred to me. As some of you are doubtless aware, I have been engaged in farming most of my life, and although I had been many years thus engaged, I knew comparatively nothing about red rust till 1867, which was the great rusty year in South Australia. This was my first wheat season in the place where I now reside, and I reaped scarcely anything at all. I had only two varieties; one of them, a sort called Goldsmith, produced no grain whatever. The other was Purple Straw, and it was with great difficulty that the wheat could be scraped from its chaff. White Tuscan was another popular variety at that time, and I noticed that White Tuscan produced fairly good grain during this rusty season, not only in my own neighbourhood, but also in other parts. It was seeing this that first gave me the idea that perhaps it would be possible to find other varieties which would also resist the attacks of rust, and I accordingly began my experiments. A few years afterwards a brother-in-law of mine began farming in America, and I communicated with him on this subject, with the result that I received from him six varieties, and out of these six one came out rust free, while the others were failures. This gave me the assurance that rust-resistant wheats could be obtained, and to this end I have been selecting varieties from that time until now. And I think—and I do not wish to say anything against crossing—that by selecting those plants which showed least rust in rusty seasons, that I have now got several excellent varieties—varieties that the millers will willingly buy. I notice in the report of the last Conference that early sowing is given as a means of keeping down rust, but in my own experience I have not found that the early sown wheat always resisted rust. In 1867, everywhere the early sown sorts and all the self-sown sorts, with the exception of White Tuscan, were absolute failures. It was only the late sown wheats, and the wheats that had been beaten down by hailstorms, that gave anything like crops. A friend of mine had not been able to begin operations till August, and he was the only man in the district who got a full crop. Again, in 1877 or 1878—I am speaking from memory—the early sown crop was the most affected by rust, and the late sown the least. Last year in my experimental plots I sowed the same varieties twice—first in the beginning of June, and again about the 8th July; and I may say that the wheats sown in July were less affected than those sown in June. All of this, I think, points to the fact that we cannot make any hard or fast rule about early and late sowing. With reference to specifics. I believe the ideas about these have all been exploded. There may be something in spraying, but it is very impracticable. In my opinion the only means to overcome the red rust is by growing those varieties which seem to offer the best resistance to rust, and the work which Mr. Farrer has been carrying on tends to that end. I know Mr. Farrer has many varieties which resist rust very highly indeed, and that quality, as far as my experience goes, stands. I have never found any of that deterioration of which mention has been made. It may take place, but I have never noticed it. As far as the application of manure to wheat is concerned, I may say that I manure my land every year. I spend about £100 annually on it, and reckon that it has paid me well. I do not think the manure has made any more rust; in fact, I should say I suffer less than if I did not use it. I do not taking two crops running off my land, but usually do not crop more than once in three years. My practice is to fallow, take off a crop of wheat, and then graze the land, the stubble being consumed in that way. I have never noticed the rust spreading from grass or any old stubble lying about; in fact, I always thought that, when the crop ripens, the rust dies. I have seen no difference, so far as rust is concerned, whether the wheat is sown in drills or broadcast, or whether you take two crops off the land in sucession. Mr. Farrer recommended stud plots. This is what I have been doing for a number of years. I have carefully selected the largest and best-shaped heads. Those heads I have threshed separately, sown the grain in plots, and then sown the seed received from the plots. I have raised most of my wheats in that way. I cull the best-shaped heads, and continue that operation until I get what I consider an improvement upon the first. My experience in respect to various wheats and the way in which they resist rust is that those wheats which resisted rust relatively well in 1867 still do. I refer particularly to White Tuscan and Purple Straw. From 1867 right up till the last two or three years, White Tuscan has resisted rust well. The only other matter I would like to refer to is bunt, and, as a practical farmer, I may be bold enough to say there is nothing in it, or in disinfecting machinery, or in anything of that sort. I am satisfied that by giving wheat a strong solution of sulphate of copper you can get rid of bunt. Whenever I receive a wheat from a grower I always make it a rule to pickle it. One year I omitted to do so, and almost every plant bunted badly. Next year I pickled, and there was no bunt. In short, there is nothing in bunt as long as you pickle.

Mr. Campbell: You have not spoken about the situation in which you put your stud farms.

Mr. Marshall: My practice is always to take the centre of a field. I plant my stud wheats under normal conditions, giving them the same chance as every other wheat on the farm. I try to get an even piece of ground, so as to give every variety the same opportunities, and I may say that those sorts which resisted rust well with me twelve years ago still do so. The wheat I got from America, that I spoke about before, had the quality of shelling its grain very easily, and I was unable to cut it with a sickle.

In reply to Mr. Farrer, Mr. Marshall said that he had received no names with the wheats which he received from America.

Mr. Marshall then invited the delegates to take samples of the various wheats which he had brought up from South Australia, and said that he would be very pleased to get reports on their behaviour in the different colonies during the coming season.

Dr. Cobb: It is evident that Mr. Marshall is an example of the farmer who could do the work we want done. I now move that we now adjourn till 10 o'clock to-morrow morning, to go into a Committee on Resolutions.

Mr. Inglis seconded. Motion carried.

The Conference then adjourned at 5 o'clock p.m.

FOURTH DAY, TUESDAY, 27 *MARCH*, 1894.

All the delegates present. Mr. McLean took the chair at 10·10 a.m.

Dr. Cobb: On behalf of the Nomenclature Committee I beg to report progress. If the Conference will agree to adjourn from half-past 12 to half-past 2, the Committee will then be able to submit a final report.

The Chairman: The motion is,—The Nomenclature Committee reports progress and asks leave to resume its sittings at half-past 12.

Dr. Cobb: I move that we do so.

Carried.

The Conference then went into Committee, which sat during the remainder of the morning.

AFTERNOON SESSION.

Mr. McLean took the chair at 2·30 p.m.

Dr. Cobb: I beg to submit the final report of the Nomenclature Committee, which is as follows:—

REPORT OF NOMENCLATURE COMMITTEE.

The Nomenclature Committee held a first meeting, of an informal character, at Adelaide in 1892. At this meeting it was decided to grow small quantities of as many wheats as could be procured.

As a result, over 500 samples were grown at Lambrigg, Queanbeyan, New South Wales, where the obvious duplicate samples were cancelled, leaving the number of distinct varieties at more than 300.

At a second meeting of the committee, held at Sydney in 1893, these varieties were examined, and sixty-five of the more promising selected for further examination. These were issued to each member of the committee and to Professor D. McAlpine (afterwards a member of this committee).

The sixty-five sorts were grown in the several colonies by the respective members, and carefully watched and described.

At a series of meetings held at Brisbane during the session of the present Conference (Professor D. McAlpine and Mr. R. Marshall, of South Australia, having been appointed additional members), these descriptions were collated, and the result is contained in the accompanying list of descriptions.

In submitting the descriptions, the Committee desire to call attention to the fact that, notwithstanding their best efforts, they have been unable to come to a definite conclusion on the names White Tuscan and White Lammas, particularly the former. In view of this and similar facts, and in view of the inevitable introduction of new varieties of wheat of better quality, we wish to express our opinion that the work of naming our Australian wheats is not yet satisfactorily accomplished, and that it is very desirable that an Intercolonial Nomenclature Committee should, for a time at least, have a continuous existence, and hold periodical meetings, with a view to securing uniformity in the naming of our wheats.

Furthermore, it appears to the Committee to be highly desirable that farmers who are cultivating varieties with the names of which they are not quite certain should have a source from which they could obtain the correct names of such varieties. In this way it is hoped that the confusing multiplicity of names may, in a large manner, be got rid of; and a farmer who is in possession of the real name of a variety which he has found, by actual experience, to give satisfactory results in his own district will be able to get with greater certainty improved reliable seed from seed-growers or a change of seed from a distance. It will, probably, frequently happen that in this way new varieties will be presented to one who has a good acquaintance with all our standard varieties, and be recognised by him as such, and that in this manner additions will be made to our lists of valuable wheats. In submitting, however, such varieties for identification, this Committee would impress on farmers the necessity, in order to get the variety identified with certainty, of sending not only seed but heads and entire plants. Verbal descriptions of the variety—*e.g.*, as regards its earliness, height, character of the straw, shelling, &c.,—will greatly help in the identification of a variety, which in any case is a matter of great difficulty.

Furthermore, the Committee desire to call attention to the importance of exhibiting accurately-named wheat plants at the offices of the various agricultural societies as well as at their periodical shows, and in a prominent place in museums. It would also serve a useful educational purpose if such wheats were grown in small plots in convenient centres, where they would be accessible to all interested in them. In agricultural districts such plots, with the specimens accurately named and labelled, might be grown in connection with the local schools for the general information of the farming community.

The Committee recognise it as plainly the duty of the Agricultural Departments of the several colonies to encourage in various ways the growth of new sorts of recognised value in rust resistance by practical farmers willing to undertake the work. We believe that this may be best done by supplying gratis such enterprising cultivators with the seeds needed in the experiments, with full information concerning the habits of growth of such wheats and the means by which such experiments may be successfully carried out; provided always that such encouragement shall be given to experimenters only on condition that full reports shall be furnished concerning the behaviour of such wheats to the Department supplying the seed.

We beg to call particular attention to the fact that our descriptions following are the result of much observation, extending over two years, on samples grown in widely different parts of Australia, and that we believe the descriptions we have written to be applicable in all parts of the country and to be worthy the attention and respect of the colonial Governments and of wheat-growers generally.

N. A. COBB, Chairman.
E. M. SHELTON.
W. FARRER.
D. McALPINE.
RICHD. MARSHALL.

Brisbane, 27th March, 1894.

I may say, in conclusion, that throughout all the work the same attention to details which has been shown during the Conference has also been shown on the Committee, and the work has been perhaps more carefully done than any other work of the same kind anywhere. I beg to move the adoption of the report.

Carried.

(The descriptions referred to in the Committee's report are given in the concluding chapter of this volume.—*Secretary.*)

On the motion of Dr. COBB, seconded by Professor SHELTON, the Conference then went into a Committee on Resolutions, which sat the remainder of the afternoon.

FIFTH DAY, WEDNESDAY, 28 *MARCH,* 1894.

All the delegates present. Mr. McLEAN took the chair at 11·30 a.m.

Professor SHELTON proceeded to read the Final Report of the Committee on Resolutions, the Conference meanwhile adjourning for lunch, from 1 p.m. to 2·15 p.m.

FINAL REPORT OF THE COMMITTEE.

PREAMBLE.

It seems proper that this Conference should give to the public certain facts regarding the evolution of the work it now has in hand. It will be remembered that the series of Australian Conferences on Rust in Wheat, of which the present is the fourth, is the first of the kind ever held. Precedents that might serve as guides in the work that was expected of them were, of course, entirely wanting. It has been necessary, therefore, not merely to devise methods of work, but the means, by which plans were given effect, had, in many cases, to be created. The Conference had no inherent powers by which it could create new facts. Until quite recently it has had to rely for its facts concerning the more practical bearings of the problem it has had to deal with upon answers to questions put forth by the Departments of Agriculture of the several colonies. These replies were often very useful, but often they were conflicting and irrelevant. It was felt, almost from the first, that the Conference must take steps to create a mass of experimental facts that would have an undoubted bearing upon the work in hand. To this end its members have carried out a vast and most comprehensive scheme of experiments, scientific and practical, the details of which occupy much of the volume of reports that have been given to the public. This experimental work has covered subjects of which the following are a part only:—

1. The relation of applied manures to the spread of the rust contagion.
2. Effect of fungicides applied in spraying.
3. Effect of cultivation.
4. The character of flag and straw of wheats as influencing the spread of the disease.
5. The extent to which the rust spores adhere to seed wheat.
6. Microscopical, chemical, milling, and baking tests of wheats, made with the purpose of determining the relation of rust resistance to known qualities.
7. Influence of insects as carriers of rust spores.
8. Determination of the particular kind of *Puccinia* affecting crops in different districts.
9. Effect (upon rust) of different times and modes of sowing wheat.
10. The creation of rust-resistant sorts by cross fertilisation and selection.
11. The relative value of different varieties of wheat.

In carrying out the experiments of which the above is an outline, members of the Conference have unanimously been led to the conclusion that efforts in this direction may most hopefully be turned towards the study of the wheat plant itself. We recognise that the wheat plant is naturally endowed with certain qualities, active or latent, which are susceptible of development to such a degree as to make it, to a very great extent, proof against the attacks of rust. Evidence has been presented to this Conference that, as far as 1867, the rust resistant-powers of certain varieties have been recognised by practical farmers of the older wheat-growing colonies. Acting upon their own success and failures, and the available facts of practical life, the members of the Conference have been led step by step, as by a common impulse, to direct their efforts, almost exclusively, to the work of bringing to light those sorts which possess in the highest degree rust-resistant power. In this way, the reports of the Conference have come to be, almost exclusively, a record of the work of its members, and latterly of efforts put forth to develop or discern this quality of rust resistance.

The proportions this new work has assumed under the hands of the representatives of the several colonies may be gathered from a few brief statements of facts:—The representatives of New South Wales have an experimental list of something over 500 varieties; Victoria, 315; South Australia, 340; Tasmania, 150; and Queensland, 250 different sorts. All told, the growth and behaviour of no fewer than 500 different sorts of wheat have been under examination by the different members of the Conference during the year last past. That the labours involved in these experimental undertakings are fruitful and for the present full of promise of larger things in the near future is shown by the facts given below respecting old-established and comparatively well-known varieties. By the use of new and unfamiliar sorts the list given might be greatly lengthened.

In all the five colonies that have been represented at these Conferences, the following varieties have enjoyed more or less immunity from rust attacks:—Improved Fife, Blount's Fife, White Fife, Blount's Lambrigg, Marshall's No. 3, Tourmaline, Pringle's Defiance, Fluorspar, Allora Spring, Horneblende, Sicilian Baart, and the various Durums.

A like unanimity is shown in respect to the sorts which have most readily succumbed to the disease. This list, of course, is too long for reproduction here. It is sufficient to say that the most pronounced of these are the numerous prolific members of the Purple Straw family with, among others, the Golden Drop, Tuscan, and Velvet Chaff varieties, all connected by certain affinities, the most pronounced of which are a large cropping capacity under favourable conditions, extreme whiteness and plumpness, with a corresponding granular structure of grain indicating the presence of much starch.

One of the noticeable results of the labours of the Conference is seen in the present hopeful view of the situation—as to rust contagion—now taken by practical men. The number of persons who believe that complete immunity from rust in the wheat crop will be secured is, perhaps, as few as ever, but the existence of the feeling that the disease may be minimised or so completely held in check that the loss from it will be small is now all but universal.

The obstacles to the final success of the work of the Conference and the nature of the obstacles likely to be encountered in the future are suggested by the following facts:—

1. The varieties which suffer most from rust, among which the disease is most easily communicable, are the white, highly starchy, and often prolific sorts made familiar in the practices of Australian farmers.
2. The sorts least susceptible to the rust disease, that are most strongly resistant thereto, are generally hard or horny in texture, and often, though not always, dark in colour.
3. These really rich wheats are constantly discriminated against by Australian millers, whose machinery, it would appear, is inadequate to the work of successfully manipulating them, and who, to a certain extent, set the fashion in flours.

It has been brought to the attention of this Conference that varieties of wheat, which in America and Europe are accounted of first value, from which indeed a large part of the flour of commerce is made, and which in Australia have shown themselves possessed of great rust-resistant power, are here, by millers, placed so low in price that their cultivation is rendered unprofitable. It is incredible that these hardy, high-quality, red and amber wheats shall be for ever excluded from Australian agriculture, that Australian farmers are doomed, as it were, to cultivate only those varieties which are whitest—*i. e.*, richest in starch—least nutritious, and which easiest fall prey to the rust disease. Surely it is only reasonable to expect, in view of the vast interests involved, that the efforts of this Conference, looking to a common understanding among farmers, millers, and the scientific men who have given direction to much of these experimental efforts should be heartily seconded by all interested. We therefore, in this special manner, direct attention to the resolution given further on, which suggests an intercolonial conference of millers, producers, and scientific men for the consideration of the question of the milling qualities of rust-resistant wheats.

This Conference desires to emphasise the recommendations of previous Conferences of this series. The effect upon the development of rust of manuring, of treatment of seed, times of sowing and reaping, are doubtless, under certain circumstances, often considerable, but taking things by and large they must be reckoned as trifling, compared with the influences of variety and time of sowing. We have shown conclusively, in the experiments of a series of years, that certain varieties of wheat are rarely, if ever, seriously affected by rust. Many other sorts, again, of a rust-liable kind generally escape the rust when sown early, but suffer seriously when late seeding is practised.

