ANNUAL REPORT

OF THE

DEPARTMENT OF AGRICULTURE

FOR THE

YEAR 1894-95.

REPORT OF THE UNDER SECRETARY FOR AGRICULTURE.

BRISBANE:

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TO THE HONOURABLE THE SECRETARY FOR PUBLIC LANDS AND AGRICULTURE.

Department of Agriculture,
Brisbane, 30th May, 1895.

Sir,—The winter of 1894 was one of the most severe experienced for many years; cold, bleak, westerly winds prevailed for a considerable period, the cold being further intensified by a continuance of frost which at one time threatened the young wheat on the Darling Downs, and completely cut down all grass and herbage, so rendering the pastures valueless for feeding purposes. That kind of weather prevailed more or less to the middle of September, when good rain fell, putting a stop to the bush fires that were in some places extensive, and had done much damage. It also gave the grass an early spring, and enabled the farmer to put his land in good tilth for an early crop of maize, potatoes, &c., and gave the young wheat a start which resulted in one of the best wheat harvests yet gathered in Queensland. Excepting tobacco—which from various causes got a set-back early in the season, that resulted in some districts in only half a crop—all produce of what is known here as the early crop was abundant. Though the produce was abundant the market was very low throughout the year, and the low prices realised left many a farmer in anything but an enviable position. Never before in my knowledge of Queensland have wheat, maize, and potatoes—our main products outside of sugar—been so low in price for such a prolonged period. A change, however, has come at last, and maize and wheat have hardened, with a tendency for still better prices, and those who have held their stock of maize for the winter market will benefit by the loss sustained by those who were depending upon the late crop, which can be written down as a failure. As a rule I think it can be safely stated that our spring crop of maize does not give as good results as the winter crop, but during the past year the rule has been proved by an exception, for the spring crop was abundant and the winter crop a failure, the results arising from opposite causes—drought and flood. The dry weather prevailing in the early part of this year, when the maize required moisture, prevented the crop from cobbing, and so ruined it for grain and as a marketable winter crop. About the same time that the winter crop on the Downs was set back, that in the North was completely destroyed by the heavy floods on the Mossman, Daintree, and other rivers, which will result in a shortage in that part of Queensland of, it is estimated, about 150,000 bushels. The stocks in hand

will, however, be sufficient to supply our wants, and it is not anticipated that importations of any magnitude will take place—which will be to the benefit of the farmers, because there is little or no chance of prices receding before the spring crop is gathered, and it is probable that prices will harden still further.

Although the winter maize is a failure for grain, it is much to be regretted that, generally speaking, no attempt was made to utilise it for fodder. Had the maize fields in which the plants failed to cob been cut down and saved for hay or placed in a silo, thousands of tons of good fodder would have been available for home use in September and October, when, as a rule, there is no feed in the pastures, and the grass has not yet begun to spring. These remarks apply especially to those who depend to a great extent on dairying, and supply milk to a factory or creamery, because it is at such times, if no provision shall have been made for a supply of winter feed, that the supply of milk runs short, and it is then that full milk commands the highest figure. The housing and feeding of dairy cattle during the winter months is a lesson farmers in Queensland are apparently slow in learning the necessity of. Yet there are signs that the present and past system of housing milking cows under the lee of a two-railed fence is gradually passing away, and that the profits to be derived from warmth and good feeding during the cold nights are forcing themselves into appreciation. When at Wallumbilla lately I found that many of the farmers there were making hay of their cornstalks, and piling them up for winter feed.

Dairy Cattle at Shows.—It being the general custom here to hold agricultural shows during the winter or early spring, an observer cannot but be struck with the miserable condition in which milch cows are presented for exhibition. To anyone who has attended similar exhibitions in the United Kingdom the contrast is most marked, and the necessary improvement can be brought about only when farmers and dairymen adopt the system of housing and feeding their cattle during the winter months, as set forth in the preceding paragraph. Here cows are taken from the paddock, or perhaps an adjoining road or reserve, placed in a pen for exhibition, and duly paraded in the ring without any preliminary care or preparation. An animal that is worthy of exhibition is surely worth some preparation before being shown as one of the dairy cattle of the neighbourhood.

Agricultural Shows.—A considerable improvement has of late been manifest in the manner in which agricultural exhibits are placed on show. More taste in arranging is being displayed, and it is hoped that the improvement thus begun will be carried on, in quality as well as arrangement. Taken altogether the shows of last year have been a great improvement on previous years, especially the dairy products, which would have compared favourably with similar products at any show in the world. One very interesting feature at the Summer Show of the National Agricultural and Industrial Association held in January last year, was a display of flax made from the linseed grown from seed imported by the Department from Ireland. The fibre attracted much attention as being a new addition to the products of Queensland, and many farmers hoped that they had found a fresh source of profit, other than that of the usual maize, potatoes, lucerne, &c.

To ascertain the value of the fibre, a parcel was forwarded to Mr. M. H. Black, to test its value in the English market, and was placed by him in the hands of prominent Dundee merchants.

The first report from Messrs. Don Bros., Buist and Co. was not of an encouraging nature, but a further communication from the secretary of the Chamber of Commerce was more satisfactory. This later report said that the flax had been examined by many spinners, and had attracted much attention. The colour and length of fibre were favourably commented upon, and dealers inquired whether it could be supplied in quantity, and at what price. A suggestion was made that a trial shipment of at least five tons should be made to be placed prominently before the trade, that the highest value might be ascertained. This proposal is now before the farmers of the Fassifern district, where the original shipment was grown. Before passing to other matters I would draw your attention to the action of committees of agricultural societies in permitting gambling by means of games of chance within their grounds upon show days. Each of the societies receive subsidy from the Government to assist them in carrying out the objects for which they exist, and I cannot think that Parliament, when voting the money for the payment of such endowment, intended that it should encourage such temptations to the young people of Queensland, or that games of chance upon a showground are included in the legitimate outside attractions that an agricultural society should permit.

Olives.—Notwithstanding the continued efforts of this Department during the past years to encourage the cultivation of the olive by the introduction and distribution of truncheons from South Australia, by the distribution of truncheons willingly supplied by Mr. Petrie, of the North Pine, by the Comptroller of Prisons from St. Helena, and from the issue of a pamphlet on the subject, very little has been done by the farmers to cultivate this very valuable and oil-producing fruit. In a country such as Queensland, where the population is small, and where, owing to climatic conditions, it is almost a necessity to market the crops as quickly as possible, the cultivation of the olive would be both profitable and beneficial. The market is never glutted with olive oil, notwithstanding the fact that the greater proportion of the oil offered under the name of olive is simply an oil prepared from the cotton seed. One professor, in lecturing at an agricultural college in America upon the cotton plant and its value, openly stated that he did not see why so many thousands of tons of cotton seed should be annually exported to Italy and elsewhere instead of being retained in the country to be made into olive oil. The olive possesses the advantage that it will thrive in sandy or rocky places, in country that could not be well utilised for other cultivation. With care and attention to the trees the industry is a most profitable one, and the product when manufactured will keep for any length of time. It is satisfactory to be able to record that an attempt has now been made to establish the preparation of the oil from the fruit. Messrs. Finucane and Zagamai have, during the fruiting season, collected a quantity of fruit from different districts, and with very primitive appliances produced a quantity of oil, to all appearances of the first quality. This being practically the first attempt to demonstrate the value of this product, and as the fruit was gathered

from many places, necessarily under all kinds of conditions, it could not be expected that the oil would be equal in quality to that produced in those countries where the industry has been followed for hundreds of years, and where the producers are born into the business. Moreover, no attempt was made to test the relative value of the different kinds of berries crushed, nor the quantity required for a given quantity of oil. However, the effort was most successful, and clearly showed that with care in cultivating the right varieties, and with proper appliances, there is money in the business.

Grapes.—Grave fears were entertained at Roma during the early months of the year that, owing to the continued wet and boisterous weather, the grape crop would be a failure, and many a farmer was bemoaning his fate. The wheat was in many places unsaleable, excepting at the lowest price ever paid for grain in Queensland, and in addition, the weather threatened to destroy what has hitherto been one of the chief industries of the district. The bad weather caused some loss of fruit, but on the whole the loss was comparatively small, and on the other hand the crop gathered was abnormally large. The distance from this now celebrated grape-growing district to its principal market prevents much extension of the trade in table grapes. The demand for wine grapes is increasing, and the reputation of the district for wine-making grapes has resulted in an increased demand for this year, and it would greatly benefit the district were the central winery system, now in force in South Australia, introduced, if it were possible. An extension of the area under grapes would speedily follow, without doubt. To carry out such a system here, the principle of the Sugar Works Guarantee Act could be applied. The grower of the table grape has, by his own action, raised up a more formidable foe than the weather. To secure an early market and big prices, some growers have placed unripe fruit upon the market, at the risk of prejudicing the public against the grapes from the district. If our growers would realise the injury they are doing themselves by sending unripe and badly-graded fruit to market, the complaints that were heard in Brisbane during the early part of last season would not be repeated. It would be much better to wait until the fruit is in a proper condition for sale, and then to give great care to the picking, grading, and packing.

Wheat.—It is with much pleasure that I am able to repeat the remarks made in my last report concerning the wheat harvest of 1894. The area under crop for 1894 was larger than in any previous year, and of the average return the same can be said. So far there is much cause for congratulation, but as regards the market price for the grain, that for 1894 harvest was very low, opening at an average of about 2s. per bushel. The cause of this can be to some extent attributed to the good harvest in nearly all wheat-growing countries during the previous four years, and the consequent accumulation of stocks. These stocks are, however, luckily for the farmer, comparatively exhausted, and prices have gone up considerably, wheat being recently quoted in Melbourne at 3s. 4d. per bushel. The following table, issued by the Registrar-General, gives interesting statistics of the wheat crops of the past ten years, especially so with regard to the average returns per acre during each year.

RETURN OF WHEAT CROPS FOR TEN YEARS.

Year.	For Grain. Acres.	Bushels.	Average per Acre.
1885 ...	10,093 ...	51,598 ...	5·11
1886 ...	6,787 ...	21,221 ...	3·13
1887 ...	8,248 ...	182,308 ...	22·10
1888 ...	9,305 ...	8,263 ...	0·89
1889 ...	8,459 ...	134,335 ...	15·88
1890 ...	10,390 ...	207,990 ...	20·02
1891 ...	19,306 ...	392,309 ...	20·32
1892 ...	31,742 ...	462,583 ...	14·57
1893 ...	28,993 ...	413,094 ...	14·25
1894 ...	28,997 ...	545,185 ...	18·80

The experiments carried out by this Department during the past three years, at Warwick, Yangan, Allora, Roma, Springsure, Clermont, Hughenden, and Herberton, have fairly established the varieties that may be looked upon as possessing rust-resisting constitutions here. This sowing the numbers of the varieties planted have been considerably reduced and the areas under each kind much extended, in order to have good and tried seed wheat available for distribution next year, where experience has shown that certain kinds are suited to the respective districts. The Instructor in Agriculture has carried out under his personal supervision the experiments here referred to, and will deal more fully with the subject in his report attached hereto. He has also now in the Press a bulletin which will contain, for the benefit of Queensland farmers, the experience gained during the prosecution of these experiments. The area sown for 1895 is, it is believed, considerably larger than in former years, notwithstanding the low price for grain at which the season opened; but owing to the continued dry season since planting the prospects at time of writing this report are not favourable for the growers. At the small village settlement of Wallumbilla alone 800 acres have been sown.

Sugar.—This industry continues to make rapid growth, and can be fairly rated as being among the first in Queensland. Much of the impetus that has been given to the growth and manufacture of sugar during the past three years can doubtless be attributed to the success of the central mills at Mackay, and to the publicity given of the results of the workings of these companies through the medium of their published balance-sheets. The establishment of these mills has without doubt led to an entire change in the industry, and especially have they been the cause of large estates being subdivided and sold or let on lease in small areas, the existing mills upon these estates being converted into a central mill. Since writing in my Annual Report for 1892-3 upon the subdivision of large sugar estates, much assistance

has been given to people desiring to enter upon sugar-farming by directing attention to the advantageous offers made by owners of the large estates, and in nearly all cases have those who acted upon the information given been satisfied. The following tables, supplied by the Registrar-General, will convey some idea of the number and acreage of the smaller holdings. It is pointed out that many of the smaller holdings grow cane only for fodder and not for sale to a mill. Some, however, are of course in the initial stage of development.

Sugar Plantations.		Number.		Total Area.
2 to 5 acres	...	191	...	783
5 to 15 „	...	434	...	4,378
15 to 30 „	...	324	...	7,482
30 to 45 „	...	170	...	6,463
45 to 60 „	...	91	...	4,823
60 to 75 „	...	37	...	2,530
75 to 90 „	...	30	...	2,506
90 to 105 „	...	15	...	1,488
105 acres and over	...	95	...	38,578
		1,387		69,031

Areas of 2 acres and under are not included.

Excluding the number and area of plantations of 90 acres and upwards, which, in the present stage of sugar-farming here, cannot reasonably be classed as small sugar farms or plantations for the reason that to properly handle a sugar farm of 90 acres a considerable amount of hired labour would be required, it will be seen that the average area of a sugar farm at the present time is 22·68 acres.

The forecast given in my last report is established by the following comparison of the years of 1893 and 1894:

	Acres of Cane Crushed.		Yield in Tons.
1893	43,670	...	76,146
1894	49,839	...	91,711

Not only did 1894 see the greatest number of acres crushed for cane, but it also gave the highest average return per acre, which latter can be set down to favourable seasons and to improved machinery. The increase of the area to be crushed during the coming season, with the consequent enlarged output that can, naturally, be looked for owing to the attention that has of late been given to sugar-growing, will probably bring our production in excess of the Australian consumption, with the result that the excess will have to find a market outside of Australia at a much lower price per ton than has hitherto been obtained. If lower prices become established, it will be those mills dealing with large quantities of cane and having the most improved machinery that will be able to work at a profit. It is difficult to estimate what the return will be for the coming season, because the change brought about by the Sugar Works Guarantee Act has

removed the former basis of calculation. The great influence that the establishment of the central sugar-mill system has exerted over the industry leads me to point out the further necessary assistance that could be given by the establishment of a State nursery wholly devoted to experiments in the growth and cultivation of sugar-cane, and I would suggest that early steps be taken towards the establishment of such a nursery. Experiments in the direction indicated have been effected in the existing nurseries at Mackay and Kamerunga, but the work carried out at these places is of necessity of a general character, and the space and attention that should be given to sugar cannot, from force of circumstances, be spared—the work that should be done would require a nursery for that class of work alone.

Coffee.—Considerable areas of land have been placed under coffee during the past year, and inquiries frequently come to hand from persons in India and Ceylon relative to the conditions under which land suitable for coffee can be secured. It has been proved that the area here suitable for coffee is large, and there is evidence that the cultivation of this product will soon be upon a firm footing, and rank among the prominent agricultural industries. The question of labour has hitherto been a bar to extended cultivation, but as it has been decided that Pacific Island labour can be employed in connection therewith, that obstacle has been removed.

Sericulture.—An effort has been made to encourage this industry in many ways—by the publication of a bulletin giving full instruction in the art, by the introduction of eggs from Italy for distribution, and by an attempt to introduce cocoons of the Tusser and Eri varieties from India. Several moths of the Tusser were obtained, but the Eri had cut out on the voyage, and the moths were found to be dead when the box in which they travelled was opened. A quantity of cocoons were obtained from the growers, with the chrysalis killed, and forwarded to Mr M. H. Black to be reeled and manufactured into silk, with the result that a beautiful piece of figured silk, about 20 inches by 6 inches, has been received from London, and is now in this museum. Mr. Wardle, the great expert on silk, stated that this silk was of remarkably good quality, and that the weaver told him he had never operated on better silk. Such an opinion is of great value when it is remembered that the cocoons sent home were not raised for that particular purpose, but were obtained from all quarters. The total weight of the cocoons received by Mr. Black was 4 lb. 6 oz.; the weight of raw silk reeled from them was 11 oz. 4 drams, leaving 3 lb. 10 or 12 drams of waste silk for spinning—a good yield of raw silk. The market value at that time of these cocoons was estimated at 16s. per lb. of silk, and this was at a time when silk was at a very low ebb. The result of the action taken was that it was ascertained many people, especially children, had been producing silk for some time, and the inquiries for a market were numerous, but as the individual quantities were too small to send to market, it was thought the Department could assist by purchasing cocoons and sending them to England to ascertain their value in the European market. This was done, 1s. 6d. per lb. being paid for cocoons in which the chrysalis has been destroyed, but although it was well known that many were engaged in rearing silkworms, the result of the adver-

tisement calling for cocoons was not satisfactory, only 11 lb. 13 oz. being secured. These were sent to the Agent-General to be placed upon the market to ascertain their value, but the financial result of the shipment is not yet known. Experience has, however, come to hand, which will be of value in the future. The Agent-General, in writing of this consignment, says, "There is absolutely no sale for cocoons in this country, as no reeling is done here. The silk trade has almost left England, and is mostly confined to the towns of Marseilles, Turin, and Lyons." The cocoons were forwarded to Turin for sale. The Agent-General further writes that a better price would be obtained if the cocoons were reeled in the colony before being sent home, as the silk loses its exquisite gloss, its nerve and vitality, if reeled long after the worms have been killed. In future, silk sent to market should be reeled.

Tobacco.—The opinion expressed in my last report that the area under this crop for 1894 would exceed that of 1893 has been confirmed, as is shown by the following statistics furnished by the Registrar-General :—

	Area under Crop.	Average Yield.
1893 ...	475 acres ...	9·64 cwt. per acre.
1894 ...	914 „ ...	10·47 „ „

The total area has thus increased nearly 100 per cent., and the return per acre is nearly 1 cwt. larger than that of the previous year.

The total yield was about 9,571 cwt., and the average price paid for the crop 8d. per lb.

The cultivation of tobacco here is almost wholly in the hands of the Chinese, though many Europeans are engaged in it, and the number is increasing. In the absence of any special returns to that effect, it is impossible to give the area cultivated by Europeans as against Chinese. The cultivation at present in use here in connection with tobacco is by custom divided between the owner of the land and the grower. Generally speaking, the tobacco that fetches the highest price here has been raised by Chinese upon land ploughed by Europeans, the Chinese being either direct tenants or working upon shares. Fully four-fifths of those engaged in the cultivation of tobacco are of Asiatic origin. Although the soil and climate of Queensland are suited to tobacco, and the leaf produced here is, as I have been informed by one well qualified to give an opinion, of better quality than that grown in the Southern colonies, the reports upon the samples sent to the Agent-General for report have not been satisfactory. The reports are all favourable as regards the quality of the leaf, but complaints are made of the want of knowledge shown in the preparation, the leaf being quite unmarketable. The point generally raised by the home experts is that the leaf submitted shows a want of proper fermentation, a knowledge of which process few of the Europeans here possess, and it is for this reason I think that so few are found cultivating tobacco in Queensland in comparison with the total number of persons engaged in the industry. I would strongly urge the appointment of an expert, not so much for instruction in the methods of cultivation, though much has yet to be

learned in that respect, but especially for the art of drying, curing, and preparing for market. The chief centres of tobacco cultivation are Warwick, Killarney, Stanthorpe, Inglewood, and Goondiwindi.

Butter and Cheese.—Only two shipments of butter have so far been made under the provisions of the Meat and Dairy Produce Encouragement Act, viz.:—

195 boxes per "Banffshire," which left here on February, 3rd, and
190 " " "Nainshire," " " " 19th.

The butter by the latter ship, which arrived first, sold at 76s. per cwt. (the account sales of the "Banffshire" butter have not yet come to hand); and though it may be thought that, from the prices that have been cabled from England, this shipment was of inferior quality, such was not the case. From an excellent diagram received from Messrs. Weddel and Co., giving full statistics of the butter trade in London, it appears that during the last fifteen years the lowest prices realised for Danish butter imported to London have almost invariably been during the month of May—the month when the shipment under notice was placed on the market. The prices begin to rise in September, good prices being obtainable until March; the best months being October, November, and December. If our exporters wish to catch the highest markets they must be prepared to ship from August to February, but it would be more satisfactory to the London merchants were regular shipments made throughout the year. The knowledge gained from the diagrams furnished by Messrs. Weddel and Co. of the butter trade in London is of the highest value, and should teach our farmers the important lesson that, if they wish to compete with their produce in the market of the world, they must adapt themselves to the circumstances demanded to provide the necessary supply; and until they learn to make provision for housing and feeding their stock during the winter months, we cannot hope to send shipments of butter and cheese to reach England when the prices are at the highest. However, until we can more fully meet our local requirements there will be no necessity for seeking a market outside our borders. There are certain months during the year when produce exceeds consumption, an inequality which can be overcome by cold storage; but the fact remains that during 1894 we imported 221,724 lb. of butter, valued at £9,485, and 65,720 lb. cheese, valued at £1,543.

Timber.—Several samples have been sent to England during the past year for testing as to their commercial value for various purposes, but no complete reports have been received of those which have been sufficiently well thought of for further testing. At the suggestion of Dr. T. Bancroft, a log of cypress pine was sent to Hongkong to ascertain whether it would find a market for the same purposes for which the Chinese use sandalwood. The report from the Chamber of Commerce at Hongkong does not, however, give hope that the suggestion is likely to be turned to account. It is to the effect that "the wood seems rich in aromatic properties, but it is questionable whether it could be used as a substitute for sandalwood."

Maize.—Notwithstanding the efforts to introduce fresh seed of improved varieties, it would appear at one time since the issue of my last report that the farmers would have to discontinue the cultivation of this crop. Never before in my recollection has the price of maize been so low, at one time 6d. per bushel being the sum obtainable for grain of good quality. The prospects, so far as prices are concerned, are, however, now much improved, though I fear not to the benefit of the farmer, owing to the failure of the winter crop from dry weather, and from that cause prices are expected to rule high for some time to come. The principal maize districts in the North have suffered severely from flood, so that no supply can be looked for from that region until the summer crop is harvested. The reports on the seed imported have been most satisfactory, and confirm the opinion that such a step is periodically necessary.

Fraser's Island.—In my last report mention was made of an intention to change the system of reafforestation there. That change has been carried out, and 700 young trees have been planted out with, as the Nurseryman reports, every prospect of success.

Cocoanuts.—The accessible islands in the vicinity of Mackay having been planted, and the majority of the plantations being practically out of danger from fire or molestation from the blacks, the base of operations has been changed to Bowen to deal with the islands in that neighbourhood. The plantations already formed are doing well, no disease or vermin having attacked the young palms. During the past year fresh plantations have been made on Seaforth Island, at Eimeo, at Kennedy Sound, on Brampton, Goldsmith, Allonby, and Stone Islands, and a commencement has been made near Bowen. The young plantations have received attention, and altogether the work carried out has been satisfactory.

Travelling Dairy.—This is still kept at work, and the public interest shown does not seem to lessen. However, with the increase in the number of creameries and butter and cheese factories that have been of late established, the time is approaching when the plant can be laid aside. The time has come when the preparation of cheese and butter upon the farm must give way to the better and more profitable system of supplying the milk to the factory, where it can be manufactured into butter and cheese in a uniform manner and upon the most approved principles. Had an Agricultural College been in existence the plant could have been located there, and a longer course of instruction could be given to pupils than is now possible under the system in force of travelling from place to place. It is pleasing to hear people in every direction acknowledging the improvement in the butter and cheese placed upon the market since the instruction given by the Dairy has had effect.

Agricultural College.—I have again to urge the necessity of an Agricultural College with an Experiment Farm attached as a much required adjunct to this Department to enable the work to be prosecuted as it should. It is an urgent necessity to provide a class of instruction for those of the youth of Queensland who are compelled to go elsewhere for the teaching they should be able to obtain here. With the limited means at disposal, such as has been possible has been done

upon the plots of land kindly set apart for the use of the Department in different places by farmers; and the little that has been effected is a powerful object lesson in the direction of what could be done with a properly-equipped Experiment Farm under the constant supervision of some person qualified for the position. I hope that the college, which has been so long spoken of, and for which money has been twice voted by Parliament, will soon be an accomplished fact.

Diseases in Plants Bill.—It is to be regretted that the time at the disposal of Parliament during last session did not permit this Bill to be passed. The diseases in fruit that are present in the various fruit-growing districts of Australia have resulted so disastrously to the growers that legislation has been enacted or is now before the Parliaments of the southern colonies dealing most stringently with the importation of fruits, disinfection of fruit-cases, inspection of orchards, and the means to be adopted when orchards are found to be infected. In no colony is the necessity for such a measure more urgent than here—an opinion which is abundantly supported by the work that has come to hand since the appointment of the Entomologist, and by the opinions expressed by fruit-growers for such a measure.

Co-operative Groups.—I regret that many of the co-operative communities settled under the Acts of 1893-4 are in a state of collapse, and are furnishing another lesson as to the utter futility of attempting settlement on the land under the co-operative system. The manner in which they were formed did not augur well for their success; the greater bulk of the people composing the groups had not the slightest knowledge of the undertaking they were entering upon, although many of them declared in their official returns that they were farmers or had farming experience. It is, moreover, a mystery to me how these men, with their avowed experience, could have permitted their fellow-members to delude them with the belief that farming could be successfully and profitably pursued with a fixed system, as provided in the rules of groups, of eight or nine hours' work a day; and it was patent from the commencement that the spirit of co-operation, so essential to the success of such schemes, was wanting. In some groups, notably the Obertown Model, the Excel Pioneers, the Woolloongabba Exemplars, and the Byrnestown, does that spirit of co-operation appear to be conspicuous by its absence; for instance, in the case of the former group there is evidence to prove that they have disposed of goods in Roma that were purchased with money advanced for the purpose for which they were formed, and have dwindled from a membership of 45 to 17, of whom only 11 are on the ground. The Excel Pioneers, having ascertained that their late secretary had made purchases without permission, declined to pay the account, with the consequence that a judgment was obtained against them, and their goods sold by public auction to satisfy the creditors. This group has dwindled from 45 to a membership of 25, of whom only 16 are present. The Woolloongabba Exemplars, starting with a membership of 59, have come down to 29, of whom 14 only can be found sufficiently enthusiastic to remain on the area. This group, which went on land at Lake Weyba in defiance of warnings as to its quality, has so far forgotten the principles under which they were formed that from the evidence of their own members it would appear that individual interest

is recognised, so that if any one earns money it is pocketed by him instead of being paid into a common treasury for the benefit of all. The Byrnestown Group have dropped from a membership of 34 to 22, of whom 18 are on the ground. During the past year many internal quarrels, and even fights, took place in this group, culminating about Christmas time in the section of the group then in power refusing to supply the minority with rations, since when it would seem that the then minority have obtained the upper hand, and have turned the tables on their late opponents. The secretary of this group openly defied a bench of magistrates to interfere with him, in which he was technically right. Several complaints have also been made to this Department concerning the methods used by this group in obtaining cattle, and otherwise dealing in them. The Mizpah Group, which started out in December, 1893, of whom high hopes were entertained, cannot show, after having been eighteen months upon their land, an average of more than one acre per man under cultivation for the money advanced to them by the Government. (Details will be found in the following tables.) It was thought that if any group had a chance of success it would be the Mizpah Group, which was often called the "Salvation Army Group," owing to the religious element present to bind them together; but although there are, no doubt, Salvationists among them, the group cannot be all so classed, many having no connection whatever with the army. The individual interest before quoted in the case of the Woolloongabba Exemplars, under which members of that co-operative community pocketed their earnings for their own personal benefit and lived upon rations bought with money advanced by the Government, is not confined to that group alone; from several other groups men have obtained outside work, and in the majority of instances have declined to place the money earned into the common fund, but have retained the money and allowed the group to feed their wives and families for many weeks together while they are earning money, and having made a start, finally abandon the group, and remove their families and effects, but in so doing invariably remember to apply for a railway pass to carry them to their destination. There are many other instances that would prove that the intentions of the Government with regard to the Co-operative Communities Acts have been, to a great extent, a dead letter; but the above instances will, I think, be sufficient to show of what material many of the groups were composed. The Obertown Model, Mizpah, and Reliance have exhausted the advances under the Acts of 1893-4, without in any degree making themselves self-supporting, and are now receiving rations as charitable relief, and it is anticipated that applications will be received from other groups as their funds become exhausted.

A feature of the composition of these groups is that there were no means of enforcing all the members going upon the area. In no case did a group go upon the land with its full strength, the Mizpah being the group that approached nearest to its full complement. Many persons appointed to membership were at the time in employment, have never been on the land, and probably never intended so to do. The following tables, showing the expenditure to date, the amount expended by each group for articles purchased on their behalf, and the returns, giving a summary of the agricultural work done during the past year, will enable you to arrive at the value to the country of these settlements:—

CO-OPERATIVE GROUPS.

STATEMENT of EXPENDITURE and BALANCES on 30TH MAY, 1895.

GROUPS.	Membership at Proclamation.	Membership, May, 1895.	POPULATION ON AREA, MAY, 1895.			ACT OF 1893.			ACT OF 1894.			Unforeseen Expenditure, £1,000—Amount Expended.
			Men.	Women.	Children.	Amount Advanced.	Amount Expended.	Balance.	Amount Advanced.	Amount Expended.	Balance.	
						£ s. d.	£ s. d.		£ s. d.	£ s. d.	£ s. d.	£ s. d.
Mizpah	35	24	22	21	64	700 0 0	700 0 0	Nil	288 0 0	280 10 10	7 9 2	...
Nil Desperandum	35	30	17	14	48	700 0 0	700 0 0	Nil	234 0 0	163 1 10	70 18 2	...
Obertown Model	45	17	11	14	49	900 0 0	900 0 0	Nil	189 0 0	189 0 0	Nil	42 14 6
Excel Pioneers	45	25	16	15	50	900 0 0	900 0 0	Nil	180 0 0	165 13 4	14 6 8	...
Reliance	41	24	11	8	29	a 945 0 0	945 0 0	Nil	207 0 0	207 0 0	Nil	...
Monmouth	35	27	25	18	38	700 0 0	700 0 0	Nil	270 0 0	197 1 1	72 18 11	...
Woolloongabba Exemplars	59	29	14	13	28	1,180 0 0	1,180 0 0	Nil	144 0 0	59 2 3	84 17 9	...
Resolute	40	33	29	21	73	800 0 0	800 0 0	Nil	342 0 0	263 3 7	78 16 5	...
Byrnestown	34	22	19	16	56	680 0 0	680 0 0	Nil	216 0 0	216 0 0	Nil	28 19 2
Bon Accord...	43	32	25	21	82	860 0 0	860 0 0	Nil	252 0 0	212 18 0	39 2 0	...
Industrial	38	35	22	18	53	760 0 0	760 0 0	Nil	261 0 0	5 6 11	255 13 1	...
Protestant Unity	35	24	24	18	52	700 0 0	700 0 0	Nil	261 0 0	22 17 5	238 2 7	...
	485	322	235	197	622	9,825 0 0	9,825 0 0	Nil	2,844 0	1,981 15 3	862 4 9	71 13 8

a £125 of this was an extra grant to cover passage fares of Group to Rockhampton.

GENERAL PURPOSES ACCOUNT (1894 ACT).

	£ s. d.	£ s. d.	£ s. d.
Amount reserved	...	156 0 0	
Amount expended—			
Reliance	60 8 10		
Byrnestown	5 0 0		
		65 8 10	
Balance	...	...	90 11 2
Unforeseen expenditure	...	1,000 0 0	
Amount expended, as above	71 13 8		
Outstanding accounts, say	20 0 0		
		91 13 8	
Balance	...	...	908 6 4

Analysis of Expenditure, 1st July, 1893, to 30th May, 1895 (1893 Act).

—	Mizpah.	Nil Desperandum.	Obertown Model.	Excel Pioneers.	Monmouth.	Reliance	Wool'gabba Exemplars.	Resolute.	Byrnestown.	Bon Accord.	Industrial.	Protestant Unity.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Tools and ironmongery	59 0 10	93 19 11	103 7 4	98 16 1	42 10 7	94 10 6	95 0 0	55 18 0	88 15 1	103 1 0	89 10 1	53 2 0
Clothing	12 7 0	27 13 9	91 3 7	89 2 6	52 5 9	144 19 5	89 18 8	100 14 3	34 15 6	72 17 4	2 14 3	74 2 10
Rations and stores	489 9 2	433 13 2	549 1 10	548 3 5	420 14 7	308 15 1	710 2 3	513 10 11	339 15 6	477 6 5	459 16 10	519 14 0
Horses, drays, and harness	53 0 9	59 7 10	58 9 0	50 10 6	90 3 3	78 10 0	59 11 11	75 19 6	79 5 6	153 7 7	66 4 0	11 10 0
Tents	45 11 7	15 17 0	2 3 6	33 19 6	...	55 10 0	...	2 15 0	7 10 0	...	8 3 0	...
Leather	5 1 6	3 15 10	5 19 10	...	...	...	...	1 0 6	16 2 10	1 0 0	3 18 8	1 0 0
Carriage and freight	11 17 0	30 1 3	42 9 9	39 3 8	23 1 9	94 0 2	136 0 0	19 19 2	26 14 9	27 9 9	35 11 7	9 4 6
Stationery, stamps, and printing	2 19 11	4 18 3	4 10 3	4 6 0	3 0 2	13 7 3	18 16 6	5 5 6	4 12 2	6 17 3	...	5 14 0
Seeds	13 1 0	13 9 6	16 16 4	13 16 5	46 5 10	22 0 0	18 7 3	20 4 8	31 13 6	12 10 2	2 15 4	15 13 2
Medicines	7 11 3	0 16 0	4 8 7	5 11 2	...	1 8 6	11 5 8	0 13 6	5 6 2	1 13 9	6 8 2	2 16 6
Rent of premises	...	10 10 0	2 0 0	...	...	...	...	...	...	...	...	...
Timber and iron	...	...	...	9 17 3	20 10 9	...	...	3 19 0	6 7 6	...	74 18 1	...
Steamer fares	...	...	...	...	...	125 0 0	...	...	...	...	...	...
Fencing	...	...	15 0 0	...	...	...	...	...	...	...	...	...
Fishing material	...	...	...	...	...	...	14 1 6	...	...	...	...	...
Poultry	...	...	...	...	...	...	11 16 11	...	...	...	...	...
Working bullocks and tackle	...	...	...	...	...	...	...	...	31 16 6	...	...	...
Sundries	...	5 17 6	4 10 0	6 13 6	1 7 4	6 19 1	14 19 4	...	7 5 0	3 16 9	10 0 0	7 3 0
Total amount allowed under 1893 Act	700 0 0	700 0 0	900 0 0	900 0 0	700 0 0	945 0 0	1,180 0 0	800 0 0	680 0 0	860 0 0	760 0 0	700 0 0

Analysis of Expenditure, 1894 Act, to the 30th May, 1895.