The importance of distinguishing clearly varieties likely to suffer or escape the effects of rust contagion is recognised by the Conference in the appointment of a Nomenclature Committee, whose work in this connection is shown in their report herewith. Preliminary to the work of this committee, the following classes have been made, in which to place the various wheats.

First Class—Rust-proof wheats, by which is meant wheats which will not permit the mycelium of rust to enter and feed on their tissues. Of such wheats there are no known examples.

Second Class—Rust-resisting wheats, by which is meant wheats which in localities suited to their growth and under normal conditions resist either the entrance of the rust mycelium into their tissues, or its subsequent growth and outburst. Of this class many examples are known.

Third Class—Rust-liable wheats, by which is meant wheats which under the usual conditions of growth offer no resistance to the rust. Australian wheats now mostly grown belong to this class.

Fourth Class—Rust-escaping wheats, that is to say, wheats which, like the third class, are rust liable, but which, if sown at the proper time, ripen so early as to be ready for harvest before the rust of an ordinary season can prevent a paying crop.*

Of these four classes the most important are the second and the fourth. The characteristics of the second class—namely, the rust-resistant wheats—have been found by a thorough and close examination of many varieties to be as follows: — First, the possession of a thick or tough skin, so tough that although the rust mycelium may enter the plant by means of the open stomata, yet it cannot break through the skin in order to mature and shed its spores, so that its further development is prevented; and, second, the presence of a waxy exudation on the surface of the plant similar to the bloom of fruit; this waxy covering when present about the mouths of the stomata prevents the rust mycelium from entering. Wheats possessing tough skins, and especially if possessing the toughness of skin in conjunction with the waxy bloom, may be grown under all conditions suitable to their normal growth without suffering seriously from rust. On the other hand the rust-liable wheats which are characterised by the possession of a thin and tender skin and often by the absence of bloom, can be grown successfully during a rusty year only in one way—namely, by sowing at such time that the plant shall be for only a short period subject to the attacks of the rust fungus. As to the proper time of sowing such wheats no universal rule can be given. Sometimes these wheats escape rust the most when sown early and sometimes when sown late; but in the great majority of cases which have been examined by the Conference early sowing has been very much the more successful. And when in addition to early sowing early-maturing varieties are selected the loss due to rust becomes, taking the average of experiences, comparatively trifling. With these facts now clearly and indubitably established one may lay down a course of action which, if judiciously pursued, will certainly in great measure do away with the losses caused by rust. Thus there are many, perhaps the majority, of wheat-growing districts where, if quick-maturing wheats be sown early, they in nine cases out of ten escape damage by rust. If, then, the farmers in these districts, when they have the opportunity of sowing early, should sow such varieties as Steinwedel and Early Para, which are quick-growing wheats, or even such prolific wheats as Hudson's Early Purple Straw, Talavera, or White Lammas, which, while not being specially quick-growing are yet able to escape rust if sown early enough, they would run little risk of loss from rust. If, however, in such districts the farmer be prevented by late rains or other causes from early sowing, then he cannot sow this class of wheat without running serious risk. He should then on no account sow these wheats, but only those belonging to the class described further on as rust-resistant.

From the above it will be understood that the principal measure recommended by the Conference for dealing with the rust pest is the growth of suitable varieties of wheat. But this is not the only measure that needs to be taken, for it has been clearly shown that varieties of wheat, both the rust-resistant and the early-maturing, are apt to change their character in the course of time, and, moreover, some of those varieties which are suitable in regard to their rust resistance and early maturing are unsuitable for general purposes owing to the possession of other undesirable qualities, and hence it is necessary that a thoroughly efficient and organised system should be established for the maintenance or improvement of the qualities of suitable existing varieties, and for the production and distribution of new and improved varieties, and at the present Conference a definite scheme of an intercolonial character has been proposed and discussed and recommendations made for its immediate establishment. By means of this scheme the farmers will have distributed amongst them, time after time, as occasion may require, rust-resistant and rust-escaping wheats suited to their districts, the good qualities of which will have been ascertained and proved by a stringent test before distribution.

The question of the marketableness of certain rust-resistant wheats has been considered by the Conference. It has already been stated that Australian millers will not buy them except at reduced prices. Supposing such were the case, the evil would not be so great as that of the rust pest, for it is obvious that a crop of fourteen bushels to the acre of a rust-resistant wheat sold at 3s. 9d. per bushel would be a very much better return than a crop of five bushels or six bushels to the acre of a rust-damaged crop sold at 4s. per bushel. But some of the highest quality wheats of the rust-resistant class have been submitted to the judgment of leading millers, who have pronounced them to be of a good milling character. Many of the resistant wheats produce grain containing a greater proportion of gluten than do the rust-liable wheats, which contain,

* Most likely a fifth class—namely, rust-enduring wheats—might properly be added.

on the other hand, a greater proportion of starch. But that these hard and highly glutinous wheats produce good and nourishing flour has been shown by the Conference. Bread of good quality has been made from this flour, and there seems little doubt that such bread is more nutritious than that made from starchy wheats. Probably the best bread can be made by mixing both classes of wheat, as is now done in England. When the value of these hard glutinous wheats becomes more widely known in these colonies there is no doubt that a greater demand for them will spring up. In the meantime, however, it should be pointed out that there is already a large and constant market for the class of hard wheats—namely, the export market—and the principal condition necessary for the export of this class of wheats is that they should be grown in large quantities, that is to say, in shiploads.

In connection with the question of the market value of wheats, the Conference recommends that the Agricultural Department of each colony should take steps to establish a system of testing wheats in the laboratory and reporting their value to the farmers.

In examining the varieties of wheat now grown in the colonies the conviction has forced itself upon the Conference that while in one of the great staple industries of this country—namely, that of wool-growing—the breeds of sheep are distinctly named, pedigrees kept, and the rules of breeding well known, in the other great industry—namely, that of wheat-growing—much confusion exists about varieties and their names, and much remains to be learnt in regard to the rules which should be followed in producing and maintaining varieties. Steps have therefore been taken, in accordance with a resolution of previous Conferences for making a complete collection of all varieties now in the colonies so as to compare them and decide upon a common system of names, and also experiments have been commenced for enlarging our knowledge concerning rules for improving the qualities of wheats and for producing new varieties.

For the purpose of formally embodying the above policy the committee recommends that the following resolutions be adopted by the Conference:—

Recommendations for the Immediate Attention of Farmers.

1. In previous years this Conference has drawn attention under the head of "Recommendations for the Immediate Attention of Farmers" to certain practical rules of proved utility in checking the spread of rusts. These rules have come to the Conference as the personal experiences of individual members, and through correspondence with the practical farmers and wheatgrowers of every section of the Australian colonies. Like all rules of agricultural practice, these recommendations are not to be taken as infallible; nor are they offered as specifics for the disease which the Conference has been called to combat. They no more than represent certain well-marked and clearly defined tendencies. But while it is true that the farmer whose practices conform to these recommendations may yet be a sufferer from the rust contagion, it is absolutely certain that he will suffer in a much less degree than his neighbour who in practice ignores these dicta of the Conference. In this respect the experiences of the past season but add force to those of previous years. The Conference therefore desires, without going to the length of repeating the rules laid down in the reports of the Melbourne, Sydney and Adelaide meetings, to re-affirm with slight modification the suggestions made in the reports of those meetings. Whatever other measures may be adopted by the farmers with the object of preventing the disease entirely or of arresting its further spread, the practices here suggested may not with safety be ignored. These recommendations briefly stated are as follows:—

- I. Early sowing and the cultivation of early-ripening sorts.
- II. Harvesting rust-infected crops in the early or "dough" stage.
- III. The growth of sorts which local experiences have shown to be rust resisting or rust escaping
- IV. The growth of wheat after fallowing, or after crops of a different order, agreeable to the true principles of rotation.
- V. Thin seeding, with due regard to varieties and local conditions of soil and climate.

Prizes for Wheats at Shows.

2. This Conference recognises the need of an awakened interest in the new facts bearing on rust resistance, and believes that the agricultural shows may contribute largely to this object. We therefore urge upon local societies the importance of offering special prizes for collections of wheats of proved value as rust-resisters; and it is further advised that these collections be kept separate from the general wheat exhibits, and that they be plainly labelled, to the end that a wide publicity be given to the general subject, as well as to the characteristics of promising sorts.

Trial of Various Wheats.

3. This Conference believing that no such cereal as rust-proof wheat has yet been discovered, but that, as shown from experiments lately carried out, by importing different varieties from countries outside the Australian colonies, and by carefully selecting and crossing them within the colonies, certain kinds have been found to

constantly escape to a considerable extent the ravages of this pest, recommends a continuance of this work of importation, selection, and crossing, with a view to securing varieties most likely to escape rust and specially adapted to the different districts of our colonies. And it having been found from evidence submitted to this Conference that certain varieties of wheat, believed to be rust-resisting when grown in one locality, have succumbed to this pest when grown in another locality, this Conference considers that while it would not be justified in specifying any particular varieties as possessing rust-resistant qualities under all conditions, nevertheless particularly recommends the following in the order given as worthy of being grown on a large scale :—

A.—RECOMMENDED FOR GROWING ON A LARGE SCALE.

I. *As rust-resistant—*

(1) Blount's Lambrigg, (2) Leak's, (3) * Belotourka, (4) Ward's Prolific, Marshall's White, Canning Downs Rust-resistant, Marshall's 3, Marshall's 8, Defiance.

II. *As prolific and moderately resistant—*

Talavera.

III. *As rust-escaping, if sown early—*

(1) Allora Spring, (2) Early Para, (3) Hudson's Early Purple Straw, (4) Early Baart, (5) Velvet Pearl.

IV. *Quick maturing wheats for late sowing—*

(1) Allora Spring, (2) Velvet Pearl, (3) Canning Downs Rust-resistant, (4) Early Baart.

B.—RECOMMENDED FOR FURTHER TRIAL ON A SMALL SCALE.

I. *As rust-resistant—*

(1) Fluor-Spar, (2) Blount's Fife, (3) Fultz, (4) Tourmaline, (5) Niagara, (6) Improved Fife, (7) Anglo-Australian or Anglo-Canadian, (8) Manitoba, (9) Square-headed Sicilian, (10) † Sicilian Baart, (11) Clarke's Rust-proof, (12) Horneblende, (13) Summer Club, D'Arblay's Hungarian, Australian Wonder, Bearded Herisson, Marshall's 4, 6, 7, Hercules, Marshall's 10, 11, 33, 36, 17, 23, 26, Battlefield, Marshall's Prolific, Thomas' Rust-resistant, White Fife, Wheaton's Rust-proof.

II. *As rust-escaping—*

(1) Jacinth, (2) Quartz, (3) King's Jubilee, (4) White Velvet.

RECOMMENDATIONS FOR GOVERNMENT ACTION.

4. Resolved—That it is desirable that a practical system for the production and distribution of rust-resisting wheats suitable to different districts should be immediately established, and that this system should, subject to modifications needed by each colony, be conducted on the following lines :—A central station for each colony for the preliminary testing of new wheats introduced into the colony, for the production of new varieties by cross-fertilisation and by selection, and for the distribution of suitable wheats thus obtained to representative districts of the colony, to be there subjected to to a sufficient test and if necessary fixed in their characters by farmers and others competent for the work, and that such wheats as pass satisfactorily this test should then be distributed to the farmers around in such a manner and by such agency as would be most suitable to the conditions of each colony. This Conference desires to place on record its unqualified approval of the course adopted by the Government of New South Wales in establishing a central wheat station and encouraging a number of farmers to grow pure seed wheat true to name on a commercial scale.

NOMENCLATURE.

5. Resolved—That in connection with the intercolonial exchange of seed now being carried on, steps be taken to continue the work of an intercolonial nomenclature committee, and that such committee be composed as at the present—viz., Dr. Cobb (chairman), Mr. Farrer, Mr. McAlpine, Professor Shelton, Mr. Marshall, and Rev. H. E. Thompson. That one or more delegates from each of at least three colonies shall constitute a quorum for the business purpose of this committee.

EXPERIMENTS.

6. The Conference re-affirms the desirability of continuing experiments and inquiries in directions such as were indicated at the Adelaide Conference. The subjects for investigation fall under the following headings :—

(*a*) The effect, as regards rust, of manuring.
(*b*) The effect of applying lime, salt, and sulphate of iron to the soil.
(*c*) Effect of different modes of cultivation.
(*d*) Effect and economical application of drainage.
(*e*) Efficacy of burning all straw, weeds, and other plants in the infected field, and of using other disinfecting agencies with a view to destroying spores.
(*f*) Relative value of rust shrivelled and plump seed.

* Belotourka is specially recommended for hot districts, either in the interior or on the coast.
† Sicilian Baart is recommended for coast as well as for interior districts.

(*g*) Relative value of different varieties of wheat.
(*h*) Effect, as regards rust, of different times and modes of sowing.
(*i*) Effect of different times and modes of reaping.
(*j*) Investigations regarding plants that act as intermediary hosts and regarding all plants that are affected by rust in the different colonies.
(*k*) Investigations as to the earliest stage of wheat in which the fungus may effect an entrance.
(*l*) Investigations regarding any insects, such as the recently discovered grubs of a *Diplosis*, which feed upon rust-spores and may be instrumental in spreading the pest.
(*m*) Investigations in regard to the influence on rust of interchange of seed between suitable localities.
(*n*) The influence which the growing of seed in hot climates has on the early maturing of wheats.
(*o*) Investigations in regard to the effect of mixture of seed in the development of rust.
(*p*) Microscopical and chemical examination of varieties of wheat in order to discover the characteristics of rust-resisting wheats.
(*q*) That in expressing the rustiness of a wheat plant it is desirable to state whether the rust occurs on the flag, sheath, or stem; and that the amount of rust in any of these localities is best expressed in terms of the amount of surface covered by the rust.
(*r*) Determination of the particular kind of *Puccinia* affecting the crops in different districts and the damage done by each.
(*s*) Investigations as to the relation between the variety of wheat and the time of attack by the rust fungus.
(*t*) Investigations to determine the presence or absence of the rust fungus in the seed.
(*u*) Investigations concerning the ability of certain wheats to endure the rust disease without injury therefrom.

The Next Conference.

7. Resolved—That it is desirable, in the interests of wheat growing in Australia, that another Intercolonial Conference on the subject of rust-resistant wheats and their milling qualities be held two years hence under the auspices of the various Governments, and that such Conference be composed equally of wheatgrowers, millers, and scientific men having a knowledge of wheat and its diseases; and it is further recommended that the meeting above recommended be held in Melbourne, Victoria.

Publication of Reports on Experiments.

8. Resolved—That it is desirable that reports of the coming season's inquiries and experiments in each colony be published by the respective Governments in the ordinary departmental publications, and that an intercolonial exchange of these reports be effected in the usual way.

PETER McLEAN, Chairman of Committee.
E. M. SHELTON, Secretary.

Brisbane, 28th March, 1894.

Votes of Thanks.

Dr. Cobb: I have a very pleasing piece of business to do, and that is to move that the members of this Conference desire to express their pleasure for the cordial reception that they have received at the hands of the Minister for Agriculture in Queensland and his officers, and for the splendid arrangements which they have made for entertaining the delegates while in Brisbane. I have much pleasure in making that motion.

Mr. Campbell: I have much pleasure in seconding it. I am sure it would have been impossible for us to have been received in a better manner. The trip to Bundaberg has given us an insight into the country which will be of great benefit to us all and to myself in particular. We have a large area of sugar country in New South Wales, but I noticed a most marked difference between the state of the sugar industry there and here. There seems, Mr. Chairman, to be great prosperity among your sugar-growing population, everybody appearing, so far as I could judge, comfortable and prosperous; but I cannot say the same with regard to New South Wales cane growers. I do not know why. Our soil and rainfall are probably as good as yours. I dare say there is a solution to the problem, but the question is one I do not think necessary to go into now. Another matter that struck me was, what a splendid thing it would be if the Government of this colony were to set apart forever as large an area as possible of that magnificent scrub country which we saw between this and Maryborough. I think if any man brought this about, future generations would bless him. We have done something of the kind in New South Wales, some thousands of acres having been reserved, and they have turned out to be a vast benefit to the public, promising to be more valuable in the future. The North Coast scrub lands will probably be rapidly taken up, and unless some action is taken to reserve large areas of them so that they cannot be touched, posterity will only know of their grand timbers and valuable plants by hearsay.

Mr. Inglis: I beg to support the motion. I must say that from the day we reached Brisbane till the present, we have been treated in a most hospitable and hearty manner. The tour to Bundaberg has, I am sure, enlightened a good many of us. At all events it has enlightened me. Before I came to Queensland, my impression was that it was a burnt-up country, and one which I would be glad to get away from; but now I can only say I wish I could stay a little longer. I would like to see a little more of Queensland, as I am convinced that it is a colony of vast resources; and, as a farmer of more than thirty years' experience in South Australia, I would like to come and try my hand at agriculture in this country.

Mr. Marshall: I can only say the delegates have been treated in a very handsome manner. I have enjoyed myself greatly while I have been here. The sugar district pleased me very much, and my impression of Queensland is that it is a colony with a great future, and one of unlimited capabilities. I have great pleasure in supporting the motion.

Mr. McAlpine: I may confess that I came to Queensland with certain foregone conclusions about its climate and the nature of the country. I am happy to say that a great many of these hasty conclusions have been dissipated, because I have found a country with magnificent resources and, notwithstanding all that has been said to the contrary, a first-class climate. Queensland's extensive territory is evidently not only capable of producing large quantities of meat and sugar, but also a good deal of wheat. Not only have we seen the country, but we have also met with great kindness. The Minister in a most genial way welcomed us to Queensland, and Mr. McLean has done more than his duty. He has treated us with great hospitality, and I feel that most of the enjoyment of my visit has been due to his kindly offices.

Mr. Farrer: After all that has been said, I think it will be best for me not to say anything.

Motion carried.

Mr. McLean: In reply I may say that we have simply done our duty, and are very pleased indeed to have this opportunity of meeting in Queensland gentlemen who represent the wheat-growing industry. It is only within recent years that the wheat industry has come into prominence in this colony, but I have no hesitation in saying that before long Queensland will be one of the greatest wheat-producing colonies in Australia. With regard to reserving some of the scrub land between this and Maryborough, I may say that action has already been taken, and that considerable reservations have been made at Palmwoods.

Dr. Cobb: I hope we shall express our gratitude to Professor Shelton for his discharge of the secretarial duties. I have the greatest pleasure in moving that this Conference thanks the Professor with acclamation.

Mr. McAlpine: I second that motion. He is undoubtedly the right man in the right place. His task has not been a light one, and we all feel certain that he has performed his duties in a manner equal to that of his predecessor, which is a compliment I think he will appreciate.

Carried with acclamation.

Professor Shelton: I think you have heard quite enough from me to-day. However, I am not wholly indifferent to thanks given in such a hearty manner, so I thank you for your cordial expressions of goodwill, the more especially as this comes from co-workers of several years' standing, although I believe Mr. McLean, Mr. Inglis, and myself are the only three members who have attended all of the intercolonial conferences so far held.

Mr. McAlpine: Before closing, I beg to move that a cordial vote of thanks be given to Mr. Farrer for the unequalled liberality and kindness with which he has treated the various colonies in supplying them with seeds and with the results of his experiments with crossbreds.

Dr. Cobb: I beg to second that. I have probably had more intercourse with Mr. Farrer than anybody else here, and can heartily endorse all that Mr. McAlpine has said. We feel in New South Wales that we are very fortunate in possessing a man like Mr. Farrer, who devotes his time to a thing he thoroughly believes in, and which we all hope as much from as he does.

Carried with acclamation.

The Chairman tendered the thanks of the Conference to Mr. Farrer.

Mr. Farrer: I thank you very much. With reference to crossbreds, I may say that the season before last we had no rust, but last season we had a good deal, which gave me the opportunity of making a good selection, which will save you a lot of trouble. My custom is to get a number of seeds from each cross, and this year I have the advantage of it. Suppose I have eight or ten plants of any single cross. Some of these plants are rusty, some not. This gives me the chance of only saving the plants which are free, and so I hope you will be spared much unnecessary inconvenience in trying these plants the coming season. I have not sent you plants that are free in every case, because I have no such plants, but I have sent plants that have been as free as possible. Of course I know I have to submit to many criticisms on this matter of cross-breeding. Professor Shelton has compared crossing in wheat to crossing in live stock, but he fails to grasp one fact. The failures in crossing with stock have been because parents which have been dissimilar had to be used. But in wheats, self-impregnation has to take place. So the force of inheritance becomes so strong that it causes one to wonder if any variation at all takes place. As a matter of fact, it seldom does take place, and if it does it is only in a minor degree. It makes the work with reference to the self-impregnated plant comparatively simple and certain. Dr. Cobb thinks that selection would be of more effect than cross-fertilisation. But improvements from selection are not permanent. They only remain as long as great care is exercised. Directly that care ceases, reversion takes place, and the plants go back. Very valuable work can be done by selection from old varieties, and this I am doing. But I do it because I want to use these selected strains as parents for cross-fertilisation, and because I think they will make better parents than ordinary plants. I thank you very kindly for what you have done. I did not expect it. My aim has been to find out the most perfect wheat, independent of any local considerations. To this end I have been sending wheats to Europe and America, and intend to send some shortly to India and France. I hope also to soon be able to start a correspondence with people in different parts of the world, so as to make my work as perfect as possible. Referring again to the matter of hard and soft wheats, I may say that in Germany hard wheats are regarded as the most rust-resistant, and also as the most nutritious. Another advantage in hard wheats is that they suffer least from weevil, and for this last reason particularly I think Queensland should go in most for hard wheats.

Mr. Inglis: I propose a hearty vote of thanks to our Chairman for the very efficient manner in which he has carried out his duties. Both inside this room and out he has given thorough satisfaction. It would take a very good man to beat him; and I believe if it had not been for his tact and the quickness with which he grasped the various points at issue, the business would probably have been prolonged a day longer.

Mr. Campbell seconded.

Carried with acclamation.

The Chairman: I thank you very much for this vote of thanks. If I am not a good chairman by this time, I ought to be one. I have had plenty of experience in the work.

The Conference then closed its sittings at 3·45 p.m.

DESCRIPTIONS OF PROMINENT VARIETIES OF WHEAT.

Thomas' Rust-resistant.—Of medium height. The dull yellow straw is furrowed, hollow, of medium thickness, stiff, tapering a little. The smooth strongish yellow ears are bald, of medium length, regular, compact, of nearly uniform diameter throughout the length, flattened obversely, erect, straight or slightly curved, rather blunt at the tip, tapering at the base, where there are two or three sterile spikelets. There are three grains in each of the fertile spikelets. The chaff is short, dull in lustre and uniform in colour, blunt at the base of the ear but short-awned toward the tip, rather soft, rather shallow, round-backed, firmly attached, and lies close to the grain, in spite of which fact, however, some shelling occurs. The grain is small, short, straight, plump, opaque, yellowish, rather plump-bosomed, blunt at both ends, and has a rather shallow crease, a mealy cross-section, and an abundant brush. A back-crease is sometimes visible. The germ-sculpture is two-fifths as long as the grain.

This variety is apparently hardy, and it is certainly fairly prolific; it ripens in mid-season, and must be sown early. It is somewhat resistant to rust. One miller reports favourably on this wheat.

Prominent Characteristics.—Medium height, strongish straw, bald yellow ears, small yellowish grain, mid-season, somewhat resistant to rust.

Blount's Lambrigg.—This is a strong-stooling wheat of medium height, yielding well under proper treatment. The straw is strong, tough, stiff, hollow, of medium thickness, slightly tapering, and of medium flexibility. The sheath is long, reaching half-way to the base of the ear. The joints are not prominent. The foliage is of medium abundance. The flag is erect, smooth, dark green, glaucous, and tough, rather narrow, and of medium length. The bald, square, erect, regular heads are smooth and yellow, of medium length and compactness, uniform in diameter or clubbed at the tip, often twisted, blunt at the tip, tapering at the base, where they present from three to four sterile spikelets. The fertile spikelets are spreading and three-grained. The chaff is of a dull uniform colour, somewhat angular-backed, deep, close-lying, firmly attached, stiff and short, nearly acute, mucronate at the base of the ear and short-awned at tip. The grain is rather small and flat, of medium length, straight, plump, opaque or horny, round-bosomed, of a yellowish or amber colour, rather pointed at the base, blunt at the tip, and presents a small brush. The crease is deep, and a back-crease is also visible. When cut the section appears horny or mealy. The germ-sculpture is large.

The Australian Blount's Lambrigg originated with Mr. Wm. Farrer in the Queanbeyan district, New South Wales, from seed imported from America. It has found favour in many parts of the country, and more and more of it is grown from year to year. It has a marked power to resist rust, and is to be highly recommended on that account. The grain is of only fair milling quality. This variety will not do well on naturally wet land, nor in a very wet season, except the drainage be good. It is a late wheat, and must be sown early. It is not suitable for coast districts. It belongs to the Defiance type, and closely resembles Pringle's Defiance and Smith's Nonpareil. It is better suited for export than for the Australian home market.

Prominent Characteristics.—Of medium height, tough straw, bald yellow ears, small flat grain, of fair milling quality, late, good yielder, resistant to rust, not likely to shell.

White Lammas.—Tall, with strong whitish straw of medium size. The ears are smooth, bald, long, very regular, somewhat open, tapering, square, erect or leaning, a trifle curved, acute at the tip, abrupt at the base, where there are two or three sterile spikelets, whitish, with the tips of the chaff almost salmon-coloured. The spikelets are narrow, and contain two or three grains. The chaff is shiny, streaked with colour at the tip, of medium length, blunt, short-awned towards the tip of the ear, rather stiff and thick, rather deep, round-backed, firmly attached, and lies pretty close to the grain. There is little or no shelling. The grain is large and handsome, long, straight, plump, opaque, yellowish, rather plump-bosomed, quite blunt at both ends, and has a long and abundant brush, a deep crease and a mealy cross-section. A back-crease is sometimes visible. The germ-sculpture is two-fifths as long as the grain.

This handsome freely-stooling, prolific, hardy, mid-season wheat is well known and deservedly popular. It is not resistant to rust, and yields grain of very good quality. It is suitable to any but the coast districts. It varies considerably in form, but is easy to recognise. A wheat we have observed under the name of Scotch Wonder also resembles the White Lammas, but is taller and more slender in all parts, even the grain being proportionately narrower though equally blunt at both ends. Dallas is a wheat much like White Lammas, but inferior to it. It has slenderer heads with smaller awns. The grain of White Lammas is typical of those held in favour by Australian millers.

Prominent Characteristics.—Tall, strong straw, bald whitish ears, tips of chaff salmon-coloured, large yellowish grain of good milling quality, mid-season, good yielder, not resistant to rust, does not shell.

Berthoud.—This is one of the most graceful and attractive of the beardless wheats. One could not wish to see a braver sight than these beautifully tinted heavily laden heads fairly leaning over with the weight of their grain, bobbing and waving on the slightest provocation. The Berthoud is a mid-season wheat of medium height, and has a strong though flexible and hollow straw of medium thickness and of rather uniform diameter—that is, not tapering much. Before ripening, the straw is green, but when ripe it is of a dull yellow colour. The ears are long, regular, open, very tapering, square, curved, and leaning over when ripe, or even drooping, acute at the tip, tapering at the base, where there are from three to four sterile spikelets. In colour the ears are yellow with dashes of faint pink, brown, or purple. The spikelets are rather narrow, and only two-grained. The chaff is peculiar, being of medium length, with blunt hooked points, which change to short awns near the tip of the ear. There is scarcely any other wheat that presents this peculiarity. As for the rest, the chaff is quite thick and stiff, not shiny, angular-backed, shallow, streaked with colour, lies close upon the grain, but is a trifle loosely attached, and this allows it to shell a little. The grain is long, plump, beautiful, and large; it is of an opaque yellowish colour, flat-bosomed, blunt at both ends, with a deep close crease and very large germ-sculpture; no back-crease is visible. In section the grain is rather horny; it is like that of White Lammas in most respects.

This is plainly a hardy sort of mid-season wheat, and with the right treatment fairly prolific. It is inclined to creep, though it does not stool very freely; but this can be compensated for by an extra quantity of seed per acre, say, a fourth to a third more than for most sorts, this being all the more necessary as the seed is usually very large. It is quite liable to rust. This wheat is not early, nor yet late. It should be sown early. It will do well on land which is not of the best character. The Berthoud has an unmistakable resemblance to the White Lammas, but the ears taper more and are more curved when ripe; it also stools less freely.

Prominent Characteristics.—Medium height, strong straw, curved yellow ears with dashes of faint pink or brown, hooked points to the chaff, beautiful large grain of good milling quality, mid-season, excellent yielder, quite liable to rust, may shell a little, good yielder.

White Essex.—Of medium height, with good stools; straw strong, of medium thickness, stiff, fairly tough, hollow, tapering but little, dull in colour, distinctly furrowed, yellow, at no time purple. The heads are white, bald—that is, not bearded—long, regular, open, tapering, square, erect or leaning, nearly straight, acute at the tip, tapering at the base, where there are two or three sterile spikelets. The narrow spikelets often contain only two grains, but, as usual where this is the case, both are large; at times they are spreading, three-grained. The chaff is of medium length, blunt near the base of the ear, acute towards the tip of the ear, and even short-awned at the end; it is very stiff, almost shiny, sub-angular backed, shallow, nearly uniform in colour, is firmly attached, and hugs the grain closely, notwithstanding which, however, it sometimes shells rather badly. The grain is large, long, straight, of medium plumpness, horny, yellowish, rather flat-bosomed, blunt at the tip, rather blunt at the base, and has a fairly deep crease and a small brush. The germ-sculpture is two-fifths as long as the grain, and is more dorsal than usual. The interior of the grain is horny. No back-crease is visible.

White Essex is a somewhat rust-liable wheat, resembling Talavera and White Lammas, one that yields fairly well and gives beautiful grain; considered of excellent milling quality in Australia. It is grown extensively in some parts of Australia.

Prominent Characteristics.—Medium height, fairly strong straw, bald white ears, beautiful grain of good milling quality, mid-season, somewhat liable to rust, shells rather badly, yields fairly well.

Australian Talavera.—Whether this is a strain of the Bellevue Talavera is uncertain; the resemblance, at any rate, is unmistakable. Like the Bellevue this present variety is of medium height or tall. The dull-yellow, furrowed straw is of medium thickness, almost semi-solid, stiff, strong, and tapers little; at no period of growth is it purple. The ears are smooth, whitish, bald, long, regular, very open, markedly tapering, square, erect or leaning a little, nearly straight, acute at the tip, tapering at the base, where there are one or two sterile spikelets. The fertile spikelets are spreading and two-grained. The chaff is dull and uniform in colour, long, blunt, mucronate near the base of the ear, acute at the middle of the ear, and short-awned towards the top of the ear, very thick and stiff, deep, angular-backed, close-lying, but loosely attached, so that a little shelling is likely to occur. The grain is large, long, straight, of medium plumpness, opaque, yellowish, flat-bosomed or almost angular-bosomed, blunt at the tip, rather pointed at the base, and has an abundant brush, a moderately deep crease, and often a faint back-crease. The interior of the grain is rather horny. The germ-sculpture is one-third as long as the grain.

Like the Talavera de Bellevue, the Australian Talavera is a hardy mid-season wheat which is inclined to creep, and stools well and yields well, and is somewhat resistant to rust. It is prolific, and its grain is of exceptionally good quality. It is grown to considerable extent in Australia, although much of the wheat grown under the name of Talavera, White Talavera, &c., is not Talavera at all, but totally different.

Prominent Characteristics.—Medium height, strong straw, bald whitish ears, large yellowish grain of exceptionally good milling quality, mid-season, somewhat resistant to rust, likely to shell a little, yields well.

Oakshott's Champion.—Rather tall, and stools well; the straw is dull in lustre, yellow, at no time purple, furrowed, very hollow, rather thick, strong, and stiff. The sheath of the topmost leaf reaches rather more than half-way to the ear. The yellowish or almost rosy, smooth, straight, erect, and regular ears are bald, long, a trifle open, tapering at the tip only, square, acute at the tip, tapering at the base, where there are from two to four sterile spikelets. There are three grains in the rather narrow fertile spikelets. The chaff is dull in lustre, uniform in colour, long, bluntly mucronate with incurved tips toward the base of the ear, short-awned towards the top, and at the tip presents one or two long awns; for the rest, it is stiff, deep, round-backed, firmly attached, and lies close to the grain, so that shelling does not occur. The grain is rather large, long, straight, of medium plumpness, opaque or partly horny, yellowish, flat-bosomed, blunt at the tip, pointed at the base, and has a deep and rather close crease, a mealy cross-section, and an abundant brush. A back-crease is rarely visible. The germ-sculpture is somewhat less than one-third as long as the grain itself.

This is a productive mid-season wheat, having many good qualities, not the least of which is its excellent grain and straw. It has been grown for some years in Victoria. It is not very liable to rust.