Rations and stores	279 0 6	162 19 4	187 8 6	119 4 6	197 1 1	207 0	56 3 4	248 15 4	216 0 0	211 18 0	5 6 11	1 10 8
Seeds	1 4 7	...	...	...	...	...	...	11 15 4	...	...	...	...
Carriage and freight	0 5 9	...	...	...	...	...	...	2 12 11	...	...	...	...
Stationery	...	0 2 6	...	0 18 0	...	...	...	...	...	1 0 0	...	1 6 9
Medicines	...	...	1 11 6	...	...	...	...	...	...	...	...	...
Fencing	...	...	...	43 9 0	...	...	...	...	...	...	...	...
Sundries	...	...	...	2 1 10	...	...	2 18 11	...	...	...	...	...
	280 10 10	163 1 10	189 0 0	165 13 4	197 1 1	207 0 0	59 2 3	263 3 7	216 0 0	212 18 0	5 6 11	22 17 5
Total amount allowed out of the £3,000	288 0 0	234 0 0	189 0 0	180 0 0	270 0 0	207 0 0	144 0 0	342 0 0	216 0 0	252 0 0	261 0 0	261 0 0
Expenditure	280 10 10	163 1 10	189 0 0	165 13 4	197 1 1	207 0 0	59 2 3	263 3 7	216 0 0	212 18 0	5 6 11	22 17 5
Balance	7 9 2	70 18 2	Nil.	14 6 8	72 18 11	Nil.	84 17 9	78 16 5	Nil	39 2 0	255 13 1	238 2 7

MIZPAH GROUP—Chinchilla, Southern and Western Line.—

Members at proclamation, 25th November, 1893 35
Members as at 30th May, 1895 24
Members on ground area as at 30th May, 1895 22
Amount expended on behalf of Group to 30th May, 1895, £980 10s. 10d.

Summary of cultivation for year 30th May, 1895—

Area under plough but lying fallow ... ... 12 acres
Area under crop ... ... 32 ,,
Area ready for plough ... ... 36 ,,

Taken off during past year—

Crops.	Acres.	Yield.
Tobacco	2	... ... 15 cwt. per acre
Broom millet	9	... ... 22 cwt. per acre
Kaffir corn	5	... ... 60 cwt. per acre
Wheat hay	12	... ... 8 tons
Oats	6	... ... 8 tons
Maize	9	... ... 150 bushels
English potatoes	6	... ... 5 tons
Pumpkins		... ... 8 tons

Orchard—

220 trees planted in their proper places.
500 trees grafted and ready for transplanting.

Grape Vines—

2,600 rooted vines about to be transplanted.
10,000 cuttings taken off for planting.

And private gardens of members.

INDUSTRIAL GROUP—Warra, Southern and Western Railway.—

Members at proclamation on 17th March, 1894 38
Members as at 30th May, 1895... 35
Members on area as at 30th May, 1895 ... 22
Amount expended on behalf of Group to 30th May, 1895, £765 6s. 11d.

Summary of cultivation to 30th May, 1895—

Area ploughed but lying fallow ... ... 4 acres
Area under crop ... ... 35 ,,
Area ready for plough ... ... 35 ,,

Taken off during past year—

Crops.	Acres.	Yield.
Wheat	2	... ... cut for fodder
Oats	2	... ... ,,
Potatoes	4	... ... 55 bags; poor yield
Maize*	20	... ... 200 bushels
Pumpkins, Marrows, Melons	... sown in corn	... 12 tons
Kaffir corn	½	... ... 3 bags grain
Sweet potatoes ...	½	... ... 1 ton
Sorghum and other fodder	1½	... ... for green feed
Garden	1	... 2,000 cabbages, ½ ton Swedes, 3 cwt. tomatoes and carrots, white turnips, onions, &c.

* About 5 acres of above cut green for green feed and hay.

Japanese pumpkins...	small area ...	yield satisfactory
Hay	...	10 tons saved from crops
Butter	...	10 cwt.
Honey	...	2 cwt.

And private gardens of members.

Improvements now being effected are on the line of dairying and pig-raising.

Bon Accord Group—Woowoonga.—

Members at proclamation at 3rd March, 1894 43
Members as at 30th May, 1895 32
Members on area as at 30th May, 1892 25
Amount expended on behalf of Groups to 30th May, 1895, £1,072 18s.

Summary of cultivation, 30th May, 1895—

Area ploughed but lying fallow ... ... 14 acres
Area under crop ... ... 5 „
Area ready for plough ... ... 17 „
Area of scrub land cleared for planting in August 30 „

Taken off during past year—

Crops.	Acres.	Yield.
Maize	15	... failure
Maize in scrub land	12	... 500 bushels
Potatoes	3	... failure
Tobacco	5	... failure through inexperience
Green feed... ...	5	... used for cattle of Group

In addition there are private gardens of members.

Resolute Group—Woowoonga.—

Members at proclamation on 21st February, 1894 ... 40
Members as at 30th May, 1895 33
Members on area as at 30th May, 1895 29
Sum expended on behalf of Group to 30th May, 1895, £1,063 3s. 7d.

Summary of cultivation to 30th May, 1895—

Area ploughed but lying fallow ... . 2 acres
Area under crop ... ... 32 „
Area cleared and ready for plough ... ... 100 „

Taken off land during past year—

Crop.	Acres.	Yield.
Maize	10	45 bushels per acre.
Potatoes	4	1 ton partial failure.
Potatoes (sweet) ...	5	8 tons per acre.
Pumpkins	... ...	5 tons per acre.
Gardens	1½	vegetables.

Byrnestown Group—Woowoonga.—

Members at proclamation on 24th February, 1894 ... 34
Members as at 30th May, 1895 22
Members on area as at 30th May, 1895 19
Amount expended on behalf of Group to 30th May, 1895, £1,929 19s. 2d.

Summary of cultivation to 30th May, 1895—

Area ploughed but lying fallow ... ... 25 acres
Area under crop... ... ... 10 „
Area ready for plough ... ... 12 „

Taken off during past year—

Crops.	Acres.	Yield.
Maize	12	25 bushels per acre
Potatoes	6	failure

And private gardens of members.

NIL DESPERANDUM GROUP—Roma.—

Members at proclamation on 30th December, 1893 ... 35
Members as at 30th May, 1895... 30
Members on area as at 30th May, 1895 17
Amount expended on behalf of Group to 30th May, 1895, £863 1s. 10d.

Summary of cultivation for year to 30th May, 1895—

Area ploughed but lying fallow ... ... 26 acres
Area under crop ... ... 2 „
Area cleared and ready for crop ... ... 9 „
Area cleared (orchard) ... ... 1 „
Area, gardens, about ... ... 8 „

Taken off during past year—

Crop.	Acres.	Yield.
Wheat ...	7½ ...	49 bushels.
Potatoes ...	3½ ...	15 cwt. (1½ acres failure.)
Maize	15 ...	10 bushels. (10 acres failure.)
Tobacco ...	5 ...	336 lb. (Drying in shed, 1½ cwt.)

OBERTOWN MODEL GROUP—Roma.—

Members at proclamation on 13th January, 1894 ... 45
Members as at 30th May, 1895 17
Members on area as at 30th May, 1895 11
Amount expended on behalf of Group to 30th May, 1895, £1,131 14s. 6d.

Summary of cultivation for year to 30th May, 1895—

Area ploughed but lying fallow ... ... 30 acres
Area under crop ... ... nil.
Area cleared and ready for plough ... ... 30 acres
Area cleared and ready for hoes and mattocks ... 120 „

Taken off land during past year—

Crops.	Acres.	Yield.
Wheat	5½	... 30 bushels
Maize	33	... 2 „
Potatoes	4	... nil.
Pumpkins	10	... nil.

And private gardens of members.

EXCEL PIONEERS—Roma.—

Members at proclamation on 13th January, 1894 ... 45
Members as at 30th May, 1895 25
Members on area as at 30th May, 1895 16
Amount expended on behalf of Group as at 30th May, 1895, £1,065 13s. 4d.

Summary of cultivation for year to 30th May, 1895—

Area ploughed but lying fallow ... ... 5 acres
Area under crop ... ... nil.
Area cleared and ready for plough ... ... 18 „

Taken off land during past year—

Crops.	Acres.	Yield.
Maize	4	nil.
Oats	4	nil.

Private ground of members, 7 acres in all, no returns kept.

Woolloongabba Exemplars—Eumundi, North Coast Railway.—

Members at proclamation on 10th February, 1894 ... 59
Members as at proclamation on 30th May, 1895 ... 29
Members on area as at proclamation on 30th May, 1895 14
Amount expended on behalf of Group to 30th May, 1895, £1,239 2s. 3d.

Summary of cultivation for year to 30th May, 1895—

Area ploughed but lying fallow ... ... 5 acres
Area under crop (including private gardens of members) 5 „
Area cleared and ready for plough ... ... 3 „
Area cleared scrub, and forest burnt off ... ... 7 „
Area fallen and in preparation for plough ... ... 8 „

Taken off land during past year—

Crop.	Acres.	Yield.
Potatoes ...	2 ...	1 ton. Failure owing to late planting.
Greenfeed ...	3 ...	not given. Feed for stock of group.

Protestant Unity—Cooran.—

Members at proclamation on 21st July, 1894... ... 35
Members as at proclamation on 30th May, 1895 ... 24
Members on area as at proclamation on 30th May, 1895 24
Sum expended on behalf of Group to 30th May, 1895, £722 17s. 5d.

Summary of cultivation for year to 30th May, 1895—

Area ploughed but lying fallow ... ... not given
Area cleared and ready for crop ... ... 162 acres
Area under crop ... ... 100 „
Private gardens of members ... ... 10 „

Crop taken off, not given—

a. Potatoes ... ... 3 acres
Sugar-cane ... ... 3 „
Tobacco ... ... 2 „
Oats ... ... 1 „
Vegetables ... ... 1 „
Maize, &c. ... ... 50 for grain
Pumpkins ... ... nil.
Maize ... ... 40 for green feed

Reliance Group—Rolleston.—

Members at proclamation on 27th January, 1894 ... 41
Members as at proclamation on 30th May, 1895 ... 24
Members on area as at proclamation on 30th May, 1895 11
Amount expended on behalf of Group to 30th May, 1895, £1,235 14s. 4d.

Summary of cultivation for year to 30th May, 1895—

Area ploughed but lying fallow ... ... 10 acres
Area under crop ... ... 6 „
Area ready for plough (the land set apart for this Group is treeless plain country, therefore no clearing is necessary).

Taken off land during past year—

Crop.	
Wheat, Maize, Sorghum, Tobacco	Only small experiment areas were sown last year, the results being satisfactory.

And private gardens of members.

MONMOUTH GROUP—Chinchilla.—

Members at proclamation 27th January, 1894 ... 35
Members at proclamation 30th May, 1895 27
Members on area as at 30th May, 1895 25
Amount expended on behalf of Group to 30th May, 1895, £897 1s. 1d.

Summary of cultivation to 30th May, 1895—

Area ploughed but lying fallow ... ... 69 acres
Area stumped but not burned off ... ... 12 „
Area under crop ... ... 50½ „

And private gardens of members.

Taken off land during last year—

	Acres.	Yield.
Potatoes	17	4 tons per acre
Wheat	30	12 bushels
Maize	70	15 „
Potatoes (winter crop) ...	12	2½ tons per acre
Pumpkins	... ...	20 „

IMPERIAL INSTITUTE.—Further shipments have been made during the past year of exhibits for the Queensland Court of the Imperial Institute, including amongst other samples of different varieties of wheat, malting barley, rye, cotton, wine, sugar, timber, wool, bananas (evaporated), tobacco, beeswax, chicory, coffee, maize, oats, &c., all being produced in Queensland. Further shipments will be made as opportunity occurs. There being no definite information available concerning the timber exhibits available for the institute, although there ought to be a considerable number, from those left with the Agent-General upon the close of the Colonial and Indian Exhibition, the Agent-General has been asked to furnish a list of those now on view, whereupon the vacancies will be filled from here. Assistance has been given to this Department through the Agent-General by the officers of the institute in connection with the testing of such articles of local produce sent to London for that purpose.

SEEDS DISTRIBUTED.—The packages of seeds and plants distributed direct from the Department between 1st June, 1894, and 31st May, 1895, consisted of:—Arrowroot, bluegrass, broom millet, buck-wheat, buffalo grass, canaigre, carob, cassava, castor oil, China millet, chocos, coffee, cotton, cow pea, date palm, dhourra, dolichos, lab lab, early amber cane, field peas, flax, German millet, ginger, gram, grape cuttings, hairy vetch, hops, Hungarian millet, indigo, Japanese pumpkins, jowai, Kaffir corn, khus khus, lentils, olives, oranges, Oregon pine seed, peccan nuts, paw paw, red Natal grass, rice, sugar palm, sulla, sunflower, tea, teosinte, tobacco, tomato, Trinity Bay cherry, wattle, wheat, yams, yambeans.

STATE NURSERIES.—An extension has been made of both Nurseries (Mackay and Cairns) during the past year, for the express purpose of cultivating sugar-cane, principally of those kinds obtained from New Guinea; the cultivation of other economic plants has, however, not been neglected. The Kola trees, obtained at considerable expense, should bear fruit this year, and it is to be hoped that seed or plants will soon be available for distribution in the North. Attention has been given to the cultivation of coffee under different conditions at Kamerunga, to ascertain the varieties best adapted for cultivation here. Attempts are being made to raise a banana equal to, if not superior to, the Cavendish, the object being to secure a fruit better able to stand shipping and handling than those now upon the market. The reports of the overseers herewith give details of the work done during the year, and attention is drawn to the large quantities of sugar-cane distributed (principally of the New Guinea varieties), with the small means at disposal for such work. The need of facilities for testing the sugar-producing qualities of sugar-cane is much felt, there being no agricultural chemist in this Department, and the laboratory of the Government Analyst is not equipped with the necessary apparatus. However, through the kindness of the Colonial Sugar Company, some of the varieties growing at Mackay were tested by Mr. G. E. Holroyde, the chemist at the refinery, New Farm, the samples of juice submitted to him being from the "Batoe," a New Guinea cane, and from the "Kewensis," a seedling received from Kew. It is intended that all the varieties of cane growing at the nurseries shall be tested during the coming season, so that only those of value to the sugar-growers shall be retained. Experiments also, as far as the land and means will permit, will be made in a systematic manner with the different fertilisers available in the market, to arrive at the effect upon the growth and sugar-producing qualities of the cane. As each Nursery is now provided with water, experiments can be more faithfully carried out. The following are the analyses arrived at by Mr. Holroyde :—

Analysis of juice from seedling cane grown at Mackay :—
Name of cane, Kewensis—

Total solid matter	...	...	...	22·75 per cent.
Total cane-sugar	...	...	...	19·60 ,,
Total fruit sugar	...	...	...	1·93 ,,
Total density	...	...	...	12·6 ,,

G. E. HOLROYDE.

Analysis of juice from New Guinea cane, first ratoon :—
Age, about ten months ; variety, Batoe—

Total solid matter	...	...	...	20·80 per cent.
Total cane sugar	...	...	...	16·85 ,,
Total fruit sugar	...	...	...	2·56 ,,
Total density	...	...	...	11·5 ,,

Deterioration by keeping the cane or juice has no doubt taken place to the extent of probably 2·7 per cent. of cane sugar.

G. E. HOLROYDE.

INQUIRIES from persons residing outside the colony for information as to the facilities for settlement here, continue to be numerous, and can be generally said to be about equally divided between temperature

and tropical cultivation. Several persons have reached here with letters of introduction from Mr. Black, and have been found occupation in the direction they were desirous of following.

Appended to my Report will be found reports from the Instructor in Agriculture, the Colonial Botanist, the Entomologist, 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 INSTRUCTOR IN AGRICULTURE.

SIR,—I have the honour to submit the following Report, as Instructor in Agriculture, for the year ending 31st May, 1895.

INSTRUCTION PROPER.—The work of instruction has followed, to a considerable extent, lines made familiar in the experience of other years. There has been the usual amount of work in the lecture field, with almost innumerable private conferences held with individuals and groups of farmers here and there. The prosecution of these duties has carried me as far North as Herberton, and to the confines of the colony on the South, and between these extremes almost every agricultural section has been visited. Work of this kind may be said to be endless. Certainly I have never yet been able to keep pace with the requests that have been received for lectures and advice in line with the foregoing. It is interesting to note the demand that has arisen, through the recent development of the dairy industry, for special information in the modern methods of fodder-growing and preservation. The need for stock food, beyond the natural supplies, has been brought painfully home to dairy farmers by the unusually severe winter of 1893-4, and the unprecedented drouth and cold of the present season. Two brief tours made through the Darling Downs district were devoted wholly to the matters of fodders and fodder-making. It is the misfortune of the Queensland Instructor in Agriculture that he has no means at his command which enables him to add demonstration—the most telling form of instruction—to oral teaching. In the subject under consideration, for instance, how much might be done if we could actually show our farmers the silo and contained ensilage and the various ways by which fodder materials, which ordinarily go to waste in Queensland, may be put in shape to meet the urgent needs of the winter months? This is, of course, only one of the themes treated in this course of instruction. In a general way the aim of the instructor has been to shape his teachings to meet the needs of the different districts he has been called to address. The mention of this fodder question goes to show how these needs change from year to year, and not unfrequently with the different seasons.

In previous reports attention has been directed to the urgent need of a school of agriculture as a means of advancing the farming interests of the colony. This matter has been so fully set forth elsewhere, and the justice of the claims of the friends of agricultural education is so universally admitted, that not much remains to be said here on the subject. The benefits that would be derived by the community from such an institution are rarely questioned. It is, however, often urged that the finances of the colony will not admit of the outlay involved in the establishment of such school. The general sense of most

civilised communities seems to be that they cannot afford to dispense with the efficient means, that agricultural colleges generally have proved themselves to be, in advancing the common welfare. In the United States there are at the present time forty-seven of these farmers' colleges, all highly endowed, and having in connection elaborate experiment farms and laboratories. In Germany there are very many more of such schools, while in the educational systems of England, France, Japan, and the older Australian colonies, except Tasmania and Queensland, agricultural colleges have a recognised position. No one ever talks of abolishing these agricultural schools and returning to the old order of things. On the contrary, the agricultural colleges generally report increasing attendance, more liberal support, and wider usefulness as their plans and possibilities become known. Moreover, these schools, wherever they have been well managed, are recognised as good investments for the taxpayer, yielding not merely a good return for the outlay involved in establishing and maintaining them, but giving precisely that form of repayment which can be obtained by the community in no other way. At the present time Queensland needs, more than anything else in the world, real agriculturists—not an agricultural class—and the upbuilding of a vital agriculture. To none can we look so hopefully, for the realisation of these aspirations, as to the youth of Queensland. These young people are worth saving to the farms and the industrial life of the colony. While I do not look upon the agricultural college as the open door by which we may hope to escape all of our besetting troubles, individual and national, I yet feel certain that this agricultural school would be a powerful means of advancing the agricultural interest through the exertions of our own youth.

Experiments with Wheat.—During the year experiments in wheat culture have been in progress at six stations—namely, Allora, Roma, Springsure, Clermont, Hughenden, and Herberton. At Allora about 266 varieties and crossbreds were grown, and at Roma 209, while at each of the other stations twenty-four to thirty standard sorts were tried. While an experiment covering a single season is far from conclusive upon any point involved, it is yet true that these experiments indicate, unmistakably, that a large area of the grass lands of the colony are amongst the best wheat soils in the world. Another remarkable fact of these experiments is the uniformly high yields obtained at a majority of the stations from all, or nearly all, of the varieties used. In the course of a long experience in the United States with wheats, I do not remember before to have observed such unanimity of results in one locality with a larger number of varieties gathered as these were, necessarily, without special reference to the capacity of the district in which they were grown. A detailed statement of the results obtained at the two principal stations, Allora and Roma, with the practical bearings of the results given by the others, is shown in the report accompanying this. This experiment work has been repeated the present season upon a somewhat larger scale at Allora and Roma, at Springsure with a limited number of trial sorts; and it is expected that the work will be continued at Hughenden and Herberton as before. The station at Clermont has been discontinued, the work at Springsure covering sufficiently this district, and a new one established at Barcaldine, where nineteen standard sorts are under trial.

These experiments in the Central districts promise to have a very important practical outcome. They have demonstrated, to my mind beyond a peradventure, that hundreds of thousands of acres of the now grazing lands of this section are wheat lands capable, under ordinary management, of producing a yield per acre equal to the highest now known in Australasia. Here is opportunity for a genuine New Queensland movement. Here is ample room for the profitable employment of the abounding energies of Young Queensland, in a business that, at every step, calls to its aid modern machinery, that involves no question of servile labour, and in the production of a great bread staple of which at the present time Queensland imports about four-fifths of all that she consumes. The results obtained in these experiments, given in the public Press from time to time, have lead to a considerable correspondence with millers and capitalists desirous of establishing a flouring mill at some point in the North where the local agricultural conditions make future supplies of wheat possible. It is not premature to say that a capacious flouring mill will be in operation in Central Queensland before the present year has ended. The establishment of this mill will mark a new era in the agriculture of an important section of the colony.

Suggested Experiments.—The work done and now under way with wheat suggests the possible extension of our experimental undertakings to other colonial crops, particularly sugar-cane. The need for more and accurate information concerning well-nigh all that pertains to the growth of this crop, facts which the circumstances of the planter prohibit him from supplying, is strongly felt, particularly in the older sugar-growing sections. For example, the effects of different fertilisers both upon the growth of cane and its contained sugar, is already a "burning question" upon many plantations, and one that is sure to increase in intensity with the passage of time. All the modern knowledge on the subject of manures does not enable the chemist, without experience, to tell the planters of a given section what fertiliser to use, and what to avoid. I suggest that these experiments be planned to test the following matters relating to the growth of cane and its sugar content:—

(*a.*) The growth of varieties.
(*b.*) The value of nitrogenous, phosphatic, potassic, and mixed fertilisers.
(*c.*) The value of stable manures and plantation refuse—megass, &c.
(*d.*) The effects of irrigation upon cane growth.
(*e.*) A chemical analysis of the cane to be made whenever necessary in the course of the experiments.

The chief if not only obstacle likely to be encountered, in these experiments, is the chemical work, without which they are of little value. This, however, is a difficulty that I believe can be overcome.

Land Inspection.—Certain properties submitted to the Government under "*The Agricultural Lands Purchase Act of* 1894" were referred to me for an opinion as to their agricultural capacity and value. This involved the personal, close inspection of these large properties, fourteen in all, and the compilation, from the minutes of my examination, of a report in the case of each. The following is the

list of properties examined by me:—Bon Accord, Canning Downs, Canning Downs South, Eton Vale, Fyrish, Glengallan, Goomburra, Gowrie, Lagoon Creek, Mount Irving, North Toolburra, Pinelands, Westbrook, and the property of F. Kates, near Hendon. The work of examining these lands has made a large inroad upon time that had to be spared from other duties.

Publications and Correspondence.—Two bulletins have been written by me in the course of the year, one of thirty-eight pages on "Manures; their Management and Use," and another (now in press), giving the results of wheat experiments for 1894, with added matter on the general subject of wheat-growing in Queensland. In addition, I have given the Press of nearly all sections of the colony matter bearing upon my work and duties which has seemed likely to be of public utility. Correspondence in other ways has called for about the usual time and attention given it in other years.

Agricultural Progress.—*Land Settlement.*—My impression is that land settlement, outside the sugar-growing districts, has gone on at a retarded pace during the year. There are several reasons for this. Labouring and middle-class people, who have been central figures in all the recent schemes for settling people on the land, have in the past year found more work and better pay, and, in consequence, are content to remain in town. The generally admitted failure of the communal groups and the wide publicity that has been given their trials and shortcomings, has had a deterrent effect upon that class who, without having any practical acquaintance with farm life, have yet tastes and aspirations that way. But the prevailing low prices of nearly all farm products during the year just past has more than anything else chilled the ardour of would-be selectors of small means. With corn at 1s. and wheat selling at under 2s. per bushel, and most other farm crops selling at corresponding low values, it is not surprising that people who have no experiences of farm life to appeal to should accept the current estimates of farming in the colony, and elect to remain in old pursuits rather than encounter the ills they know not of. The truth is that outside the sons and daughters of Queensland farmers who, under the present system, largely drift away from farm life, we have very little of the material in our present population out of which a yeomanry can be made. To send the labourers, mechanics, and tradespeople who make up so large a portion of our population upon the raw land would be little short of cruelty. To the surplus agricultural population of other lands in the main we must look for the upbuilding of the colony. I have no bran new warranted-to-work scheme for settling people upon the unoccupied lands of Queensland. I realise this, however, that wild lands are reclaimed and occupied, and States carved out of the wilderness, in obedience to certain general facts. The upbuilding of an agricultural community cannot be accomplished by writing a newspaper article, calling a public meeting, or securing a legislative enactment. Settlers come always, and only in response to a real demand for them; and where this desire for new-comers is made practically apparent, distance will not deter them. The Pacific States of America have, equally with those of the Atlantic slope, received their full quota of foreign immigrants. The wonderful story of the settlement of the Canadian and

American States is a long one, and need not be gone into here. However, it is instructive to note the influences that have been in operation in inducing and maintaining that stream of restless home-seekers that, with scarce an interruption in the last half century, has followed the sun in its Westward march. In these immigrant-receiving States everybody appreciates the importance of securing new-comers and works to that end, and the general government aids the movement in various ways. States have their immigration bureaus and agencies, as do the railway and steamship companies. Even counties and townships have organised machinery for securing a share of the new life that is flowing in around them. Money bribes are not offered, because that form of inducement is as likely to bring the thriftless and improvident as the worthy immigrant. This intense popular faith in the country, and zeal for its upbuilding, takes practical form (1) in persistent ingenious advertising in all European centres of population, (2) in supplying lowest steamship and railroad rates to the new land, and (3) in giving all immigrants the best of land at the lowest price. The American Homestead Act of 1861, by which 160 acres of Government land became the property of the selector after five years of residence, and the payment of about £3 10s. for deed and survey fees, has done more towards the creation of the American New West than perhaps all other influences combined. Queensland will get her share of thrifty land-seekers when a fairly unanimous popular feeling for immigration finds expression in the practical ways indicated above.

The Inducements of Farming.—It is sound public policy to encourage by all possible means the class of soil workers in the colony, because farming concentrates in the country people, wealth and production. To say of a country that farming cannot be carried on profitably there, is tantamount to a confession of incapacity for civilisation itself. Farming does not tend to individual aggrandisement. It can have no attractions for the speculator anxious to acquire the wealth of the land without giving an equivalent. But, if the cultivation of the soil does not lead to opulence, it gives what is much better—independence. It, better than any other calling, meets the capacities and satisfies the wants and ambitions of the common, average men who make up the great mass of humanity. Anyone who will open his eyes can see the immeasurable superiority of Queensland farmers to the like class—the labourers, mechanics, and small tradesmen—of the towns, in all that ministers to contentment. The past year has been a particularly trying one to the farmers of the colony, by reason of the low values of those things which stand for the farmer's labour. But low prices have not been confined to Queensland. Wheat, maize, hay, butter, cheese, and pork have uniformly, during the year, sold for higher—often much higher—prices here than in Canada and the Western American States. We get some idea of the inducements Queensland has to offer skilful agriculturists, by reference to the condition of certain branches of farming in the colony of known suitableness and recognised general importance:

Tobacco Culture.—There is a strange perversity in the fate which, by common consent, relegates tobacco-growing, requiring the utmost skill and industry combined with the keenest intelligence, to the most

conservative class of our population—the Chinese. Everything connected with the growth and preservation of this crop in Queensland may be said, without exaggeration, to be out of date and wholly of the past. The coarsest and least valuable varieties are grown, the cultivation of the crop is done almost entirely with the hoe, and the subsequent curing, the most delicate of agricultural processes, is hardly up to the standard of efficient hay-making. It is scarcely necessary to suggest the improvements that are necessary in order to place the cultivation of this crop upon a modern basis. The first step in this direction will have been taken when the business passes into the hands of men who are themselves capable of improvement.

Dairying.—Co-operative or business dairying is a very recent phase of Queensland agricultural development. The movement by which the principal part of the Darling Downs district has been brought within range of well-equipped factories is the most important development made in connection with this industry. Here, again, the condition of the farmers in relation to the factory is most unsatisfactory. The bulk of the "milkers" are the poorest of dairying stock, giving no more than a few pints of milk per cow daily, for a few months of each year. To get the milk of twenty dairy cows, 100 of these milkers must be kept. I do not know of a single dairy herd in the colony that meets modern requirements in the case. Provision is rarely made for winter feeding of the cows, much less for winter housing. Not only is the winter supply of milk always light, but long summer feeding is necessary to bring the half-starved cows again into full profitable condition. There is an ample field in Queensland for men imbued with the true dairy spirit. Queensland is yet a large importer of dairy products. For nearly two-thirds of the year these command higher prices in Brisbane than in London.

Stock Feeding.—The great recent development of the over-sea trade in colonial products, coupled with cold transportation, clearly make possible a new farming industry in Queensland. We now have a share in the English market, which demands and pays liberally for everything that is good. These demands cannot be fully met by the uncertain products of wild pastures. Shrewd farmers, the owners of good land, will find profit in feeding to ripeness sheep, lambs, pigs, poultry, and even cattle. Pastures of prairie grass, lucerne, rye, and rape, and the shilling maize, will all be brought into requisition for this purpose. Men of small means living near seaport towns will find profitable business in feeding to fatness, and dressing to meet the requirements of the London market, the farmers' poultry which so often gluts the local markets. Here the refuse of meat works and again the shilling maize will find appreciation.

Wine-making.—A long and widely-extended experience has proved that the best of the wine grapes grow vigorously and healthfully, fruiting abundantly. These grapes are made, often by the crudest methods, into wines locally popular. That commercial wines are possible under improved conditions of manufacture seems an obvious corollary from these two facts.

Coffee and Rice Growing.—The growth of coffee has been attempted here and there in a small way at various points on the Queensland coast between Cooktown and Brisbane. Although these

efforts have in nearly every case been markedly successful, the cultivation of coffee has in only very few instances assumed business proportions. It is claimed that existing labour conditions forbid this, a statement that may well be questioned. More recently there has been a considerable revival of interest in this crop. In like manner a few half-hearted attempts at rice-growing have been made by white men in the North, but not much has come of these efforts. Latterly the growth of this important cereal has fallen entirely into the hands of Chinamen. Both crops have as undoubted a place in the agriculture that is to be, in Queensland, as the suger-cane or banana.

All this indicates not so much the present deficiencies of practical agriculture in Queensland as its possibilities. Here are opportunities for every man and every degree of ability. We are too slow to realise that no sacrifice is too great to make for the upbuilding of the primary agricultural industries of this colony, upon which all substantial prosperity rests. Nothing in pride, prejudice, or conservation ought to be allowed to impede efforts looking to the conversion of these potential resources into living realities. When we can base anticipations of business and revenue upon great crops of wheat, tobacco, maize, and coffee, as well as sugar, we shall still be subject to "hard times"—"the poor you always have with you"—but we shall always have at our command the antidote for bad times. The American people probably have had as severe a recent experience of the general depression as the people of Queensland. They, however, have the true remedy for depression in a great class of soil workers. Upon the results of the labours of these farmers now every eye is fixed. The burden of all the newspapers is the story of the crops as it unfolds before the advancing sun. No item concerning the crop prospects is too insignificant for publication. Every American realises that if the planted maize, wheat, tobacco, and cotton developes a crop, the depression is only a matter of weeks, and the country is saved again. All this is platitudinous, but truisms on this subject will bear oft repeating.

As bearing upon this proposition that agriculture will ultimately save the country, and how and when, the present condition of the Darling Downs is an interesting illustration. We see here one of the best bodies of agricultural land in Australia, convenient to railways and markets, given over mostly to sheep-raising. The owners of the great estates which occupy so much of the district realise, almost to a man, that these lands are too valuable for the uses to which they are at present put. The present situation in the Downs may be put in mathematical form something as follows:—Grazing is to farming as one sheep (to the acre) is to twenty bushels of wheat. Happily the day seems near when these magnificent farm lands will be put to the uses for which Nature designed them. Squatters have told me that the most profitable portions of their work were the fields of wheat and maize. The present improved status of the live and dead meat trade means the ultimate firm establishment of mixed grazing and farming upon these Queensland prairies. The Downs will become the seat of a great business; that of preparing the steady supply of ripened bullocks, sheep, and lambs demanded by this commerce in live stock. This, however, will compel the growth of lucerne, prairie grass, maize, and wheat—farming, in short. It can easily be shown from the statistics of other countries that when this change has wrought its course the Darling Downs will be greater, in the number and quality of its flocks and herds, than it now is.

System in Farming.—In my report of last year I had occasion to refer to an unfortunate tendency, often conspicuous in the operations of our farmers, towards farming for prices instead of profits. This tendency is seen in the practice of planting heavily of those crops which for the time being have a high market value, and proportionately reducing the area of all other farm products. How this practice results to the farmer may be inferred from the facts furnished in the market reports of the last year. Maize, which sold for under 1s. per bushel six months ago, now fetches nearly 3s., while wheat has gone from 1s. 9d. per bushel to 3s. and upwards. The price of tobacco again has fallen considerably in the course of the year, while hay and potatoes have remained nearly stationary in sale price. Clearly the present and prospective values of farm crops do not furnish a satisfactory basis for a course of cropping. If the farmer knew the prices that the crops that he is sowing would fetch at harvest time his talents would be misapplied in farming; his proper place is among the bulls and bears of the grain markets. The imaginations of the class of farmers referred to above have been not a little excited by the late rise in the value of wheat. The country newspapers tell us that farmers in the wheat-growing sections are now ploughing every available acre for wheat seeding. This means nothing less than that a great area of badly prepared land has been hastily sown to wheat—or would have been had seasonable rains fallen—which almost certainly will result in a yield so poor that, should the high prices be maintained, there will be no profit in it to the farmers. Again, the men who succeed in Queensland, and everywhere else, as farmers are those who grow crops suited to their soils, the general demands of the markets, and their own personal tastes. These crops are grown in orderly succession, based on their known relations to each other and the soil. This and much more is called "scientific farming;" but is it not also practical?

I attach herewith a complete list of the varieties of wheat in cultivation the present season at Allora, Roma, and Barcaldine. Respectfully submitted.

E. M. SHELTON,

Department of Agriculture, Instructor in Agriculture.

Brisbane, 31st May, 1895.

Lists of Wheats grown on the Farm of Mr. Wm. Deacon, near Allora. Sown 15th and 16th May, 1895.

No.	1,	1	row—	Blount's Lambrigg
,,	2,	1	,,	Bega
,,	3,	1	,,	No. 1 Bearded
,,	4,	1	,,	Galland's Hybrid
,,	5,	2	,,	Hudson's Early Purple Straw
,,	6,	2	,,	Steinwedel No. 5 Bearded
,,	7,	2	,,	Blount's No. 10
,,	8,	2	,,	Amethyst
,,	9,	2	,,	Quartz
,,	10,	2	,,	Thomas' Rust-proof
,,	11,	2	,,	White Tuscan (Dr. Cobb)
,,	12,	2	,,	White Tuscan (Mr. Inglis)
,,	13,	2	,,	White Lammas
,,	14,	1	,,	Belotourka
,,	15,	2	,,	Red Provence
,,	16,	2	,,	White Fife
,,	17,	2	,,	Australian Club
,,	18,	2	,,	Oakshott's Champion

List of Wheats—*continued.*

No.	19,	2	row—	Tunnack
,,	20,	2	,,	Town and Country
,,	21,	2	,,	Hercules
,,	22,	2	,,	Jacinth
,,	23,	2	,,	Ward's White
,,	24,	2	,,	Mexican Spring
,,	25,	2	,,	Tourmaline
,,	26,	2	,,	Lava
,,	27,	2	,,	Pringle's No. 5
,,	28,	2	,,	Queensland Defiance
,,	29,	2	,,	Excelsior
,,	30,	2	,,	Cythere White
,,	31,	2	,,	Galatian Summer
,,	32,	2	,,	Murray River

Indian Wheats.

,,	33,	2	,,	African
,,	34,	2	,,	Indian Pearl
,,	35,	1	,,	White Ghoni, white chaff, bearded
,,	36,	1	,,	White Ghoni, red ears, bald
,,	37,	1	,,	White Wheat
,,	38,	1	,,	Panuan Wheat, white ears, bald
,,	39,	1	,,	Daman Wheat, white ears, bearded
,,	40,	1	,,	Hard Wheat, bearded
,,	41,	1	,,	Hard Wheat, bald
,,	42,	1	,,	Lowland White
,,	43,	1	,,	Hard Wheat
,,	44,	2	,,	Robbins' Rust-proof
,,	45,	2	,,	King's Rust-proof
,,	47,	10	,,	Buckley's Rust-proof
,,	48,	8	,,	Wheaton's Rust-proof
,,	49,	6	,,	Brown's Rust-proof
,,	50,	6	,,	Battlefield
,,	51,	6	,,	Ballarat Spring

Farrer's Crossbreds.

,,	52,	2	,,	F. (1) R. 247
,,	53,	2	,,	F. (1) R.R. 281A
,,	54,	2	,,	F. (1)
,,	55,	4	,,	F. (1) bearded wheat
,,	56,	2	,,	Indian F
,,	57,	1	,,	(Horneblende × Blount's Lambrigg) × Horneblende
,,	58,	2	,,	Leak's × Horneblende
,,	59,	1	,,	193 c King's Jubilee
,,	60,	1	,,	(Ruby × Ward's Prolific × Horneblende × Ward's White
,,	61,	1	,,	Jacinth × Horneblende × Ward's White
,,	62,	1	,,	Fultz × Blount's Lambrigg
,,	63,	1	,,	(Anglo Canadian × Improved Fife) × White Naples
,,	64,	1	,,	(Horneblende × Leak's) × Marshall's No. 3
,,	65,	1	,,	(Jacinth × Ladoga) × Cape
,,	66,	1	,,	43A × Ladoga
,,	67,	1	,,	Bega × Horneblende
,,	68,	1	,,	(Jock × Blount's Lambrigg) × Horneblende
,,	69,	1	,,	Improved Fife × Blount's Lambrigg
,,	70,	1	,,	(Quartz × Leak's) × (Horneblende × Ward's White)
,,	71,	1	,,	(Vermont × Blount's Lambrigg) × Horne-blende
,,	72,	1	,,	(Vermont × Leak's) × Cape
,,	73,	1	,,	Horneblende × Summer Club
,,	74,	1	,,	Blount's Fife × Vermont
,,	75,	1	,,	Red Mexican × Ward's White
,,	76,	1	,,	Summer Club × Horneblende
,,	77,	1	,,	Blount's Wheat × Amethyst
,,	78,	1	,,	Vermont × Ward's White
,,	79,	1	,,	Blount's Fife × Ward's White
,,	80,	1	,,	Improved Fife × Blount's Lambrigg
,,	81,	1	,,	Jock × Ward's Prolific
,,	82,	1	,,	Horneblende × Indian D.
,,	83,	1	,,	Horneblende × Indian B.
,,	84,	1	,,	Jacinth × Ward's White
,,	85,	1	,,	Horneblende × Indian G.
,,	86,	1	,,	58A × Ward's Prolific
,,	87,	1	,,	Moscow Hairy × Indian D.

List of Wheats—*continued.*

No. 88, 1 row—Vermont × Blount's Lambrigg
„ 89, 1 „ Vermont × Blount's Lambrigg
„ 90, 1 „ Horneblende × Early Baart
„ 91, 1 „ Horneblende × Indian G.
„ 92, 1 „ King's Jubilee × Goldendrop
„ 93, 1 „ Vermont × Ward's White
„ 94, 1 „ King's Jubilee × Tourmaline
„ 95, 1 „ Vermont × Leak's
„ 96, 1 „ Ward's White × Tourmaline
„ 97, 1 „ (Blount's Fife × Ward's Prolific) × Ward's White
„ 98, 1 „ Jacinth × Ladoga
„ 99, 1 „ Amethyst × Indian B.
„ 100, 1 „ Steinwedel × Early Baart
„ 101, 1 „ Unknown
„ 102, 1 „ Vermont × Ward's White
„ 103, 1 „ Blount's Fife × Vermont
„ 104, 1 „ Horneblende × Leak's
„ 105, 1 „ Horneblende × Indian A.
„ 106, 1 „ Horneblende × Early Baart
„ 107, 1 „ Jacinth × Early Baart
„ 108, 1 „ Ward's White × Tourmaline
„ 109, 1 „ Blount's Fife × Ward's White
„ 110, 1 „ King's Jubilee × Indian A.
„ 111, 1 „ Ward's White × Horneblende
„ 112, 1 „ Horneblende × Blount's Lambrigg
„ 113, 1 „ King's Jubilee × Vermont
„ 114, 1 „ Amethyst × Indian D.
„ 115, 1 „ (Australian Glory × King's Jubliee) × Improved Fife
„ 116, 1 „ (Steinwedel × Amethyst) × Horneblende
„ 117, 1 „ Ward's White × Horneblende
„ 118, 1 „ Fultz × Blount's Lambrigg
„ 119, 1 „ Quartz × Leak's
„ 120, 1 „ Horneblende × Indian A.
„ 121, 1 „ (Steinwedel × Amethyst) × Horneblende
„ 122, 1 „ (King's Jubilee × Amethyst) × Horneblende
„ 123, 1 „ King's Jubilee × Tourmaline
„ 124, 1 „ Blount's Lambrigg × Ward's White
„ 125, 1 „ Blount's Lambrigg × Saxon Fife
„ 126, ½ „ Red Tuscan × (Horneblende × Indian A.)
„ 126A, ½ „ Red Tuscan × (Quartz × King's Jubilee)
„ 127, ½ „ Selection B. (Steinwedel × Amethyst) × Horneblende (Horneblende × Indian D.)
„ 127A, ½ „ King's Jubilee × Ward's White
„ 128, ½ „ (Improved Fife × Blount's Lambrigg) × × F. (1)
„ 128A, ½ „ Steinwedel × King's Jubilee
„ 129, ½ „ Improved Fife × (King's Jubilee × Indian G.)
„ 129A, ½ „ King's Jubilee × Ward's White
„ 130, ½ „ F. (1)
„ 130A, ½ „ (Quartz × Ward's White) × (King's Jubilee × Tourmaline)
„ 131, ½ „ (Steinwedel × Amethyst) × Horneblende
„ 131A, ½ „ (Quartz × Ward's White) × (King's Jubilee × Tourmaline)
„ 132, ½ „ Steinwedel × (Amethyst × Horneblende)
„ 132A, ½ „ (Jacinth × Amethyst) × (King's Jubilee × Improved Fife)
„ 133, ½ „ Steinwedel × (King's Jubilee × Indian A)
„ 133A, ½ „ 193 × Summer Club A and B.
„ 134, ½ „ Leakrigg
„ 134A, ½ „ 193 × Summer Club C and D.
„ 135, ½ „ King's Jubilee × (Amethyst × Horneblende)
„ 135A, ½ „ 193 × Summer Club E, F, and G.
„ 136, ½ „ (Steinwedel × Amethyst) × Horneblende × (Horneblende × Indian D.)
„ 136A, ½ „ 209A2 × King's Jubilee × Improved Fife
„ 137, ½ „ (Steinwedel × Indian D) × (Amethyst × Horneblende)
„ 137A, ½ „ F (1) × Indian B.
„ 138, ½ „ Improved Fife × Indian G.
„ 138A, ½ „ 171 (62)
„ 139, ½ „ Steinwedel × (Indian A × Horneblende)
„ 139A, ½ „ 173 (Horneblende × Indian A.) (Indian A. × Indian G.)
„ 140, ½ „ Rattling Jack × (Quartz × King's Jubilee)
„ 140A, ½ „ 217A Little John
„ 141, ½ „ King's Jubilee × Indian A.
„ 141A, ½ „ Horneblende × Summer Club "Go Ahead"

List of Wheats—*continued.*

No. 142, ½ row—Go Ahead (193 × Summer Club)
,, 142A, ½ ,, (Horneblende × Summer Club) × F. (1)
,, 143, ½ ,, Go Ahead
,, 143A, ½ ,, Improved Fife × Etawah
,, 144, ½ ,, Go Ahead
,, 144A, ½ ,, (Sicilian Square-headed Red × Horneblende) × (Horneblende × Ward's White)
,, 145, ½ ,, Go Ahead
,, 145A, ½ ,, (Horneblende × Ward's White) × Indian G.
,, 146, ½ ,, Go Ahead
,, 146A, ½ ,, (Horneblende × Summer Club) × (Quartz × King's Jubilee)
,, 147, ½ ,, King's Jubilee × Ladoga
,, 147A, ½ ,, (Fountain × Blount's Lambrigg) × Indian G.
,, 148, ½ ,, Horneblende × Early Baart
,, 148A, ½ ,, (Blount's Lambrigg × Ward's White) × Indian G.
,, 149, ½ ,, Australian Glory × (King's Jubilee × Improved Fife)
,, 149A, ½ ,, (Steinwedel × Horneblende) × Indian G.
,, 150, ½ ,, Horneblende × Indian A.
,, 150A, ½ ,, Horneblende × Summer Club
,, 151, 10 ,, Fultz × Marshall's No. 3.
,, 152, 8 ,, Horneblende × Freeling
,, 153, 8 ,, Horneblende × Marshall's No. 3
,, 154, 8 ,, Horneblende × Leak's
,, 155, 7 ,, Fultz × Marshall's No. 3
,, 156, 1 ,, Trigo Barella (Argentine)
,, 157, 1 ,, Saldome (Argentine)
,, 158, 2 ,, Gore's Indian No. 1
,, 159, 1 ,, Inglis Inoculated Steinwedel No. 1
,, 160, 8 ,, Australian Wonder
,, 161, 4 ,, Ward's Prolific
,, 162, 4 ,, Leak's
,, 163, 2 ,, Hercules
,, 164, 8 ,, Bearded Herrison
,, 165. 4 ,, Fultz
,, 166, 2 ,, Victorian Defiance
,, 167, 2 ,, Ward's Prolific
,, 168, 6 ,, Vennings
,, 169, 8 ,, Grosse's Prolific
,, 170, 6 ,, Lazistan
,, 171, 14 ,, Improved Fife
,, 172, 10 ,, Manitoba
,, 173, 12 ,, Blount's Fife
,, 174, 6 ,, Budd's Early
,, 175, 20 ,, Tardent's
,, 176, 4 ,, Marshall's No. 3, Purple Straw
,, 177, 20 ,, ,, No. 3, White Straw
,, 178, 8 ,, ,, No. 7
,, 179, 8 ,, ,, No. 17
,, 180, 8 ,, ,, Prolific
,, 181, 8 ,, ,, No. 24
,, 182, 4 ,, ,, No. 27
,, 183, 6 ,, ,, No. 37
,, 184, 4 ,, ,, Success
,, 185, 6 ,, ,, No. 17
,, 186, 8 ,, ,, No. 35
,, 187, 16 ,, ,, No. 15
,, 188, 14 ,, ,, No. 6
,, 189, 13 ,, ,, No. 33

End of First Tier.

SECOND TIER.

,, 190, 20 row—Marshall's No. 36
,, 191, 23 ,, ,, No. 11
,, 192, 12 ,, ,, No. 10
,, 193, 4 ,, ,, No. 19
,, 194, 25 ,, ,, No. 9
,, 195, 31 ,, ,, No. 8
,, 196, 40 ,, ,, No. 4
,, 197 and 198—Inglis' Battlefield. West half of large double strip
,, 199 and 200— ,, Success. East half of large double strip
One acre Inglis' Rust-proof
North end of first tier of small plats sown to Marshall's No. 4

List of Wheats grown on the Farm of Mr. D. McCullum, near Roma. Sown 21st and 22nd May, 1895.

No.	1,	6 rows—	Grosse's Prolific
,,	2,	4 ,,	Jacinth
,,	3,	2 ,,	Herculus
,,	4,	1 ,,	Belotourka
,,	5,	1 ,,	Town and Country
,,	6,	4 ,,	Red Provence
,,	7,	2 ,,	Galland's Hybrid
,,	8,	2 ,,	Steinwedel's No. 5 Bearded
,,	9,	2 ,,	Trijo Barella No. 1 (Argentine)
,,	10,	2 ,,	Soldome No 2 (Argentine)
,,	11,	2 ,,	Galatian Summer
,,	12,	2 ,,	Tunnack
,,	13,	2 ,,	Amethyst
,,	14,	2 ,,	Tourmaline
,,	15,	2 ,,	Lava
,,	16,	4 ,,	Excelsior
,,	17,	2 ,,	Ballarat Spring
,,	18,	6 ,,	Murray River
,,	19,	2 ,,	White Tuscan (Dr. Cobb)
,,	20,	2 ,,	White Tuscan (Mr. Inglis)
,,	21,	2 ,,	Cythere, White
,,	22,	2 ,,	Queensland Defiance
,,	23,	2 ,,	Blount's Lambrigg
,,	24,	2 ,,	Pringle's No. 5
,,	25,	16 ,,	Tardent's
,,	26,	2 ,,	No. 1 Bearded
,,	27,	10 ,,	Australian Wonder
,,	28,	4 ,,	Blount's No. 10
,,	29,	2 ,,	Hudson's Early Purple Straw
,,	30,	4 ,,	Mexican Spring
,,	31,	2 ,,	Australian Club
,,	32,	4 ,,	Leak's
,,	33,	2 ,,	White Fife
,,	34,	8 ,,	Improved Fife
,,	35,	10 ,,	Blount's Fife
,,	36,	6 ,,	Indian Pearl
,,	37,	6 ,,	African
,,	38,	2 ,,	Hard Weat, bald
,,	39,	2 ,,	Daman
,,	40,	2 ,,	Lowland White
,,	41,	2 ,,	White Ghoni, white chaff, bearded
,,	42,	1 ,,	White Ghoni, red chaff, bald
,,	43,	1 ,,	Pannuan, white chaff, bald
,,	44,	6 ,,	King's Rust-proof
,,	45,	12 ,,	Battlefield
,,	46,	4 ,,	King's Beauty
,,	47,	16 ,,	Inglis' Inoculated Steinwedel No. 1
,,	48,	10 ,,	Brown's Rust-proof
,,	49,	6 ,,	Robbin's Rust-proof
,,	50,	6 ,,	Thomas's Rust-proof
,,	51,	10 ,,	Wheaton's Rust-proof
,,	52,	22 ,,	Buckley's Rust-proof
,,	53,	2 ,,	White Lammas
,,	54,	2 ,,	Quartz
,,	55,	2 ,,	Ward's White
,,	56,	2 ,,	Fultz
,,	57,	2 ,,	Bega
,,	58,	2 ,,	Oakshott's Champion

FARRER'S CROSSBREDS.

,,	59,	2 ,,	F. (1), bearded
,,	60,	2 ,,	F. (1)
,,	61,	2 ,,	Indian F.
,,	62,	½ ,,	193 × Summer Club (No. H)
,,	62A,	½ ,,	King's Jubilee × Indian A.
,,	63,	½ ,,	193 × Summer Club (No. E)
,,	63A,	½ ,,	King's Jubilee × Indian A. (No. H)
,,	64,	½ ,,	193 × Summer Club (No. G)
,,	64A,	½ ,,	(Steinwedel × Amethyst × Horneblende) × (King's Jubilee × Ladoga)

List of Wheats—*continued.*

No. 65, ½ row—193 × Summer Club (No. G)
" 65A, ½ " Indian A.
" 66, ½ " 193 × Summer Club (No. J)
" 66A, ½ " Horneblende × Early Baart
" 67, ½ " T. (1) × Indian B.
" 67A, ½ " (Steinwedel × King' s Jubilee) × F. (1)
" 68, ½ " (Horneblende × Summer Club) × (Indian B. × Indian D.)
" 68A, ½ " Steinwedel × Amethyst. Selection B.
" 69, ½ " Blount's Lambrigg × Indian G.
" 69A, ½ " White Naples × Indian G.
" 70, ½ " (193 × Summer Club) × (Indian B. × Indian D.)
" 70A, ½ " (Steinweidel × Amethyst) × (King's Jubilee × Ward's White)
" 71, ½ " (Horneblende × Summer Club) × (Steinwedel × King's Jubilee)
" 71A, ½ " Steinwedel × (Amethyst × Horneblende)
" 72, ½ " Steinwedel × (Amethyst × Horneblende)
" 72A, ½ " Horneblende × Early Baart
" 73, ½ " (Improved Fife × Blount's Lambrigg) × Etawah
" 73A, ½ " Hudson's Early Purple Straw
" 74, 1 " Improved Fife × Blount's Lambrigg
" 75, 1 " Ward's White × Tourmaline
" 76, 1 " Fultz × Bount's Lambrigg
" 77, 1 " Moscow Early × Indian D.
" 78, 1 " Summer Club × Horneblende
" 79, 1 " Amethyst × Indian B.
" 80, 1 " (Vermont × Blount's Lambrigg) × Horneblende
" 81, 1 " Vermont × Ward's White
" 82, 1 " Horneblende × Indian G.
" 83, 1 " King's Jubilee × Improved Fife
" 84, 1 " King's Jubilee × Indian H.
" 85, 1 " (Blount's Fife × Ward's Prolific) × Ward's White
" 86, 1 " King's Jubilee × Ladoga
" 87, 1 " Unknown
" 88, 1 " (Steinwedel × Amethyst) × Horneblende
" 89, 1 " Sicilian Square-headed Red × Improved Baart
" 90, 1 " Quartz × Zimmerman
" 91, 1 " Quartz × Vermont
" 92, 1 " (Quartz × Leak's) × (Horneblende × Ward's Prolific)
" 93, 1 " (Horneblende × Leak's) × Lazistan
" 94, 1 " Sardonyx × Ward's Prolific
" 95, 1 " Quartz × Leak's
" 96, 1 " Horneblende × Indian B.
" 97, 1 " Horneblende × Early Baart
" 98, 1 " Vermont × Leak's
" 99, 1 " (Horneblende × Blount's Lambrigg) × Horneblende
" 100, 1 " Horneblende × Indian A.
" 101, 1 " Horneblende × Moscow
" 102, 1 " Horneblende × Ward's White
" 103, 1 " Chatsbury × Horneblende
" 104, 1 " Blount's Wheat × Amethyst
" 105, 1 " Blount's Fife × Horneblende
" 106, 1 " Indian B. × Indian D.
" 107, 1 " Blount's Fife × Vermont
" 108, 1 " Blount's Fife × Ward's White
" 109, 1 " Steinwedel × Early Baart
" 110, 1 " (Horneblende × Leak's) × Marshall's No. 3
" 111, 1 " Quartz × Amethyst
" 112, 1 " (Ruby × Ward's Prolific) × (Horneblende × Ward's White)
" 113, 1 " Amethyst × Indian D.
" 114, 1 " Ward's White × Horneblende
" 115, 1 " Jacinth × Ladoga
" 116, 1 " Jacinth × Ward's White
" 117, 1 " Horneblende × Blount's Lambrigg
" 118, 1 " (Jock × Blount's Lambrigg) × Horneblende
" 119, 1 " Jock × Ward's Prolific
" 120, 1 " King's Jubilee × Indian G.
" 121, 1 " Vermont × Blount's Lambrigg
" 122, 2 rows—Blount's Lambrigg × Saxon Fife
" 123, 2 " Horneblende × Leak's
" 124, 2 " Leak's × Horneblende
" 125, 2 " Horneblende × Marshall's No. 3

List of Wheats—*continued.*

No. 126, 2 rows—Horneblende × Freeling
„ 127, 4 „ Fultz × Marshall's No. 3
„ 128, 12 „ Marshall's No. 9
„ 129, 12 „ Supposed Marshall's No. 9
„ 130, 8 „ Marshall's No. 36
„ 131, 12 „ „ No. 24
„ 132, 10 „ „ No. 11
„ 133, 8 „ „ Prolific
„ 134, 8 „ „ No. 27
„ 135, 10 „ „ No. 17
„ 136, 12 „ „ No. 37
„ 137, 4 „ „ No. 3 Purple
„ 138, „ „ No. 3
„ 139, „ „ No. 3
„ 140, 12 „ „ Success
„ 141, 12 „ „ No. 29
„ 142, 16 „ „ No. 6
„ 143, 16 „ „ No. 35
„ 144, 16 „ „ No. 10
„ 145, 10 „ „ No. 15
„ 146, 20 „ „ No. 21
„ 147, 20 „ „ No. 4
„ 148, 8 „ „ No. 33
„ 149, 8 „ „ No. 22
„ 150, 12 „ „ No. 19
„ 151, 16 „ „ No.
„ 152 and 153 Marshall's No. 8
„ 154 and 155 Budd's Early
„ 160 and 161 Inglis' Rust-proof
„ 162 and 163 Inglis' Success
„ 164 and 165 Inglis' Battlefield.

Varieties of Wheats grown upon the Station of Mr. W. H. Campbell, near Barcaldine. Sown 26th and 27th April, 1895.

Plat. 1, ½ acre nearly, Allora Spring
„ 2, ¼ „ „ Budd's Early
„ 3, ¼ „ „ Jacinth
„ 4, Mexican Spring
„ 5, Indian Pearl
„ 6, Canning Downs Rust-proof
„ 7, Red Californian
„ 8, Indian Club No. 1
„ 9, Indian Club No. 2
„ 10, Gore's Indian
„ 11, Indian Early
„ 12, Freeling
„ 13, Ward's White
„ 14, Australian Wonder
„ 15, Early Para
„ 16, Marshall's No. 3
„ 17, Tourmaline
„ 18, Algerian
„ 19, ½ acre African

REPORT OF THE COLONIAL BOTANIST.

Sir,—I have the honour to submit the following as a brief report of the work of my department during the past year, 1894-5.

It is gratifying to me to be enabled to say that the people have evinced, if possible, an increased interest in botanic matters, thus I have been kept very busy to satisfy all requirements. The material forwarded for identification and other information has also formed valuable additions to both the Herbarium and Botanic Museum, assisted in the work of developing our rich flora, and furnished what is so much required—viz., material for effecting exchanges with kindred institutions in other parts of the world. While expressing my pleasure

at the ready help rendered to me by correspondents in distant parts of our colony by acceding to my requests for specimens, seeds, &c., of indigenous plants. I would again urge upon your notice the necessity of some further effort being made at collecting specimens of the indigenous flora, and particularly the woods. Up to the present only about 600 are known, and I have no hesitation in saying that 1,000 exist. Amongst the yet unknown kinds many may be far more suitable for various purposes than those at present in use. The value of a collection such as I have already gathered together cannot be over-estimated, and this is acknowledged by all our practical men; therefore I am induced to again press the matter of having the collection completed as soon as possible. While upon this subject I would ask that no public money be spent in collecting wood samples for the European market except such have attached to each sample the scientific as well as the vernacular names. It must not be thought that in making this request I am speaking more as a botanist than an artizan. All who have had to do with our woods will agree with me in saying that the vernacular name alone is useless, or even worse, for so frequently the same vernacular name is given to very dissimilar woods. Besides woods, the museum has been enriched by many other products of the vegetable kingdom during the year.

The small vote for additional works to the Botanic Library I have expended in the purchase of needful publications. These are essential to the botanist, for without them no satisfactory work can be accomplished.

The publications issued during the year are the one mentioned in my last report as in the printer's hands—viz., "Botany Abriged," "Botany Bulletin Nos. IX. and X." No. XI., devoted entirely to Algæ, is nearly all in type, and will be issued shortly. Besides these I have prepared, at your request, in bulletin form, "A Half-century of Notes for the Amateur Fruit-growers." As these works speak for themselves I need add nothing further about them.

From my various writings upon the Queensland Flora, it must have been observed how deep an interest I have always taken in the economic features of the plants, and particularly how often I have advocated the collecting and cultivating of the indigenous grasses. This matter was referred to in my last report, but nothing in the direction which I there advocated has been carried out—viz., the collecting of all the kinds, and cultivating each on a small scale, partly with a view to education, and partly with a view to obtaining authentic seed for more extensive experiments. To only collect and distribute the seed would be to just continue what I have been doing, as opportunity offered, for years past. This mode is doubtless of advantage, but is wanting in the public benefit which would result from the grass garden, which I ask to be planted in some suitable locality near the metropolis.

Following my usual course of recording in these Annual Reports any additional fungi-blights which have been noticed upon the vegetation, I have to record the following additions for the year. The names of fungus and host plant are given; all further information will be found in my Botany Bulletins

Dimerosporium Tarrietiæ, Cke. and Mass. On leaflets of *Tarrietia trifoliolata* at Eumundi.

Puccinia heterospora, Berk. and Curtis. On an indigenous Hibiscus.

Ustilago sorghi, Link. On the inflorescence of Sorghum.

Phyllosticta circumscissa, Cke. The Shot-hole fungus. On cherry trees.

Phoma bambusina, Speg. On stem of a seedling sugar-cane.

Camerosporium punctiforme, Cke. and Mass. On salt-bush.

Aschersoma oxyspora, Berk. On leaves of *Cinnamomum Oliverii*.

Glœosporium palmarum, Cke. and Mass. On leaves of *Archontophœnix*.

Glœosporium periculosum, Cke. and Mass. On fruit of *Rhodomyrtus macrocarpa*.

Fusarium heterosporum, Link. On an ear of wheat from Herberton.

Epicoccum micropus, Corda. On the foliage of young *Quercus*.

A number of noxious weeds and reputed poisonous plant specimens have been received for identification and report, but the most of these have been referred to in previous reports. The few others will be found in my publications.

F. MANSON BAILEY,
Colonial Botanist.

REPORT OF THE ENTOMOLOGIST.

I have the hononr to submit the following Report for the year ending 30th June, 1895, relating to the work of the branch of the Department of Agriculture under my charge.

The office of Entomologist not having been created until August, 1894, the fact that the department has made provision for investigating matters relating to economic entomology and plant pathology is perhaps not so widely known as might otherwise happen. Nevertheless many problems of vital significance to those engaged, both in horticulture and agriculture, have been tendered by the public for solution. This will appear from the following summary of topics that have formed the objects of special investigation and report:—

ECONOMIC ENTOMOLOGY.

Apple.—Instances of injury to this fruit at Brisbane by the caterpillar of the Peach Moth (*Conogethes punctiferalis*, Guenée); to it at Stanthorpe and Brisbane by the Fruit Fly (*Tephritis*); to the tree at Gatton by the Wooly Aphis (*Schizoneura lanigera*); to the foliage at Brisbane by the caterpillar of *Prodenia testaceioides*.

Pear.—The Gall Mite (*Phytopus sp.*) at Maryland; the Fruit Fly (*Tephritis*) in the Goodna and Dawson districts; the Peach Moth (*Conogethes punctiferalis*) at Brisbane.

Quince.—The Fruit Fly (*Tephritis*) at Brisbane.

Plum.—The Fruit Fly (*Tephritis*) several instances.

Peach.—The Red-banded Galeruca (*Monolepta rosea*) destroying both leaves and fruit at Ipswich; the Peach Aphis (*Myzus cerasi*) doing considerable damage there also; the Peach Moth (*Conogethes punctiferalis*) Mount Cotton; the Fruit Fly (*Tephritis*) Dawson River, Brisbane, &c.; the St. José Scale (*Aspidiotus perniciosus*) New South Wales; the White Scale (*Diaspis amygdali*), Brisbane.

Fig.—The figleaf Galeruca, Brisbane, &c.

Orange.—The Red-banded Galeruca (*Monolepta rosea*), consuming young foliage and blossoms at Gladstone; the Tree-borer, No. 1 (*Monochammus fistulator*), at Coomera; Tree-borer, No. 2 (undetermined), Gympie; the Shot-hole Wood Beetle (*Scolytus sp.*); the Black Bug (*Leptoglossum membranaceum*), at Raglan; the Bronze Bug (*Oncoscelis sulciventris*), at Toowoomba and elsewhere; the Orange-tree Hopper (*Desudaba maculata*), Coomera; Orange-puncturing Moths (*Ophiderinæ*), Brisbane, Brookfield, Cooktown, &c.; Orange-tree Aphis (*Siphonophora sp.*), several applications; Coccidæ, including the Purple Wax Scale (*Ceroplastes rubra*), White Scale (*Chionaspis-citri*), Red Scale (*Aspidiotus coccineus*), Purple Round Scale (*Aspidiotusficus*), Glovers Scale (*Mytitaspis Gloveri*), several applications.

Paw-paw or Papaya.—Tunnelling insect injuring apical growth, Kamerunga.

Mango.—Pink Wax Scale (*Ceroplastes rubra*), Brisbane and Bundaberg; Fruit Moth Borer (*Argadesa materna*); Fruit Fly (*Tephritis sp.*), at Brisbane; the Sida Plant Bug (*Dysdercus sidæ*), Bundaberg; White Mango Scale, Mackay.

Loquat.—Leaf-eating Beetle (*Cryptocephalus sp.*), at Brisbane; Peach Moth (*Conogethes punctiferalis*), at Brisbane; Fruit Fly (*Tephritis sp.*), at Brisbane.

Guava.—Fruit Fly (*Tephritis sp.*), at Georgetown.

Persimmon.—Fruit Fly (*Tephritis sp.*), Goodna.

Wine Palm.—Fruit-boring Caterpillar (*Tineidæ*), Brisbane.

Mulberry.—Black Scale (*Lecanium depressum*), at Brisbane.

Vine.—Bag-worm (*Thridiopteryx Hubneri*), at Brisbane; Leaf Beetle (Fam. Eumolphidæ), at Gayndah.

Rosella.—Rosella-leaf Caterpillars (*Cosmophila xanthindyma* and *Ganitis revocans*), at Brisbane.

Broom Sorghum.—Peach Moth (*Conogethes punctiferalis*), at Brisbane; Cecidomyid Fly (*Diplosis*), at Goodna.

Sugar-cane.—"Grub Pest" (*Scarabæidæ, larvæ*), at Herbert River, Mackay, Bundaberg, Isis Scrub, and Coomera; Sugar-cane Mite (*Tarsonemus Bancrofti*), at Pialba; Caterpillar Borer (*Nonagria exitiosa*), Mackay; Large Longicorn Larva (Fam. Cerambycidæ), at Sandwich Islands.

Tobacco.—Leaf-eating Caterpillar (*Prodenia testaceoides*), at Maryborough.

Bean.—Bean Maggot (*Oscinis sp.*), at Brisbane and Ipswich, and Stalk Borer (*Lemna violacea*), at Mackay.

Cow-peas.—Bean Plant Bug (*Riptortus serripes*), at Brisbane.

Potato.—Mealy Bug (*Dactylopius sp.*), at Toowoomba; Epilachna Beetle (*E. multipunctata*), at Brisbane; Cut-worms (*Agrotis suffusa*), doing serious injury at Cairns; Potato Moth (*Lita solanella*), at Rocklea; Nematode tuber disease, Deception Bay (Dr. T. L. Bancroft).

Sweet Potato.—Potato Weevil (*Cylas formicarius*), Mackay and Hemmant.

Cabbage.—Leaf-eating Caterpillar (*Plutella cruciferarum*); Stem-boring Caterpillar (*Hellula undalis*); and Vaginula Slug (*Vaginula Leydeyi*, Simroth), at Brisbane.