Prominent Characteristics.—Rather tall, strong straw, bald yellowish ears, rather large yellowish grain of good quality, mid-season, not very liable to rust, does not shell, productive.

Marshall's No. 3.—This is a somewhat erect wheat that stools fairly well and yields fairly well. The straw is of medium length to tall, of medium thickness and strength, stiff, not brittle, hollow, slightly tapering, rather shiny, furrowed, whitish when ripe, at no time purple. The long, bald, regular, smooth, yellow ears are open, tapering, square, erect, straight, rather acute at the tip, rather abrupt at the base, where there are two or three sterile spikelets. The spikelets are spreading, and three-grained. The chaff is of medium length, the outer being blunt, while the inner is short-awned above the middle of the ears and long-awned at the tip of the ear. Generally speaking, the chaff is stiff, almost shiny, close-lying, firmly attached, round-backed, and uniform in colour. The grain is rather hard, of medium size to large, rather long, straight, never hump-backed, of medium plumpness, opaque, amber-coloured, flat-bosomed, blunt at the tip as well as the base, and has a smallish brush, a deep crease, and a horny cross-section; it does not shell out.

This is a hardy, mid-season, fairly rust-resistant sort, yielding a good quantity of grain. There is a strain with purple straw, which is otherwise entirely similar.

Prominent Characteristics.—Medium height to tall, rather strong, yellowish straw, bald yellow ears, grain amber and of medium size and good quality, mid-season, fairly prolific, and fairly resistant to rust; not liable to shell.

Frampton.—The straw of this wheat is yellow in colour, rather dull, of medium height, thickness, and flexibility; it is hollow, uniform in diameter, and furrowed. The stalk when ripening is purple. The smooth, tapering, straight, erect, compact, bald, yellow heads are of medium length or long, acute at the tip, tapering at the base, and possess four to six sterile spikelets at the bottom. The fertile spikelets are spreading and three-grained. The chaff is pretty firmly attached, bluntly mucronate, close-lying, somewhat angular-backed, short-awned at the tips of the ears, rather shallow, dull and uniform in colour. The grain is large, yellow, opaque, rather plump-bosomed, of medium length and plumpness, blunt at the tip, pointed at the base, and possesses an abundant brush and a close deep crease. The back-crease is usually, though not always, visible.

Frampton is a rust-liable early or mid-season wheat, which stools well and yields a plentiful harvest of grain of first-class milling quality. It is well known in South Australia and Victoria. It resembles White Tuscan.

Prominent Characteristics.—Of medium height, purple straw, bald yellow heads, large yellow grain of first-class milling quality, mid-season, rust-liable, productive.

White Naples.—This is a variety not yet grown by Australian farmers. Though rust-liable, its grain is almost perfection. It stools well, is of medium height, and has an almost semi-solid straw possessing all possible good qualities in a medium degree. When ripe, the straw is of a whitish-yellow colour; it is never purple. The sheath of the upper leaf is rather short—less than half as long as the distance from the upper joint to the ear. This latter is whitish, bald—that is, not bearded—of medium length, regular, compact, tapering at the top, square, erect, straight, acute at the tip, abrupt at the base, where there are four or five sterile spikelets. The fertile spikelets are somewhat spread out, and contain two or three rather large grains. The rather blunt smooth chaff is of medium length, and changes so as to become acute or even short-awned at the tip of the ear. It is dull and uniform in colour, fairly stiff, shallow, sub-angular on the back, is rather loosely attached, and does not hug the grain closely. These latter qualities, of course, permit of some loss by shelling; but this loss is not great with this variety. The grain is of medium length, straight, of medium plumpness, opaque, yellowish, flat-bosomed, blunt at the tip, pointed at the base, and has a very deep crease, and a large germ-sculpture one-third as long as the grain. The interior of the grain is rather horny. No back-crease is discernible.

The White Naples is rather early, and is regarded in France as a first-class milling wheat, yielding a beautiful flour of excellent quality. It stools well, and is fairly prolific. The seed came to this country from France, and has not yet been introduced to the farmers.

Prominent Characteristics. — Medium height, fairly good, whitish-yellow straw, bald whitish heads, large yellowish grain of superior quality, mid-season, rust-liable, fairly prolific, liable to shell.

Early Para.—Its rather weak straw is the worst fault of this otherwise desirable sort. The stools, when full-grown, are above medium height. The rather smooth and shiny whitish straw is almost semi-solid, of medium stiffness, tapering, rather brittle and weak. The sheath of the upper leaf reaches less than half-way to the ear. The smooth whitish bald heads are of medium length, somewhat irregular, open, tapering, flattened obversely, nearly erect, straight or slightly curved, acute at the tip, tapering at the base, where they present about three sterile spikelets. The fertile spikelets are spreading, and contain three grains. The chaff is lustrous, thick, uniform in colour, of medium length, blunt or mucronate near the base of the ear, acute and short-awned toward the tip of the ear, stiff, somewhat shallow, almost angular-backed, rather firmly attached, but not lying close on the grain. In spite of these latter facts, however, little shelling takes place. The grain is of medium size, of medium length, or even long, straight, of medium plumpness, opaque, yellowish, flat-bosomed, blunt at the tip but tapering in that direction, pointed at the base, and has a rather small brush, a moderately deep crease, and a mealy cross-section. A back-crease is sometimes visible. The germ-sculpture is two-fifths as long as the grain.

Early Para is among the earlier of the prolific and rust-escaping varieties. It stools well but does not creep, and its grain is of very good quality. If only by selection the straw could be strengthened—a matter of no great difficulty, we believe—this variety would eclipse many of the sorts now grown. If sown early, it ripens its grain before the warm moist spells likely to occur in late mid-summer. This variety originated, we believe, in South Australia, and for a season or two it was much spoken of as the coming variety, but it soon lost favour on account of the weakness mentioned above. It has been tried in all the Australian colonies. It is related to King's Jubilee.

Prominent Characteristics.—Medium height, weak and brittle white straw, bald whitish heads, yellowish grain of medium size and good quality, very early, rust-liable, but escaping if sown at the proper season, prolific, little liable to shell.

King's Jubilee.—Stools fairly well, but does not creep, and is the medium height. The straw is hollow, fine, weak, and brittle, which is a great pity, for most of the other qualities of this variety are highly desirable ones. For the rest, the straw is coarsely furrowed, dull, whitish, and of rather uniform diameter, and bent at the joints. The foliage is abundant, rather dark-green in colour, drooping, not glaucous, hard or scabrous, and very brittle and weak. The smooth, whitish, bald, erect, and straight ears are of medium length, irregular, tapering, square, and have spikelets that barely touch each other, an acute tip, a tapering base, and three or four sterile spikelets at the bottom. The rather narrow fertile spikelets contain three grains. The chaff is uniform in colour, long, acute, long-awned throughout, rather shiny, shallow, angular-backed, firmly attached, and lies close to the grain, and on this account difficult to thresh. The grains are of medium size, long, straight, rather thin, opaque, whitish, plump-bosomed, blunt at the tip, but tapering in that direction, pointed at the base, and have a rather abundant brush, a shallow open crease, and a large germ-sculpture. A back-crease is often visible. The interior of the grain is mealy and white.

This is one of the very earliest varieties. It stools fairly well, and yields well on good soil. The structure or composition of its tissues renders all its parts weak and brittle. It is very liable to rust, but if sown early it ripens before much damage is done. This wheat will never give satisfaction except in situations protected from strong winds, and where there are no heavy downpours, as both these agencies cause it to lodge dreadfully. It will also lodge from its own weight on land rich in nitrogen. We believe that by selection this wheat might be improved in respect to its weak straw, and it would then be a very useful variety—one that might possibly do for the warm moist coast districts. We believe King's Jubilee originated in South Australia some years ago. It has not come into general cultivation. Early Baart is one of the parents of this sort.

Prominent Characteristics.—Medium height, weak and brittle straw, bald whitish ears, long whitish grain of medium size and good quality, very early indeed, productive, not liable to shell—in fact, rather difficult to thresh, liable to rust, but frequently escaping on account of earliness.

Improved Fife.—Of medium height, but with good stools, and, like all Fifes, late. The straw is yellow, at no time purple, dull in lustre, furrowed, of medium thickness, hollow, strong, stiff, and tapers but little. The rather scanty foliage is inclined to be erect, narrow, smooth, dark-green and glaucous. The ears are almost rosy, smooth, bald, of medium length, regular, a trifle open, tapering, flattened obversely, erect, straight, acute at the tip, tapering at the base, where there are two or three sterile spikelets. The spreading fertile spikelets contain three grains. The chaff is of medium length, dull and uniform in colour, bluntly mucronate near the base of the ear, and short-awned above the middle of the ear, rather thin and soft, rather shallow, round-backed, pretty firmly attached, and lying pretty close to the grain. Some shelling generally occurs. The grain is small or of medium size, of medium length, straight, of medium plumpness, semi-translucent, whitish or yellowish, plump-bosomed, blunt at the tip, rather pointed at the base, and has a deep crease, a rather horny cross-section, and an abundant brush. A back-crease is rarely visible. The germ-sculpture is two-fifths as long as the grain.

Improved Fife is a hardy rust-resistant late sort—a typical Fife; it stools well, is fairly prolific, and yields a grain of good quality, rich in gluten, and valued in America by the millers. Where lateness is not an objection, it is worthy of attention. It must be sown early.

Prominent Characteristics.—Medium height, strong yellow straw, bald rosy ears, small yellowish grain, valued in America by millers, late, fairly productive, somewhat liable to shell, rust-resistant.

Fultz.—A rather tall free-stooling wheat, not far removed from the Fife type, not yet grown to any extent in this country. The foliage is rather abundant and somewhat glaucous. The straw is whitish-yellow in colour, stiff, strong, above medium height and thickness, rather tough, hollow, furrowed, and lustrous. The stalk when ripening is usually green, rarely almost imperceptibly purple. The sheath of the upper leaf is long, reaching more than half-way to the ear. The heads are bald, yellow, smooth—that is, not velvety—rather long, regular, open, tapering, straight, erect, and have from two to three sterile spikelets at base. The fertile spikelets are three-grained and spreading. The chaff is uniform in colour, not too firmly attached, and holds the grain only fairly well, deep, close-lying, long, acutish, short-awned towards tip of the ear, stiff, and has a dull appearance. The grain is amber-coloured or reddish, of medium size and length, straight, opaque, rather flat-bosomed, and blunt at both ends; it has an abundant brush. A back-crease is barely visible; when cut across with a knife the section appears horny.

Fultz is a well-known latish variety, somewhat above medium height. The best strains of it are prolific, and yield a grain considered in America to be of good milling quality. It is highly resistant to rust. Manitoba and Russian resemble this variety in type.

Prominent Characteristics. — Rather tall, strong, whitish-yellow straw, bald yellow heads, grain of medium size, considered in America to be of good milling quality, latish, prolific, not liable to shell, highly resistant to rust.

Saskatchewan Fife.—This is an American strain of the Fife sort. The straw is of medium height, fine or of medium thickness, glaucous when young, stiff, strong, fairly tough, hollow, of rather uniform size, furrowed, dull and whitish in colour, but green when ripening—never purple. Like all Fife wheats, Saskatchewan has scanty, narrow, tough, glaucous foliage, of a dark-green colour, and inclined to be erect. To say that the ears are yellow, bald—*i.e.*, not bearded—of medium length, regular, neither open nor compact, but medium in this respect, tapering, flattened obversely, erect, straight, acute at the tip, and abrupt at the base, and that they present two to four sterile spikelets at the base, is only to say that they are typical Fife ears. The fertile spikelets are well spread and contain three grains. The chaff is short, blunt near the bottom of the ear, short-awned at the middle of the ear, and long-awned at the tip of the ear; it is dull and uniform in colour, stiff, rather shallow, roundish-backed, firmly attached, and lies close to the grain, so that little shelling occurs. The grain is rather red, small, short, straight, plump, horny, plump-bosomed, blunt at both ends, and has an abundant brush and a rather deep open crease, and a germ-sculpture two-fifths as long as the grain. A back-crease is visible. The inside of the grain may be either horny or mealy, according to the season and locality where it is grown.

This variety is late, but hardy and highly resistant to rust, and is a fairly good stooler and yielder. It closely resembles the other Fife wheats, especially the Red Fife. The seed came to this country from the United States.

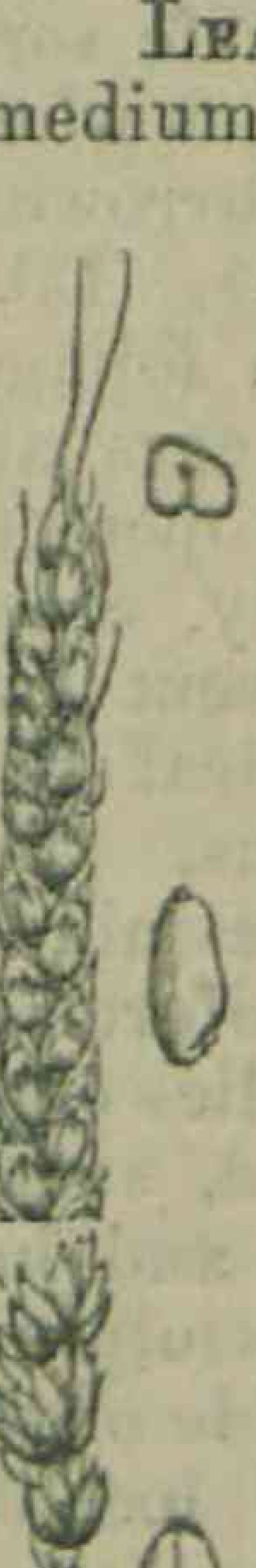
Prominent Characteristics.—Medium height, strong whitish straw, bald yellow heads, small reddish grain, late, fair yielder, highly resistant to rust, not liable to shell.

White Fife.—This is one of the best of the Fife wheats. It is a late and hardy creeping sort. It is a little below the medium height, and has a strong, fine, and somewhat flexible (for a Fife) though somewhat hollow straw of nearly uniform diameter. In colour the ripe straw is shiny and purplish. The furrows and joints are rather prominent. The foliage is rather scanty, inclined to be erect or leaning, of medium length, narrow, smooth, rather dark green and glaucous, and, like that of other Fifes, tough. The ears, of medium length, are neither open nor compact, being medium in this respect. They are whitish, smooth—that is, not velvety—beardless, of medium length, regular, tapering, flattened obversely, erect, or leaning or curved, acute at the tip, and rather abrupt at the base, where there are three or four sterile spikelets. The ears are composed of spreading spikelets, containing at least two grains each. The chaff is short, mucronate, blunt near the base of the ear, but acute higher up, short-awned near the middle of the ear, long-awned towards the tip, stiff, dull and uniform in colour, rather shallow, sub-angular-backed, firmly attached and lying close to the grain, but shelling badly. Though the grain is rather small, it is of medium length and medium plumpness. It is straight, red or dark amber, horny, plump, or rather angular-bosomed, blunt at both ends, having a small brush and a deep open crease. When cut with a knife the section appears horny. A back-crease is sometimes visible.

White Fife is highly resistant to rust, stools well, and is a fair yielder; but, like other Fifes, is rather late, and needs to be sown early. Its grain is less acceptable to Australian millers than many other sorts, but such grain finds a ready market in Europe. Similar wheat is grown to a very large extent in the United States and Canada, and the flour made from it is considered to be superior. This sort is distinctly different from other Fifes.

Prominent Characteristics.—A little below medium height, strong purplish straw, bald whitish heads, smallish amber grain, late, fairly productive, highly resistant to rust, liable to shell badly.

Leak's.—This is a rather slender-eared wheat, a little above the medium height. It stools well, and the straw is stiff and of medium thickness, almost semi-solid, and somewhat brittle; it is of a dull yellowish colour, distinctly furrowed, and of rather uniform diameter. The foliage is not very abundant, the flags being rather narrow and distinctly glaucous, especially when young. The smooth, beardless, long, slender, erect, regular and yellowish ears are tapering, a trifle open, nearly straight, acute at the tip, tapering at the base, where there are two to four sterile spikelets. Although the spikelets are rather narrow, they contain three grains. The rather shallow, round-backed chaff is blunt in the lower part of the ear, acute elsewhere, short-awned at the tip of the ear, stiff, uniform in colour, rather dull, and is firmly attached and lies close upon the grain. The grain is of medium size and length, straight, of medium plumpness, opaque or horny, yellowish, angular-bosomed, blunt at both ends, especially at the base, and has a smallish brush, and deep open crease, and a large germ-sculpture. A back-crease is rarely visible. On being cut with a knife, the section is seen to be somewhat horny.