Pasturage, &c.—Fly Bug of Western Districts (*fide*, E. Shelton); Grass-root pest (undetermined), at Surat; Cecidomyid Fly (*Lasioptera vastatrix*) of *Andropogon sericeus*, at Brisbane; Cecidomyid Fly of *Arundinella nepalensis* (*Diplosis sp.*), at Brisbane.

Shade Trees, &c.—White Cedar Caterpillar *(Teara redacta)*, at Brisbane and Roma; Scale Insect of White Cedar *(Lecanium depressum)*, at Roma; Figtree Leaf-hopper *(Psylla fici)*, at Brisbane; Figtree Shoot Borer *(Phlœtribus sp.)*, at Brisbane. Bay-worm of Conifers *(Thridiopteryx Hubneri)*; Albizzia Stem-Borer *(Cryptophasa unipunctata)*. On various trees at Brisbane—the Red-banded Galeruca *(Monolepta rosea)*.

Flower Garden Pests.—Maiden-hair Weevil (Fam. Curculionidæ), at Brisbane and Pimpama; Orchid Beetle *(Crioceris)*, at Brisbane; Rose Flower Opener (Beetle, Fam. Nitidulidæ, at Brisbane. Leaf-eating Caterpillar *(Thalassodes pieroides)*, at Brisbane; "Bush-house Pests" (Wood Lice, Order Crustacea), at Brisbane; Ants (*Iridomyrmex purpurascens)*, at Bundaberg.

Store Pests.—Including the Angoumois Grain Moth (*Gelechia cereallela*); *Sitroperda panicea*, *Lasioderma serricorne* (in cigars), *Silvanus surinamensis*, *s.? cassiæ*, &c.

In addition, information has been requested and supplied on matters pertaining to insects' nomenclature, insects' habits, and systematic entomology generally.

Imported Insects.—The few opportunities that have occurred for noting recently Imported Insect Pests have resulted in the discovery of the Beetle Borer *(Sphenophorus obscurus)* on two occasions in sugar-cane from the Sandwich Islands; Bean and Pea Weevils *(Bruchus fabæ*, *Bruchus pisorum*, and *Bruchus chinensis)*, on cow peas and sugar peas, &c.; a weevil-borer of Canaigre; and the Codlin Moth and Mussel Scale on Tasmanian apples. On the other hand, the asserted introduction and establishment here of the notorious *Phylloxera* was also inquired into, with the result of discovering that there was no evidence whereupon to base it.

It has been observed that *Vaginulus Leydiyi*, Simroth, a large and conspicuous slug, probably of foreign origin, that was formerly confined to the Botanical Gardens, has now found its way to South Brisbane, where it already occurs in large numbers. And as it has been reported to be partial to cabbages, it may be expected to damage other succulent vegetables also. The eggs, laid in masses beneath the ground, readily adhere to the roots of plants, and this circumstance apparently affords the means for their wide dissemination.

Parasitic and Predaceous Insects.—These have also claimed considerable attention. The especial "scale insects' enemy," *Cryptolæmus montrouzieri*, whose existence in Australia and useful work was made known by the Entomologist in 1889, has been recently transported by Mr. Albert Kœbele to Honolulu, greatly to the advantage of horticulturists there resident; and applications for the shipment of consignments of the same friendly beetle have been recently received both from Ceylon and from New Zealand. Other scymnid and lady-bird beetles, representing the genera *Rhizobius* and *Orcus*, whose important rôle was also proclaimed by the Entomologist at the same time, have recently been introduced into and established in California, likewise through the instrumentality of Mr. Kœbele. Moreover, a request has been preferred by the South Australian Bureau of Agriculture for a supply of a minute hymenopterous parasite that has been discovered to hold the Red Scale of the orange and other trees in check in the vicinity of Brisbane.

At the same time our own requirements in this direction have not been lost sight of. As the outcome of a personal application, it was found possible to enlist the services of the abovementioned expert, prior to his visiting India and Ceylon, in this service, with the result that specimens—unfortunately dead on arrival—of an egg parasite of a large hemipterous insect allied to our Orange Tree Bug (*Oncoscelis*) were received from Ceylon. These insects, it is thought, should prove useful in combating the local pest, and a further endeavour will be made to obtain living individuals. Mr. Kœbele has also drawn attention to the fact that the Wax Scale insects of India are victimised there by a small hymenopterous insect, and has expressed a hope that it may be found practicable to secure a supply wherewith to contend with the *Ceroplastes* which, brought here a few years since, is being disseminated throughout the colony. Local observation has brought to light the existence here of a small hymenopterous insect, belonging to the family Braconidæ, that feeds upon the maggot of the peach and of so many other fruits, and also that of another hymenopterous parasite that preys upon the ordinary grain weevil. It is feared, however, that the former of these is itself kept in check by a secondary parasite.

With the exception of an instance of silk cocoons being destroyed by the Hide Beetle, *Dermestes vulpinus*, no matters relating to either apiculture or sericulture have been referred to the Entomologist. He is anxious, however, to endeavour to further these industries, and to receive, therefore, suggestions from those engaged in them, as to the manner in which this desire can, in their opinion, be best given effect to.

VEGETABLE PATHOLOGY.

Amongst the questions relating to plant pathology proper—*i.e.*, to vegetable parasitic and other diseases—that have been referred to this branch of the department for solution, the following may be enumerated:—

Apple.—Bitter Rot, caused by the fungus *Glæsporium fructigenum*, Berk., at Brisbane; Apple Scab or Tasmanian Black Spot, caused by the fungus *Fusicladium dendriticum*, on fruit from Stanthorpe and from Hobart; Apple Phoma, on fruit at Brisbane, and "Leaf Blight" from Toowoomba.

Pear.—Leaf Blight, primarily caused by the mite *Phytopus*, at Maryland.

Plum.—Leaf Fungus, caused by a fungus, *Helnmithosporium*, sp., in the Logan district.

Peach.—Leaf Brand, caused by *Puccinia prunorum*, Fkl. (*Uromyces amygdali*, Cooke), at Brisbane.

Apricot.—Shot-hole Disease, caused by *Phyllosticta circumcissa*, at Gatton; Cherry Gumming Disease, at Stanthorpe.

Fig.—A blight affecting shoots at Toowoomba.

Oranges, &c.—Leaf Scab, at Rocklea and elsewhere; Die Back and Gum Disease, occuring at Northampton Downs, Cairns, &c.; Bark Canker, at Redland Bay and Maryborough; Rust of Fruit, caused by the mite *Phytopus oleivorus*, in Wide Bay district, &c.; Shedding of Fruit, at Brisbane and elsewhere; Leaf Variegation, at Gatton; Lemon Fruit Brand, caused by *Tubercularia citri*, on importations from New South Wales.

Mango.—Fruit discolouration, at Brisbane and elsewhere.

VINE.—Black Spot or Anthracnose, caused by *Glæosporium ampelophagum*, from Brisbane, Ipswich, Gatton, Wallumbilla, Dawson River, &c.; Fruit Rot, caused by *Monilia fructigena*, from Gatton; Fruit Rot of Lenoir Grape, caused by *Phoma uvicola*? from Wynnum; *Glæosporium pestiferum*, from Brisbane; Leaf Fungus, *Isariopsis clavispora*, from Brisbane; Twig Fungus, *Pestalozzia uvicola*, from Brisbane; Powdery Mildew or Oidium, from Brisbane.

STRAWBERRY.—Leaf Blight, caused by *Sphærella fragariæ*, at Brisbane.

COFFEE.—Jamacia Leaf Disease, caused by *Cercospora coffieicola*, Berk. and Cooke, at Mackay.

OLIVE.—Fruit Rot, caused by *Monilia fructigena*, at St. Helena.

BANANA.—Plant decadence, at Esk.

TOBACCO.—Blue Mold, caused by *Peronospora hyoscyami*, at Cooroy and elsewhere.

SUGAR-CANE.—Gumming Disease or Bacteriosis, occurring in the Wide Bay, Burnett, and Mackay districts; Red Rot of Stalk—the same; "Rust" or Cane Freckle—the same; True Cane Rust, caused by *Uromyces Kuhnii*, at Mackay; Cane Sperme (*Strumella sacchari*), from all the above localities; a new blight affecting cane from British New Guinea.

BROOM SORGHUM.—Rust, and a Leaf Blight, caused by a species of *Colletotrichum*, from Redbank Plains.

TOMATO.—Black Rot, from Brisbane and Darling Downs; Plant Blight, from Brisbane.

POTATO.—The new Potato Disease, or Plant Bacteriosis, at Tiaro.

CHILLI.—Fungus Disease of Fruit.

GARDEN PLANTS.—Oidium of Rose, caused by *O. lencoconium;* and Leaf Brand of Rose, caused by *Actinonema rosæ*; and Violet Disease, caused by *Puccinia violæ*, from Brisbane.

The study of certain fungus organisms has also been undertaken with other objects in view than the discovery of the etiology of diseased conditions. Thus some preliminary inquiries have been made for the purpose of discovering how far the different forms of fungi that cause disease in certain insects might be made available for the destruction of such as are inimical to plant growth. Amongst those that have in this way claimed attention are: the three fungi *Microcera rectispora*, *Microcera coccophila*, and a vegetable parasite of *Lecanium*, with reference to their employment in coping with scale insects; also *Empusa musci*, a fungus that checks here the increase of house-flies, and that might possibly be made available when artificially cultivated, not only for contending with these domestic pests, but also for checking the maggot which may be credited with the destruction of about 50 per cent. of our soft fruits. Similarly an *Entomopthora* that occurred on a lettuce destroying Cut-worm (*Agrotis sp.*) was made the object of investigation, and likewise certain fungi that destroy our wood-feeding caterpillars belonging to the family Xyloryetidæ, to which attention was drawn by Mr. R. Illidge. Again cultivations of a fungus, used, as is affirmed, in France for the destruction of "Vers Blancs" or White Grubs, were submitted by the Instructor in Agriculture. These special organisms had already perished when received, and thus their suggested application for the destruction of the well-known sugar-cane pest could not be tested.

No instance of disease affecting either bees or silkworms was brought under notice.

INTRODUCTION AND DISSEMINATION OF PLANT PESTS AND DISEASES.

The arrival on two separate occasions in the colony from the Sandwich Islands of sugar-cane intended for use as "seed," harbouring an insect not previously established in the cane fields of the colony—*i.e.*, the notorious Beetle-borer, *Sphenophorus obscurus*, one of the worst insect pests of this valuable plant, as well as other incidents, have suggested the propriety of again urging the expediency of a special Act of Parliament being passed which shall authorise the Governor in Council to prohibit or regulate the importation from beyond the colony of any plant, fruit, vegetable, or other merchandise that may be reasonably expected to harbour or be affected by any insect fungus or disease, and which shall empower a duly constituted authority to detain and examine the same whenever arriving, and prevent their being distributed until certified under its hand to be free from insect fungus or disease, or even, whenever circumstances render such act necessary, condemn; to, in fact, follow the procedure of other countries in thus safe-guarding the interests of both agriculturists and horticulturists.

The manner in which insect and fungus pests are allowed to increase and are disseminated is again a matter to be commented upon. Many of the more pronounced enemies of vegetation included in the categories of pests and diseases are not indigenous to the colony. Thus if one residing in an isolated district raises one's plants from seeds he will not experience the undesirable effects inseparable from the presence of these upon them, and his profits, *cæteribus paribus*, will be proportionately increased. It happens, however, that it is not expedient for him to confine his attention to locally-raised seedlings, but that he should rather obtain plants from one or more of the many establishments existing for the purpose of supplying them. But under present circumstances the chances in so doing of his simultaneously acquiring plant pests also that will in the future largely militate against the success of his operations will be very great indeed. And even if he does not receive these plant pests upon the trees themselves that it is his special object to cultivate, ordinary shade or ornamental trees or shrubs—and herbaceous plants too—may be the vehicle for their conveyance. The professional nurseryman and florist is not alone culpable under these circumstances, for there are other agencies in the colony that also compass the dissemination of these checks on successful horticulture. The planting operations in connection with Arbor Day are, it is evident, largely responsible for the dissemination of plant pests, at least through the length and breadth of Southern Queensland.

Then, again, those that have resorted to measures for coping with these plant pests and diseases have in many cases their labours increased and protracted owing to the apathy and inertness of their neighbours, whose cultivations yield an ever-present source for re-infestation.

Our cultural industries thus suffer to a much greater extent from this domestic traffic in plant pests and diseases than they do from introductions from beyond the colony that are from time to time brought under notice; in fact, under present circumstances these plant emporiums act as the centres of propagation and dissemination that serve to give to these importations the baneful influence that they

exert. Some nurserymen, it has been ascertained, are willing to guarantee that the plants that they send out are free from the presence of insects and diseases, but all should be compelled to do so.

It were most desirable that public sentiment were instructed regarding the importance of these considerations, but past experience, especially that of other countries, has shown that this is extremely difficult to effect, and thus it may be questioned whether the unanimity that is so needful should not be secured by legislative enactment.

FIELD WORK.

Investigations in the field have demanded two visits to the Mackay district—during September-October, and in December, 1894—and one to the Wide Bay and Burnett district in the interval between the former two. These have been in connection with an inquiry into the gumming disease of sugar-cane and the grub pest of sugar-cane respectively. Visits have also been made to Tiaro in reference to potato disease, to Ipswich in reference to peach aphis, to Laidley in connection with the fruit fly, and to Pimpama and Coomera in reference to reported sugar-cane disease.

HENRY TRYON,
Entomologist.

REPORT OF CURATOR, BOTANIC GARDENS.

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.

IMPROVEMENTS.—I have been enabled, by means of the "unemployed" sent here by the Colonial Secretary's Department, to effect many much-needed improvements in the Gardens. The greater part of the bank along the river frontage has been graded off, and all the unsightly holes filled up.

By taking advantage of the opportunity afforded by the making of the large tunnel in the city, I was enabled to procure nearly 2,000 cubic yards of good ballast, with which I made a very good road 17 feet wide, with necessary drains, &c. This has been a very great improvement indeed.

I have continued the palm avenue on to the river, thoroughly trenching the ground, and have greatly improved that portion of the Gardens near Albert street gate, substituting broad symmetrical walks for the lop-sided design formerly there.

DRAINAGE.—One of the great needs of our Gardens has been drainage. I have managed, although I had none of the materials at hand ordinarily used for this purpose, to vastly improve the Gardens in this respect during the year under review. I set some men to work to quarry stone on the opposite bank of the river, and had it conveyed across the river in dredge punts kindly lent by the Marine Department. This proved most useful for the purpose of drainage as well as sundry other purposes. I also utilised the dead bamboos cut out to give space and light to the living ones, and these made really excellent drains.

There is yet an area of the Gardens where it has never been found possible to induce anything to flourish. I allude to what is called the Hill, and yet portions of it which I have trenched and drained prove good ground, and I hope soon to have it all in an equally good condition.

Drainage is work which, of course, cannot be seen on the surface, but without it success is impossible; and with the drainage now laid down in the Gardens the flood of 1893 would not do anything like the damage which was done at that time.

Asphalting.—The asphalt walks in the Gardens had fallen (as was noted in my last report) into a sad state of disrepair, and this was greatly aggravated by floods and tropical rains. These had always been previously repaired by special vote, and not out of ordinary contingencies, but there being no vote available, and the work being urgent, I cast about for some means of accomplishing it out of materials available. It fortunately happened that good gravel was being dredged at Indooroopilly bridge, and, as it was cheaper for the contractor to have this discharged at the Gardens than to take it to sea, it was given to the Gardens. About 1,500 tons were discharged, and of this about 1,200 tons have been converted into asphalt and laid down at a comparatively small cost. A mixing shed was erected of materials to hand, a capital boiler was extemporised by cutting down an iron malt tank; the tar required only cost in all £17 10s., and the area of asphalt laid was 4,780 square yards, which, at the moderate estimate of 2s. per square yard, would, if done in the way formerly practised, have cost £478. Every walk, too, has been carefully graded, and at all points where there has been in former years a rush of water during heavy rains, gratings have been placed the full breadth of the walks, with masonry traps and masonry sewers, so that it is now quite impossible for the walks to be blocked in times of heavy rains, as used to be formerly the case. A good deal of this kind of work yet remains to be done, and it is being steadily pushed along with. When it is all completed I shall not be disposed to look upon a flood with anything like the same apprehension as, say, two years ago, because one of the chief dangers of a flood to vegetation is the stagnant water which remains in the soil after the principal mass of waters has retreated.

Seeds, &c.—An old house formerly occupied by the Immigration Agent on Kangaroo Point, but ruined by the flood of 1893, was handed over, and from the materials contained in it I erected a commodious seed store and other needful offices. I am much in want of working sheds, and should there be any other old material at any time available, I shall be only too glad to remove it and turn it to a profitable account.

Plant Labelling.—Botanical gardens should always, as a matter of course, have the trees and shrubs and specimens of the principal plants therein labelled. Prior to the floods of 1893, I had been able to do a good deal in this direction, but the labels were at that time almost all destroyed, and we had to begin over again. With what success this has been done may be gathered from the statement that the plants, trees, &c., are now better labelled than ever before, and that the Gardens will now compare favourably in this respect with any colonial gardens. The labels, too, have been made of imperishable materials, and will pass through any flood without injury; they have been attached at a sufficient height to be out of the way of mischievously inclined persons, and at the same time can be easily read. They give the common name, scientific name, native country, and natural order of each plant. I do not mean to relax my efforts in this direction until

every tree and shrub in the Gardens is labelled. This labelling has not been done, as heretofore, by means of a special vote, but out of our ordinary contingency fund.

Horticultural Lectures.—The Department of Public Instruction having granted the use of the Normal School (girls) for Monday evening in each week, I am about to deliver a series of twelve popular lectures entitled "A Queensland Garden Illustrated," and trust that they will prove as acceptable to the public and as well attended as those heretofore delivered by me.

Curator's Residence.—It is of course well known that in the floods of 1893 I lost my residence and, together with a large quantity of furniture, all my books, &c., which I had been collecting for many years.

I received no compensation of any kind. The want of a residence has been a great hardship to me, and has greatly interfered with my work. So necessary is a curator's residence regarded, that when a new botanic garden is projected it is always the first work carried out, and the Acclimatisation Society has recently obtained an Act of Parliament to enable them to mortgage their property in order, amongst other things, to erect a residence for their manager. I have recently offered, if allowed, to build a good house out of a large quantity of beautiful granite which came from South America as ballast, and as this can be done at an extremely low cost, and the result will be a comfortable and sightly residence, I trust that the matter will be favourably considered.

Nut-grass.—This weed, during a few months after the floods of 1893, when it was found impossible to work the land, increased to some extent; but it has now been checked and reduced to quite manageable limits. This weed is found in most tropical botanic gardens in both hemispheres, and with diligent cultivation need not excite any particular alarm. In fact, the very presence of these weeds of cultivation ensures that constant attention to the stirring of the soil which is such an essential feature in all good gardening. During one period of the year, generally in the months of February and March, it is good policy to allow nut-grass to attain its full growth, short of seeding, and then to rapidly go over the cultivated land and fork it out. This has the effect, if persevered in, of greatly reducing it, and at the same time of benefiting the land. When we desire to clear nut-grass from any given piece of ground, we find no difficulty in doing so by planting it with perennials which are robust, and throw a heavy shade. I find the various species of beautiful flowered Cannas very excellent for this purpose.

Machines, Tools, &c.—As it was imperative to provide tools, materials, &c., required by the large number of unemployed, and in connection with their work, out of our ordinary contingency fund, which was certainly not calculated to stand any such strain, I have found considerable difficulty in getting through the year with the sum at my disposal, and have been obliged to resort to many makeshift expedients in order to do so.

Labour and Staff.—No change has been found necessary in the staff here during the year under review.

I desire to record my warm appreciation of the excellent way in which all the members of the staff responded to the claims upon their increased energy and attention necessitated by employment of the extra men.

Exchange of Plants.—This has been continued as usual, with gratifying results. I enclose a list of plants, Appendix A, and seeds, Appendix B, now available (some in considerable quantities) for distribution and exchange.

Government Domain.—The sum voted for the care of the Government Domain has been economically and usefully expended. Considerable improvements have been made in the way of drainage, &c. The tennis lawn has been levelled and top-dressed, and other useful work performed.

APPENDIX A.

BOTANIC GARDENS, BRISBANE.

List of Economic Plants, Shade Trees, &c., Available for Exchange.

Aberia caffra
Acacia Farnesiana
,, horrida
Agathis robusta
Agati grandiflora alba
Alphitonia excelsa
Anona cherimolia
,, reticulata
,, (sp.)
,, squamosa
Araucaria Bidwilli
,, Cunninghamii
,, excelsa
Artocarpus integrifolia
Barklya syringifolia
Bauhinia alba
,, Galpini
,, Hookeri
,, New Guinea
,, parviflora
,, purpurea
,, splendens
Bixa Orellana
Brassaia actinophylla
Cæsalpinia coriaria
Calodendron capense
Calycanthus floridus
,, præcox
Carica papaya
Carya olivæformis
Cassia fistula
,, pistaciæfolia
Castanospermum australe
Cinnamomum camphora
Cedrela odorata
,, Toona
Celtis sinensis
Ceratonia siliqua
Cercis siliquastrum
,, sinensis
Cherry—Trinity Bay
Citrus aurantium, var. nobilis
Coffea arabica
Cupressus Lawsoniana
,, pendula
,, sempervirens
Cyphomandra betacea
Cytisus ramossimus
Dais cotinifolia
Dillenia indica
Diospyros (sp.)
Duranta Ellisii
Duranta Plumieri
Elæocarpus grandis
Endiandra virens
Erythrina indica
,, insignis
,, ovalifolia
,, speciosa
Erythroxylon coca
Eugenia jambos
,, uniflora
Excæcaria sebifera
Ficus Benjaminea
,, bengalensis
,, aspera
,, carica
,, Cunninghamii
,, gracilipes
,, macrophylla
,, nitida
,, Pinkiana
Flacourtia cataphracta
Genista Attleyana
Gleditschia orientalis
,, triacanthos
Gouania domingensis
Grape Vines (24 varieties)
Grevillea robusta
Hæmatoxylon campeachianum
Harpephyllum caffrum
Harpullia pendula
Hibiscus arboreus violaceus
,, syriacus
,, tiliaceus
Hura crepitans
Hymenosporum flavum
Ilex paraguayensis
Jacaranda mimosafolia
Japanese Wineberry
Jatropha curcas
Juglans (sp.)
Juniperus bermudiana
Kydia calycina

APPENDIX A—*continued.*

Lagerstrœmia Archeriana
,, Flos-Reginæ
Leucanea glauca
Maba natalensis
Macadamia ternifolia
Mammea americana
Mango Giant
,, Daintree River
,, and other varieties
Melia japonica
Mimusops Elengi
Morus alba
,, nigra
Myrospermum Pereiræ
Nephelium Litchi
New Guinea Plants
Olives
Oxyanthus natalensis
Palms, various
Passiflora edulis
,, laurifolia
,, quadrangularis
Persea carolinensis
Phœnix dactylifera
Photinia japonica
,, serrulata
Pimenta communis
Pinus halapensis
Pistacia atlantica
Plumeria acuminata
Podocarpus elata
Poinciana regia
Populus alba
,, dilitata
Psidium Cattleyanum
,, guayava
,, pyriferum
Ptychosperma elegans
Punica granatum
,, dulcis
Quercus pedunculata
,, virens
Rhaphiolepis ovata
Rhus (sp.)
Schinus molle
Schotia latifolia
Sechium edule
Shrubs and Creepers, various
Sideroxylon Pohlmannianum
Stenocarpus sinuatus
Sterculia acerifolia
Tabernæmontana coronaria
,, dichotoma
Tapioca, sweet
Terminalia Arjuna
Thea assamica
Thuya aurea
,, Biotia
,, Lobbii
Vanilla cuttings
Cuttings of plants in great variety

APPENDIX B.

List of Seeds Available for Exchange.

Acacia Farnesiana
Albizzia odoratissima
Andropogon sericeus
Antigonon leptopus
Araucaria Bidwilli
,, Cunninghamii
Aristolochia elegans
Bacularia monostachya
Barklya syringifolia
Bauhinia alba
,, Hookeri
,, purpurea
Benincasia cerifera
Bixa orellana
Brunfelsia latifolia
Buckinghamia celsissima
Cassia mimosoides
,, pistaciæfolia
Castanospermum australe
Cinnamomum camphora
Cocos plumosa
Coffea arabica
Cupania (sp.)
Datura cornigera
Diplothemium maritimum
Dombeya mollis
Dracæna draco
Duranta Plumierii
Eucalyptus Baileyana
,, corymbosa
,, corynocalyx
,, crebra
,, fibrosa
,, hæmastoma
Eucalyptus leucoxylon
,, maculata
,, melanophlia
,, microcorys
,, obliqua
,, pilularis
,, piperita
,, Planchoniana
,, resinifera
,, rostrata
,, saligna
,, tereticornis
,, trachyphloia
Euphoria longana
Excæcaria sebifera
Ficus Benjaminea
,, Cunninghamii
,, macrophylla
Gleditschia triacanthos
Grevillea robusta
Hæmatoxylon campeachianum
Hibiscus tiliaceus
Jatropha curcas
Juniperus bermudiana
Lafœnsia punicæfolia
Lagerstrœmia Flos-Reginæ
,, indica
Livistona australis
Macadamia ternifolia
Medicago lupulina
Melilotus leucantha
Myrospermum Pereiræ
Ochna atro-purpurea
Onobrychis sativa

APPENDIX B—*continued.*

Oreodoxa regia
Panax elegans
Panicum crus galli
" maximum
" teneriffæ
Phaseolus caracalla
Pimenta communis
Poinciana regia
Pseudosuga Douglassi
Quercus (sp.)
Rhaphiolepis indica
Ricinus communis
Sabal Blackburniana
Schotia latifolia
" speciosa
Stenocarpus sinuatus
Sterculia acerifolia
Taxodium distichum
Tecoma stans
Tectona grandis
Terminalia Arjuna
Thuja pendula
Trachycarpus excelsa
Trifolium Pratense
Tristania (sp.)
Vicia sativa

I have, &c.,
PHILIP MACMAHON, Curator.

TRAVELLING DAIRY ANNUAL REPORT.

SIR,—Herewith I have the honour to submit to you the Annual Report of my work and teachings for the year ending 30th May, 1895, and the results likely to accrue therefrom. My work for the past year was similar to that of previous years—viz., disseminating a practical knowledge of dairying, the manufacture of butter and cheese on the latest and most approved methods, the selection of most suitable breeds of cattle for dairy purposes, system of milking and feeding, buildings to suit the climate, and matters appertaining to dairying generally.

I gave instructions on the preparation of butter intended for export, and made several experiments in the use of bacteria for the ripening of cream—a process which has occupied the attention of butter-makers in Denmark and other important centres of dairying. The results of the experiments were forwarded to your office, whence it was made known all over the colony through the medium of the Press. I addressed public meetings at nearly every place visited, and explained, to the best of my ability, all matters which were likely to interest those engaged in the industry. My efforts in this respect have been much appreciated, and I feel satisfied that many of my suggestions will materially assist in the development of the industry.

During my leave of absence at the end of last December I paid a visit to New South Wales and Victoria, and devoted most of the time at my command to visiting factories, refrigerating chambers, and some of the best dairies in either colony. I also made strict inquiries relative to the export of butter, cheese, pork, and poultry, in order to give the farmers of Queensland the benefit of the knowledge I obtained on my return.

During the past twelve months seventeen places have been visited; 17,539 gallons of milk were treated; 10,599 gallons gave a return of 11,106½ lb. of green cheese, and 6,940 gallons yielded 2,459 lb. of butter. In all 274 pupils were instructed.

At each place visited, the operations of the Dairy were watched with the deepest interest, and a great many who were prejudiced against any departure from the old ideas were convinced of their errors, and have since adopted a more skilful method of manufacture.

Others who had very little knowledge of dairying are now in a position to place on the market a saleable article.

At many places the list of pupils enrolled for instruction contained more names than the number fixed by your Department—viz., fifteen at each course, consequently applications were forwarded for an extension of time, and were granted in all cases where considered expedient.

It is to be regretted that, owing to the limited time at each place, a thorough knowledge of dairying in all its branches cannot be imparted, and nearly every district visited is anxious for another course of instruction, as the ten days is not sufficient to give pupils more than a partial education.

If the Dairy were stationed at one place where pupils could be taught scientific dairying, it would prove extremely beneficial. At present I am unable to teach thoroughly the bacteria process of treating cream or sterilising of milk, owing to the short stay at each place, and the unsuitability of many of the buildings wherein operations are carried on.

Many young men are anxious to attend the Dairy instructions for a period of six months, but the expenses of travelling will not permit of their doing so. If the Dairy were placed on a fair-sized farm it would afford a better opportunity for those desirous of obtaining a thorough grounding in everything connected with dairy work.

Progress made during the Last Twelve Months.—It must be apparent to many the rapid strides made by the industry during the past year. Wherever milk is procurable in any quantity you will find either a factory or creamery established, especially on the Darling Downs—a district admirably adapted for dairying. The farmers and large land-owners are every day realising the importance of the industry, and the large proportions it bids fair to assume at no distant date.

The majority of farmers find that it will not pay to follow the old system of dairying—*i.e.*, milking inferior cattle, making no provision for winter feed, and carrying on individual dairying. They are now giving attention to the selection and feeding of their dairy herds, and providing fodder for a time of need.

They also, with a few exceptions, favour the factory system. That there are exceptions I am sorry to say, but I am confident that within the next twelve months individual dairying to any extent will have become a thing of the past. As a proof of the growth of the industry during the past twelve months, we have now twenty-three cheese and butter factories and twenty-seven creameries in the Southern portion of the colony, as against sixteen factories and thirteen creameries previously, an increase of seven factories and fourteen creameries. There are others, but of less importance than those enumerated.

A few of the factories, however, are not turning out an article fit for export; but when it is found that the produce of such places will not bear inspection, the only course left open is to improve on the method of manufacture.

I am afraid that only those using refrigerating appliances will be able to compete with those factories equipped with such improvements, particularly with regard to butter-making; and I would advise those who are not in a position to obtain machinery for freezing to convert their milk, during the summer months, into cheese.

A more perfect system of dairying is required. Although our progress has been marked, we are still far away from a perfect system of dairying, and until we bring the average yield per cow up to about 4 lb. of butter weekly, dairying will not be as profitable as otherwise it would be.

To enable us to arrive at the above results, we must breed for quality and feed for quantity. We must regulate our herds so as to always have a number of cows in milk, and make ample provision for their keep.

A bad cow requires the same amount of labour in milking, and, as a rule, more food than a good one. We cannot neglect such important matters and compete with the southern colonies, where their system is more complete. The winter is now upon us, and before it is over we shall probably be compelled to import butter to supply our own demands.

The following figures show the amount and value of the importations of butter and cheese for 1893:—Quantity of butter for 1893, 271,106 lb., valued at £11,456; and cheese, 366,031 lb., valued at £8,069. For 1894, 221,724 lb. of butter, valued at £9,485; and 65,720 lb. of cheese, valued at £1,543. These figures are encouraging, and show that there is a considerable falling off in our importations, particularly in cheese.

During my travels I have been observant as regards the advantages of the districts visited, and found that in most instances they were favourable for successful dairying.

Many, however, of the more favoured districts have neglected the natural advantages, and have done nothing in the way of dairying. The only dairyman from whom I succeeded in procuring reliable figures was Mr. C. W. Campbell, of Westbrook, Darling Downs.

Mr. Campbell has of late years devoted a great deal of attention to dairying, and by judicious management has found it to be very remunerative. The whole is under the management of Mr. David Mallison and his wife, to whom Mr. Campbell attributes much of his success. A record is kept of the number of cows milked, and the weekly returns. The figures for the last six months show that he has milked on an average forty-five cows daily, for a return of 4¼ lb. of butter per cow weekly, and expects to still further increase the yield by a thorough system of milking. Under the present system, the cows are fed during the winter months only. The cows during the winter nights are housed in a building 72 feet long by 30 feet wide. A passage runs through the centre of the building, on each side of which are two rows of stalls, each 4 feet 6 inches in width. The cows are allowed to run in the paddock during the day.

Why I particularise this instance is that I could not find another dairyman who keeps a similar record.

Export Trade.—At your request I visited Brisbane on the 16th January for the purpose of classifying butter intended for export to London, under the provisions of "*The Meat and Dairy Encouragement Act of* 1893." I regret to state that owing to the various grades contained in the lot prepared for inspection, I felt justified in not passing it. The same day, at the request of Mr. Robinson, I visited the Lowood Valley factory, and gave the manager instructions in the preparation and packing of butter for export.

The first week in February I again visited Brisbane to classify and brand butter from the above factory, some of which I was compelled to reject, but I passed 195 boxes, weighing 4 tons 17 cwt.

The greater part of two days was spent in examining and branding the lot. The delay was due to the want of knowledge in placing each day's butter where it could be conveniently branded without opening every case.

Since then I am exceedingly gratified to learn that the result of the shipment was highly satisfactory, especially as the experiment was made under adverse circumstances. The butter left Brisbane per

"Banffshire" on 3rd February, and reached London about 17th May, the voyage thus taking about 104 days, or considerably more than twice the time occupied in the trip from Victoria.

Another consignment was sent in the "Nairnshire," which left Brisbane ten days later than the "Banffshire," and arrived in London ten days earlier than the latter vessel.

Both shipments arrived in excellent condition. The cost of shipping in each case was 1d. per lb. gross weight.

A lot of inferior butter (unbranded) was sent by both these ships, which, if sold as Queensland butter, must have a damaging effect on our export trade.

There were many difficulties to contend against. The weather at the time the buttter was manufactured was most unfavourable. The temperature of the refrigerating chamber was allowed to vary too much. Again, the removal of the butter from the freezing room to Eagle Farm, a distance of nine miles, exposed to a temperature of about 90 degrees. This high temperature would have a tendency to impair the quality of the article considerably. The timber from which the boxes are made, too, should be well seasoned. Under these circumstances I think Queenslanders have every reason to feel proud of the result of the experiment.