Leak's is a hardy and fairly prolific sort, having the form of the Fife wheats, not early nor yet late, yielding a grain of fair milling quality. It resists rust fairly and is free from shelling, and on these accounts is cultivated to considerable extent in Australia, especially South Australia. It should be sown early. It holds the grain well.

Prominent Characteristics.—Above medium height, yellowish somewhat brittle straw, bald yellowish ears, yellowish grain of medium size and fair quality, rather late, fairly productive, fairly resistant to rust, not liable to shell.

Battlefield.—The straw of this variety is dull yellow, hollow, distinctly furrowed, somewhat brittle, stiff, slightly tapering, and of medium strength and thickness. The stalk when ripening is green, not purple. The sheath of the topmost leaf is long, reaching nearly half-way to the ear. The joints are dark and prominent. The bald, nearly straight, erect, regular heads are of a yellow colour, smooth—that is, not velvety—square, tapering, of medium length and compactness, acute at the tip, tapering at the base, where they present from three to six sterile spikelets. The fertile spikelets are three-grained and spreading. The chaff is dull and uniform in colour, long, deep, rather round-backed, loosely attached, not lying very close upon the grain, rather soft, bluntly mucronate at base of the ear, and long-awned towards tips. Considerable shelling occurs. The grain is yellowish or amber-coloured, of medium size, long, straight, almost angular-bosomed, of only medium plumpness, almost horny-pointed at the base, blunt at the tip, and possesses an abundant brush and a very deep open crease. A back-crease is occasionally visible. When cut with a knife the section of the grain generally appears horny. The germ-sculpture is one-third as long as the grain.

Battlefield originated in South Australia. It has not yet come into general cultivation, in spite of its good qualities. It is fairly resistant to rust.

Prominent Characteristics.—Medium height, yellow and somewhat brittle straw, bald yellow heads, yellowish or amber grain of medium size, mid-season, productive, fairly resistant to rust, rather liable to shell.

Cape.—A freely-stooling somewhat early or mid-season wheat of South African origin. The straw is of medium height or below, yellow, at no time purple, of medium thickness, hollow, furrowed, stiff and strong, and tapers but little. The smooth, yellow, straight, erect, regular ears, are bald, of medium length, very slightly open, of uniform size throughout the length, square, acute at the tip but abrupt at the base, where there are one or two sterile spikelets. The fertile spikelets are rather narrow though three-grained. The dull and uniformly light-coloured chaff is long, blunt, but incurved-mucronate, short-awned at the tip of the ear, stiff, almost angular-backed, rather shallow, firmly attached, and hugs the grain closely, so that shelling almost never occurs. The grain is large, long, straight, of medium plumpness, opaque, very light amber-coloured, almost angular-bosomed, blunt at the tip, rather pointed at the base, and has a brush of medium size, and a deep rather close crease. There is no back-crease. In cross-section the grain appears mealy. The germ-sculpture is one-third as long as the grain itself.

Cape is a prolific mid-season wheat, which is, we think, quite liable to rust. The grain appears to be of good quality. The wheat most nearly resembling Cape is Leak's.

Prominent Characteristics.—Medium height, strong yellow straw, bald yellow heads, large amber grain, mid-season, productive, quite liable to rust, not liable to shell.

Pringle's Defiance.—The wheat which has been known in Queensland under the name of Defiance seems to be identical with this. It is of medium height, and the straw is glazed, whitish, furrowed, hollow, thick, strong, stiff, and tapering. The sheath of the topmost leaf reaches less than half-way to the ear. The whitish or yellow, smooth, straight, erect, regular ears, are bald, rather long, or of medium length, compact, tapering, square, acute at the top, abrupt at the base, where there are three to five sterile spikelets. Three grains fill the spreading fertile spikelets. The chaff is dull in lustre, uniform in colour, long, rather acute, short-awned towards the tip, rather thin and a trifle soft, shallow, almost angular-backed, firmly attached, and lie somewhat close to the grain. It shells somewhat. The grain is of medium size and length, straight, of medium plumpness, horny, amber-coloured, rather plump-bosomed, blunt at the tip and also at the base, and has an abundant brush, a rather deep crease, and a horny cross-section. A back-crease is usually visible. The germ-sculpture is two-fifths as long as the grain.

Pringle's Defiance is a hardy, prolific, latish wheat, resistant to rust, and yielding a grain almost identical with that of Blount's Lambrigg. It stools freely, and thrives—that is, yields some sort of a crop, even on rather poor land and with poor treatment. Wheats answering this description are grown in all the Australian colonies, the most prominent of which is Smith's Nonpareil.

Prominent Characteristics.—Medium height, strong whitish straw, bald whitish or yellow heads, amber grain of medium size or small, late, productive, rust-resistant, somewhat liable to shell.

White Velvet.—This handsome rather early variety receives its name from the fact that its chaff is covered with fine hairs, and it is called the *White* Velvet to distinguish it from the red-eared velvety sorts. When ripe the straw as well as the ear is whitish. Being of medium height, it possesses, as one would expect, a fine semi-solid straw of medium strength and flexibility, not, however, remarkably tough. The straw tapers but little, and is distinctly furrowed; at no stage of its growth is it purple. The sheath of the upper leaf is rather short, being only two-fifths as long as the distance from the uppermost joint to the ear. The short, regular, compact ears are beardless, nearly straight, erect or slightly leaning, square, rather abrupt at the tip, abrupt at the base, where they present only two or three sterile spikelets. At the tip of the ear the chaff of the spreading three-grained spikelets is acute or even short-awned, but at the base of the ear it is blunt. The chaff is of medium stiffness, dull, round-backed, fairly deep, of uniform colour, firmly attached, and lies close upon the grain, so that it is not liable to shell much, a quality that recommends this variety in districts where strippers are in use. The White Velvet wheat has a beautiful little grain, nearly white, of fine milling quality; it is short, straight, plump, opaque, flat-bosomed, tapering towards the blunt tip, blunt at the base, with an abundant brush and a close deep crease. A back-crease is never visible on grains well filled out. Inside, the grain is snow-white and mealy.

It is quite liable to rust, but is rather early, and may escape rust on that account. It stools fairly well, and as the grain is small, it requires less bulk of seed per acre than the larger grained sorts. Our impression is that it does best in limestone country. It stools well, but does not creep.

Prominent Characteristics.—Medium height, white straw of medium strength, bald white velvety heads, beautiful small white plump grain, of excellent milling quality; moderately early, productive, rust-liable, not liable to shell.

Hudson's Early Purple Straw.—This is a tall, beardless, free-stooling wheat, with a strong stiff straw of medium thickness. When ripening, the straw becomes first purple and finally yellowish. The ripe straw is dull coloured, and though quite hollow is tough. The foliage is abundant, long and drooping, of a medium green colour, and never very glaucous. The numerous large, long, and regular ears are erect, and rather compact, especially at the tip, where they are slightly clubbed and end abruptly; they are almost equally abrupt at the base, there being seldom more than two sterile spikelets at the bottom. The fertile spikelets are spreading, and contain three or four large, long, yellowish grains of medium plumpness. The chaff is nowhere very blunt, and towards the tip of the ear is armed with awns, the very topmost spikelet bearing awns of considerable length. In colour the chaff is uniform and dull; it is smooth—that is, not velvety—deep, and round-backed, and is firmly attached and lies very close upon the grain, thus giving this variety the property of holding the grain fairly well and so allowing the use of any sort of harvesting machinery without much loss. The grain threshes out easily, and will fetch the highest price in Australia, being of first-class milling quality. It is opaque, of a yellowish colour, plump-bosomed, blunt at both ends, and has a deep crease. When cut with a knife, the inside of the grain shows mealy, and the bran appears thin, and this demonstrates one of the few faults of this wheat—namely, starchiness. The flour will be beautiful and white, but deficient in gluten. The germ-sculpture is small, occupying only one-fourth the length of the grain. A faint back-crease is often visible.

It will not do very well in an adverse season or on badly drained ground. It is very liable to rust, but being a very early wheat, it will usually ripen its grain early enough to escape the bad effects of the warm moist weather likely to occur in October and November. If sown early it will ripen in November if the season is fairly good. Hudson's Early Purple Straw is a very prolific wheat, and is beyond question one of the very best of the purple straw sorts. It is not now grown to any extent here, but it is sure to come into favour as soon as it can be distributed and becomes known. Steer's Early Purple Straw, Farmer's Friend, Fill-bag, Rattling Tom, Red Straw, Northern Champion, Jacinth, and possibly Red Tuscan, are different strains of Purple Straw, very similar in form to Hudson's Early Purple Straw, and equally rust-liable, but for the most part are later. All are prolific.

Prominent Characteristics.—Tall, strong purple straw, large bald rosy heads, large yellow grain of superior quality, quite early, very productive, very rust-liable, not liable to shell.

STEINWEDEL.—This is another of the early and prolific, but delicate and rust-liable, bald, purple-straw varieties, and one that stools moderately well. It originated in South Australia, but has found favour in many places outside that country. Its besetting fault is its liability to shell, and so great is this, that, unless the grower can put his machinery into the crop at will on any given date where the Steinwedel is ready, and go through his harvesting with good speed, he is sure to suffer much loss. Shortly after the grain commences to harden the chaff begins to break away and the grain to fall out, and a few dry days is sufficient to allow a large percentage of loss, especially if winds prevail to knock the ears about a little. The stools are tall or above medium height. The strong and stiff, though hollow, straw is of medium thickness, furrowed, slightly brittle, tapers little, and is of a dull purplish colour. The flags are large and drooping, and of a light-green colour, and decidedly weak. The ears have prolific written large all over them; they are rosy, smooth—that is, not velvety—large, long, regular, compact, of uniform size, flattened obversely so widely spreading are the four to five grained spikelets, erect, straight, blunt at both ends, without sterile spikelets or with, at most, one. The chaff is of medium size, soft and rather thin, mucronate but blunt—the inner, however, with

short awns below, and long ones towards the tip of the ear—shallow, round-backed, dull and uniform in colour; but, though crowded close upon the grain, loosely attached. The grains are large to medium in size, of medium length, straight, of medium plumpness, opaque, yellowish, somewhat flat-bosomed, or even angular-bosomed, blunt at both ends, with a fairly large brush, a deep open crease, and a large germ-sculpture. A back-crease is often visible, and the section of the grain is mealy.

The grain of Steinwedel is starchy, but of first-class milling quality, from the Australian point of view, and consequently it brings a good price in Australia. Owing to its earliness, this variety escapes rust in many districts if it is sown early and well on good land. It is unsuitable for coast regions. On account of the bad qualities mentioned above, this wheat is going out of cultivation.

Prominent Characteristics.—Tall, strong purple straw, large bald rosy ears, large yellow grain of very good quality, early, very productive, very rust-liable, shells badly.

Rattling Jack.—This is an old and well-known sort which, however, has of late years gone out of favour. It is quite short and stiff, and grows a dense stool. The straw is stiff and strong, of medium and rather uniform thickness, very hollow, only fairly tough, distinctly furrowed, and purplish in colour. The sheath of the upper leaf reaches considerably more than half-way from the last joint of the ear. The foliage is abundant, light-coloured, and drooping. The bald, smooth, straight, erect, regular, short, rosy ears are clubbed, quite crowded, flattened, blunt at the tip, tapering at the base, where there are three or four sterile spikelets. The three-grained spreading spikelets are supplied with chaff of medium length. In the lower part of the ear the chaff is bluntly mucronate, but at the tip of the ear there are several rather long awns. There is never any shelling, for the reason that the deep round-backed chaff is stiff and lies very close upon the grain and is firmly attached. The crowding together of the spikelets also tends to prevent shelling. The grains are large, of medium length, straight, of medium plumpness, opaque, yellowish, rather flat-bosomed, blunt at both ends, especially the tip, with an abundant brush, a rather deep crease, and a germ-sculpture occupying not more than one-third their length. A back-crease is rarely visible. The interior of the grain is rather mealy.

Rattling Jack may be called an abbreviated purple-straw wheat. Except in form it completely resembles the purple straws, being delicate, and very liable to rust, but a great yielder in a good season, and on good, well-cultivated land. Though the ears are short, they contain a surprising amount of grain. This wheat will stand gales without breaking down, and without much shelling. The grain is of very good milling quality, from the Australian point of view. Grosse's Prolific is a variety closely resembling this, but is taller and has larger ears, with fewer sterile spikelets at the base, and consequently tapering less in that part; it is more prolific than Rattling Jack.

Prominent Characteristics.—Rather short, strong stiff purple straw, short bald club-shaped ears, large yellow grain of good quality, rather early, productive, rust-liable, does not shell.

Ward's Prolific.—This wheat has won great celebrity in Australia on account of its power to resist rust, in which respect it is certainly remarkable. It is a wheat a little above the medium height, with a weakish, fine, almost semi-solid straw, which tapers but little, and is of a dull yellowish colour when ripe, and glaucous when young—never purple. The plants have scanty foliage of an erect habit, with short, narrow, smooth, and more or less glaucous, dark-green flags of remarkable toughness. Ward's Prolific stools only fairly well, its brown ears being of medium length, or long, regular, open, tapering, flattened obversely, erect or leaning a little, straight or nearly so, rather acute at the tip, smooth—that is, not velvety—and tapering at the base, where there are three to five sterile spikelets. The spreading spikelets are rarely more than four-grained. Of course the chaff varies in form in different parts of the ear; towards the base it is mucronate, though the points are dull and turned inwards slightly; towards the tip, however, it is short-awned and sharp; it is of medium length, stiff, dull and uniform in colour, shallow, round-backed, firmly attached, and close-lying, so that shelling never occurs. The quality of the grain leaves something to be desired, according to Australian millers, but the flour, though not so white as that from purple straw wheat, is undoubtedly of good quality. The grain is of medium size, rather long, straight, of medium plumpness, opaque or horny according to season and locality, yellowish, rather flat-bosomed, blunt at the tip, rather pointed at the base, and has a small brush, and a rather deep, close crease. No back-crease is visible, and the germ-sculpture is small, being only one-fourth to two-sevenths as long as the grain. When cut the grain shows a horny interior.

Ward's Prolific does not yield so well as its name might indicate, on account of its spare habit of growth, but with a little above the usual amount of seed per acre it does fairly well. It mills only fairly well, though it is a wheat that varies in this respect. It is highly resistant to rust, and suits all parts of New South Wales, but evidently requires several seasons in which to become acclimatised. It is of medium earliness. In outward appearance when nearly ripe Ward's Prolific somewhat resembles Allora Spring, but the grains of the two varieties are widely different. Victorian Defiance and South Australian Wonder are similar to Ward's Prolific. Marshall's White is a white-chaffed Ward's Prolific.

Prominent Characteristics.—Medium height or a little above, weakish straw, long brown bald ears, yellowish grain of medium size and only fair quality, mid-season, not very productive, very rust-resistant, and not liable to shell.

Marshall's No. 8.—This is a somewhat erect-growing wheat, producing very fair stools. The straw is of medium length to tall, rather strong though rather fine and flexible, tough, semi-solid, tapering, somewhat shiny, furrowed, yellowish, at no time purple. The smooth, bald, brownish, regular ears are rather long, of medium compactness, tapering, square, erect, straight, acute at the tip, tapering at the base, where there are two or three sterile spikelets. The chaff is of medium length, the outside scales being blunt, while the inside ones become short-awned towards the tip of the ear; for the rest, it is stiff, shiny, close-lying, firmly attached, somewhat angular-backed, deep, and streaked with colour. The grain is rather hard, of medium size to large, of medium length, straight, not hump-backed, of medium plumpness, opaque, yellowish white, flat-bosomed, blunt at the tip, rather pointed at the base, and has a rather abundant brush, a crease of moderate depth, and a horny cross-section. The germ-sculpture is one-third as long as the grain. Shelling does not occur.

This is a hardy, rust-resistant, mid-season variety, yielding fairly well. Related to Ward's Prolific.

Prominent Characteristics.—Medium length, rather strong, yellowish straw, bald, brownish heads, grain of medium size to large, and of fair milling quality, mid-season, fairly prolific, rust-resistant, not liable to shell.

Allora Spring.—This is a variety which came to this country from California, under the name of Pugh's Rust-proof. In Queensland it has found great favour, and has often gone under the name of Ward's Prolific or Queensland Ward's Prolific, owing probably to its outward resemblance to that wheat. The grains of these two wheats, however, are widely different, and the Allora Spring is very much the earlier wheat. The

present variety is that sometimes referred to as "ninety-day wheat" or "three-months wheat," names which have also been applied to wheats of the Velvet Pearl type—in both cases, on account of the extreme earliness. The present variety is of medium height. The dull yellow furrowed straw is fine, semi-solid, a little too weak and brittle to be desirable, and but slightly tapering. The sheath of the topmost leaf extends less than half-way to the ear. The smooth, red, bald heads are of medium length, regular, open, tapering, square, erect, straight or somewhat curved, acute at the tip, abrupt at the base, where there are one or two sterile spikelets. There are three grains in each of the spreading spikelets. The chaff is somewhat streaked with colour, dull in lustre, of medium length, blunt near the base of the ear, but short-awned a little higher up and long-awned at the top, of medium stiffness, shallow, almost angular-backed, rather loosely attached, and not lying very close to the grain, in consequence of which considerable shelling is likely to occur unless the grower is prompt and handy in harvesting. The grain is small or of medium size, short, straight, plump, opaque, whitish, flat-bosomed, blunt at the tip and also at the base, and has an abundant brush, a rather deep crease, and a mealy cross-section. A back-crease is generally visible. The germ-sculpture is two-fifths as long as the grain.

By its marked earliness this wheat escapes rust. Moreover, it is not very rust-liable. It stools rather sparingly, but yields fairly well, and its grain though small will be found acceptable to Australian millers. Allora Spring resembles to a certain extent the wheat next described—Californian Spring.

Prominent Characteristics.—Medium height, rather brittle yellow straw, reddish bald heads, beautiful small white grain of very good quality, very early, prolific, escaping rust through its earliness, liable to shell.

CALIFORNIAN SPRING. — A rather short, early, bald wheat, with reddish-brown ears. The dull whitish straw is fine, semi-solid, rather stiff, inclined perhaps to be brittle, of rather uniform size, not any too strong. The straw is green when ripening. The sheath of the topmost leaf reaches less than half-way to the ear. The joints are rather prominent. The heads are brown, bald, smooth, erect, straight, regular, compact, of uniform size throughout, square or obversely flattened, acute at the tip, tapering at the base, where there are three or four sterile spikelets. The fertile spikelets are spread out considerably, and contain three or four grains. The chaff is dull in lustre, somewhat streaked with colour, of medium length, rather blunt at the base of the ear, but acute and short and stiff-awned at the tip, stiff, deep, round-backed, does not lie very close, and is rather loosely attached. In consequence of these latter qualities some shelling takes place, but less than would be expected. The grain is of medium size, rather short, straight, plump, opaque, yellowish (not so white as Allora Spring), plump-bosomed, blunt at both ends, and has a rather small brush and a shallow crease; a back-crease is visible. When cut across with a knife the grain shows a mealy interior. The germ-sculpture is a little more than one-third as long as the grain.

This is an often fairly prolific sort, worthy of trial. It is not now grown in this country to any extent. It is almost early enough to fairly be called rust-escaping. It resembles the Allora Spring.

Prominent Characteristics.—Rather short, rather brittle straw, bald reddish-brown ears, small white grain of good quality, early, fairly prolific, rust-liable, but escaping bad effects through earliness, somewhat liable to shell.

Robins' Rust-resistant.—A wheat above the medium height, that stools well and yields well. It does not creep. The straw is of medium length, stiff, furrowed, hollow or semi-solid, dull, slightly tapering, of medium strength and flexibility. The joints are prominent. The bald, erect, straight, square, regular heads are of medium length, a trifle open, slightly tapering, acute at the tip, rather abrupt at the base, where they present from one to three sterile spikelets; they are smooth—that is, not velvety—and brown in colour. The spikelets are spreading and three-grained. The chaff is close-lying, very firmly attached, round-backed, has a distinct rib, is dull, shallow, of medium stiffness and length; the mucronate tips are bent inwards; it is short-awned toward the tip of the ear, and uniform in colour throughout. The grain is large, plump-bosomed, straight, rather horny, of medium plumpness, amber-coloured, blunt at the base, pointed at the tip, and possesses a small brush. The crease is open and deep; a back-crease is rarely visible. When cut with a knife, the section of the grain appears horny. The germ-sculpture is one-third as long as the grain itself.

This mid-season variety originated in South Australia, and is a promising one in some respects. It resembles Red Provence and Clawson to some extent in outward appearance, but is earlier than either, and the ears are more erect. It is new to this colony. It is decidedly rust-resistant. It is a cross of which Ward's Prolific is a parent.

Prominent Characteristics.—Above medium height, moderately strong straw, bald brown heads, large amber grain, mid-season, fairly prolific, rust-resistant.

Sicilian Square-headed Red.—Various observers have called this a typical rust-resistant wheat, and in some respects the statement is true. It certainly resists rust in a marked degree, owing no doubt to its very glaucous ears, straw, and foliage, and to the toughness of its tissues. Its grain, however, is small and unattractive, and it will be impossible to induce farmers to have anything to do with it. However, though it is a small wheat with small ears, it stools freely and yields well, and it will stand a very hot dry climate on almost any kind of good soil, clayey or limestone.

The straw is of medium height, very strong, of medium thickness, very stiff, tough, hollow, of rather uniform diameter, dull white when young and purplish when ripe, furrowed. The foliage is rather scanty, erect, dark-green, but rendered whitish or glaucous by an abundant waxy bloom. The ears are quite peculiar, being bald, short, regular, very compact and hard, of uniform size throughout their length, square, erect and rigid, straight, blunt at both ends, smooth and glaucous, red or brown in colour, and having from two to six sterile spikelets at the base. The three-grained spreading spikelets have short, stiff, shallow, round-backed, fairly firmly attached, close-lying, dull and uniform coloured chaff, which is blunt near the base of the ear, but acute toward the top, and even has a few short awns at the tip. The grain is small, short, oblique, flat, of medium plumpness, horny or opaque, reddish, almost angular-bosomed, blunt at both ends, with a small brush and rather shallow crease reaching but little more than half-way through the grain. The germ-sculpture is large and oblique; a back-crease is barely visible. According to the season and locality in which it is grown, the grain shows a horny or a mealy inside when cut in two with a knife.

The Sicilian Square-headed Red does not shell, and has another good quality in the fact that it ripens its grain with great rapidity, the time between the first appearance of the ear and the hardening of the grain being unusually short. It creeps and stools well, and yields fairly well. On this account it is earlier than one would expect. It is possible that this wheat may prove highly useful as a parent in getting new cross-breds suitable for Australian conditions. Tourmaline is a variety identical with this. Both will stand considerable wind, and may on that account and on account of their rust-resisting qualities be found of use in the coast districts. It is a mid-season variety. When used as a parent in making a cross it transmits its qualities strongly.

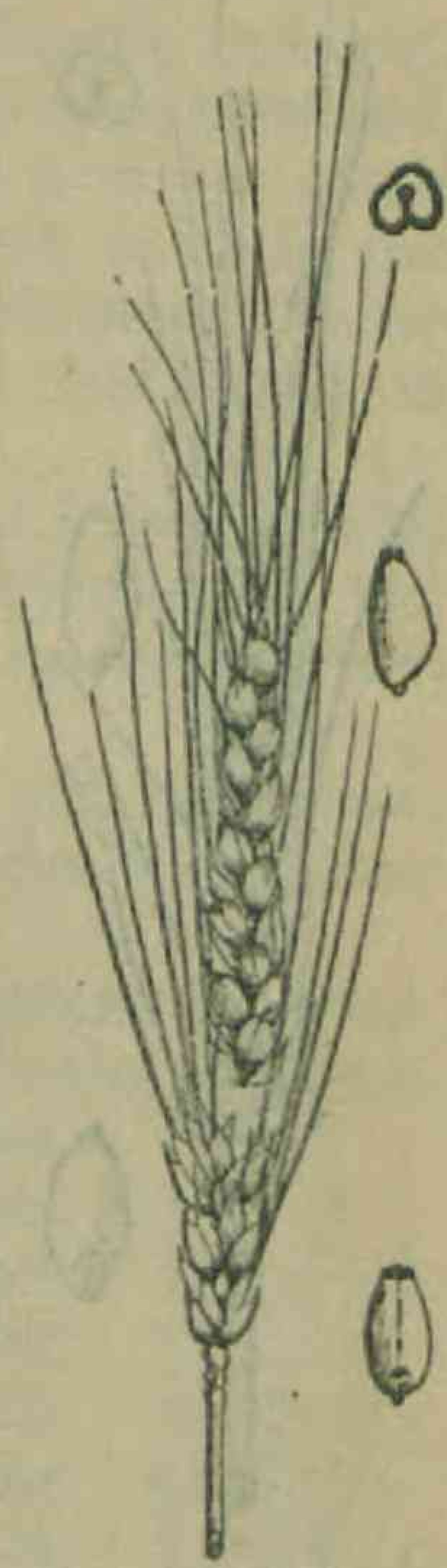
Prominent Characteristics.—Rather below medium height, short bald reddish ears, small red grain of questionable quality, mid-season, yields fairly well, very resistant to rust, not liable to shell.

VELVET PEARL.—This wheat will serve as an example of the red-eared velvet-chaffed varieties, a number of which seem to have originated or to have been more particularly cultivated in California and Mexico. It is of medium height, and has a rather shiny, yellow, fine, semi-solid straw, possessing all the good qualities in a medium degree. When ripening the straw is yellow, never purple. The sheath of the upper leaf is less than half as long as the distance from the uppermost joint to the ear. The ears are red and velvety, and this fact, together with the bright yellow straw, give the plants a particularly bright and attractive look. The ears are beardless, of medium length, very regular, compact, somewhat tapering, square, erect or leaning, straight or slightly curved, acute at the tip, abrupt at the base, where there are two or three sterile spikelets. The fertile spikelets are spread out wide like an open fan, and contain three or four grains. The dull and streaky chaff is of medium length, acute and short-awned throughout the length of the ear, rather deep, round-backed, of medium stiffness, but rather loosely attached and not lying close to the grain, so that shelling is likely to occur unless the handling is well-timed and careful. The grain is smallish, short, very plump, opaque, whitish, flat-bosomed, blunt at both ends, with a shallow close crease and a comparatively abundant brush. A back-crease sometimes is visible. When cut with a knife the interior of the grain shows up very mealy. The germ-sculpture is large—that is, two-fifths as long as the grain.

Velvet Pearl is a very early wheat, giving a grain of very good milling quality, from the Australian point of view, but is only a fairly good yielder, as it stools rather sparingly in an upright manner. It will stand a dry climate, in fact seems particularly suited to such. Although the stools are small, this is easily compensated for by thicker sowing. The bulk of seed per acre is about the same as for other varieties, the seed being small. The wheats, of which this is an example, seem to have come into favour in but few parts of the world. The variety known as Red Californian, with velvet chaff, appears to be identical with the present; both resemble Allora Spring, but the latter has not velvet chaff. New Zealand Velvet, appears to be the same as Velvet Pearl. A wheat known as Mexican or Red Mexican is identical with this. Velvet Pearl is early—early enough, perhaps, to be called rust-escaping. It is identical with Blé de Mars de Californie of France. A considerable quantity of it is grown in South Australia.

Prominent Characteristics.—Medium height, short, bald, velvety, red heads, smallish white grain of good quality, very early, fairly good yielder, liable to shell.

CANNING DOWNS RUST-RESISTANT.—This variety hails from Queensland. It is very early, and will ripen in time to escape rust. It is very short, even dwarf in stature, and stools rather sparingly in an upright manner, but nevertheless yields well with the right treatment. The dull, yellow, furrowed straw is fine, semi-solid, flexible, tapering, and is too weak and brittle; at no time of its growth is it purple. The smooth, rather rosy ears are short, have spikelets barely touching each other, are tapering, square, leaning, straight or a little curved, acute at the tip, rather abrupt at the base, where there are two or three sterile spikelets. The beards are of medium length, rather orderly, whitish, very rough, of equal length, spread but little, and are not shed at maturity. The spikelets spread but little and are three-grained. The dull and rather uniformed coloured chaff is of medium length, acute, stiff, shallow, sub-angular backed, firmly attached, and hugs the grain closely, so that shelling is not likely to occur. The opaque, yellowish grain is of medium size, length, and plumpness, is rather full-bosomed, blunt at the tip but tapering in that direction, pointed at the base, and has a small brush and a deep close crease. A back-crease is often visible. The germ-sculpture is two-fifths as long as the grain itself.



The name given to this wheat would imply that it has rust-resistant properties. It has, and it certainly is early enough to be a rust-escaping sort. The grain is of fairly good quality. In appearance the Canning Downs Rust-resistant resembles a number of wheats now grown in India, and we believe that it is, in fact, related to them, if not of them. All such wheats are remarkable for their ability to yield something of a crop, even on poor land and with bad treatment. It yields much more than one would suppose from its appearance. The grain is acceptable to Australian millers.

Prominent Characteristics.—Short, weak, yellowish straw, whitish or rosy bearded heads, yellowish pointed grain of medium size and good quality, very early, yields fairly well, both rust-resistant and rust-escaping, not liable to shell.

Gore's Indian.—This is an early dwarf sort, stooling in an upright manner. The straw is short, not very strong, fine, flexible, semi-solid, tapering, dull yellow in colour, furrowed, at no time in its growth purple. The smooth, bearded, yellowish ears are rather short, regular, of medium compactness, tapering, square, leaning, nearly straight, acute at the tip, tapering at the base, where there are generally only two sterile spikelets. The beards are of medium length, rather fine, rather orderly, whitish, somewhat spreading, of unequal length, and are not shed at maturity. The narrow spikelets usually contain three grains. The chaff is of medium length, acute, stiff, rather shiny, close-lying, firmly attached, round-backed, somewhat shallow, uniform in colour. Shelling does not occur. The grain is somewhat hard, of medium size and length, straight, not hump-backed, rather thin, opaque, whitish, flat-bosomed, blunt at the tip but tapering in that direction, pointed at the base, and has a small brush, a crease of medium depth, and one white and mealy cross-section. The germ-sculpture is one-third as long as the grain.

This variety is hardy, early, yields fairly well under the right treatment, and resists, or at least escapes, rust fairly well. An Indian wheat, apparently related to Canning Downs—one suited to warm climates. There is a strain with brown ears and slightly darker grain.

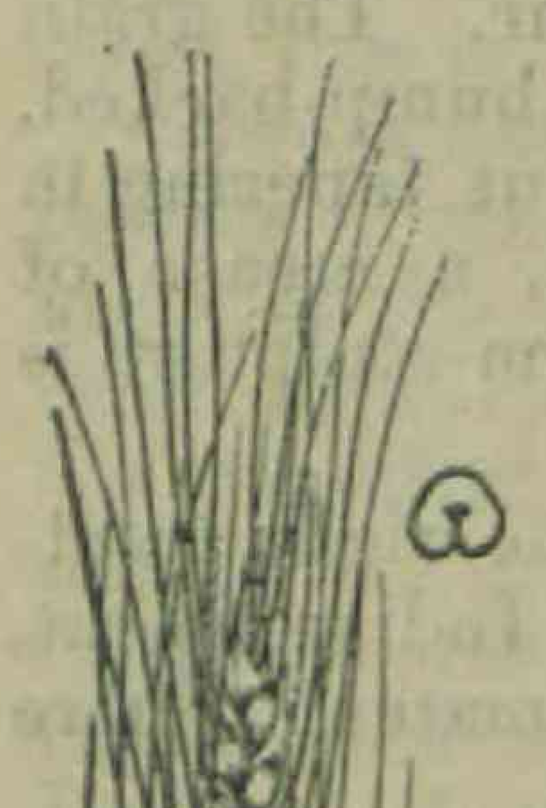
Prominent Characteristics.—Short, not very strong straw, bearded yellowish heads, tapering grain of medium size and fair milling quality, early, escaping damage from rust, fairly prolific, not liable to shell.

Early Baart.—Somewhat below the medium height and stools pretty well, though not in a creeping manner. The dull yellow, distinctly furrowed, uniform-sized, almost semi-solid straw possesses most of the good qualities in a medium degree. At no time in its growth is the straw purple. The smooth whitish ears are bearded, rather irregular, of medium length, compact, tapering, obversely flattened, erect or leaning, straight or a trifle curved, acute at the tip, tapering at the base, where there are two to four sterile spikelets. The beards are long, fine, not very orderly in arrangement, of unequal length, brownish in colour, spreading, and are not shed at maturity. The spreading fertile spikelets contain three grains. The chaff is of medium length, acute, stiff, dull in lustre, uniform in colour, rather shallow, angular-backed, firmly attached, and hugs the grain closely. The grain is rather large, long, straight, of medium plumpness, rather horny, yellowish, flat-bosomed, blunt at the tip but tapering in that direction, pointed at the base, and possesses an abundant brush and a quite deep narrow crease. A back-crease is usually visible. The section of the grain when cut with a knife appears horny. The germ-sculpture is from two-fifths to one-third as long as the grain.