I am confident that the exportation of butter from this colony can be successfully accomplished, and if reasonable care be exercised we can look for a like result in the exportation of cheese. This should give confidence to those engaged in the industry, for I believe we have no need to fear that the London market will be overdone. Some of the countries hitherto contributing largely to that market have fallen off to a considerable extent, while others have reached the limit of their output.

Suggestions.—The success of a factory in a great measure depends on the milk producers, and unless every care is taken with the milk before it reaches the factory it is impossible with the most skilful manipulation to produce a first-class article. All factory managers should insist on having the milk properly cooled and aerated on the farm, which would minimise the risk of turning out an inferior article. Artificial coolers, at a trifling cost, can be obtained which answers the purpose admirably. Another important matter, which does not receive the amount of attention it deserves, is the milking of unhealthy cows. It is by no means uncommon to see cows in the milking yard suffering from cancer, tuberculosis, and other disgusting diseases, which must seriously menace the health of consumers. In my opinion every dairy should be registered, and a strict supervision kept over all cows milked, in order that the health of those who consume the product might to some extent be protected.

Our dairying industry is only in its initial stage, and to make it a thorough success we cannot afford to leave a stone unturned in establishing an export trade.

The Meat and Dairy Encouragement Act is a step in the right direction, but the provisions under which the butter is shipped are not, in my opinion, sufficiently stringent, and only necessitate the article being first-class and properly packed; this alone will not warrant its being landed in good condition.

No doubt the butter may be in good order when passed by the inspector, but there are other considerations—unseasoned timber may have been used in the boxes, and the leaving of the butter exposed to a high temperature after being branded, or during transit to port, and fluctuations of temperature during the voyage home.

Now that we are competing in the world's market, to do so successfully we must keep the article up to the standard there, and if possible surpass our rival competitors. Every precaution must be taken against blending with inferior butter or exporting anything but the best, otherwise we shall destroy a name which it may take years to regain.

The dairyman must be prepared for a reduction in the prices hitherto ruling. I know the margin of profit left him at present is not great, but the difficulty can be overcome by his increasing the production of milk from the same number of cows. The present supply could easily be doubled by breeding for quality and feeding for quantity. Above all, the calf must be done away with.

I would advise some of our factory-owners to combine the manufacture of cheese with that of butter, and convert the milk into cheese at such seasons of the year when butter is cheap, thereby equalising the market.

Unless cheese is properly got up, and manufactured under the combined Canadian and Cheddar system, there is no use of our attempting to export.

I am also of the opinion that there is a great future for the farmers of Queensland in the pig and poultry business; and now that we have a market opened up for the above products we should be in a position to move along in the path of prosperity. There is an old saying that the darkest hour is just before daylight, and I think we have seen the darkest.

That our export trade should be a success it is of vital importance that refrigerating cars be provided to bring the produce to market, otherwise the high temperature would impair the quality of the article considerably. If refrigerating cars were run on our railways, say, twice a week, it should meet the situation, and leave no grounds for producers to complain. The additional expense incurred would not be great, as the cars could be charged with ice in Brisbane, and kept cool for a return journey of about 250 miles.

In conclusion, I may state that the services of the Dairy were much appreciated at every place visited.

Much knowledge has been disseminated from pamphlets issued by yourself, Professor Shelton, and other officials from the Agricultural Department, and at nearly every place I have been the people expressed their gratitude for the courtesy extended from your Department in rendering them all the information possible in matters appertaining to agriculture, &c.

I have also to acknowledge with thanks the courtesy and assistance I have received from the hands of the various committees organised 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 14th MAY 1894, to 6th MAY, 1895.

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 required to make a pound of Butter.	Gallons of Milk made into Cheese.	Pounds of Cheese made.	Gallons of Milk required to make a pound of Cheese.	Gallons of Milk the Cream of which was returned.
	1894.								
Crow's Nest	14 May to 25 May	727	252	105	2·40	475	573	0·82	
Emu Creek	4 June to 14 June	1,084	605	245	2·46	479	574½	0·83	
Cabarlah	22 June to 5 July	986½	468	187	2·50	518½	542	0·95	
Gowrie Junction	13 July to 9 Aug.	1,879	1,257½	456	2·75	449	461½	0·97	172½
Gowrie Little Plain ...	29 Aug. to 8 Sept.	480½	303½	100	3·03	177	194½	0·91	
Ramsay	18 Sept. to 28 Sept.	1,458	1,179	395	2·98	249	249	1·00	30
South Toolburra	9 Oct. to 19 Oct.	641½	308	95	3·24	333½	340	0·98	
Darkey Flat	26 Oct. to 6 Nov.	1,058	399	144	2·77	659	655	1·00	
Greenmount	15 Nov. to 27 Nov.	4,167½	224	88½	2·53	3,943½	4,201½	0·93	
Chinchilla	5 Dec. to 15 Dec. 1895. 8 Jan. to 18 Jan.	1,287	290½	80½	3·60	996½	905	1·10	
Jondowaie	7 Feb. to 16 Feb.	999½	235½	70	3·36	764	726	1·05	
Industrial Group (Warra)	27 Feb. to 9 Mar.	416½	99½	30	3·31	317	318	0·99	
Warra	15 Mar. to 26 Mar.	426	195	77	2·53	231	242½	0·95	
Mitchell	4 April to 17 April	423½	211½	96	2·20	212	218	0·97	
Roma	25 April to 6 May	475½	194	67	2·89	251½	281	0·89	30
Total	...	16,510	6,222	2,236	2·78	10,055½	10,481½	0·95	232½

REPORT OF OVERSEER, STATE NURSERY, MACKAY.

Sir,—In submitting my Annual Report of the State Nursery here, I have the honour to state that generally the trees and plants growing in the grounds have increased rapidly in growth and size during the last year. Considerable interest has been exhibited by the public, and much inquiry has been made regarding horticultural and agricultural pursuits. Catalogues have been brought by farmers seeking information as to whether such and such seeds or plants would succeed in this district, and I am perfectly satisfied that the instruction given will be the means of saving a considerable deal of disappointment. One school committee at least has considered it desirable that the children should on Arbor Day have some instruction given them in grafting, budding, inarching, layering the selection, and making of cuttings, the different kinds of trees that can be budded or grafted, and those that can only be increased by inarching, &c. I had intended to give a lesson on the initial principles of botany, but circumstances prevented me; but when there is so much written and said about the necessity of experiment stations carried on by scientific men, I think that men who have to handle, grow, and analyse members of the vegetable kingdom should have botanical knowledge, so therefore a few lessons given to the children in the State and other schools would be advantageous, especially in sugar districts, where the industry is to derive such benefit from scientific knowledge and labour.

Everything else agricultural or horticultural pales before the rage for sugar here, and to keep up with the demand all attention has been given to it for some time past, and the new ground (6½ acres) will greatly assist in supplying the demand for new sorts of cane. It has been asserted that the public have taken little interest in the New Guinea canes, as they do not know, for want of analyses, what they are worth; but this can hardly be said to be correct, for the reason that from the 30th of January to the 16th May 118 farmers have applied for and have been supplied with "sets," and the New Guinea sorts have been in the greater demand. The appearance to the eye is satisfactory as regards the probable growth, and the non-scientific process of chewing a piece has satisfied a good many people that these canes contain sugar. The whole of these canes will not be analysed until they are ripe, and if there be one or more good ones among them then there will not be much reason to grumble.

Mahoavu is a very strong-growing cane, sub-ventricose between the joints, a dark, dull plum colour, very heavy; a grand farmer's cane if it will do for the mill. Had I not been careful in distribution, it would all have disappeared in a few days.

Chenoma.—A dull green, tinted with dull purple, a much thinner cane than the last, but very long and a great stooler; will grow a heavy crop.

Oiva has somewhat the appearance of Rose Bamboo, but with less of the rose tint in it. The growth is doubtful.

Arabora.—A purple cane with a distinct ring under the joint of white; a heavy solid cane, but not hard; grows a great crop.

Batoe is like Arabora, but thicker and of the same colour. The glaucous ring is spread downwards nearly to the next node. Mahoavu, Arabora, and Batoe are the three that have been looked upon with most favour by the farmers; they are canes that will give a large return with little handling.

KIKERIA is of a beautiful deep orange colour, with bright purple stripes, the orange and purple being about equal in width; thick and heavy, but of doubtful growth.

OORAYA, a dull indistinct purple, growing a great length, and having twenty canes on a stool.

IDUARI, resembling Striped Bamboo, but not such a strong grower. Ooraya and Iduari have not been fancied by the farmer, like the preceding sorts, on account of their being thinner, with consequently more canes to cut and handle, but no doubt the weight of cane produced upon the same area of land will be equal to any of the others.

OIVA and KIKERIA were later in starting after planting, and as the eight sorts are growing in eight rows the others got ahead of them, and overgrowing them they did not have an equal chance. It is probable had either been grown away from the other canes they would have done equally as well. Now that the ratoons are showing, Chenoma, Iduari, and Ooraya are far in advance of the others.

The two new ones, McLean and Akewa, planted at the end of January, are making great progress, and are, like all the rest of the New Guinea canes, great stoolers, some showing twenty-five canes from a single "set." When these "sets" arrived we picked out about the half of the sets contained in each sack, of which about two-thirds have grown, but out of the sackful that came from Honolulu only twenty showed signs of life, all of which were top plants. This result proves, I think, that only "top" plants should be imported from such long distances.

The signs of rust which appeared during the very wet weather disappeared very quickly when the weather dried up, and did no harm, Ooraya and Iduari being affected the most.

Bronchen Blauch and Bronchen Royee (two Duponts) will both be done away with, as no value is put upon them. Without these two there will remain nineteen sorts in the Nursery.

The fence across the road at the south-west corner of the Nursery has been erected, so that the outside ground is now safe from cattle, and will, if the weather permits, soon be all planted, chiefly with the New Guinea varieties, and Striped Bamboo, Rose Bamboo, Louzier, Meerah, and Kewensis, which are the kinds generally asked for by farmers. Kewensis has developed into a splendid cane, not so long as many others, but thick, exceedingly heavy, and producing a large number of canes to a stool. The crop coming on is in fine condition, and a good many tons will be ready for distribution by October.

To keep up the supply of cane from "plant cane," it would be necessary to plant as much during the coming season as has been done this; therefore, to prepare land for the purpose, I am clearing out all crops that do not appear to be much sought after at the present time. The Arnatto (*Bixa orellana*) has been grubbed up, a few young plants being retained close to the south fence; these had grown into trees 7 inches in diameter with 20 feet spread of branches. One row of the Tamarinds (*Tamarindus indica*) has also been cleared away; they had also become trees covering 20 feet, but with the land thus

made available there will not be as much land for use, including the new land, as there has been this year. By draining, a further area of about one acre could be added.

Rubber.—The two rubber plants are doing well, both the Para and Ceara. The latter will, I think, be safe from any frosts that may occur in July, as they are now 18 feet high.

Litchi (*Nephelium Litchi*) have grown well, and several of them bore fruit, but which was nearly all destroyed by the larva of some moth.

Oranges.—The Indian orange, Ladoo, turns out to be a mandarin of very fine quality. Mozambique belongs to the dulcis, and is a very good orange. Several fruits are now ripening. The Bahia still refuses to thrive, and is far behind the Indian ones in size.

Candle Nuts (*Aleurites moluccana*) are growing well, and some of them will probably flower during the coming summer.

Star Apple (*Chrysophyllum Cainito*) has grown a large tree, with a beautiful foliage, but has not flowered as yet.

Indian Mangoes (*Mangifera indica*) have made great progress, and several of them have borne fruit, which is very fine, far in advance of any of the seedlings grown in the neighbourhood.

Persimmons, Date Plums (*Diospyros Kaki*).—Varieties grow but slowly, but three of them have flowers; borne fruit this season.

Plums (*Prunus*).—Several varieties do well, and have borne fruit, and are likely to prove a great advantage to this neighbourhood. The English varieties show no sign of flowering, nor do the English peaches, Royal George, Noblesse, &c. The only prospect of improving the peach is by raising seedlings. All the seedlings the fruit of which I have seen are very inferior, but no doubt they are to be improved by persistent seedling raising.

Hog Plum (*Spondias dulcis*).—They have grown well, but have not yet fruited.

Coffee (*Coffea arabica*) makes fair progress, and the plants are bearing for the first time. The Liberian also grows well, but has not borne.

Tea (*Thea bohea*) have grown well, and bare abundance of seed.

Agaves (*Agava rigida*, var. *Sisalana*) have grown into large plants.

Fourcroya (*Furcræa gigantea*) have made large plants, but, unfortunately, the proposed fibre company fell through, so that these fibre plants are for the present not wanted. Whenever, however, they may be required their growth is certain.

Cassava (*Janipha Manihot*), Arrowroot (*Maranta arundinacea*), Turmeric (*Curcuma longa*), Ginger, West Indian (*Zingiber officinale*), &c., have all done well.

Hedge Plant.—The cutting up of large estates into small farms necessitates a large amount of fencing that was not before required. It is a considerable item in the expense of starting operations. The

posts are generally to be found on the land or near by, but the time is fast coming when they will have to be brought from a distance. Everyone is cutting down, and nobody planting timber, with the resultant annihilation of the timber. To meet the difficulty, hedge planting will have to be resorted to, for which purposes no plant in the colony is so thoroughly adapted as the common Lemon. If where fences are being erected, or along existing fences, a few seeds were dropped in at about 18 inches apart, a hedge would in about four years be obtained, that no man or beast could penetrate. There is a row growing here, not quite five years old, with stems 6 and 7 inches in diameter. Plants of course can be used instead of seeds. The raising of quick-thorn for hedges in the old country is a business, and a similar business could be made of raising lemons here. A lemon-hedge six or seven years old would require something in the way of a locomotive to punch through it.

Grapes.—All the sorts sufficiently established gave a large crop of fruit, but the incessant rain during the latter days of January brought on mildew, and between it and the quantity of water that fell the crop was nearly all destroyed, a state of affairs that was generally through the district. Where quantities were brought into town, half ripe, for Christmas, those were about all that were saved.

Improvements.—The erection of the much-needed office and seed-room combined has been a great benefit to me. My office duties have so increased that had it not been for this advantage I could not possibly have got the work done.

Engine Shed.—The engine and pump have been covered over with a substantial shed, and by increasing the length of the shed a few feet beyond the engine, I have managed to make a small room where the engine tender can sleep, a difficulty in this respect having been felt since he was employed, the town being the only place where lodgings can be procured, which necessitated a walk of over three miles, night and morning. The work is not quite finished, as we only work at the building when we cannot get on the ground, but all is covered in and dry.

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

Fruits.

Bahia Oranges
Jaffa Oranges
Indian Oranges—2 varieties, Ladoo and Mozambique
Japanese Oranges—Citrus trifoliata
Lemons—Citrus limonum
Lime—Citrus limetta
Persimmons—Diospyros Kaki, several varieties
Pineapples—Ananassa, 6 varieties
Grape Vines—Vitis vinifera, 30 varieties
Grape Vine—Vitis labrusca, 1 variety
Japanese Plums—Prunus, 11 named and several unnamed sorts
Leechee—Nephelium Litchi, 3 sorts, No Mai Chee, Varhak Yep, Hung Lee
Chinese Plum (an Apricot)—Hung Sum Lee
Plantains—Musa, 8 unnamed varieties
Indian Mangoes—Mangifera indica, 18 sorts:—Kistapal chotta, Khahaureeah, Kachehaee, Goa, Bangalore, Fuzree, Ferogabonnee, Bahandoorea, Kista palburra, Bengal No. 2, Arbuthnot, Gopal Bhog, Chuckheea, Alphonsa, Madam, Dalhugny, Langera, Madras

LIST OF FRUITS, ROOTS, GRAINS, AND PLANTS, ETC.—*continued.*

Star Apple—Chrysophyllum Cainito
Bael-tree —Ægle marmelos
Figs—Ficus carica, 3 varieties
Passion Fruit—Passiflora edulis, Granadilla-Passiflora quadrangularis
Papaw Apple—Carica Papaya, new variety
Puneala Plum—Flacourtia Catafracta
Monstera—Monstera deliciosa
Hog Plum—Spondias dulcis
Custard Apples—Anonareticulata
Sweet Sop—Anona squamosa
Brazilian Cherry—Eugenia (sp.)
Walnut—Juglans regia.

Plants of economic and commercial interest.

Para and Ceara Rubber
Arnatto—Bixa Orellana
Ramie—Bœhmeria nivea
Coffee—Coffea arabica
Coffee—Coffea Liberica
Coffee—Coffea maregopipe
Coffee—Coffea and 2 Hybrids
Tea—Thea bohea
Indigo—Indigofera tinctoria
Ceara—Manihot glaziovi
Dolichos—Dolichos lablab
Dolichos—Dolichos uniflora
Pigeon Pea—Cajanus indicus
Sun Hemp—Crotalaria juncea
Field Pea—Princess Sophy
Golden Amber Cane—Sorghum specs.
Sugar-cane—Saccharum officinarum, 18 sorts, New Guinea Mahoaovua, Chenona, Oiva, Arobora, Batoe, Ooraya Iduari, Akewa, McLean, Kikeria, Striped Bamboo, Rose Bamboo, Louzier, Nerha, Malabar, Kewensis, Rappoe; one unnamed from Yeppoon
Jute—Corchorus capsularis and Olitorius
Tea Oil Plant—Sesamum indicum
Teosinte
Arrowroot—Maranta arundinacea
Sisal Hemp—Agave sisalana
Candle-nut—Aleurites moluccana
Yams—Dioscorea, several sorts
Divi Divi—Cæsalpinia coriaria
Walnut—Juglans regia
Rain-tree—Pithecolobium saman
Sissoo—Dalbergia sissoo
DurantaPlumieri.

LISTS OF SEEDS AND PLANTS FOR DISTRIBUTION.

Bahia Oranges
Japanese Oranges
Indian Oranges
Ramie
Grape-vine Cuttings, 18 sorts
Seedling Mangoes
Tamarinds
Seedling Oranges, from five sorts
Seedling Mandarins
Sugar-canes, 18 sorts, first available in October
Indian Figs
Turmeric Rhizomes
Arrowroot Rhizomes.

Seeds.

Cajanus indicus
Corchorus capsularis and Olitorius—Jutes
Sesamum indicum—Teal Oil
Dolichos uniflora
Dolichos lablab
Teosinte
Arnatto.

D. BUCHANAN,
Overseer.

SEEDS, PLANTS, &C., DISTRIBUTED.

Number of Recipients	161
Quantity of Sugar-cane distributed	49 tons 15¼ cwt.
Number of Cuttings	3,218
Seeds (pints)	48½
Seeds (packets)	24
Fruits	89
Rhizomes	16
Nuts	12
Trees	979
Mangoes	225

Meteorological Report to the end of April, 1895.

—	Extreme Maximum.	Mean Average.	Extreme Minimum.	Mean Average.	Rainfall.
1894.					
May	81	76·4	42	54·28	6·92
June	80	72·20	39	47·11	5·49
July	74	68·18	38	41·18	1·11
August	82	76·12	37	47·27	0·73
September	84	79·27	42	50·9	2·12
October	92	83·11	58	62·10	1·19
November	95	86·18	60	64·9	7·40
December	89	83·22	60	64·30	10·73
1895.					
January	96	91·22	63	68·6	8·17
February	94	85·7	64	67·23	32·35
March	91	82·17	59	65·17	5·53
April	84	79·1	56	62·00	6·41
Mean average maximum for the year	...	81·2			
Mean average minimum for the year	...	...	...	58·10	
Rainfall for the year	...	...	...	...	91·37

ANNUAL REPORT OF OVERSEER, STATE NURSERY, KAMERUNGA.

Sir,—I have the honour to submit my Report of progress made at this Nursery during the past twelve months. The weather has, on the whole, been most favourable for the growth of tropical plants, 94½ inches of rain having fallen in 152 days of that period. This moist season has also been very favourable for the growth of weeds, and it has been very difficult to keep these pests from seeding.

New Guinea Sugar-cane.—During June and July, 1894, some 2,250 plants of this cane were distributed to nine planters in the Port Douglas, Cairns, and Herbert districts. The plants were packed in bags, and were apparently received in good condition, as no complaints were made. During January of the present year, 83,400 plants were distributed packed in cornsacks. In some instances these plants were received but in poor order. The canes were young and tender, and had been blown down by a severe gale. It is evident from this experience that cane plants should be cut during the winter months, when the eyes of the cane are not prominent, and the cane itself not so delicate. Canes in nursery should be planted so as to enable this to be done. By your directions the whole, or nearly the whole, of the variety known as Batoe was retained and planted in a field by itself. This cane will be available for distribution in September of the present year. There will probably be 20 tons for distribution. None of these New Guinea canes have exhibited any kind of disease. A slight rusting in one or two varieties was noticed, but this did not appear to hinder the growth in any way.

Naoe seems to be the worst cane of the collection. It is backward, and produces but few canes.

Arabora.—A purple cane, slightly contracted at the nodes. Shows no tomentum except a little on the basis of the leaves. It is a good ratooner.

Batoe.—Also a purple cane, considerably contracted at the nodes. It is a rapid grower, and would in the tropics probably yield its crop in ten or eleven months.

Oiva.—A yellowish-brown cane; seems a poor sort.

Iduari.—Purple and yellowish ribbon. This is a good cane for the farmer. Rapid grower and stools well.

Akewa.—This is a smallish cane, green when in the shade, but on exposure turning purple. It is a perfectly straight-growing cane.

Oraya.—Small purple cane. A poor, unpretentious variety.

Mahoaovu.—I regret none of this variety was retained at this Nursery. From its appearance in its own habitat it was deemed the best cane of the New Guinea collection.

All these canes doubtless will improve with cultivation. It seems a pity a complete collection of New Guinea canes cannot be obtained and planted in a special nursery. There are probably at least 100 varieties in British New Guinea, some of them doubtless of great value. The possible introduction of varieties of the cane-borer will, however, be a deterrent. Four varieties of sugar-cane from New South Wales have been received from S. MacNaughton, Clarence River. These have been cut and again planted. They were mostly of the bamboo variety—Bamboo Blush, Bamboo Ray, Bamboo Seedlings, and Lucia. All the bamboo varieties show signs of careful cultivation. The Lucia, however, is the strongest grower, but splits or cracks longitudinally very much when forming cane. It would, however, give a very large yield. The bamboos are all of a more refined character, and would probably pay well in saccharine matter. No disease has been observed in any of these canes. A quantity of plants will be available for distribution about December next.

It should be observed that no opportunity offers of obtaining analytical examination of the juice of canes at this Nursery, and consequently no authentic data can be given of the sugar-producing quantities of any variety. It would seem that a nursery devoted entirely to sugar-cane growing should be established whereon a chemist and laboratory with means of crushing might be established.

Coffee.—Field No. 3, section 2, has been devoted to the growth of this plant. It contains 1 acre, and the whole has been planted with Arabian variety. The trees are of different ages, planted as opportunity offered. The older bushes, now nearly four years old, are in full bearing. A tree at that age yields 11 lb. of coffee in pulp. A white man can pick 90 lb. of berries, working nine hours per diem. One pound of this coffee in pulp yields 9 oz. of berries in parchment. After drying and clearing of parchment and silver skin fit for market, it yields $2\frac{1}{2}$ oz. of pure coffee. This gives a yield of $1{,}806\frac{1}{4}$ lb. of coffee fit for market per acre. From four-year-old trees this is a large crop, and would be worth nearly £100. The disadvantages are these: A man can pick 90 lb. per diem of coffee in pulp, working nine hours per diem, but I fear he would not do so much throughout the season, as berries would get scarcer after the first picking, and perhaps the average would be down to 60 lb. throughout the season. For this 6s. 8d. would have to be paid. Sixty pounds of coffee in pulp produces $11\frac{1}{9}$ lb. of coffee fit for market, which, at 1s. per lb., would be worth 11s. $1\frac{1}{3}$d. This is the crop after four years of waiting. It is evident to me that wages could not be paid to labourers at the usual rate of

6s. 8d. per diem; but in cases where large families could be employed, coffee planting would certainly pay. Coffee apparently will grow and yield as well in North Queensland as in other tropical countries. During 1894 110 lb. of coffee seed was distributed to seventy-two individuals. This serves to show the desire of farmers to plant coffee. The distribution extended from Cape York to the locality of Brisbane. It should be noticed that coffee does not retain its vitality for more than about four months after gathering. It might be added that coffee should be planted at least 7 feet apart; 8 feet is not too far when the soil is very rich. One acre at 7 feet finds room for 889 plants; at 8 feet apart, 680 plants. One pound of coffee dried in pulp will give sufficient seeds for an acre at the latter distance. A few trees of Liberian variety planted at the same time with the Arabian do not show such progress; and six plants of the maregopipe variety received in July, 1893, from yourself have not yet borne fruit, and are backward as compared with the ordinary Arabian.

Bananas.—A considerable number of the varieties brought from British New Guinea and some of those obtained from Java have fruited. They are all very interesting from a botanical point of view, but none of them have the commercial value of the Cavendish variety, which is almost exclusively grown in this neighbourhood by Chinese farmers for export. Most of the sorts, with one exception, are tall growing, sparse fruiting varieties.

Barrego is a fairly good fruiter, and the fruit is pleasant to eat.

Mabudaun (No. 21) partakes more of the character of the Cavendish, in that it is somewhat dwarfed in habit with fairly large bunches of fruit. The fruit has not been tasted. Some of the varieties are positively useless, and do not take kindly to our soil or climate, bearing bunches with one dozen or so of fruit. Perhaps after careful treatment many of the sorts will improve. At present it would be folly to distribute these bananas to anyone for economic purposes.

Dacca variety has proved itself a shy bearer, and apart from its beauty as a plant is of little value in these parts.

Musa superba is also a fraud so far as fruiting is concerned, notwithstanding it is a very handsome plant and attains probably the greatest height of any of the *Musa* Family.

Moku.—Two only plants of this banana from the West Indies survived. These were planted in a bush-house, and are now throwing shoots, which will in time be planted outside. No attempt to throw fruit has been made by this variety. Growing in the bush-house, however, very handsome leaves have been displayed and greatly admired.

Musa textilis, received during the earlier part of the present year, have proved successful, so far as the safe introduction of that plant from Manilla goes. A considerable grove of this fibre plant is growing in Field No. 2, section 2, there being scarcely a miss. The plants came packed in cocoanut fibre, and soon developed vigorous life. The same vigour has not, however, been maintained; notwithstanding the plants look healthy at the present time, and from the number of shoots now showing there will soon be a quantity available for distribution. I should be glad to learn how this fibre is extracted, and receive the necessary plant for its manipulation. Specimens of fibre have been obtained and sent to you, extracted from our various wild bananas; but the extraction by hand is expensive and tedious.

Fibre Plants.—*Fourcroya gigantea* and *Agava rigida*, var. *Sisalana*, are both growing in Field No. 3, section 1.

Fourcroya gigantea is an excellent doer, and bears abundant large leaves full of what I believe to be a good fibre. Nothing could equal this plant for waste places. It will thrive on the poorest of soils. If machinery is brought to bear and the fibre utilised, it should prove a source of wealth to the colony, besides forming a source of labour for unemployed.

Agava rigida, var. *Sisalana*, has not the vitality of *Fourcroya gigantea*. There is a sharp, horny-like termination to the young leaves, and this spike is in the habit of damaging the unfolded leaves, making an incision crosswise in the epidermis of the older leaves, and eventually cutting them in two—thus spoiling the leaf, and doubtless injuring the plant. This is so very contrary to Nature's law, that it was some time before I could realise the truth. Perhaps others have noticed this very peculiar fact in Nature. It may be that disturbing its habitat has something to do with it, and I think very probably this peculiarity will be only maintained when the plant is in its earlier stages.

The leaves of the *Pineapple* make an excellent fibre; but machinery is required for its extraction in paying quantities.

Bœhmeria nivea has never done well in this Nursery. It grows, but sends up but few indifferent fibre stalks. Until some process of separating the beautiful fibre of this plant is discovered, it will be a useless appendage to this Nursery.

Abutilon peripocifolium has not, as was expected, become a pest. But the fibre plants *Urena lobata* and *Triumfetta pilosa* have overrun the country. These plants were not introduced from this Nursery, but at some time prior to its formation. They are called in the vernacular "Chinese Burr." It would appear, however, that these pests are both indigenous; at least, our Colonial Botanist does not say anything to the contrary in his Synopsis of the Queensland Flora. Fibre extraction is, however, apparently one of the industries that require very cheap labour.

Terminalia Catappa.—This handsome tree has developed well; but, notwithsanding it has flowered on several occasions, it has not yet fruited. For beauty and elegance, perhaps, this is the most suitable for tropical school gardens. It has, however, the disadvantage of being easily injured by high winds, but the shade it maintains is exquisite. It forms a favourite lounging-place for South Sea Islanders in their islands.

Artocarpus incisa (The True Breadfruit).—What plants survived among those received from Fiji have, during the last season, done remarkably well; and I am in hopes that during the next or following seasons fruit will appear. Very urgent inquiries have been made for this plant, but up to the present no distribution has been possible. It is, however, satisfactory to note that it has fruited in the Townsville Botanic Gardens, and an essay will be made to obtain some plants of this particular variety, as many varieties of *Artocarpus incisa* are worthless as fruit-producers. The missionaries of New Guinea have introduced into that possession varieties from other Pacific islands, their own variety being valueless.

CINNAMOMUM VERUM.—The Cinnamon tree does well with us. No essay has been made to collect the bark, but a trial has been made, which proved successful, of endeavouring to propagate the plant from cuttings. This may be done by taking half-ripened wood, and placing firmly in a nice composition of light soil under a bell glass.

ELÆIS GUINEENSIS.—Very satisfactory progress has been made by this palm. It seems to be in the fulness of health. One or two of the specimens have borne monecious flowers, but no fruit has yet ripened. I hope next year to chronicle its having fruited.

DIVI DIVI (*Cæsalpinia coriaria*).—This tree has flowered during the past year. At time of writing some of the plants are covered with pods giving promise of a supply of seed for distribution. The flowers are perfumed, and afford a happy resort for all kinds of honey-eating insects. I should think in about two months' time the ripe pods will be available for the public. Many inquiries have been made for seed of this valuable tannin plant, but up to the present no seed has been available for distribution.

SPONDIAS DULCIS.—This handsome tree matured its fruit for the first time this year. It is to be recommended as a jam-making fruit. The preserve is almost if not quite equal to apricot or strawberry. Unfortunately the fruit-fly seems to be very fond of it as a ground in which to lay its eggs, and on this account scarcely one fruit was allowed to ripen on the trees. However, if picked green, it is found that it will ripen packed in boxes of hay. There will, I think, be abundance of this fruit for distribution next year. The whole ripe fruit should be planted when plants are required. It is a deciduous tree.

KOLA ACUMINATA (The Kola Nut).—This tree has thriven very well indeed during the past twelve months. In some instances the specimens have attained a height of 9 feet. Fruit may be looked for next year. An endeavour has been made to propagate this wonderful tree from cuttings, and I am very glad to say it has been successful. Cuttings of half ripened wood under bell glasses have germinated. As this tree costs so much to introduce, this fact is of great value to would-be cultivators. A limited quantity of cuttings can be supplied to those persons who have glass frames or convenient bell glasses. In this connection a supply of hand glasses would be very useful at this Nursery, and should be supplied. I may mention that the Kola tree is very shy for the first three years, but now it has started to grow in earnest. The past favourable season has had no doubt much to do with it.

GARCINIA MANGOSTANA.—Very little growth is noticeable in these plants, but one plant in the open looks promising and well. The balance have been detained in the bush-house, but will be planted out in the coming wet season. So little is known of the habits of this, the king of fruits, that I have had to labour somewhat in the dark in its regard. As the plants are alive, and the one outside is equal in growth to those in the bush-house, I have great hope of ultimate success.

Vanilla.—Many plants of this spice have died; the rest are not looking so well as could be wished. I have thought the shade of Frangipani too dense, and have thinned the trees of the grove so as to let in more light. However, the plants planted in the Erythrina grove do not seem to be flourishing, so developments must be awaited.

Diospyros Kaki.—This tree fruited for the first time this year, bearing two fruit.

Oranges.—All the varieties of oranges, with the exception of the Mozambique, have developed bark-splitting, which results in the death of the tree. Some specimens of branches thus diseased were forwarded, by your request, to Mr. Tryon for examination, but he, it seems, could not determine the cause. The Jaffa oranges probably show this disease more acutely than any of the other varieties, although all the Maltese sorts are dead. The fruit of the Mozambique has been attacked by the fruit-fly, and nearly every one destroyed. It would be interesting to be able to supply the enemy of the fruit-fly to orchards in this locality, for all the gardens in this neighbourhood are more or less infested with the pest.

Bell Apple.—This climber, received from Fiji, has fruited this season. It is one of the *Passiflora*. As a plant it is very interesting. The flowers are beautiful, and also the fruit, but it lacks the qualities of the *Passiflora edulis* or *Passiflora quadrangularis*, when eaten. To form a screen for unsightly buildings nothing could be better. A few seeds will be available for distribution shortly.

Tamarind.—This tree has fruited for the first time this year. It is a most valuable addition to curries. The ripe pods should have their shells removed, the pulp soaked for two hours in boiling water, when the seeds and fibrous matter should be separated, and the residue placed in curry ten minutes before dishing. It is interesting to know that this tree will bear fruit in four years from the time the seeds are planted.

Paw-paw.—Indian and Honolulu varieties of this valuable fruit have been introduced. I question, however, if any variety will prove superior to our common sort. Some specimens of this plant were forwarded to you some time ago suffering from a disease, or being attacked by some insect which has not yet been determined, though no moving pests have been observed. Whatever it may be it certainly causes the ultimate death of the plant, as the rotting process, commencing at the termination, gradually eats down the stem, destroying it in its course. One specimen of this interesting plant bears its fruit in spadixes of three. This is one of the Queensland varieties, and grows over an old pigsty, where the soil is very rich. This should prove interesting to scientific men.

Carob (*Ceratonia siliqua*).—This tree has not yet borne fruit, although abundance of male flowers have appeared. It is probable that two plants received from Malta may be fertile, being grafted. They are very backward as compared with our own seedlings, which have attained a height of 18 feet, while those from Malta are not more than 5 feet. It is, however, problematical if in any case it will prove of value.

Pecan Nut (*Carya olivæformis*).—Nuts of this American fruit were received from you during the earlier part of this year, and have germinated fairly well. These plants will be planted out in Field No. 3, section 3, at present uncultivated.

Yams (*Dioscorea*).—A considerable number of varieties of this tuber are now growing in this Nursery. Perhaps the best is the Panna or potato yam. It is gratifying to have found out that from the seed of this variety better results are obtained than by planting this yam itself. The seeds appear like small apples on the vine, and are densely purple when cut. Planted as the yam itself they yield 12 lb. of a vegetable which many people aver is equal to English potatoes. It would appear also that yams planted from seed bear not only more abundantly in the ground, but also bear more seed or apple on their tops. The other varieties of yams need but little mention. It would appear that this vegetable (the staple food of the South Sea Islanders) is not appreciated in this country except by a very few. A lack of knowledge has a great deal to do with this.

Arrowroot (*Maranta arundinacea*).—Abundance of the true arrowroot is now available for distribution. As many varieties of plants, even sweet potatoes, are used to manufacture a flour called arrowroot, it is worthy of note that *Maranta arundinacea* may be obtained, and that it thrives very well indeed in this locality. As some misunderstanding has arisen as to the name of this plant, it may be observed that the true rendering of arrowroot is, according to Baron von Mueller, Aru Aru, the Brazilian name for flour.

Sweet Potatoes.—A considerable number of both tops and tubers of the Dalrymple Island variety have been distributed. Some persons report favourably of this sort. The British New Guinea yacht "Merrie England" often calls when in the Straits for a supply of this vegetable.

Yam Bean.—What you sent me in November proved indifferently fertile. Nearly all that came up were attacked by caterpillars, which succeeded in destroying most of them. Those that survived have not yet shown any signs of flowers.

Ginger.—The West Indian ginger received during September of last year grew fairly well, and doubtless there will be a quantity of rhizomes for distribution when they are unearthed. Ginger, however, does not do well in our light soil. Some roots of the common or Chinese variety have been unearthed, and an essay made to convert it into a preserve with moderate success. Evidently the rhizomes require early treatment for this purpose.

Permanent Improvements.—The roads dividing the Nursery into blocks of one acre each have been as far as possible formed, and a layer of stonebreaker refuse placed on the crown. In one instance when the rain-water was washing the roadside drain into holes, a roughly-paved drain has been formed, and between Field No. 3 of sections 2 and 3 a retaining-wall formed of stones removed from near the surface of Field No. 3, section 2, has been nearly completed. A culvert over the waterway at this point is in course of formation by Nursery labour.

The erection of a steam pump and boiler on the old railway reserve on the bank of the Barron River has been completed and connected with two large reservoir tanks in the Nursery grounds; total capacity 5,000 gallons. Reticulation pipes conveying the water to various parts of the Nursery enclosure have been laid down. The pump, with a capacity of 3,000 gallons per hour, works well, but owing to plentiful rain since the erection, has not up to the present been required. During the dry months of June, July, August, and September, however, it will prove a great boon and saving of labour, as up to the present water had to be hauled in the Nursery cart, wasting both time and labour, besides being inadequate to our requirements. A cottage with conveniences has been built for a caretaker near the pump on the Barron bank. The whole of the old railway reserve has been stumped ready for ploughing. Fencing material is on the ground for fencing in this portion of Government land, which has been attached to the Nursery. It will be possible at but little further expense to irrigate the whole of that area, which consists of about 3 acres of fairly level land. Another bush-house is in course of erection. I find that a bush-house covered with wire-netting forms a good roof when covered with Casurina branches fastened down by wire stretched over them. Other permanent improvements have been made by planting out trees along roadsides, consisting of mangoes, some Honolulu palms, and other economic and ornamental plants.

Manure.—Kainit (German potash salt), has been used with good result. It would appear to be, in a measure, an insecticide. Positive data regarding island guano and phosphates cannot be given, as no opportunity has occurred of gaining the requisite information, notwithstanding they have been used. It will, I think, be necessary to obtain in the future some refuse from meat works, to help to make our soil. In some cases cow-pea has been dug in for a nitrogenous manure; with what effect is not at present apparent.

Entomological.—Mr. Albert Kobele, of Honolulu, visited during the year, and gave some useful hints and receipts regarding his special science. I have found a large increase of slugs, which the natives call *Tocule*. These pests do a great deal of damage during the night, and I find it is almost impossible to grow temperate-zone vegetables on this account. A kind of *Epilacna* beetle quite destroyed a grove of *Hibiscus sabdariffa*, nothwithstanding the seed was planted so as to ripen during the winter months, when there is usually a dearth of these pests. Several collections have been forwarded to the Entomologist, the Rev. T. Blackburn, Adelaide, for examination, many of which have proved new to science. I find Quibble's compound, when well diluted, of great service as an insecticide. It is necessary to have some rat-proof seed-chambers, as these pests do great damage to seeds.

Requirements for 1895.—I would respectfully draw your attention to the fact that there is no seed-room into which rats and other vermin are unable to penetrate; and would suggest that a building be erected near this cottage to form a seed-chamber, office, and nucleus

of a museum, fitted and arranged accordingly; that a small library of works connected with botany and agriculture be added, to include the Dictionary of Gardening, edited by George Nicholson, A.L.S., the want of which has been very acutely felt.

A horse-power with shed, in which should be fixed coffee-pulper, corn-crusher, and winnowing machine, is also required.

Schedule A gives the weather report; Schedule B, plants received during the year.

I have, &c.,

EBENR. COWLEY,

Overseer, Kamerunga State Nursery

SCHEDULE A.

WEATHER REPORT.

Month.	Mean Maximum.	Mean Minimum.	Mean Temperature.	Rainfall.
1894.				
June	77·2	61·4	69·3	11·230
July	76·0	59·0	67·5	1·350
August	78·8	60·0	69·4	0·955
September	81·3	62·9	72·1	0·325
October	85·3	66·3	75·8	1·075
November	84·0	68·4	76·2	7·987
December	87·3	70·6	78·9	3·375
1895.				
January	89·9	72·5	81·2	9·965
February	86·7	72·8	79·7	24·615
March	83·4	70·2	76·8	13·815
April...	81·3	68·8	75·0	18·600
May	80·0	65·5	72·7	4·010

Mean Temperature for the twelve months ... ... 74·55 degrees

Total Rainfall for the twelve months ... ... 97·302 inches.

SCHEDULE B.

Seeds and Plants Received.

Month.	Seeds or Plants.	From whom received.	Results.
1894.			
August	Various Sugar-canes ...	Saml. McNaughton, N.S.W.	Good ; doing well.
September	West Indian Ginger ...	Under Secretary for Agriculture ...	Fairly well ; not unearthed.
October	Arenga saccharifera ...	Department of Agriculture, Brisbane ...	Have grown.
November	Yam Bean	Department of Agriculture, Brisbane ...	Nil, at present.
1895.			
January	Musa textilis	British Consulate, Manilla	Excellent growth so far.
March	Lahina Cane Plants ...	Honolulu, *viâ* Brisbane	Only six plants grew.
March	Pecan Nuts	Under Secretary, from America	Fair germination ; plants look well.
April	Khus Khus	Under Secretary, Brisbane	No germination at present.
April	Tobacco seed	Astrolob Mountains, B. New Guinea ...	Just above ground.

SCHEDULE C.

Seeds, Plants, &c., Distributed.

Number of Recipients	153
Quantity of Sugar-cane distributed	5,290 plants.
" " "	411 bags.
Coffee Seeds	133 lb.
Coffee Plants	142
Tobacco Seed	19 packets.
Other Seed	81 "
Roots, &c.	76 "
Fruit Trees	87

SCHEDULE D.

List of Plants, Cuttings, Tubers, and Seeds, available for Distribution at the Kamerunga State Nursery.

Plants.

Name.	Uses and Description.
Cumquat Orange	Small Orange; fruit for preserves.
Common Orange	Small tree; fruit.
N.G. Bananas	Twenty varieties.
Common Banana vars.	Dacca, Sugar, Cavendish, *superba*.
Citronella	Perfume grass.
Panicum maximum	Large grass for stock fodder.
Sugar-cane, N.G. varieties—	
Arabora, Batoe, Iduari, Chenoma, Oiva, Akewa, Oroya, McLean, Oiboku, Naoe	Sugar.
Sugar-cane from N.S. Wales—	
Bamboo Ray, Bamboo Blush, Bamboo Seedling, Lucia	Sugar.
Rappoe Cane from Thursday Island	Sugar.
Coffee Arabia	Beverage.
Musa textilis	Fibre.

Cuttings.

White Mulberry	Food for silkworms
Frangipani	Extraction of perfume.
Erythrina, red and white	Ornamental tree.
Duranta, blue	Hedge plant.
Japan Orange	" "
Bauhinia var.	Ornamental tree.
Cinnamomum verum	Spice.
Kola Nut	Beverage.
Sweet Potato	Vegetable.
Rubber Ficus	India-rubber.
Para Rubber	Rubber.
Grape	Fruit.

Tubers.

Yams—	
Trobriand, Panna, Fortuna, Ouvi, Cornucopiæ, Glomeratus	Vegetable.
Ginger	Preserve, spice.
Jamaica Underground Nut.	
Turmeric	Curry ingredient.

SCHEDULE D—*continued.*

Seeds.

Broom Millet	Broom-making.
Cow Pea	Fodder and green manure.
Kaffir Corn	Seed for poultry and fodder.
Tobacco—	
Fly River, Havannah, Astrolabe ...	Smoking.
Castor Oil	Medicinal.
Natal Red Grass	Grass fodder.
Guinea Grass	Fodder.
Texas Millet	Fodder.
Divi Divi	Tannin.
Cassia grandis	Ornamental.
Albizzia odoratissimus	Ornamental; few only.
Dalbergia sissoo	Timber and ornamental.
Bauhinia	Ornamental and fibre.
Dhall urber	Food.
Tamarindus indica	Fruit.
Anona cœur de bœuf	Fruit.
Coffee	Beverage.
Cotton	Manufacturing.
Teosinte	Fodder.
Vi	Fruit; seed later on.

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

DEPARTMENT OF AGRICULTURE, BRISBANE.

BULLETIN No. 5.

SECOND SERIES.

A HALF-CENTURY OF NOTES

FOR THE

GUIDANCE OF AMATEUR FRUIT-GROWERS.

TO WHICH IS APPENDED

A COMPREHENSIVE LIST OF THE FRUIT-BEARING PLANTS FROM TIME TO TIME INTRODUCED INTO QUEENSLAND.

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.

1895.

PREFATORY REMARKS.

THE present pamphlet has been prepared with a view of assisting amateur fruit-growers to a knowledge of that branch of horticulture. An alphabetical arrangement of the paragraphs has been adopted in order to facilitate reference. Only one or two of the many modes of performing the various operations are described, and those selected are of the simplest kind, and such as have been usually adopted by myself.

I am quite aware that no amount of lectures and books will complete the education of the fruit-grower; his art can only be acquired by practical experience. The few isolated notes which the present pamphlet contains may, I hope, prove useful to the amateur and beginner, but if further explanation or advice is needed, the applicant should call upon me, when it will gladly be given.

Persons using this publication should possess two others issued by the Department of Agriculture, viz.: "A Companion for the Queensland Student of Plant Life," and "Botany Abridged," in which are many hints to cultivators not here reproduced.

F. M. B.

April, 1895.

CONTENTS.

NOTES FOR THE GUIDANCE OF AMATEUR FRUIT-GROWERS.

No. 1.—ACCLIMATISING AND HYBRIDISING.

That the first is a misnomer all practical men acknowledge. By attention and management individual plants may have their constitutions so strengthened as to be enabled to endure more climatic hardships than the plants could stand if left to fight their own battles; but no change of a permanent character has taken place in the plants; left to themselves they perish. Look, for instance, at the plants which become naturalised. They come from countries with climates somewhat similar to our own, therefore one cannot be surprised that they spread. But where are the South African plants which spread with such rapidity over the Southern colonies? None are to be found amongst our weeds, except it may be those of almost cosmopolitan character; our climate is uncongenial to them. Yet under the fostering care of the cultivator these may be seen thriving when well looked after. Plants can only be changed by cross-breeding, or, as it is more generally termed, hybridising. This is a work in which all lovers of plants may take part, and therefore a few words in this little pamphlet are allowable. In performing this work the person must have an object in view. It may be to obtain a more hardy, robust plant, to give flavour to an insipid fruit, or the aim may be to obtain a fruit which would mature at an early or later period, and he will choose his plants for operating upon accordingly. It is taken for granted that he is conversant with the various parts of a flower. Thus all that need be said of the *modus operandi* is that the pollen has to be taken from the anthers of one plant and placed upon the stigma of another. To prevent the chance of the stigma having been impregnated previously, it will be necessary to select an unopened flower, which, if large, only remove the stamens (but if it is found that any of the anthers have burst, choose another flower, for probably some pollen therefrom has become attached to the stigma). After this, dust the pollen taken from what may be termed the male parent upon the stigma, and cover the flower operated upon with a small piece of muslin so as to exclude insects. To perform the operation upon the grape is very difficult, on account of the smallness of the buds, and it being necessary in this case to remove from the flower to be fertilised all the outer envelopes before there is the least sign of bursting, to prevent the chance of the stigma having already been impregnated. One of the objects for conducting these operations should be with a view to obtaining strong, healthy roots, that would endure the trying character of our climate. Work of this kind comes quite within the scope of the amateur. It requires a very large amount of patience, and disappointments will be many. Look around, and for encouragement see what has been achieved by others, the advantages of which we now enjoy. Man finds the crude material scattered all over the earth's face, and it is his duty and privilege to use the intellect with which he is endowed in fashioning it so that it may be of more and more use to himself and others.

No. 2.—BARK WOUNDS.

It not unfrequently happens that while working the ground amongst fruit trees with the plough, spade, hoe, or other implements, large portions of the stem-bark is either badly bruised or knocked off altogether. When such accidents happen, the injury should be attended to at once. If the bark is not wholly severed from the stem, replace it as neatly as possible; but in all cases make a mixture of, say, cowdung and soil, and of this place a thick plaster over the wounded part, and secure the same by strips of cloth. I should have considered this notice needless had I not observed how seldom any attention was paid to wounded trees in this colony, and the serious loss sustained by the neglect, not to mention the lopsided appearance of the trees when they ultimately do recover. If badly wounded in the pruning season, cut the opposite branches well back, so as to keep as far as possible a well-balanced head.

No. 3.—BLACKBERRY.

There are several good fruiting kinds of this fruit in the colony, which might be profitably grown. They bear well in most parts of Southern Queensland, and the fruit is large, showy, and well-flavoured. The plants continue producing fruit most of the summer, and are amongst the simplest to cultivate. They should be planted, when grown for the sake of the fruit, in rows, say, ten feet apart, the plants in the row, say, six feet asunder. It is best to trellis the rows to train the plants upon. Prune well in, so that the fruit may be easily gathered.

No. 4.—BUDDING OR INOCULATING.

This can only be performed when the sap is well up in the plant, that is to say, in full circulation, when the bark will be found to separate readily from the wood without injury to either. Choose the early morning or cloudy days for the work.

There are a number of ways in practice for performing the operation. One only, that known as the shield or T-budding, need be brought under notice.

The tree or plant to be operated upon is called the stock. Select as smooth and clear a place as possible to insert the bud, have your knife sharp, and the shoot from which the bud is to be taken, as well as the ties, handy, remembering that the more quickly the work is performed the better. First, make a short transverse cut through the bark to the wood, from the centre of this line make a longitudinal cut down the stem, these two will make a figure resembling the letter T. This down cut-line will require to be much longer than the cross-line, but the length will depend upon the size of the bud to be inserted. Next, the bud should be prepared. (Fig. 1.) Hold the shoot from which you intend to remove the bud with the left hand, and after selecting a sound plump bud, cut off the leaf, leaving about a quarter-of-an-inch of the leaf-stalk; then enter the knife about half-an-inch below the eye or bud and draw it gradually upwards and inwards under the bud, bringing

Fig 1.

Fig 2.

Fig.3.

it out in a similar way at a somewhat shorter distance above. A portion of wood will also be taken out, and this is generally removed by slightly bending back the bark above the eye, and with the thumb and point of knife nipping hold of the end of the piece of wood and quickly twitching it out. Care will have to be taken that in doing this the root as it were of the bud is not removed. If this has occurred the operator will observe a little hole immediately under the eye of the bud. This one, therefore, must be thrown away and another prepared. When a perfect bud has been prepared, loosen the bark at the point where the incisions made in the stock or plant to be operated upon meet (Fig. 2), that is to say, the top of the down cut of the T-shaped cuts, with the back of the blade or the bone handle of the budding-knife, and insert the bottom end of the prepared bud and gradually press it downwards beneath the bark of the stock, until the upper end of the inserted bud is nearly level with the horizontal cut, then take your knife and cut off the top of the bud at the cross-line in the stock. (Fig. 3.) The next thing to do is to bandage. Begin at the bottom and bind round moderately tight, drawing the bandage tightest immediately below and above the eye of the inserted bud. Where a number of buds are to be inserted, shoots of the tree or plant to be multiplied will have to be cut off and prepared; thus—choose healthy shoots with plump buds, cut off the leaves about a quarter of an inch up the leafstalk. When thus prepared, carry these bud-sticks in a tin of water or in a damp cloth to the place where the plants to be budded are growing; if this is not done the buds will often perish while the work is being performed. The best ties will be found narrow strips of calico, but sewing twine will answer the purpose very well. If the stocks are fast-growing plants, the buds will require looking over within about ten days' time, to loosen the bandages to prevent them cutting the trees. Peaches budded in December, if cut down, the buds will break and form, if attended to, for planting out the following winter. Slightly reduce the head of the stock at the time of budding, and further reduce as the bud grows out, and when this is strong enough cut the whole of the stock off just above the bud, or you might leave a few inches of the stock above the bud to tie the growing bud to for support. With several kinds of plants it is better not to remove the wood from the bud, but insert altogether; the shield should be then cut somewhat thinner. With roses it is safer not to remove the wood. This is also the case with vines, figs, mulberries, and even the orange. When the sap first begins to rise in the mulberry, buds from the previous year's wood may be used.

No. 5.—CANKER OR GUMMING.

Severe and careless pruning has often been known to bring on this trouble, but want of proper drainage is the main cause. Old trees more frequently suffer than young ones. If it is found to proceed from over-luxuriance, have recourse to root-pruning. Gumming is akin to canker, and brought about by the same causes, when spoken of in connection with trees. Canker, or gumming, which in common language we may look upon as synonymous terms, when applied to many other plants, is brought about by constitutional weakness, often to be accounted for by the plants having been grown upon the same ground year after year without change of seeds or sets.

No. 6.—CURRANTS.

In the cooler parts of our extensive colony, say, from about Stanthorpe to the border, there is reason to believe that spots may be found where these small delicious European fruits would thrive. They require a good rich loamy soil, rather heavy than otherwise. The usual mode of propagation is by cuttings, which should be twelve inches long, made from the lower ends of strong, well-ripened shoots, cut off close to the old wood. In planting, remove all the buds from that part of the cutting placed in the soil, which should be three parts of its length. Plant in a bed at about six inches asunder for the first year. When planting out for fruiting allow a space of about five or six feet between the plants. In pruning the bushes thin out the shoots so as to let plenty of air and light into the bush, and cut back the shoots left. The black currant requires a damper soil and more room than the red and white. Make your cuttings and do all planting soon after the fall of leaf.

No. 7.—CURRANT GRAPE.

Of this there are several kinds. The two which I remember to have succeeded best in South Australia were the one known as the "Zante Currant," and the other the "Cape Currant." The first of these is a vigorous grower, and requires plenty of room and long prunings; the plants should not be planted less than ten feet apart. The other makes but little wood and should be pruned pretty close; the bunches are smaller, but the berries are rather larger and more highly flavoured. The general mode of propagation and cultivation is the same as required by other vines.

No. 8.—CUSTARD APPLE.

In common language this includes the Cherimoyer, bullock's-heart, sour-sop, sweet-sop, &c., fruits of South America and the West Indies. They thrive well in the northern parts of the colony and also in a few localities in Southern Queensland. They are all fruits worthy of cultivation, and are propagated by seed and layers. They require a free rich soil and little pruning; in fact, only to have the long shoots shortened and those with a tendency to cross removed. These latter remarks apply equally to the date plums, or persimmons, and it may be further stated that with the rank-growing kinds of each of these fruits judicious root-pruning will throw them into bearing instead of wood-making.

No. 9.—CUTTINGS.

What the propagator understands by this name is a portion detached from a plant for the purpose of increasing or perpetuating a species or variety of plant, and is adopted in the propagation of kinds which cannot be depended upon coming true from seed, and those which thrive upon their own roots, as, for instance, the grape vine. Stocks for working apples and other kinds of fruit-trees upon are often raised from cuttings taken from both the branches and roots. Vine cuttings should be made from well-ripened, healthy wood of the last year's growth, should be cut to the length of about fifteen inches, with a bud at the base. Such cuttings may be planted in the vineyard where they are to remain, or in beds to be removed the following year to the vineyard. I would recommend the former mode.

In planting be careful that the soil comes in close contact with the base of the cutting, and as a rule plant so as to leave but one eye above the surface. These long cuttings are best in my opinion for vineyard planting. As some, however, prefer plants of the vine which have been raised from eyes—an excellent method if for pot culture—a word or so may be given about the operation. In this colony it might be well to use, say, an old brandy case for the purpose; bore holes in the bottom, put in a good drainage, say a quarter of the depth of the box, mix up a good rich compost of loam, leaf-mould, sand, and cowdung, and with this nearly fill up the box. Into this thrust the eyes with the wood downwards, and the bud or eye of course upwards. The eye being first prepared thus:—Cut the eye with about half-an-inch of wood above and below it. Some prefer to have three inches of wood below the eye and a quarter-of-an-inch above. Others cut close to the eye below and leave three inches above. In all cases only well-ripened, plump buds should be selected. The box should be placed in a bushhouse or in a sheltered situation, and watered with great care.

Form your cuttings as soon as possible after they are cut from the trees or vines, and if you are not ready to plant them at once in beds or where they are to stand, place them by the heel in the soil in some cool spot, but do not defer any longer than can be avoided. All this work has to be done between the fall of the leaf and the swelling of the buds for the spring growth.

Coco-nut fibre refuse, leaf mould, sand, and charcoal make the best compost for striking cuttings of all soft-wooded plants.

No. 10.—DOUBLE CROPPING.

That alluded to is the pernicious practice one so frequently meets with in Queensland plantations of cropping between the rows of fruit trees. This robs the trees of nourishment, air, and light, besides preventing that stirring up of the soil so beneficial to the roots. If you desire to grow fruit trees, give them a fair opportunity of rewarding you for the labour bestowed upon them. What is said here about fruit trees applies equally to plants of smaller growth, such as the pineapple, &c.

No. 11.—DOUBLE GRAFTING.

This is generally resorted to when it is desired to dwarf certain varieties of fruit, and the kinds wished to be grown are known not to thrive well upon the dwarfing stock when worked direct upon it. The object is achieved thus: Suppose a pear be the fruit which it is desirous to dwarf, and one of those known not to take kindly when worked direct upon the quince, which is generally used as a dwarfiing stock. You then first bud or graft a kind known to take freely to this stock, and when the worked plant has made sufficient growth you work upon it the kind first desired, and in this the union will be found perfect, as it will be pear upon pear, although the plant derives its nourishment through quince roots. The Beurré Diel is one generally recommended for grafting or budding upon the quince.

No. 12.—DYING OFF AND DYING BACK, CAUSE OF.

Melons and other soft-wooded plants may often be found to die in patches in a well-tilled and drained field during heavy rains occurring at the early stage of their growth, and it is at times hard to

make the cultivator believe that the death has been caused by stagnant water at the roots; he will tell you that the land does not hold water; but two or three days' rain during hot weather is as harmful to these tender plants as long-continued stagnant water at the roots of hard-wooded trees. The amateur cultivator often attributes the loss to the work of insects or fungus, when, if any such are found upon the dying plants, they are only carrying out their object in life, namely, making use of decaying vegetable matter, and were in no way connected with the first cause of the plant's decay.

When one sees the tops of his trees dying back, the roots should be examined, and the cause will in most cases prove to be stagnant water at the roots; and remember that this may and does occur in sandy land, for beneath the sandy loam is often a very poor retentive clay subsoil into which if the roots penetrate they are pretty sure to come to grief in wet seasons, at which times the roots absorb too much moisture, and that of an injurious character. Trees suffering in the manner just stated may be found to have sent down taproots into a subsoil unsuited to them, and not from stagnant water; then treat them as directed in root-pruning. Manure, mulch, and, if dry, water; prune away all the dead shoots and branches. After this the trees will likely send forth a numerous growth of shoots. These must be attended to and thinned out where they are not required or the trees will suffer from the overcrowding of the branchlets.

No. 13.—FALL OF MANGO FLOWERS AND THE YOUNG FIG FRUIT.

The falling off of the mango flowers is sometimes so great that persons at times begin to fancy that the crop is going to be a failure for that season, and attribute the cause to various things—if it happens to be dry, to the want of rain; if wet, to the abundance of rain. Were they, however, to examine the fallen flowers, they would find probably the majority of such to be male, this sex, by some unknown reason, having predominated in the panicles. A similar occurrence may be observed with mulberry flowers. Some trees will drop nearly all their flowers, the cause of which may be traced to the tree having produced a superabundance of male flowers, or that there has been a scarcity of this sex, and the female flowers were not fertilised; but the first proposition will be the most likely. Here it may not be inaptly mentioned that pear-trees, in countries where this tree thrives, frequently blossom profusely, but fail to perfect fruit. In such cases it has been found a good plan to, a few days before the blossoms open, thin out the buds with a pair of scissors, so as to leave only a few of the strongest buds near the centre of each cluster to open.

The premature falling of the fruit of the fig-tree has puzzled many, and the cause has been attributed to most unlikely things, one being the non-fertilisation of the female florets. The fig-tree might be said to bear two distinct crops each year; the first comes upon the last year's wood, and the second upon the new wood. Those produced upon the old wood are most apt to fall on account of the irregular sap-flow from fitful weather, so frequently experienced at the time, as well as the greater supply required at that period by the foliage. The attachment of the fruit to the tree differs in nowise from the leaf, and when anything occurs to interrupt the regular flow of the sap, the delicate nature of the articulation is sure to suffer, and the leaf or

fruit, more particularly the latter, must fall. In the second crop the fruit and leaves grow together at the same joints of the branch, and the season being more advanced, the circulation of the sap is more regular, and in localities or countries suitable for its cultivation, there is a continuous ripening of figs up to the time of the fall of the leaf.

Here would seem a convenient place to point out to the amateur a few fallacies regarding the fertilising or non-fertilising of the ovules. What is commonly known as the fruit is but the development of one or more parts of the ovary envelopes, and the aim of the cultivator at the present is directed towards the increase of these and the decrease of the seed, which is the true fruit, until this latter becomes nearly or quite obliterated, as may be seen in the increased number of so-called seedless fruits. That such forms produce their fruit in abundance one need but point to the currant grape and the date plum as instances. Some, I know, are found to express a belief that pollen exercises some mysterious power upon these sterile ovaries, but that it does would be hard to prove. Such a belief, however, in the present case is harmless. It is a very different thing with a project which has been set on foot for the introduction of an insect into Australia with the idea that it would, by working about in the interior of the fig, take the pollen from the male and deposit it upon the stigmas of the female florets, and that by their fertilization the figs would be prevented falling from the trees until maturity. It seems hard to believe in this magic power when one has studied a fig fruit. My views upon the subject are given above; however, I feel sure no fruit-grower in Queensland will be found hardy enough to advocate the introduction of more insect life of this description. Another fallacy is that fruits of the melon tribe are deteriorated by being fertilised by inferior kinds. For instance, they suppose that a fruit of the water-melon when fertilised by the pollen of a pie-melon is deteriorated in that individual, whereas the change can only take place in the next generation. It is from the great difficulty experienced in keeping these plants true and up to a standard of excellency that has made me advise the sowing of none but carefully-selected European seeds.

Oranges and similar trees are apt to throw off their young fruit if, when suffering from drought, a heavy watering be given to them. The water should have been given when the trees first showed signs of requiring it; but always water through a mulch.

No. 14.—FUNGUS AND INSECT BLIGHTS.

Even in a little pamphlet upon fruit trees, like the present, it becomes necessary to say a word or so about blights. The entomologist, from his knowledge of the life history of each insect, will be best able to state both the mode and time to deal with them with a view to keep them in check or eradicate them altogether, but it is a pretty general rule in Queensland to take little notice of these matters until too late, that is to say, when the crop is past hope. I do not pretend to offer a sure remedy for these maladies, but as a partial preventive, would advise the amateur to pay particular attention to having the heads of his trees well open so that light and air may get well amongst the branches, and to be careful to thin out the fruit. The first work, however, should be to drain well the land, and at the winter pruning to clear from the stem and branches all loose or dead bark, and wash them down with

some insecticide, such, for instance, as that known as Bordeaux Mixture, and from the bursting of the leaf-buds until near the maturing of the fruit syringe the fruit at short intervals with that or some other fungicide or insecticide. For clearing all sorts of trees from aphis, and similar pests, nothing is better than tobacco water. Use 2 oz. of strong tobacco to 1 gallon of boiling soapsuds; this is better than clear water. And bear in mind that neglected plants are more subject to disease than others, therefore study their requirements, and so far as possible keep them healthy. A gentleman has just informed me that the following he has found most efficacious in clearing trees of scale insects:—Boil together, say, 10 lb. of good unslacked lime and 5 lb. of sulphur to a paste-like consistency; reduce with water and strain so as to allow being applied to the trees with a syringe.

No. 15.—GOOSEBERRY.

This hardy European deciduous shrub might be grown with a fair share of success in and around Stanthorpe. The soil best adapted for these plants is a deep sandy loam. The usual mode of propagation is by cuttings, which should be made from good plump shoots of the previous summer's growth, cut off close to the old wood. These shoots, if long, cut down to about a foot in length. Like the currant cuttings they should be prepared and planted in a bed for the first year. When planting out for fruiting, allow a distance of five feet between the plants. In after pruning keep the bush well open by thining out superfluous shoots, and shorten all the long ones. Make your cuttings and do all the planting early in the winter.

No. 16.—GOOTEE.

This is a name sometimes used for that mode of propagation by which branches are induced to emit roots while an integral part of the tree. It bears the same relationship to the cutting as inarching does to grafting; and, like inarching, is by the propagator only practised in difficult cases. In the present mode of obtaining young plants, a shoot is selected for operation, say, not more than one and a-half foot from the end. The bark is then wounded. (I have generally formed one or more tongues, the same as for layering.) Around this a quantity of coco-nut fibre waste is secured, and this is surrounded by tempered clay, similar to grafting clay; this is better secured by a cloth, or the continual dropping of the water may cause it to fall. After this some vessel is to be secured above the bandage, to contain water, which from a leakage at the bottom a continual dropping of the water is allowed to fall upon the fibre-waste. This will induce the formation of rootlets from the tongues or wounded parts, into the fibre-waste; after a while, when it may be supposed rootlets have been emitted, it will be well to remove a ring, or almost a ring, of bark, say an inch wide, from the branch below the bandage. The whole of the work is troublesome and not worthy of consideration except by the plodding Chinese. Those who intend trying this mode of propagation would find the month of September the most suitable.

No. 17.—GRAFTING.

Few, if any of the various arts practised by the horticulturist, are of equal antiquity with that of grafting. Yet from quotations one now and again meets with their knowledge of the subject must

have been vague in the extreme. For we find Pliny credited with saying that a tree in the garden of Lucullus, was so grafted as to bear apples, almonds, figs, grapes, olives, pears, and plums—which would, we know, be quite impossible.

In order that a vital union may take place it is essential that the two parts employed should have a natural affinity to each other, either as varieties of the same species, species of the same genus, or genera of the same natural order. This latter is not always a success, for while we find Photinias work freely and thrive upon the quince, the pear has never been known to take upon plums or cherries. Uncongenial stocks are at times used, but when this is done the graft is made below the surface of the soil and reliance placed upon the scion emitting roots which become the ultimate roots of the plant.

Like other horticultural operations there are many modes of grafting, but directions for performing two or three will be sufficient to notice. That generally known as whip or tongue grafting is the one most generally practised. The plant to be grafted is called the stock, and the piece to be placed thereon is the scion. The head of the young tree or branch to be grafted should be cut off just above a bud if possible, as this sometimes prevents the old wood from dying back; then cut off the side of the stock a slice about two inches long in a sloping direction, then make an oblique cut into the stock in a downward direction at about the centre from where the slice of bark and wood has been removed, this will form a tongue. (Fig. 4.) Next prepare the scion. This need not be more than about four inches long and a slice of the bark and wood should be taken off one side and a tongue formed by cutting in an upward direction. (Fig. 5.) Fit the tongue upon the scion into the tongue made upon the stock in such a manner that the inner barks of each—the scion and the stock—come in direct contact with each other. (Fig. 6.)

Fig. 4

Fig. 5.

Fig. 6

When the stock is larger than the scion, of course this contact can only take place on the one side of the stock. All now required is to bind the two together, and if the grafting has been done below the surface of the soil earth up pressing it with the hands close around the scion to about an inch of the top to exclude as far as possible the air. Should the graft have been made above the soil or on the branches of a tree, it will require to be at once covered with prepared clay or grafting wax.