Early Baart is hardy, very prolific, and early, and therefore rust-escaping wheat, yielding a grain of good milling quality, from the Australian point of view. It is free from shelling, but the straw is none too strong. The wheat known as Stockton Defiance appears to be identical with Early Baart. That known as Du Toits is also so nearly indentical that a separate description is unnecessary, the only difference being that the Du Toits has more regular ears and is a trifle less early, holds its grain less firmly, and has purplish straw. Its name would indicate that Early Baart is of Dutch, very likely South African, origin. It is grown to considerable extent in some parts of Australia, but less now than formerly.

Prominent Characteristics.—Somewhat below medium height, moderately strong yellow straw, whitish bearded ears, rather large tapering grain of good quality, early, very polific, rust-escaping on account of its earliness, not liable to shell.

Darblay's Hungarian.—Of medium height, and stools well. The yellow, somewhat shiny straw, is plainly furrowed, hollow, of medium thickness, strong. The smooth, yellow, erect, straight, bearded heads are long, rather regular, open, square, acute at the tip, abrupt at the base, where there are two or three sterile spikelets. The beards are of medium length, or rather short, fine, not very orderly in arrangement, whitish, spreading, of unequal length, and are not shed at maturity. There are three grains in each of the spreading spikelets. The chaff is of medium length, the outer being long-awned, somewhat soft, shiny, uniform in colour, deep, almost angular-backed, firmly attached, and hugs the grain closely, so that little shelling occurs. The grain is of medium size, long, straight, of medium plumpness, horny, amber-coloured or red, flat-bosomed, blunt at the tip, but tapering in that direction, pointed at the base, and has an abundant brush, a deep crease, and a horny interior. A back-crease is sometimes visible. The germ-sculpture is two-fifths as long as the grain.



This is a hardy, latish, prolific, mid-season variety, hitherto unknown in this country. It is decidedly resistant to rust.

Prominent Characteristics.—Medium height, strong, yellow straw, whitish, bearded heads, amber grain of medium size, rather late, decidedly resistant to rust, not liable to shell.

French Early Bearded.—In height this variety is a little above the medium. The dull-yellow, almost semi-solid straw is rather fine, but is only moderately strong, stiff, and tough. The bearded, rosy ears are fairly regular, compact, of uniform width, or slightly clubbed, square, erect, straight, abrupt at both ends, especially the tip, and present only one or two sterile spikelets at the base. The beards are long, fine, orderly, light brownish, of unequal length, spreading, and are not shed at maturity. There are three or four grains in each of the spreading spikelets. The rather dull and uniform coloured chaff is of medium length, acute, deep, round-backed, very firmly attached, and lies close to the grain. This latter is of medium size, of medium length, straight, of medium plumpness, rather opaque, amber-coloured, plump-bosomed, pointed at the base and inclined to be so at the tip, and has a rather small brush, and a rather deep and close crease. When cut with a knife the interior of the grain appears horny. A back-crease is visible near the tip of the grain only. The germ-sculpture occupies one-third of the length of the grain.

This rather early variety stools well, and yields well, but it is doubtful if it can be introduced into this country on account of the objection of the threshers to bearded wheat of any kind. It stools well and is fairly resistant to rust.

Prominent Characteristics.—Medium height, strong yellow straw, bearded rosy ears, large amber or yellow grain, rather early, prolific, rather resistant to rust, not liable to shell.

Anglo-Australian.—This late variety is highly resistant to rust, and on that account alone included here. It is a little above the medium height. The dull yellow, furrowed straw is rather slender, hollow, strong, rather flexible yet rather tough, and tapers but little. The joints are prominent. The sheath of the topmost leaf extends upwards half-way to the base of the ear. The smooth, rosy, long open, erect, regular ears are bearded, a little tapering, rather square, straight or slightly curved, acute at the tip, tapering at the base, where there are as many as four to six sterile spikelets. The beards are long, fine, rather straggling, whitish, spreading, unequal in length, and are not shed at maturity. The narrow spikelets contain three grains as a rule. The chaff is dull and uniform in colour, rather long, stiff, deep, angular-backed, firmly attached, and lies close to the grain. Shelling occurs freely. The grain is of medium size, of medium length, straight, of medium plumpness, horny, red, flat-bosomed, blunt at the tip but tapering in that direction, pointed at the base, and has a small brush, and a rather shallow close crease. A back-crease is visible. On being cut open with a knife the grain is seen to be horny inside. The germ-sculpture is one-third as long as the grain.

This wheat is a mid-season one, not very prolific, yielding a grain not approved by Australian millers. It may prove useful in securing new resistant cross-breds. It is a wheat well known to experts, and seed can be procured in most of the Australian colonies from their respective Departments of Agriculture. The upper node is short—a prominent characteristic. Anglo-Canadian is identical with this.

Prominent Characteristics.—Above medium height, tough straw, bearded rosy ears, small red grain of inferior milling quality, mid-season, not very prolific, very highly resistant to rust, liable to shell.

Bearded Herisson.—The Bearded Herisson is a late sort, above the medium height, that stools well in a creeping manner. The straw is purple, furrowed, dull coloured, hollow, strong and rather stiff, and tapers but little. The smooth, rosy, glaucous ears are bearded, of medium length, somewhat irregular, crowded, clubbed, square, erect, straight, blunt at the tip and also at the base, where there are one or two sterile spikelets. The fine whitish beards are rather short, straggling, spreading, of unequal length, being short near the base of the ear, and are not shed at maturity. The spikelets spread widely, and contain four grains. The chaff is short, stiff, dull and uniform in colour, deep, almost angular-backed, firmly attached, and lies close to the grain, so preventing shelling. The grain is small, short, straight, plump, opaque, red or ruddy-brown, flat-bosomed, blunt at the tip, somewhat pointed at the base, and has a small brush, a mealy cross-section, and a deep crease. A back-crease is generally visible.

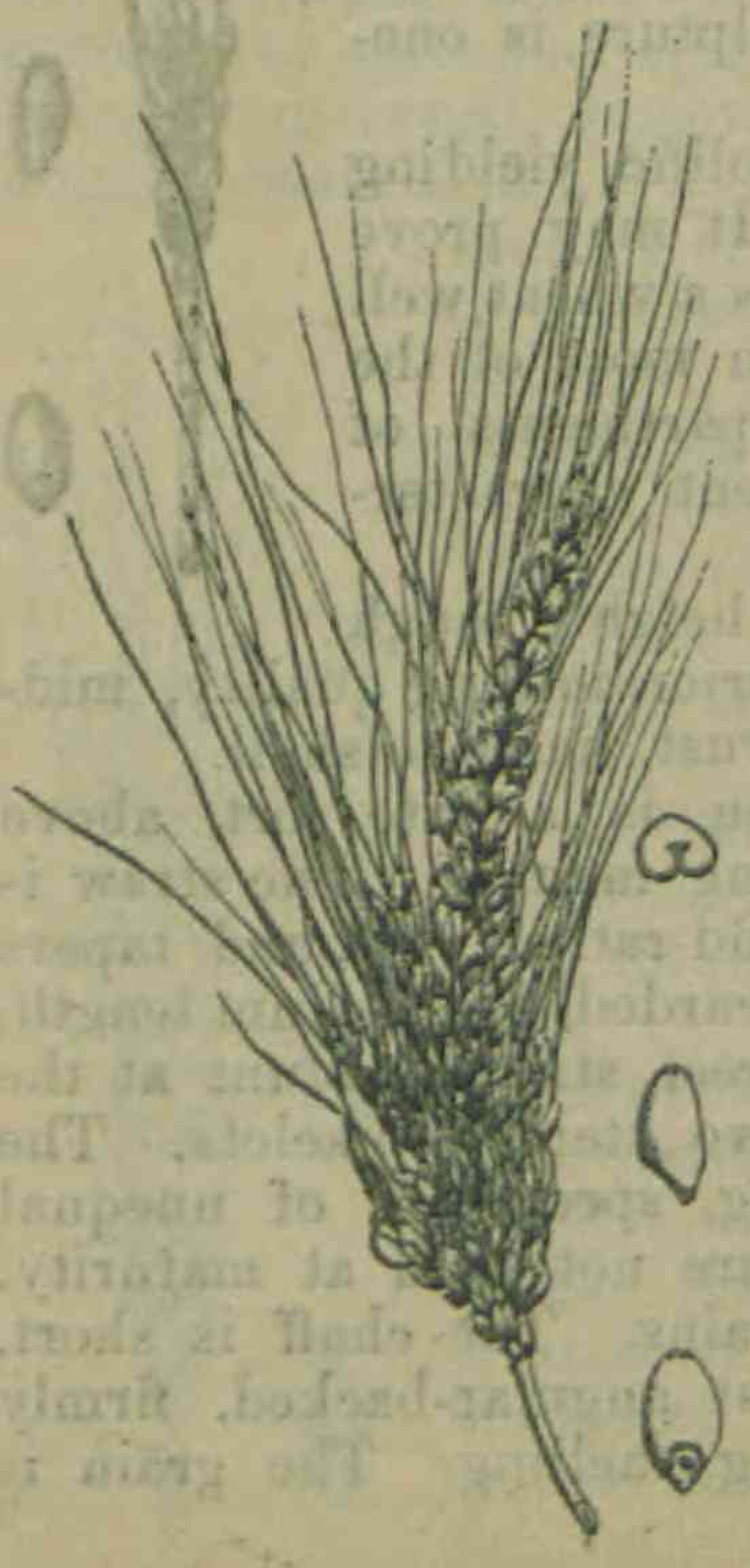
The Bearded Herisson is a variety that is suited to land of indifferent quality, even in cold and mountainous districts. It is decidedly resistant to rust, and is pretty certain to yield something of a crop under almost any circumstances within reason. It is essentially a poor-country wheat. The grain is of fair quality.

Prominent Characteristics.—Above medium height, purple strong straw, bearded rosy ears, small ruddy grain of only fair quality, mid-season, prolific, decidedly resistant to rust, not liable to shell.

RIETI.—Rieti is a wheat somewhat above the medium height. The straw is dull in lustre, rather smooth, yellow, hollow, fine, of medium flexibility, strong, and tapers but little. The sheath of the topmost leaf reaches more than half-way to the ear. The smooth, red ears are bearded, long, regular, open, tapering, flattened obversely, leaning when ripe, straight, acute at the tip, abrupt at the base, where there are as many as four to six sterile spikelets. The beards are long, fine, rather orderly in arrangement, brownish, spreading, of unequal length—that is, shorter below—and are not shed at maturity. The spikelets spread somewhat and contain two grains. The chaff has a dull lustre, is uniform in colour, of medium length, rather stiff, thin, rather shallow, round-backed, rather firmly attached, and lies close to the grain. There is considerable shedding. The grain is large, long, of medium plumpness, horny, red, flat-bosomed, blunt at the tip but tapering in that direction, pointed at the base, and has a small brush, a deep close crease, and a horny cross-section. No back-crease is visible. The germ-sculpture is less than one-third as long as the grain.

Rieti is a rust-resistant mid-season wheat, not very prolific. It may be useful as a parent in securing resistant cross-breds. The seed came to this country from France. Anglo-Australian resembles this variety in outward form, but its ears are white, while those of Rieti are red.

Prominent Characteristics.—Above medium height, strong yellow straw, bearded red ears, large red grain, mid-season, not over prolific, rust-resistant, liable to shell.

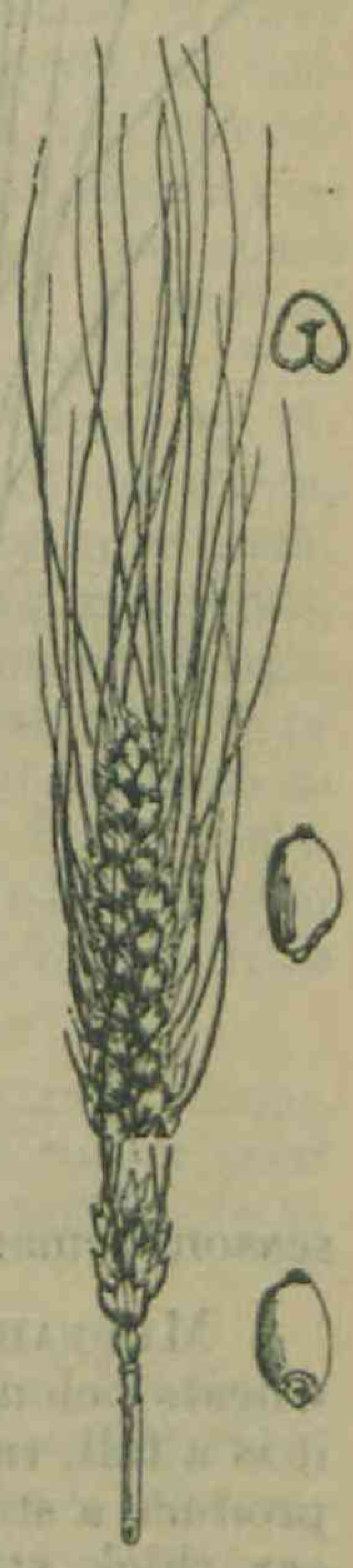


MIRACLE OR MUMMY.—This is one of the few poulard wheats that have found a certain degree of favour in Australia, more especially, we believe, in Queensland. It is above medium height, and is easily recognised by its multiple or compound ears, a way of growing which has caused it to be sometimes dubbed "Hen and Chickens." The dull yellow, furrowed straw is solid, fine, flexible but strong, and tapers but little. The foliage is drooping, rather abundant, and of a light-green colour. The smooth, glaucous, brown ears are multiple—that is, compound at the base—bearded, of medium length, irregular, crowded, tapering, flattened much, leaning, straight or curved, blunt at the tip, abrupt at the base, where there are several sterile spikelets. The whitish or brownish beards are of medium length, fine, straggling, somewhat parallel, of unequal length, and are not shed at maturity. The narrow spikelets contain two grains. The chaff is short, very blunt, soft and thin, dull and nearly uniform light-brown in colour, deep, very angular-backed, firmly attached, and lies close to the grain. Shelling is not likely to occur. The grain is of medium size and length, curved, hump-backed, of medium plumpness, opaque, yellowish, flat-bosomed, blunt at the tip, pointed at the base, and has a small brush, a crease of medium depth, and a very mealy cross-section. A back-crease not visible.

The Miracle or Mummy is a hardy, rust-resistant, fairly prolific, mid-season or latish wheat, yielding a grain of only fair quality. The Queensland millers are said to pay a good price for it. A farmer on first seeing a good sample of Mummy growing is apt to be quite taken with it, judging from the compound ears that it will be a great cropper ; it is disappointing in this respect, however, as it stools rather sparingly and is not remarkably prolific. There is a strain of Mummy having white ears that appears to be the best. The brown-eared strain tends to have blackish beards, while the white-eared strain has a much lighter coloured beard. This wheat also occurs under the name of Young's Bearded.

Prominent Characteristics.—Above medium height, strong yellow straw, bearded yellow compound ears, white grain of medium size, mid-season, not remarkably prolific, rust-resistant, not liable to shell.