Rind-grafting is perhaps the best for the amateur to attempt at first. It must be performed in spring, when the bark easily separates from the wood, and will be found the most suitable mode to adopt when large stocks or the large branches of a tree are to be grafted. The stock or branch is cut or sawn off straight across, then pare off all the roughness caused by the saw. Then cut a straight line through the bark from the crown down the stem Then prepare the graft or

scion as directed for whip-grafting, only without the tongues, and as at the thin base of the scion the bark will be seen to project beyond the wood, this should be cut off, or otherwise it may curl back when slipping in the scion. Having the scion now ready, with the back of the point of the knife ease the bark from the wood on either side of the longitudinal cut so as to insert the base of the prepared scion, which is to be slipped down between the bark and wood of the stock, until nothing is seen of the sloping side cut on the scion. (Fig. 7.) Then bandage and clay or wax as before directed. A four-inch scion will be quite long enough, and cover all except one bud with the clay.

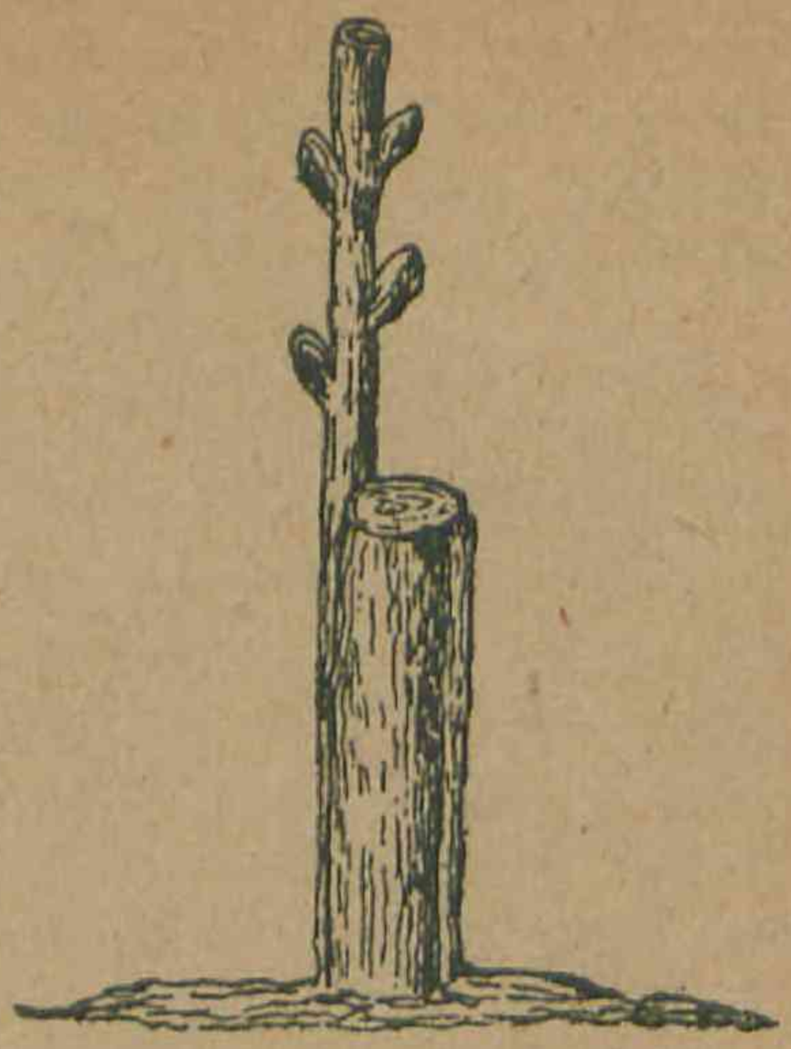

Fig. 7.

Side-grafting is employed for inserting scions without cutting off the head of the branch operated upon, and is of the greatest use for inserting fruiting spurs in such trees as pears and cherries, which may have been injured by ignorant or careless fruit-gatherers. The base of the scion or spur is prepared very much like that just described and slipped under the bark somewhat similar to budding, only instead of a solitary bud, a short fruiting spur is usually used. (Fig. 8.) After being bandaged, it is clayed as described for other grafts. It will be understood that, like rind-grafting, side-grafting can only be performed when the sap is rising; and it may be here remarked that the scions in all cases should be in a more backward state than the stock or tree to be grafted. Thus it is usual to cut them off the trees some time before they are to be used, and keep them buried in some cool spot until required. Our seasons vary so much that it would be unsafe to state even a particular month as the most suitable for grafting. If you have many it will be necessary to begin earlier; it should be done just when the sap is rising and the leaf buds are swelling in the stocks; this will be the best guide to go by.

Fig. 8.

Grafting clay is prepared by damping and working together about two parts of clay and one part of cowdung. Grafting-wax may be made, for using lukewarm, of three parts each of resin and beeswax and two parts of tallow; or these ingredients may be prepared of equal proportions by melting all together in an iron pot over the fire, and afterwards allowing the composition to cool.

No. 18.—GRANADILLA.

This is an old name for the passion flower, but now restricted to the larger kinds of passion fruits. They can only be recommended for planting in the tropics and the warmer parts of southern Queensland. Being rampant climbers, they require plenty of trellis room; at least a space of twenty feet should be allowed to each plant. There is no need, however, to allow them to run wild; attention should be paid to training, stopping, and removing laterals where too thick.

Some kinds show a tendency not to set their fruits, these will require hand fertilising. The operation is most simple, all that is needed being the removal of pollen from the anthers of the same or another flower, and placing it upon the stigmas. In case these parts may not be known by the amateur, it may be briefly stated that the anthers which contain the pollen dust are usually five in number, hang from the points of threads, and burst to let out the pollen on the side away from the centre of the flower. The stigmas are the knobs at the ends of the usually three branches of the spreading centre-piece of the flower. In the morning the pollen will usually be seen oozing from the anthers, this can be taken upon the finger-tip or a camel's-hair brush and placed upon the stigmas by a child.

No. 19.—GRAPE VINES.

For open planting, the rows should be about seven feet asunder, the plants in the rows say about five feet from each other. Cuttings serve the purpose equally as well as rooted plants. If the latter are used, plant deeper than recommended for most plants; cut off all bruised roots, and carefully spread out the others. Select the two best plump eyes nearest to the stem of the plant, and cut back to them. When these grow out a few feet nip out their growing points to prevent the formation of long rambling shoots. The following winter prune according to strength of plant. Never allow a vine to run wild; keep them well to the stock, or you will find all your best fruiting wood formed at too great a distance from the main stem to produce superior fruit. When the bunches are well shown, go carefully over the plants, stop the shoots, say, at the second or third joint above the last bunch; take out all thin, poor, worthless shoots even though they may be showing fruit, for such would never come to perfection, and would rob the better shoots. Encourage the growth of a strong shoot where such may be ultimately required; do not, however, allow this to extend far before stopping; remove all laterals below the fruit, and shorten all upper ones. Do not wait for your vines to show signs of blight, for then it may be found too late, but use the sulphur bellows and syringe with Bordeaux mixture early and frequently. Finally, do not plant vines if you are going to neglect them, or you will be a nuisance to your neighbours.

No. 20.—INARCHING.

This mode of propagation is sometimes called grafting by approach, but is only practised upon plants like the mango, which do not succeed well, or at all, under other methods. The spring time is best to perform the operation, or in this colony at any time when the sap is in full flow. If the plant to be increased is planted out, then the stocks will require to be in pots, so that they may be taken to the tree. These are then placed in position convenient for receiving a branchlet of the tree. Prepare thus—cut the side of the stock and the side of the branchlet and tongue, as directed for whip-grafting, fit together in a similar manner, then tie and clay as in other grafting, from which this differs only that the top of the stock and the scion, as the branchlet bent from the tree may be termed, are not severed at first from their respective plants. Be careful in fitting together the stock and branchlet so that the inner barks come fairly together. It will be found advisable in this mode of grafting to, after a time, begin

gradually to cut the branchlet from the tree to encourage it to depend upon the stock for support. Of course, if the desirable species is in a pot it can be taken to a planted out stock, and have one of its branchlets inarched upon the stock. The former mode is best, as a number of potted stocks could be taken to a desirable tree, and plunged around it to have branchlets inarched upon them, which, when taken, could be removed.

No. 21.—LAYERING.

This is one of the most natural modes of propagation and largely used in increasing plants which are not found to strike root readily from cuttings. The fruit-grower will find the method of use to multiply stocks for working, also a ready means of propagating choice or new kinds of grapes, which have been grafted upon strong stocks to force a growth of wood. Layer plants are not always the best for planting out permanently, for all plants do not thrive well upon their own roots; for instance, the orange seldom forms a strong, healthy tree from a layer; it, however, is quite the reverse with the fig, mulberry, olive, &c.

This method of increasing plants without at once separating from the parent is performed in various ways. For plants of a brittle character it will be found of service to give the branchlet of which it is intended to form the layer a twist between the thumb and finger to cause it to crack longitudinally at the part where the bend will occur beneath the soil, and where the tongue will be formed. In forming this latter, always cut from just below one of the upper buds of the branchlet as it lies in the soil, by so doing there will be less likelihood of the branchlet snapping off. Let the knife enter below the bud to about the centre of the branchlet, and then draw it upwards for the length of about an inch; this will form a tongue from which young roots will spring in due time. While tonguing, the branchlet must be held steadily in position by the left hand, then with the right hand place some light soil over the tongued part, press this down and place over it a portion of brick or rock, which will be found preferable to the usual peg. For blackberries, currants, and gooseberries, the best plants are formed by inserting the growing points of the shoots in a hole made by a dibber-stick.

In layering the long shoots of grape vines, the serpentine arching method will be found most advantageous. The shoot as it grows along the ground is layered in loops, whenever the shoot has made growth enough to form a loop.

When it is intended to layer a plant, the ground around should be well broken up, and, if convenient, a coating of compost, somewhat similar to what is usually employed for potting plants, added to the soil. When the layering is done, carefully mulch, and in dry weather keep the ground damp by watering, and you will be satisfied with the results.

No. 22.—MANGO.

This requires a good rich soil with a free subsoil, shoud always receive a good mulching, pruning just sufficient to prevent crossing and overcrowding of the shoots, and the removal of any sickly shoots which may show a tendency to gum or canker, watering only in very dry weather. Never plant where they would be shaded by other trees. Plant none but approved varieties. Do not trust to seedlings, or you

may more than likely meet with disappointment. The bug, and its attendant the black fungus, in nine cases out of ten show that the subsoil is injurious to the plant; if so, have recourse to root-pruning. Propagation by inarching and layering. Mr. Shaun informs me that he has successfully budded mangoes at Bowen. His mode is to nip the points out of the coloured sappy shoots when six or so inches long; this causes the development of the eyes in the lower part of the shoots. When these are nice and plump he uses them for budding young healthy stock, in the usual way by removing the wood from the bud. The operator requires to have a dexterous hand and a sharp knife, so that the work may be quickly performed without bruising either the bud or young stock. The plan seems feasible enough, and if as stated a success, is a very great improvement upon the usual inarching. Raise seedlings for stocks, if such be required.

No. 23.—MANURES.

Upon this subject a bulletin having been issued by the Agricultural Department little need be said in this pamphlet, except a word or so as to their application to fruit-bearing plants. When the fruit farm or garden is situated far from a township the owner should be careful to store up everything in the shape of manure for future use —the droppings of all the animals he may keep, soot, bones, all decaying vegetable matter, sweepings, ashes, and burnt earth.

The orchard would receive much benefit from being sown now and again with some leafy winter-growing plant—say, one of the vetches—to be dug or ploughed under at the end of winter for green manure. I have used turnips for this purpose in South Australia with great advantage to the trees. Care must be taken in turning such plants in that they are well buried, or they are likely to prove a nuisance.

To the vine, bones or bone-dust, charcoal and decomposed vegetable matter are good manures.

The apricot is apt to gum and canker at the roots if supplied with fresh, rank manure. So if this fruit be grown, supply the trees with well rotted manure, or a dressing of leaf-mould and a good mulch; but the manure from stables where the horses have been bedded with sawdust is not safe, therefore such manure as this should be used most sparingly.

No. 24.—MULCHING.

This is a very important and necessary work in a climate like Queensland. It is the process of applying various substances as covering for the soil above the roots of trees, in order to prevent evaporation, and so preserve a uniform degree of heat and moisture. It is also of particular value as supplying a top-dressing when rich manure is used for the purpose, as its nutritial properties are washed down to the roots by rain or artificial watering. All recently planted fruit trees should therefore, where possible, be mulched. In this case, the mulching need only cover a little more than the radius occupied by the roots beneath. But in old trees, if the whole cannot be mulched it need not be placed close to the stems, but should extend a distance outside the radius covered by the branches, for it is here that the feeding roots of the tree will be found.

No. 25.—ORANGE TRIBE.

Unless you intend going to an amount of trouble and expense quite beyond the value of probable return, never plant the orange and its allies upon any but land well drained or with a dry sweet subsoil, or immediately the roots come in contact with unaerified soil the tops of the branches die back. If, however, you are determined to have one or more of these trees in such unsuitable soil, cut through all the perpendicular roots with a sharp spade from time to time, and keep the soil well forked up around the tree up to the stem, to prevent the rootlets forming a mat-like mass, apply over this a good mulching of stable manure (not sawdust), and water well during dry weather. Our orange plantations have suffered from an ignorance of their needs. A "talkative gasbag" sees a tree grow in some favoured locality as it were in a state of nature, and without any inquiry or examination into the nature of the subsoil travels the country over, and at times displays his ignorance by writing to the papers giving the gratuitous information that upon no account should the ground be stirred about these trees. There are numbers of good practical men in the colony who will bear me out in saying that, in nine cases out of ten, these trees are benefited by the forking and manuring of the land about their roots, but the "gasbag" got his letter into the papers contradicting this, and therefore all practical men must go to the wall and the trees die. If the selection of site for the orangery be in your choice see and obtain a spot sheltered from strong winds, especially the westerly winds of our early summer months.

No. 26.—PAPAW.

This is one of the most useful of tropical fruits, but in the southern parts of Queensland has so far not been utilised to the extent it might have been. The fruit used in quite a green state is excellent cooked as a vegetable marrow, and when ripe it quite equals the rock melon. Besides which the milky sap in a dried state has a marketable value in Europe. The tree when in southern Queensland should be given rich soil and a sheltered situation. It is better to plant rather close, say six feet or so apart, which would allow thinning out the males at the first flowering of the young trees. In cleaning away weeds, great care must be taken not to injure the stems. It is said that in some of the South Sea Islands the natives have a belief that by nipping out the heads of young trees, such become female. At first this strikes one as a wild superstition; but why should there not be some truth in the statement? The papaw is related and somewhat similar with regard to sexes to the melon, and it is a common practice with gardeners to obtain old melon seed because the vital powers of such seed is impaired, and although will not produce such rank-growing plants, the plants from the old seed always show more early female blooms, thus an earlier and more abundant crop of fruit. Do we not also top the shoots of these plants for the same purpose? I may be met here with the statement that the sexes are both borne upon the same plant in the melon, while they are on separate trees in the papaw, which is scarcely a fact, for the so-called male papaw often, if not always, bears fruit at the end of the long loose panicles, and although I have never seen it, I can easily believe in there being male flowers upon the female plants. Will some one try the South Sea Islanders' plan?

No. 27.—PEACH.

Of this fruit there are two distinct races. What may be termed the Persian race is by far the most beautiful and possesses a most delightful fragrance and flavour, but it is useless to attempt to cultivate these on the coast side of the range. Here we must be content with the inferior kinds which may be called the Chinese race. Persons planting peach trees should bear this in mind, particularly if purchasing their trees from the southern colonies, or they may suffer loss and disappointment. Grow only early kinds, on a dry soil, with a sunny aspect, mulch, but give little other manuring, prune well back at the winter pruning, attend to directions given in paragraph on fungus and insect blights, and the loss of crop from the maggot will be reduced to a minimum.

No. 28.—PINEAPPLE.

The original home of this fruit is said to be the sandy sea-shore of South America. We may naturally suppose, therefore, that the principal requirements of such a plant are warmth, lime, salt, and moisture. And in some parts, taking advantage of this knowledge, growers have given crushed oyster-shells and leaf-mould as manure to their pines, and thereby improved the fruit. It is not my object here to praise or condemn the practices adopted by the growers of this fruit in the Brisbane district, but a few words may be given to the amateur. Choose, if possible, a site facing the east, the soil a sandy loam. If the subsoil is a retentive clay, have it well and thoroughly drained, for although the ill-effects from a want of properly aerifying the soil may not be so apparent during dry seasons, it will be rather too plain when we have a superabundance of rain. Plant singly in rows, say, not less than six or seven feet asunder—more if you can afford it—and the plants in the rows about four feet apart. The suckers should be from healthy stools. Remove a few of the lower leaves, and trim off any broken or bruised parts from the base and roots with a sharp knife, and then fix the sucker firmly in the soil. This being done, it would be advantageous to the young plant to receive a mulching of well-rotted manure. The after culture should be to regulate the number of suckers; never allow the stools to become a thick mass, which can only produce small worthless fruits. It is not advisable to supply the plants with fresh rank manure. Let the manure be stacked and applied to them when it is decomposed.

No. 29.—PLANTING FRUIT-TREES.

This operation in Queensland should be done as early as possible, with diciduous trees say about the falling of the leaf, this is necessary on account of the so-called spring months being so frequently dry and windy; give a distance of quite 20 feet between each tree; bones may be placed under the trees, or bonedust mixed with the soil, but upon no account allow fresh rank manure to come in direct contact with the roots of trees in planting. Do not let the roots of a tree be exposed any longer than can be avoided between the time of digging it up and re-planting; they should not be allowed to become dry. By the drying and exposure of the roots at such a time many trees are nearly dead before planting.

The ground having been duly prepared for the reception of the trees, and a peg placed at the spot each tree is to occupy, let two perform the work of planting. The one with a spade will dig out a

hole just large enough to comfortably receive the roots, the other will place and hold the tree in position, and attend to spreading out the roots and distributing the soil with his hand as it falls from the spade of the other operator. Particular attention will require to be paid that the young tree is not planted too deeply; better err in planting too shallow than too deep. When the roots are covered, the earth over them should be gently trodden down, then fill in the rest of the soil about the tree, over which spread a coating of half-rotten manure for a mulch, after which, if the young plant be an evergreen, give a watering, but this is not required with deciduous trees. Before planting, each tree should be examined, and all roots which have been much bruised or broken in digging up, cut clean off with a sharp knife. The head will have also to be reduced to correspond with the roots. So far as possible choose mild, moist weather for all planting. Finally, do not plant more ground than you have properly prepared, and what you will be enabled to keep in order—bear in mind that a single acre well cultivated will return more than ten neglected ones, and that a neglected cultivation plat is a nuisance to all your neighbours.

No. 30.—PREPARATION OF LAND FOR FRUIT-TREES.

The whole area of the land to be planted must be drained (if it does not possess a natural drainage) and trenched either by spade or plough. If this work has to be performed with the spade, open a trench about two feet wide, one full spit and the shovelling deep, and remove the soil from it to where it is intended to finish the piece of work; then with a sharp pick break up the bottom of the trench as deep as possible and leave it rough, but if the land is very poor, and you have manure, mix some in with the soil broken up by the pick; then fill up with the first spit of the next two-feet wide slice of land, and so continue until the whole area has been turned over. Bones, sweepings, and rubbish of almost any kind, except it contains nut grass or other objectionable things, may with advantage be mixed into the lower spit to enrich it.

No. 31.—PRUNING.

Something has to be said under this heading, but it is quite impossible to give instructions on paper for performing this important work. In many of our gardens trees are left to their own free will to grow as they please, or they are lopped most unmercifully, after which treatment, if they do not die right out, they send up a vigorous growth which, receiving no attention, form mostly weak, barren wood. Where a person knows nothing about pruning, he should, for his own advantage, obtain instruction from one skilled in the art. The different kinds of fruit trees require different modes of pruning, and it is necessary to have a knowledge of the various varieties to prune with advantage. A few general hints may be given—namely, keep the trees dwarf, say, with a stem not over two feet high, remove all shoots which would have a tendency to prevent the formation of an even-balanced head, and all that would cause crowding, and by this means prevent the free admission of air and light; if this is attended to in the young tree, there never would be seen the fearful lopping which disfigures so many trees in Queensland plantations. The shortening back of shoots must, in all cases, be done with a knowledge of the style or habit of

the tree, its mode of bearing, and other things being taken into consideration. In the vine only wood enough should be left to bear the quantity of fruit of which the plant is considered able. In the orange the head should be kept open by removing when young a quantity of the small branches, and all those likely to cross, for these, if left to themselves for a few years, would chafe the other branches. By some it is considered that shortening back the shoots of figs prevent, in some measure, the falling of the first crop.

No. 32.—QUINCUNX.

This name is given to the form resulting from planting in rows with one plant opposite the centre of each vacancy between two plants in the row on each side of it, as in this diagram :—

It is most usually adopted in orchard planting as it allows working the land in so many different directions.

No. 33.—RASPBERRY.

Until some attention is paid to cross fertilisation it is not probable that this fruit will be successfully cultivated on the coast side of the Range; but Queensland is an extensive country, and in the cooler parts, say, the Stanthorpe district, the plant might thrive; and as there is a possibility that a Queensland amateur may take it into his head to grow this fruit, a few directions as to planting and pruning may be given.

The ground should be dug deep, and if not fairly rich liberally supplied with manure. Obtain good strong suckers, plant in groups of threes, four feet asunder in rows fully six feet apart. Cut one of the suckers down to within two or three inches of the ground, another to about two feet, and the other to, say, three feet. It would be better if possible to mulch. When the canes shoot they must be gone over and all superfluous shoots, if any, thinned out. After gathering the fruit the old bearing shoots must be cut clean away to make room for the young shoots for the next season's crop. Let all planting be done early in the winter.

No. 34.—REST.

The principal reason why so many of the deciduous plants from more regular climates succeed but poorly in Queensland can be accounted for in the continual excitement they are subjected to by the variability of our climate. Rest is as much a necessity to plant, as to animal life. It is not an absolute condition that the time in which a plant takes its rest should be in the cold or hot season, for we find the rest time of a number of bulbous plants to be during the hottest time of the year, only it must be dry; if damp, as in our climate, they are excited into growth, lose their rest, and often perish. Something similar happens to a number of deciduous plants. They lose their winter rest by a fall of rain exciting them into a growth which is nipped by following cold. Our climate does not afford the rest required by such plants, which is a cold wet winter and a hot dry summer. Fruit trees from such climes lose here the congenial spring weather so necessary for the development of both leaf and flower. Thus it is that one

seldom sees a fruit of the fragrant luscious Persian race of peach, and has to put up with the almost scentless and flavourless fruit of the China race. A few growers have done something towards raising superior varieties, but much remains still to accomplish before we can lay claim to have created a race of these fruits worthy of a name. The amateur may render good service in this direction by carrying on the work of cross-fertilisation, and I would advise that in all cases that the plant found to thrive in our climate be used as the female parent.

No. 35.—ROOT PRUNING

This is usually performed by digging a trench round the tree if of moderate size, say about 18 inches from the stem, about 18 inches deep, cutting through all the roots you meet with a sharp spade as well as thrusting the spade under the tree to cut, at the same depth, through all perpendicular or tap-roots. This will often check a luxuriant growth of wood and throw the tree into bearing fruit. The same treatment is often necessary to prevent the formation of tap-roots. If the land is poor it is well in filling in the trench to mix with the soil some well rotted manure. In all cases, however, it is well to mulch the tree after the operation. If desired the roots so cut off may be saved for grafting upon, or planting in beds for a growth of stocks. Apples, pears, plums, and many other stocks are obtained from root-cuttings, and when root-pruning trees, many of the roots cut off would answer the purpose. The cuttings of the roots should be about nine inches long, and should be planted in rows, say, two feet apart, in well prepared ground. Plant about six inches asunder in these rows, leaving only about one inch of the top end of the root-cutting above the surface, press the soil close to the roots, and don't allow them to be smothered with weeds.

No. 36.—SCIONS

The scion, or as it is often 'called, graft, is a portion of a branch removed from one plant with the object of being inserted or grafted upon another. In selecting these scions, always take portions of the branchlets having the knots or buds pretty close, and the wood round and plump. When cut from the trees the length might be about six inches to allow for shortening when being used. The base part of the one-year-old wood is best, but of apples, pears, plums, &c., it seems to be immaterial. With the peach I have found it best to have a portion of the two-year-old wood to cut into for making the splice. They should be cut off the trees after the leaves have fallen, and placed in a cool damp spot to prevent sprouting, for it is necessary when grafting, that the scion should be in a more backward state than the stock.

No. 37.—SEEDLINGS.

I am led to say a few words under this heading from an erroneous idea being in circulation, namely, that seedling fruit trees—that is to say unworked trees—are preferable to worked ones for planting. I can imagine nothing that would be more detrimental to the fruit-growing industry than that such a practice should be pursued. Besides the loss of time between the fruiting of the worked trees and that of the seedlings, we must bear in mind that there is no dependence to be placed in seedlings as to what the character of their fruit may be. It may prove superior, but in nine cases out of ten it will be found inferior to its parent. Again, the great variation sure

to occur in size, form, colouring, flavour, and time of ripening in an orchard of seedling trees would seriously inconvenience the owner, as he would have such a mixed sample to send to market. At present a cry has been started that the mango comes true from seed, which in a general sense is the reverse of fact. Seeds from a tree growing at a great distance from others may produce trees with fruits similar to the parent from which they sprang, but a variation amongst these will likely be observable. A large quantity of this fruit offered for sale in Brisbane is the produce of seedling trees, and I am sure no one will consider this skin, string, and bone is equal to the luscious fruit produced by the old named varieties, some of which were introduced by the Acclimatisation Society nearly twenty years ago. In planting fruit for profit, know what you are planting; and if you think proper to try experimenting for new kinds, set a piece of ground apart for the purpose.

No. 38.—SEED SOWING.

Writers point out what is doubtless a fact, that oily seeds, which readily decompose, are amongst the most perishable, while starchy seeds, which are less subject to change, are the most tenacious of life. A number of trees also require that their seeds should be sown or placed in soil directly they are removed from the fruit, for if allowed to dry there is but little chance of their germination. This is particularly the case with the mango, and in Australia it is almost as bad with the stones of cherry, plum, and some varieties of the peach. The mango should be planted singly, but pretty close together in boxes, but the other kinds mentioned, and all similar seeds, may be mixed with earth, and so kept until near the spring, when they should be planted in rows for working approved kinds upon. The mangos, when convenient, should be potted singly for inarching. With the orange tribe it is best to sow in beds directly taken out of the fruit, and if slightly shaded, and moderately watered, they will soon form nice plants for planting out into rows for working. It is of the greatest importance that seed should be good and sound, but of some kinds, so long as they will germinate, the older they are the better. And this is particularly the case with the melon, cucumber, and their allies. In the old seed their vegatative powers have become weaker with age, therefore the plants raised do not make so vigorous a growth, and such plants produce a greater abundance of early female flowers, therefore better crops of early fruit, a very great advantage to the grower.

No. 39.—SELECTION OF TREES.

Deal with some respectable nurseryman, and be sure that the trees are worked upon suitable and healthy stocks, and true to name. Visit if possible the nursery during the time the kind of fruit you wish to plant is in season, and select your varieties when you see how the tree is thriving, remembering, however, that some, which you may see doing but indifferently, may thrive better in the site which you intend planting, and *vice versâ*.

Be careful about planting much advertised fruits or trees offered for sale at auctions, much disappointment having accrued from this means of obtaining plants in the colony. In large plantations the loss and inconvenience incurred by fruit trees having been supplied ncorrect to name, shows how very important it is to deal with a thoroughly reliable nurseryman when purchasing your trees.

No. 40.—SHADING.

In shading young plants or trees planted out during warm weather never use old barrels, boxes, or tins. Use small or large boughs according to the size of the plant to be shaded, sticking the ends in the grounds a little distant from the plant, and drawing the tops together over its head. In shading seed beds use the same material, but not too thick. Boughs from small-leaved trees or shrubs answer for this purpose best.

No. 41.—SITE.

It frequently so happens that choice of site is not in the power of the planter, and such in all probability will be the case with most for whom this pamphlet has been prepared; for let me again reiterate the statement that all herein written is for the amateur and beginner, not the trained professional. Likely enough the piece of ground to be planted will be of the very worst description for the purpose, yet by care and constant attention to the requirements of the trees the owner may derive much pleasure and profit from the devotion of a piece of land which previously had been lying waste. First of all, however, he must pay particular attention to remedy any defects in the subsoil, having it well drained if it possesses no natural drainage, to prevent the lodgment of water, let in the air, and keep the ground sweet. If, however, the choice of site is in the power of the intending planter, see that the soil is suitable, more particularly with regard to subsoil. A gravelly subsoil is one of the best for fruit-trees generally speaking, as it furnishes a natural drainage, and saves the expense and labour of doing this artificially. And let it be remembered that no trees will remain healthy and produce good fruit with stagnant water at their roots. In selecting the site also take a good survey of the surrounding country to find out whether the situation is open to those cold, dry, cutting winds which are so prevalent in Queensland during the early months of summer. Consider, also, if at present sheltered, what effect the clearance of adjoining scrub or forest might have upon the site; also whether it is subject to flooding from backwater, or to a washing away of the soil by rushing water during long continued wet weather. Visit the land and judge for yourself before spending money and time upon a piece of land only capable of making and keeping you poor.

No. 42.—STAKING.

For some few plants, such as the grape vine for instance, for a few years at least it is necessary to stake. There is, however, but little excuse for their use in the fruit garden or orchard now that the trees are usually grown as dwarfs. If you prefer staking your trees, be careful not to allow them to chafe the bark off the stems of the trees in windy weather, which they are apt to do if not well looked after. You will also have to give a look from time to time at the ties, and loosen them to prevent the trees being cut; if this is neglected, gumming or canker often takes place.

No. 43.—STOCKS.

In the present instance this term is restricted to the plants upon which other allied kinds are worked by budding, grafting, &c. By this means a strong, vigorous, healthy root can be furnished to a plant naturally of delicate constitution. It is also frequently found

that while the soil of your garden may not be suitable for a plant which you much desire to grow, by working it upon another variety which the soil suits, your desire can be accomplished. Labour can be saved by working your tree upon those kinds which have not a tendency to throw up suckers. Who has not seen the endless trouble caused by the multitude of suckers which spring up around plum and cherry trees? all of which might have been saved by working upon non-suckering stocks. I would, therefore, recommend the use of the peach for plum, apricot, peach, and nectarine; mahaleb for the cherry (particularly if the land is of a chalky character). Pears should be worked upon pears in most instances; some kinds, however, do remarkably well upon free-growing quinces (*See* Double Grafting); the apple upon the Irish peach or other blight-proof kind.

No. 44.—STOPPING.

This is a term applied to the nipping off of the extremities of shoots. It causes the formation of laterals, and in melons and cucumbers is most useful in throwing the plants into bearing, and keeping the plants close and compact. This should be done with such plants when the runners have made about two feet of growth. The grape vines require stopping—first, just before the bursting of the flower buds, and afterwards to keep them within bounds.

No. 45.—STRAWBERRY.

Perhaps everyone knows how to grow this most delicious fruit; still a short notice may be given for the novice. If possible, choose for the purpose a site with an eastern aspect, a good loamy soil, and if your soil is not of such a description, make it up, if clayey, by the addition of sand, charcoal, sweepings, &c., and if sandy and therefore too loose, by the addition of a more clayey soil. The land should be trenched, and the first spit well manured. Plant in rows, say, about two feet apart, and let the plants in the rows be eighteen inches asunder; mulch with well-rotted manure, and if the weather be dry give a watering. During their growing season keep clear of weeds, and, if not required for future planting, trim off all the runners.

No. 46.—THINNING FRUIT.

If we were not aware of the fact, a glance at the bulk of fruit brought into the city of Brisbane for sale would at once show to the practical gardener or fruit-grower that little or no attention was being paid in Queensland to this most important operation. The exhaustion consequent upon the production of seed is a chief cause of the decay of plants. This explains why fruit trees are weakened or rendered temporarily unproductive, and some killed, by being allowed to ripen too large a crop of fruit, or to "over bear" themselves, as it is termed. It is to be sincerely hoped that amateurs, who one may often hear boasting of the breaking down of their trees from the weight of fruit, will bear this in mind. All who understand anything about the subject of fruit-growing consider that thinning is one of the most important of operations. It should be done with a bold and fearless hand, and the perfection of that which is left on the trees will amply reward the owner at the harvest time; and his reward will not only be in the superior fruit, for the trees being kept unweakened from over bearing

will be enabled to mature their wood, and deposit their store of sap to aid in the production of the following year's crop. Allow the air and light to get round each fruit, and less harbours will be found for the lodgment of insect life.

No. 47.—TRUNCHEONS.

This is a name applied to strong offsets obtained from the base of old tree stumps. In the propagation of the olive and a few other trees, these strong truncheons are of great service to the planter, as by their use many years are gained. They are obtained in the following manner:—An old tree is cut down to a stump of about a foot high, which is left in the ground. From this stump is usually sent up a number of shoots which start from the enlarged base of the stem at or just below the surface of the ground; these are allowed to grow for a few years, or until their stems attain a diameter of one or two inches, when they are cut off at about two or three feet from the ground, and and with an axe each is severed with a portion of the original stump at its base. These offsets are termed truncheons and are ready to be planted out permanently wherever a tree is required. A truncheon it will thus be seen comes intermediate between a cutting and a sucker, and, where plants allow of such division, is a most useful mode of propagation.

No. 48.—WATERING FRUIT TREES.

If your trees suffer much during a long spell of dry weather, and you have plenty of water handy and the leisure to apply it to the trees, do not give it to them in a half-hearted manner. Have them well mulched, if this has not already been done, and then give each tree which is suffering a good soaking. This may likely prove sufficient to carry on the tree until a change in the weather, if not, repeat the dose. This will be found much more beneficial to the trees than frequent light sprinklings. Never, if it can possibly be avoided, water without first mulching the trees. A forking up of the soil previous to the mulching and watering, or under the mulch, if already there, will also be found beneficial to the trees.