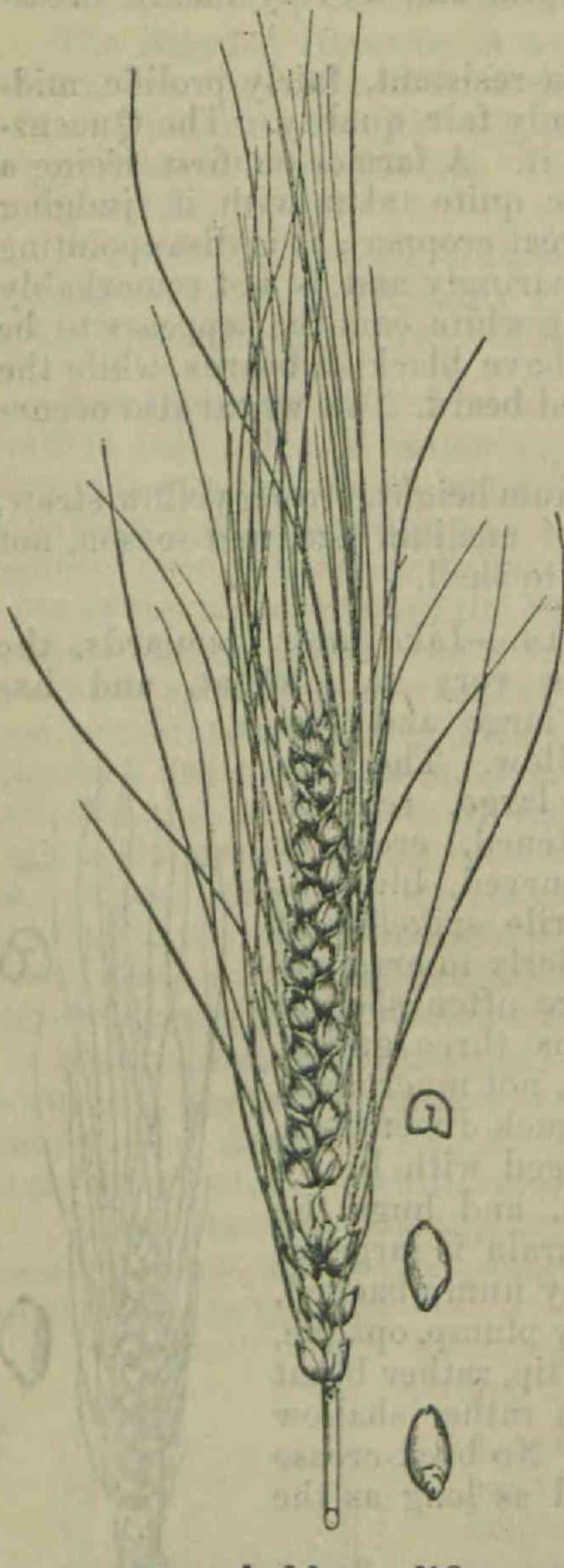
Smooth White Poulard, or Algerian.—Like most poulards, the Algerian or Smooth White Poulard is a very tall wheat, and has stiff, coarse and tough, solid straw with large and prominent joints; in colour the straw is yellow. The ears are whitish, bearded, smooth, long and large, regular, very compact, somewhat pyramidal, flattened, erect or leaning or drooping, straight or slightly curved, blunt at both ends, and present only one or two sterile spikelets at the base. The beards are long, coarse, orderly in arrangement, whitish or brownish, parallel, and are often shed at maturity. Each spreading spikelet contains three grains. The chaff is rather short, somewhat blunt, not mucronate, softer than one would expect in an ear of such dimensions, almost shiny, very deep, the outer being edged with brown or purple, angular-backed, firmly attached, and hugs the grain very closely, and holds it well. The grain is large, of medium length, a trifle curved, very markedly hump-backed, and in consequence very unusually thick, very plump, opaque, yellowish, plump-bosomed, very blunt at the tip, rather blunt at the base, and has an abundant brush, a rather shallow and open crease, and a very mealy interior. No back-crease is visible. The germ-sculpture is one-third as long as the grain.



This is a mid-season variety adapted to poor soil and other adverse conditions. It will yield something with little care, and on cold wet soils where the drainage is poor—in a word, under circumstances where most wheats would be a failure. It is resistant to rust, and is a very prolific sort; but the grain, though handsome, is of poor milling quality. It succeeds in coast districts. Algerian resembles Galland's Hybrid in appearance, but the form of grain and the colour on the outer chaff serve to distinguish the one from the other. Both have been grown in Australia for some years, but not extensively. The grain is used for chicken-feed.

Prominent Characteristics.—Very tall, coarse strong yellow straw, large white-bearded heads, large yellowish grain of very poor milling quality, mid-season, very prolific, rust-resistant, not liable to shell.

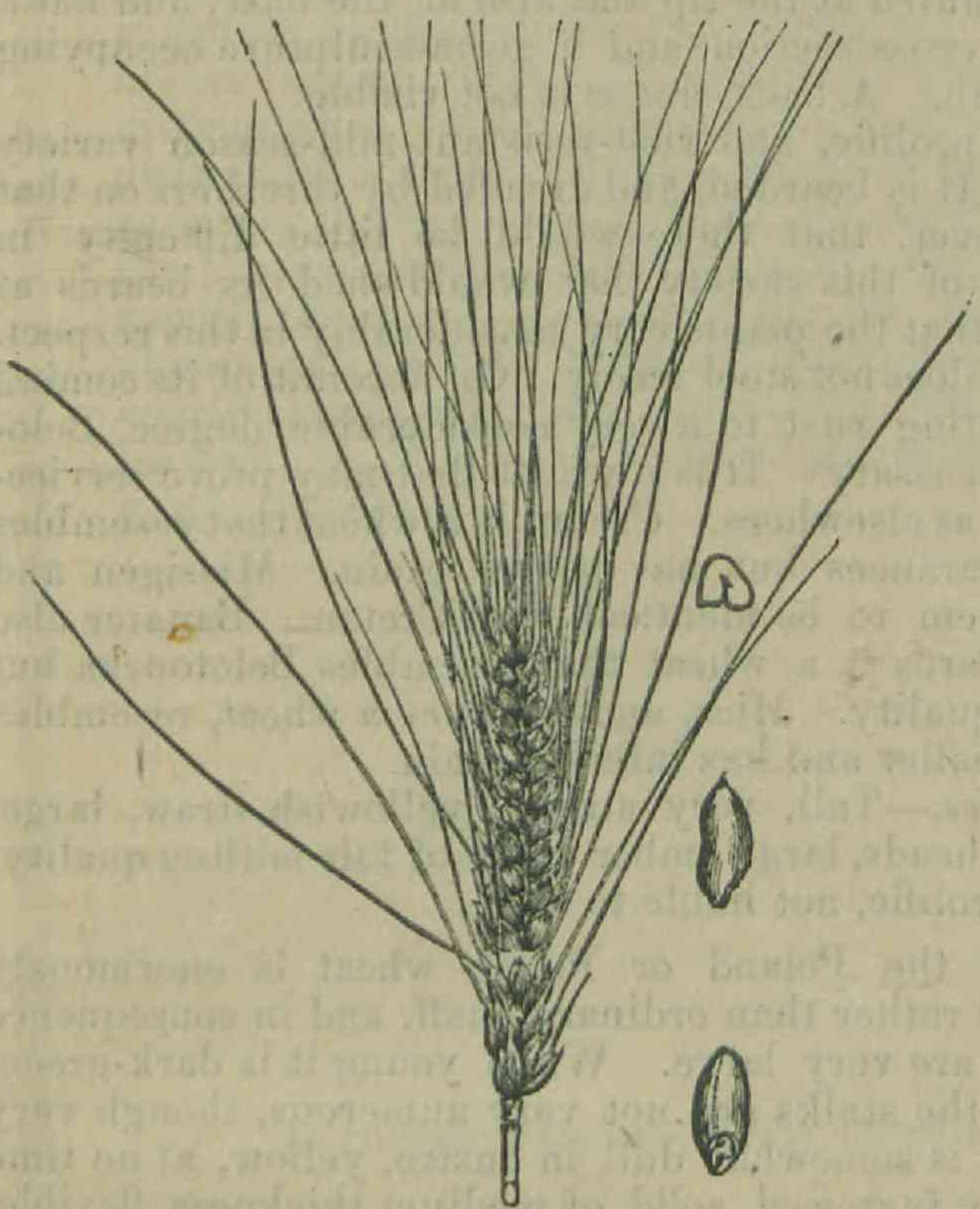
Galland's Hybrid.—Very tall and coarse is Galland's Hybrid, otherwise known as American Centennial, and to the French as *Pétanielle blanche.* The coarsely furrowed, yellow straw is dull in lustre, thick, stiff and strong, solid or nearly so, and of rather uniform diameter. The joints are large and prominent. The large, long, smooth, whitish or yellowish ears are bearded, very regular, compact, somewhat tapering, flattened, erect or leaning, straight or but slightly curved, blunt at both ends, and present but one or two sterile spikelets at the base. The beards are long, coarse, rather orderly in arrangement, whitish, nearly parallel, and are shed at maturity. The chaff is short but large, the outer being blunt, shiny, rather soft, uniform in colour, deep, very angular-backed, not very firmly attached, and hugs the grain so closely that shelling is not likely to occur. The grain is large, long, curved, rather hump-backed, of medium plumpness, opaque or horny, but usually the former, yellowish or amber-coloured, flat-bosomed or angular bosomed, blunt at the tip but tapering in that direction, very pointed at the base, and has a small brush, a deep crease, and a rather horny cross-section, though mealy when the grain is opaque and yellowish. A back-crease is rarely visible. The germ-sculpture is two-fifths as long as the grain itself.



Galland's Hybrid is an enormously prolific, hardy, rust-resistant, mid-season or somewhat late variety. It has been known to yield 90 bushels to the acre. The grain is very inferior for flour, and is used for fowls. In appearance this variety resembles Algerian, and to a less extent the larger *durums* such as Xeres. A wheat has come under our notice under the name of Hebron. This appears to be identical with Galland's Hybrid. Salvator appears to be the same wheat. It is grown in many parts, but not extensively. It will flourish on poor soil, and with little care.

Prominent Characteristics.—Very tall, coarse, strong, yellow straw, very large yellowish bearded ears, large dark yellowish grain of very poor milling quality, mid-season, remarkably prolific, rust-resistant, not liable to shell.

Medeah. — This is one of the mid-season, solid-strawed, bearded wheats belonging to the species *Triticum durum*. Like other *durum* wheats, it is a tall, rank-growing wheat which, though it creeps when young, does not produce a stool with many stalks. The straw is very strong, solid near the ear, thick, stiff, though it usually bends under the weight of the heads, very tough, dull yellow-coloured, tapering; it is never purple. The sheath of the upper leaf reaches one-half three-fifths the distance to the ear. The five joints are prominent and brown; the large, dark, and glaucous leaves are thin and drooping; the large flat ears are brown, glaucous, regular, and are made decidedly handsome by the long, straight, dark-coloured beards. Although only of medium length, the ears are so crowded with grain that they lean over on the stalk on account of their great weight. In form they are straight, of uniform size throughout or slightly clubbed, and blunt at both ends. There is seldom more than one sterile spikelet at the base of the ear. The beards are coarse, orderly, brown or black, spreading or nearly parallel, of equal length, the lower being only a little shorter, and they are often shed at maturity. The three to four grained spikelets are widely spread out in the form of a fan, and are free from down, except on the midribs. The long, stiff, and thick chaff is very firmly attached, and lies very close upon the grain, so that there is no chance of the grain falling out and being lost. The chaff is glaucous, angular-backed, and deep, and of a streaky brown colour. Like other *durum* wheats, the Medeah has a large and long, often somewhat curved, and rather thin grain. The grain, however, is often opaque and of a yellowish colour, instead of being horny and amber-coloured. It is rather pointed at both ends, presents a close and very deep crease, and even occasionally a faint back-crease; the germ-sculpture is very large and the cross-section horny.



This wheat is a very prolific one, hardy, of medium earliness, and so very resistant to rust that it can be grown even in coast districts, but it is not of good milling quality. The bread made from it, although it is not so white, and fails to rise as well as that made from finer wheats, is very nutritious, and has a flavour surpassing that used in most English-speaking countries, where the demand is for *white* bread, regardless often of other things. On account of its so-called solid straw, this wheat yields a great weight of hay per acre, and it may be recommended on that account, but it remains to be shown that this hay is of as good quality as that from fine wheats. Medeah is grown extensively in the countries surrounding the Mediterranean Sea, especially in Algeria and other North African countries. It is a little earlier than Belotourka.

Prominent Characteristics.—Tall, very strong, yellowish straw, large, handsome, bearded brown ears, large, long, amber, hard grain of rather poor milling quality, mid-season, very resistant to rust, very prolific, not liable to shell.

Belotourka. — This is a rather late hard wheat from Southern Europe, and has been introduced into Queensland more extensively than elsewhere in Australasia. The grain is superior to that of most hard wheats. Belotourka is a very tall wheat, whose dullish yellow furrowed straw is solid or nearly so, of medium thickness and flexibility, strong, and tapers but little. The drooping, light-green foliage is rather scanty considering the great size of the plants; the sheath of the uppermost leaf reaches less than half-way to the ear. The smooth light-brown ears are bearded, regular, very compact, of nearly uniform width, strongly flattened, leaning when ripe though nearly straight, blunt at both ends, and have only one or two sterile spikelets at the base. The fine brownish beards are long, very orderly in arrangement, parallel or somewhat spreading, of equal length, and are rarely shed at maturity. The spreading spikelets contain three grains. The chaff is glaucous, of a light-brown colour, dull and uniform, of medium length, rather bluntly mucronate, and, like that of all other hard or *durum* wheats, angular-backed, deep, firmly attached, and lying close upon the grain. Shelling never occurs under ordinary circumstances. The grain is large, long, straight or slightly curved, of medium plumpness, opaque or horny according to season and locality, yellowish or amber-coloured, rather plump-bosomed, somewhat pointed at the tip and also at the base, and has a small brush, a rather mealy cross-section, and a germ-sculpture occupying only two-sevenths of its length. A back-crease is not visible.

Belotourka is a hardy, prolific, and rust-resistant mid-season variety having many fine qualities. It is bearded, and dreaded by threshers on that account. We believe, however, that there would be little difficulty in getting, by selection, a strain of this variety that would shed its beards at maturity, as we have noticed that the plants vary considerably in this respect. Like most bearded wheats, it does not stool freely. On account of its coming quickly to maturity and resisting rust to a very considerable degree, Belotourka can be sown late if necessary It is a wheat that may prove serviceable in coast districts as well as elsewhere. Cretan is a wheat that resembles Belotourka in outward appearances but has poorer grain. Missigen and Atlanti are two sorts that seem to be identical with Cretan. Banater also resembles Cretan closely. Paros is a wheat that resembles Belotourka but has larger grain of a poorer quality. Mica, another *durum* wheat, resembles most of these sorts, but is smaller and has inferior grain.

Prominent Characteristics.—Tall, very strong, yellowish straw, large, handsome, brownish bearded heads, large amber grain of fair milling quality, mid-season, rust-resistant, prolific, not liable to shell.

Poland.—The chaff of the Poland or Polish wheat is enormously developed, resembling leaves rather than ordinary chaff, and in consequence of this the ears are very large. When young it is dark-green, and creeps, but the stalks are not very numerous, though very tall. The straw is somewhat dull in lustre, yellow, at no time purple, distinctly furrowed, solid, of medium thickness, flexible, but strong. The ears are very long and large, yellowish, bearded, smooth, fairly regular, open, a little tapering, flattened, leaning or drooping, curved, blunt at the tip, tapering at the base, where there are three to five sterile spikelets. The beards are of medium length, fine, straggling, whitish, parallel or spreading, of unequal length, and are sometimes shed at maturity. The chaff is very abundant, extremely long and foliacious, blunt, soft, dull in lustre, and uniform in colour, deep, angular-backed, firmly attached, and lies loose in the ear; shelling does not occur. The grain is very hard, very large and long, straight, thin, horny, dark amber-coloured, angular-bosomed, blunt at the tip, pointed at the base, and has an abundant brush and a deep crease. A back-crease is rarely visible. The grain is horny inside. The germ-sculpture is often less than one-third as long as the grain.

This peculiar variety is late, and is useless for flour. It is used for green stock food in some parts of Europe; and this leads us to call attention to it here as being worthy of trial for those purposes in this country. The grain is rich in gluten, and is suitable for macaroni and for stock. It is much grown in North Africa—for instance, in Egypt and Algeria. It is sometimes called Mammoth Rye. It is very resistant to rust.

Prominent Characteristics.—Very tall, very strong, yellow straw, very large, chaffy, bearded pendulous ears, very large, long, dark grain of very poor milling quality, mid-season, rust-resistant, prolific, not liable to shell.

Among the wheats we have just described are representatives of four distinct species, namely :—

Triticum sativum, or Fine Wheats, *e.g.*, Purple Straw, Talavera.
Triticum durum, or Hard Wheat, *e.g.*, Belotourka, Medeah.
Triticum turgidum, Poulards, *e g.*, Mummy.
Triticum polonicum, Polish Wheat, *e.g.*, Poland.

These different species are easily distinguished one from another. The latter three, *durum*, *turgidum*, and *polonicum*, are always bearded, and have a straw which near the ear is solid, or nearly so. These two characters are sufficient to distinguish them from the fine wheats, which always have a hollow or at most only semi-solid straw. The Polish wheat is easily distinguished by its immense ears with enormously developed chaff. To distinguish a Poulard from a *durum* is not so easy, but it can be done with certainty if the following facts are carefully considered:—1. The chaff of the Poulards is thin, soft, and short, while that of *durums* is thick, stiff, and usually long. 2. The grain of the Poulards is rather soft, short, and plump, and usually decidedly hump-backed, while that of the *durums* is nearly always long, hard, and horny, seldom plump, and almost never hump-backed. 3. While the Poulard grains are very mealy inside, the *durums*, as a rule, are not so.

By Authority: Edmund Gregory, Government Printer, William street, Brisbane.