No. 49.—WEEDS.

This word may be said to have no definite application to any particular plant or species of plants; but whatever kinds spring up in cultivation plots that are injurious to the plants under cultivation come under the appellation. Destroy all such interlopers at the earliest possible convenience, and never upon any account allow them to seed, or the trouble will be multiplied. If they are bad—that is to say, got somewhat the upper hand of you—dig or fork them in, and thus they will be made to return to the soil a percentage more than they have taken from it. Of course, with such weeds as nut-grass this plan cannot be adopted. Every particle of this terrible pest should be forked out and burnt.

No. 50.—WORMS.

If these are abundant and therefore troublesome, it is recommended to water the soil with a weak solution of carbonate of ammonia. This will cause the worms to come to the surface in a nearly helpless state. Or water the soil with pretty strong lime-water. Wire-worms are in some seasons very destructive to seeds of

stone-fruit sown for rearing stocks. Probably if these were washed with some preparation before sowing, similar to the mode adopted with corn at times, to prevent its being eaten by vermin, it might have the effect of preventing the wire-worm's attack. For an account of Nematoid worms see "*A Companion for the Queensland Student of Plant Life.*"

LIST OF FRUIT-BEARING PLANTS.

In the following list is given both the local and systematic names of the greater part of the fruit-bearing plants which have been introduced into the colony. To each, also, is attached a note as to its value as a fruit, or the part of the colony in which it would be most suitable to plant it.

That such a list has been long wanted most will acknowledge when they think of the many plants which after years of care they have thrown away as useless. In the garden many of these plants are well enough, as they add to the variety; but the grower of fruit for sale must study to produce a marketable commodity, and this list will furnish the means of preventing many a mistake being made in the future. Little over one-half of the kinds enumerated are worthy of the fruit-grower's attention. (None of the Queensland indigenous fruits are included.)

AKEE-TREE (*Blighia sapida*). Tropical fruit of which there is little probability of a sale.

*ALLIGATOR APPLE (*Anona palustris*). This has been introduced as a fruit tree, but it would not be wise to plant it, except for ornamental purposes, as the fruit has the reputation of being poisonous.

ALLIGATOR, OR AVOCADO, PEAR (*Persea gratissima*). It is useless to try cultivating this fruit out of the tropics. Fruit not likely to find a ready sale.

ALMOND (*Prunus Amygdalus*). This fruit might be cultivated about Stanthorpe, but is not likely to crop well on the coast side of the Range. The dry winds during the time of flowering is against it.

AMATUNGULA, OR NATAL, PLUM (*Carissa grandiflora*). Not likely to become a marketable fruit. The same may be said of other species of this genus which have been introduced and distributed in Queensland.

AMLA (*Phyllanthus emblica*). It is not likely that the fruit would sell.

ANCHOVY PEAR (*Grias cauliflora*). Tropical fruit not likely to prove saleable.

APPLE (*Pyrus Malus*). A few kinds, especially some raised by the late Mr. A. J. Hockings, crop pretty well on the coast side of the Range. But from Warwick to the border is the place for this fruit.

APRICOT (*Prunus Armeniaca*). This has not proved a success below the Range, but from Warwick to the border it will likely do well. Varieties of this fruit should be obtained from Japan and China for the coast lands, and then we might succeed in finding a variety that would bear, but we probably never shall while we persist in introducing them from America and Europe.

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* For more detailed account of this and some other fruits noticed in this list see my sketch of the Economic Plants of Queensland, published 1888.

AVERRHOA CARAMBOLA ("Tamara-tonga" of the Malays). No market is likely to be found for this fruit.

AYER-AYER (*Lansium domesticum*). Tropical fruit not likely to find a market.

BAEL TREE (*Ægle Marmelos*). Not a fruit likely to pay for growing.

BANANA (*Musa sapientum* and others). We have excellent kinds, all required is better cultivation.

BARBADOES CHERRY (*Malpighia glabra*). Not a fruit likely to find favour with the public.

BARBADOES GOOSEBERRY (*Pereskia aculeata*). Unworthy as a fruit; similar to the prickly pear.

BAOBAB (*Adansonia digitata*). Not worth cultivating as a fruit.

BERBERRY (*Berberis vulgaris*). The common form of this plant may be seen in many of our gardens. But when planted for the sake of its fruit the seedless variety should be chosen (*B. vulgaris*, var. *asperma*). From this we are told that the confectioners of Rome make their *Comfiture d'Epine vinette*. It is propagated by layers, cuttings, and suckers. Some say that if suckers are used such plants bear seeded fruits, which, I, however, have never found to be the case; they may at times bear seeded berries, just as we find to be the case with the currant grape and many other seedless fruits. I see no reason why this fruit should not be grown for profit. This variety does not attain a great size, therefore, might be planted in rows, say, eight feet apart, and allowing, say, six feet between the plants. Will grow on the coast land, but would thrive better, say, from Warwick to the border. Give poor land, and prune only to keep the bushes open, and shorten straggling long shoots.

BLACKBERRY (*Rubus, sps.*). Varieties of several species of this genus are cultivated for their fruits, which they produce excellent in quality and in great abundance.

BLIMBING (*Averrhoa Bilimbi*). Not likely to become a marketable fruit.

BRAZILIAN CHERRY (*Eugenia uniflora*). A pretty fruit, and the flavour admired by some, but scarcely worthy of culture for the fruit market.

BRAZIL NUT (*Bertholletia excelsa*). If planted, it should be to the north of Brisbane.

BREAD FRUIT (*Artocarpus incisa*). Plant only within the tropics.

BREAD NUT (*Brosimum Alicastrum*). Should only be planted within the tropics.

BRINGALS (*Solanum Melongena*). This is also known as "Eggfruit," "Begoons," and "Aubergines." The plant thrives and produces plenty of its fruit under little or no culture, but hitherto there has been little demand for the fruit.

BULLOCK'S HEART (*Anona reticulata*). A tropical fruit which bears fairly well about Brisbane, but not as yet in great demand.

CAFFRE CHESTNUTS, OR AFRICAN ALMOND (*Brabeium stellulifolium*). The seeds of this plant are roasted and eaten like chestnuts. The plant would not be worth planting for the purpose of selling the seeds.

CALABASH TREE (*Crescentiā cujete*). An ornamental tree, but useless as a fruit for the market.

Cannon-ball Tree (*Couroupita guianensis*). The pulp of the fruit edible, but not worth growing for its fruit.

Cape Chestnut (*Calodendron capense*). Not worth planting for its fruit.

Cape Gooseberry (*Physalis peruviana*). Give an eastern aspect and poor land, and there is no reason why this plant should not be planted for profit.

Carob (*Ceratonia siliqua*). Not worth cultivating in Queensland where such excellent indigenous and exotic fodders thrive.

Cashew Nut (*Anacardium occidentale*). Plant north of Brisbane.

Chalta (*Dillenia indica*). The fleshy calyxes of this plant are used for fruit, but are not a marketable commodity.

Cherimoyer, or Jamaica Apple (*Anona cherimolia*). *See* paragraph on "Custard Apple."

Cherry (*Prunus cerasus*). From Stanthorpe to the border is the place for this fruit.

Cherry Plum (*Prunus cerasifera*). Bears but poorly except over the Range.

Chestnut, Sweet (*Castanea sativa*). If this plant is to be grown, introduce good kinds. The plant has borne in several localities.

China Pear (*Pyrus sinensis*). Fruits well below the Range; but although used for cooking, this fruit is so wanting in flavour that it is scarcely worthy of a place in the orchard.

Chocho or Chayota (*Sechium edule*). A plant generally grown and most useful, but finds little sale.

Citron (*Citrus medica*). *See* paragraph on "Orange Tribe."

Coco Nut (*Cocos nucifera*). Will only thrive on the tropical coast.

Coco Plum (*Chrysobalanus Icaco*). Should only be grown in the tropics, and the fruit is not one likely to be in demand.

Cornus capitata (or *Benthamia fragifera*). Unworthy of growth for its fruit.

Cucumber (*Cucumis sativus*). Largely grown, the early crop often paying well for shipping to Sydney and Melbourne.

Currant (*Ribes rubrum*, Red; *R. rubrum*, var. *album*, White; *R. nigrum*, Black). *See* paragraph upon these fruits.

Currant Grape (*Vitis vinifera*, a seedless variety). *See* paragraph on these fruits.

Custard, or Sugar, Apple (*Anona*, a common name for several species). *See* paragraph on the subject.

Damson Plum, or Satin-leaf (*Chrysophyllun olivæforme*). A worthless fruit, but has been planted for such.

Date Palm (*Phœnix dactylifera*). Seedlings are more likely to prove bad than good. Import suckers from female plants of good varieties.

Date Plum, or Persimmon (*Diospyros Kaki*). Many excellent kinds obtainable from the nurseries.

Durian (*Durio zibethinus*). Only will grow in the humid tropics; scarcely likely to pay.

Earth-nut, or Pea-nut (*Arachis hypogæa*). This crops well, and should pay for cultivation from its many uses. It is only placed in this list from being sold as nuts for eating raw or roasted.

Elderberry (*Sambucus nigra*). Not worthy of culture.

Fig (*Ficus carica*). Plant good kinds, which thrive in this climate.

FILBERT (*Corylus Avellana*, var.). Plant at Stanthorpe, and from there to the border.

GOOSEBERRY (*Ribes Grossularia*). *See* paragraph upon this plant.

GRANADILLA (*Passiflora quadrangularis*). *See* paragraph upon these plants.

GRAPE (*Vitis vinifera* and other species). *See* paragraph upon these plants.

GREWIA ASIATICA. This Indian shrub is grown there for the sake of its fruit, but would not sell in Queensland.

GUAVA (*Psidium Guava* and other species). Will grow in all the warmer parts of Queensland, but not much sale for fruit.

HAZEL NUT (*Corylus Avellana*). Plant from Stanthorpe to the border.

HEDGE LEMON (*Citrus trifoliata*). Only useful in this colony in some localities, where it might be used either as a hedge plant or stock for its allies.

HOG PLUM (*Spondias dulcis*). Not worthy of a place in the orchard.

HOVENIA DULCIS. Sometimes called Chinese Raisin, but unworthy as a fruit.

JACKFRUIT (*Artocarpus integrifolia*). Will bear abundant crops of large (at present) unsaleable fruit.

JAVA ALMOND (*Canarium commune*). Not worthy of planting as a fruit.

JUJUBE (*Zizyphus jujuba*). A pleasant-flavoured fruit, but scarcely a saleable one.

KEI APPLE (*Aberia caffra*). A good hedge plant, not worth planting for fruit.

KUMQUAT (*Citrus japonica*). *See* paragraph on "Orange Tribe." The oval variety is an excellent one for preserving.

LEMON (*Citrus medica*, v. *Limonium*). *See* paragraph on "Orange Tribe."

LENG OR LING (*Trapa bicornis*). Not worth planting. No sale for it.

LIME (*Citrus medica*, var. *Limetta*). *See* paragraph on "Orange Tribe."

LITCHI (*Nephelium Litchi*). Might pay for cultivating in the tropics. Grows pretty well about Brisbane.

LONGAN (*Nephelium Longana*). Not worth planting.

LOQUAT (*Photinia japonica*). Thrives pretty well in some parts of Southern Queensland.

LUTEO (*Baccaurea sapida*). Tropical. Scarcely a payable fruit.

MABOLO (*Diospyros discolor*). The fruit showy, but not equal to the date plum.

MAHALEB (*Prunus Mahaleb*). Useful for stocks to work cherries upon.

MANGO (*Mangifera indica*). *See* paragraph upon this fruit.

MANGOSTEEN (*Garcinia Mangostana*). Will only have a chance in some of the humid gullies of tropical Queensland.

MEDLAR (*Pyrus germanica*). Will not pay, but might be grown in the Stanthorpe district.

MELON, THE SWEET OR ROCK (*Cucumis Melo*). Must have new ground to grow good-flavoured fruit, and the seed should be obtained from Europe.

Monstera Deliciosa (Ceriman of America). This curious fruit is not worthy of culture by the fruit-grower, but the plant being handsome in appearance might fill a gap in the private garden.

Mulberry (*Morus nigra*, the black; *M. alba*, the white). The black possesses the best flavour, and will fruit well in all parts of Queensland. The tree most generally met with in Queensland are all forms of *M. alba* and *M. indica*; and, while they produce their fruit in abundance, it is wanting in flavour.

Nectarine (*Prunus Persica*, var. *lævis*). Should only be planted from Stanthorpe to the border, until kinds are obtained suitable for the coast country.

Olive (*Olea europea*). Bears abundantly in some localities, but it being usually wet at the time the fruit ripens, this will be very much against the manufacture of good oil.

Orange (*Citrus Aurantium*). *See* paragraph on subject.

Otaheitean Apple or Hog-plum; also, Wi, or Vi, Apple (*Spondias dulcis*). Not worth growing.

Otaheitean Gooseberry (*Phyllanthus disticha*). No sale for fruit.

Papaw (*Carica Papaya*). *See* paragraph upon this fruit.

Peach (*Prunus Persica*). *See* paragraph upon this fruit.

Peach-palm (*Bactris Gasipaës*). Scarcely worth planting for the sake of its fruit.

Passion Fruit (*Passiflora edulis*). This fruit is easily grown, and finds a ready sale.

Pear (*Pyrus communis*). Grow from Warwick to the border. Other parts of the colony only suitable to a very few kinds.

Pecan Nut (*Carya olivæformis*). A fruit that should be cultivated. Thrives well, and bears good nuts at Maryborough.

Persimmon. *See* "Date Plum."

Pineapple (*Ananas sativa*). *See* separate paragraph on the plant.

Plums (*Prunus domestica*). The varieties of this fruit, such as the gages, egg plum, and others, thrive well over the Range, and the varieties of other species from Japan thrive and bear upon the coast lands.

Pomegranate (*Punica Granatum*). Not much sale for this fruit.

Prickly Pear (*Opuntia*, several kinds). Not worthy of culture for sale.

Puneala Plum (*Flacourtia cataphracta*). A fruit never likely to be in demand.

Pumpkin (*Cucurbita Pepo*). Many excellent varieties largely grown.

Quince (*Pyrus Cydonia*, common; *P. Cydonia*, var. *sinensis*, China Quince). Grow from Stanthorpe to the border.

Rambutan (*Nephelium lappaceum*). Not worthy of culture for sale.

Rhubarb (*Rheum Rhaponticum*). Perhaps it may be said that this plant ought not to be designated a fruit, as the part used is the leafstalk, but as this part is used as a fruit it may be allowed a place in this list.

Raspberry (*Rubus Idæus*). *See* separate paragraph upon this fruit.

Rose Apple (*Eugenia Jambos*). Not worthy of culture for sale.

Roselle (*Hibiscus sabdariffa*). The sharply acid, well-coloured, fleshy involucres and calyxes are used for preserves. Will grow anywhere on the coast side of Range.

Sapodilla Plum (*Achras sapota*). A tropical fruit, not likely to find a ready sale.

Seaside Grape (*Coccoloba uvifera*). Not worth growing as a fruit.

Sepistan or Sebesten (*Cordia Myxa*, var. *latifolia*). Not worth growing as a fruit.

Shaddock or Pampelmos (*Citrus decumana*). *See* paragraph on "Orange Tribe."

Sierra Leone Peach (*Sarcocephalus esculentus*). A tropical fruit, not likely to find a market.

Sour Sop (*Anona muricata*). A tropical fruit of little value for the market.

Squash (*Cucurbita melopepo*). Many varieties in cultivation.

Star Apple (*Chrysophyllum cainito*). A tropical fruit not likely to find a ready sale.

Strawberry (*Fragaria vesca*, and other species). *See* separate paragraph upon the fruit.

Strawberry Pear of America (*Cerius triangularis*). This fruit, like the prickly pear, is not likely ever to prove very saleable.

Sweet Sop (*Anona squamosa*). A fine fruit, sells pretty well. A good cropper in North and South Queensland, but not over the Range.

Tamarind (*Tamarindus indica*). Better varieties of this should be introduced.

Tomato (*Lycopersicum esculentum*). This plant is largely grown for the market.

Tree Tomato (*Cyphomandra betacea*). This shrub thrives well and produces plenty of fruit, but as yet the fruit is not in demand.

Ugni (*Eugenia Ugni*). This nice little fruit was introduced and grown at the Botanic Gardens, by Mr. W. Hill, near thirty years ago, but it did not like the climate.

Vangueria Edulis. Not likely to prove a saleable fruit. A plant was introduced into Queensland many years ago under this name, but really belonging to a very different natural order, the fruit of which was also quite worthless.

Walnut (*Juglans regia*). Good kinds should only be planted, and the seedlings used for stocks.

Wampee (*Clausena Wampi*). Will fruit well, but fruit not likely to sell.

Water Chestnut (*Trapa bicornis*). Worthless as a marketable nut, but might be grown upon any still waters.

Water Lemon (*Passiflora laurifolia*). This climber is best suited for the tropical parts of the colony.

Water Melon (*Citrullus vulgaris*). Give fresh land and use seed from Europe of approved kinds.

White Gourd (*Benincasa cerifera*). A fruit equally as useful as the pie-melon.

Wineberry. A worthless *Rubus* has been introduced from America under this name.

Wine Palms (*Caryota urens* and *Diplothemium maritimum*). Not likely to pay for growing for the sale of its fruit.

Wood Apple (*Feronia elephantum*). The pulp of this fruit can be made into jelly, but the fruit would never be saleable.

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

Queensland. [May, 1895.

DEPARTMENT OF AGRICULTURE, BRISBANE.

BULLETIN No. 6.

SECOND SERIES.

WHEAT-GROWING EXPERIMENTS,

WITH

OBSERVATIONS ON

THE GENERAL SUBJECT OF

WHEAT-GROWING IN QUEENSLAND.

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:

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EXPERIMENTS IN WHEAT CULTIVATION.

The experiments with wheat, first undertaken by the Queensland Department of Agriculture in 1891, grew directly out of the recommendations of the Intercolonial Rust in Wheat Conferences, the first of which was held in Melbourne in 1890. At the Melbourne conference, the following resolution was adopted:—"This Conference is of opinion that each of the Australian Governments should institute as early as practicable a series of experiments * * * * * * * such experiments to be continued over a succession of years, and the results to be published periodically for free distribution among all concerned." At the conferences subsequently held at Sydney, Adelaide, and Brisbane, the desirableness of carrying out such experiments was reaffirmed, while the Adelaide conference made the additional recommendation that in each of the colonies "a practical system for the production and distribution of rust-resistant wheats, suitable to different districts, should be immediately established" The history of the efforts that have been made in Queensland to carry out the spirit of these recommendations is easily told. In 1891, at two points on the Darling Downs, a thorough test of the use of fungicides and mineral fertilisers upon growing wheat was made, without conclusive results, so far as the rust disease was concerned. Two years later the work of testing varieties upon a large scale was begun at Canning Downs, near Warwick, and at Roma. This work was greatly extended the year following. The Darling Downs station was transferred from Canning Downs to near Allora, and additional stations were established in the North at Springsure, Clermont, Hughenden, and Herberton. During the present year (1895) this experimental work is in progress at Roma, Allora, Springsure, Barcaldine, and Herberton.

The object of this report is to give the public, in succinct form, the results obtained in 1894 at the five stations abovementioned, and in addition certain facts and observations upon the general question of the economy of wheat production in Queensland.

SCOPE OF THE EXPERIMENTS.

It will be seen from the foregoing that the Queensland wheat experiments owe their inception to the series of Intercolonial Rust in Wheat Conferences, and have been directed primarily towards the solution of the rust problem as affecting wheat culture. It had long been noticed by practical men that certain varieties of wheat seemed

especially subject to the rust disease, while others, often growing in close proximity to the diseased, enjoyed comparative immunity from its attacks. The very numerous and telling facts of this character, current, have led, not members of the conference only, but well-nigh all students of the rust disease, to the conclusion that efforts in the direction of coping with it must be turned towards the study of the wheat plant itself. Acting upon these facts of practical life, and those brought out in the course of numerous experiments, our aim has been to bring to light varieties possessing in the highest degree this rust-resisting power. In a sense, then, our work has been a simple one, to gather together from far and near those varieties of wheat which may be expected to resist disease best, and by cultivation, selection, and cross fertilisation fix in their offspring those desirable qualities sought. This search for disease-opposing varieties is not inconsistent with what may be called the secondary purposes of the experiments. In the Central and Northern sections of the colony the possibility of wheat-growing even has been a mooted point, and where the success of wheat culture has been demonstrated, experimental knowledge of the varieties best suited to the soil and climate of the district is often wanting. Our experiments in wheat-growing have, therefore, been conducted towards definite ends, as follows:—(1) the discovery of truly rust-resisting or rust-escaping* varieties; (2) the introduction of varieties suitable in a general way to the soil and climate of particular districts of the colony; and (3) the distribution among the farmers of such sorts of proved value. The reader will understand, then, that the object of these experiments has been to discover facts and not to grow great crops. The facts once made clear will help wheat-growers to avoid loss from disease and the use of unsuitable sorts, and thus secure profitable crops.

CONDITIONS OF THE ROMA TRIALS.

The Roma experiments were carried out upon the farm of Mr. P. Smith, distant from the township about four miles. Here, as in the case of each of the other experiment stations, the use of the ground was generously donated the Department by the owner. The soil used in this experiment was, for the most part, a heavy clay loam, a "wheat land" of more than the average fertility of the farming lands of the neighbourhood. The tract is a low-lying one, and so is subject to the action of water during very wet weather; but no harm came to our experiments from this cause. The sowing was accomplished on 16th and 17th May, dates which may be said fairly to represent the average practices of the farmers of the district in respect to wheat seeding. The wheat was sown in rows 1 foot apart, the number of rows given to each sort depending upon the importance of the variety, and, to a certain extent, the amount of seed available. Every sort was marked with a numbered stake. The season was a favourable one to the crop, which germinated promptly after sowing, and maintained a steady growth, uninterrupted by drought or excessive rains. The growing wheat received occasional hoeings, sufficient to keep all

* By a rust-escaping sort is to be understood one having no special powers of rust resistance, but which, by its early habit of growth, escapes the disease, to which later and slower maturing sorts fall a victim.

weed growths in check. The season, in respect to the prevalence of rust, was well calculated to test the powers of resistance of the different varieties. Rust was generally prevalent in the Roma district, very few fields of wheat escaping, while many were badly damaged by the disease. Moreover, a field of more or less infected wheat abutted the experimental plots through the entire length of the system, so that every sort was subjected to the influences of the rust spores coming from this field during the entire period of their growth.

WHAT THE TABLES SHOW.

The following tables, giving the essential facts of the principal experiments of the series, do not call for much explanation. The standard of rustiness herein set up, perhaps more than any other of the tabular sub-headings, calls for a word of explanation. This standard is that recommended by the Rust in Wheat Conference, at the Brisbane meeting, and it assumes that between the numbers 1 and 10, every degree of rustiness to which the wheat plant is liable, may be represented. Thus the number 10 placed against a sort indicates that that variety has taken the rust disease in its most virulent form to very rottenness. This condition of the infected plant would be indicated by the more or less complete occupation of leaf and stalks by the rust pustules, with corresponding loss and shrinkage in the grain. The number 5 would indicate a strong disease-growth upon leaf and sheath, the stalk remaining nearly or quite free, while the numeral 1 shows a scanty though noticeable development upon the foliage only of the plants of the sort against which it is placed. With this explanation the reader will not go far astray in his estimates of the rust susceptibility of the different sorts, as indicated by the standard here employed. We speak with less confidence of the statement of the "milling qualities" of the different sorts given in the tables. This "milling quality" is an intangible, undefined, and undefinable something which to a considerable extent varies with the temperament of millers, the machinery at their command, the prevailing fashion in flours, and other circumstances quite outside the qualities of wheat itself. Wheat may be stigmatised as "bad milling" this year, and within a year be in high favour with millers. Two years ago the highly rust-resistant durum wheat Belotourka came under the ban of millers. Farmers were cautioned against growing it, and the hint was emphasised by a pronounced cut in the price of this sort. During the current season a number of millers have urged farmers to sow Belotourka and the red wheats, and the highest market prices are promised for the crop. For these reasons the reader is advised to take with certain degrees of allowance our expressed gauge of the milling qualities of the different sorts, except where such positive statements as "flinty," "hard," &c., are used. These statements apply equally to the tabular showings of the Allora and Roma experiments. In Table No. 1 the yield per acre—not given in Table No. 2—of the Roma varieties is given. This in every case has been calculated from small areas carefully harvested and threshed out by hand.

Table No. 1—Results in Detail of Wheat Experiments at Roma, 1894.

No. of Plat.	Name of Variety.	Seed obtained from	When Sown.	When Ripe.	Days of Growth.	Bald or Bearded.	Rustiness (Scale, 1—10).	Tillers (much or little).	Character of Straw.			Shells (much or little).	Yield per Acre (bushels).	Milling Quality.
									Flag.	Strength.	Height (inches).			
1	Unknown	Geo. Inglis, S.A. ...	16 May	1 Nov.	169	bearded	2	little ...	slight ...	fine strong	45	little ...	27	good
2	White Essex	ditto ...	16 ,,	7 ,,	175	bald ...	1	medium	medium	medium	48	,, ...	...	,,
3	No. 1 Bearded	ditto ...	16 ,,	23 Oct.	160	bearded	1	,,	,,	strong ...	36	,, ...	29	,,
4	Leak's	ditto ...	16 ,,	6 Nov.	174	bald ...	1	much ...	,,	,, ...	51	,, ...	22	fair
5	Old Red Straw	ditto ...	16 ,,	7 ,,	175	,, ...	2	,, ...		,, ...	48	,, ...	31	good
6	King's Bearded	ditto ...	16 ,,	,,	169	bearded	2	,, ...	much ...	medium	39	much ...	18	,,
7	Talavera	ditto ...	16 ,,	12 ,,	180	bald ...	1	medium	slight ...	,,	48	little ...	22	,,
8	King's Purple Straw	ditto ...	16 ,,	0 ,,	178	,, ...	1	,,	medium	weak ...	...	,, ...	...	,,
9	White Tuscan	ditto ...	16 ,,	10 ,,	178	,, ...	traces	,,	,,	strong ...	...	,, ...	...	,,
10	Blount's Lambrigg	ditto ...	16 ,,	15 ,,	183	,, ...	,,	,,	,,	,, ...	...	moderately	...	not good
11	Wheaton's Rust-proof	ditto ...	16 ,,	9 ,,	177	,, ...	,,	,,	slight ...	medium	...	little ...	22	medium
13	Galland's Hybrid	ditto ...	16 ,,	...	...	bearded	...	,,	,, ...	weak ...	...	medium	...	not good
14	King's Beauty	ditto ...	16 ,,	28 Nov.	196	,,	4	,,	,, ...	medium	45	little ...	31	good
15	Excelsior	ditto ...	16 ,,	14 ,,	182	bald ...	4	fairly ...	medium	strong ...	48	,, ...	18	,,
16	Inglis' Battlefield	J. M. Inglis, S.A. ...	16 ,,	1 ,,	169	,, ...		medium	,,	,, ...	45	medium	27	,,
17	Marshall's No. 10	R. Marshall, S.A. ...	16 ,,	7 ,,	175	,, ...	1	much ...	,,	medium	48	little ...	31	medium
18	Ditto 36	ditto ...	16 ,,	7 ,,	175	,, ...	traces	little ...	,,	weak ...	48	,, ...	27	,,
19	Ward's White	ditto ...	16 ,,	4 ,,	172	,, ...	,,	medium	ight ...	strong ...	45	,, ...	31	,,

20	*Inglis' Rust-proof*	*J. M. Inglis, S.A.* ...	*16* „	*16* „	*184*	„ ...	1	much ...	much ...	„ ...	48	...	29	good
21	*Hercules*	*R. Marshall, S.A.* ...	*16* „	*2* „	*170*	„ ...	traces	„ ...	slight ...	„ ...	48	little ...	25	medium
22	*Marshall's No. 11*	*ditto* ...	*16* „	*1* „	*169*	„ ...	„	„ ...	medium	medium	51	„ ...	31	„
23	Ditto 7	ditto ...	16 „	5 „	173	„ ...	½	„ ...	„	strong ...	51	„ ...	34	ood
24	Ditto 4	ditto ...	16 „	5 „	173	„ ...	traces	„ ...	slight ...	„ ...	45	„ ...	29	„
25	Ditto 3	ditto ...	16 „	1 „	169	„ ...	„	medium	much ...	medium	45	„ ...	31	„
26	Ditto 6	ditto ...	16 „	7 „	175	„ ...	„	much ...	medium	„	54	„ ...	36	„
27	Ditto 8	ditto ...	16 „	8 „	176	„ ...	„	medium	slight ...	strong ...	51	„ ...	34	„
28	Unknown	ditto ...	16 „	1 „	169	...	„	...	...	...	51	...	38	„
29	Marshall's No. 3 White Straw	ditto ...	16 „	29 Oct.	166	bald ..	...	medium	much ...	medium	48	little ...	40	„
30	Ditto 9	ditto ...	16 „	29 „	166	„ ...	„	much ...	slight ...	strong ...	51	„ ...	31	medium
31	Ditto 3 Purple ...	ditto ...	16 „	29 „	166	„ ...	„	medium	medium	medium	45	„ ...	31	good
32	Buckley's Rust-proof	ditto ...	16 „	7 Nov.	175	„ ...	„	much ...	„	strong ...	48	...	22	medium
33	Marshall's Success	ditto ...	16 „	4 „	172	„ ...	½	...	„	„ ...	54	little ...	38	good
34	Galatian Summer	...	16 „	19 „	187	„ ...	free	...	„	„ ...	42	„ ...	27	hard red
35	Marshall's No. 22	R. Marshall, S.A. ...	16 „	1 „	169	„ ...	1	...	„	„ ...	52	„ ...	40	good
36	Ditto 24	ditto ...	16 „	1 „	169	„ ...	½	...	much ...	medium	52	„ ...	36	„
37	Ditto 21	ditto ...	16 „	1 „	169	„ ...	slight traces	...	„ ...	„	52	medium	31	medium
38	Ditto 33	ditto ...	16 „	7 „	175	semi-bearded	½	...	„ ...	fine strong	53	little ...	34	good
39	Marshall's Prolific	ditto ...	16 „	29 Oct.	163	bald ...	slight traces	...	„ ...	medium	45	„ ...	29	„
40	Marshall's No. 19	ditto ...	16 „	2 Nov.	170	„ ...	„	...	„ ...	strong ...	48	„ ...	36	medium
41	Ditto 17	ditto ...	16 „	2 „	170	„ ...	„	...	„ ...	weak ...	45	„ ...	27	„
42	Ditto 29	ditto ...	16 „	10 „	178	„ ...	free	...	„ ...	strong coarse	48	medium	36	good
43	King's Rust-proof	ditto ...	16 „	10 „	178	„ ...	½	little ...	„ ...	soft ...	48	much ...	34	„
44	Marshall's No. 37	ditto ...	16 „	11 „	179	„ ...	½	...	light ...	strong ...	48	little ...	31	„

TABLE No. 1—RESULTS in DETAIL of WHEAT EXPERIMENTS at ROMA, 1894—*continued.*

No. of Plat.	Name of Variety.	Seed obtained from	When Sown.	When Ripe.	Days of Growth.	Bald or Bearded.	Rustiness (Scale, 1—10).	Tillers (much or little).	CHARACTER OF STRAW.			Shells (much or little).	Yield per Acre (bushels).	Milling Quality.
									Flag.	Strength.	Height (inches).			
45	Brown's Rust-proof	R. Marshall, S.A. ...	16 May	9 Nov.	177	bald ...	3	...	much ...	weak ...	48	much ...	31	good
46	Marshall's No. 35	ditto ...	16 ,,	3 ,,	171	,, ...	½	...	medium	strong ...	45	little ...	29	,,
47	Wheaton's Rust-proof	ditto ...	16 ,,	3 ,,	171	,, ...	½	medium	slight ...	medium	45	,, ...	25	flinty
48	Marshall's No. 15	ditto ...	16 ,,	1 ,,	169	,, ...	1	...	much ...	strong ...	45	much ...	34	medium
49	Battlefield	ditto ...	16 ,,	29 Oct.	166	,, ...	traces	little ...	medium	,, ...	45	medium	45	,,
50	Marshall's No. 27	ditto ...	16 ,,	6 Nov.	174	,, ...	2	...	slight ...	fine strong	45	little ...	27	,,
51	Venning's...	A. Venning, S.A. ...	16 ,,	1 ,,	169	,, ...	2	little ...	,, ...	medium	48	,, ...	29	,,
52	American Pearl (Allora Spring)	Mr. McPherson, Q. ...	16 ,,	3 ,,	171	,, ...	½	...	...	...	45	...	40	good
53	Ambrose's Stand-up	Mr. Hume Black, England	16 ,,	very late	...	,, ...	...	...	...	...	...	...	...	...
54	Indian Early	Hon. J. D. Macansh, Q.	16 ,,	23 Oct.	160	,, ...	1	little ...	slight ...	weak ...	30	little ...	22	medium
55	Indian Pearl	...	16 ,,	23 ,,	160	,, ...	1	,, ...	,, ...	,, ...	30	,, ...	31	,,
56	Gore's Indian No. 1	...	16 ,,	20 ,,	157	bearded	½	medium	,, ...	,, ...	33	,, ...	27	fair
57	Ditto 2	...	16 ,,	20 ,,	157	,,	½	,,	,, ...	,, ...	33	,, ...	...	...
58	Canning Downs Rust-resistant	...	16 ,,	23 ,,	160	,,	1	little ...	,, ...	,, ...	36	,, ...	...	good
66	Tardent's Blue	H. Tardent, Roma ...	16 ,,	7 Nov.	175	bald ...	2	much ...	medium	strong ...	57	,, ...	...	fair
138	Pringle's No. 5	Department of Agriculture, Tasmania	17 ,,	10 ,,	177	,, ...	5	medium	much ...	coarse and brittle	52	much ...	36	flinty
138A	French Early (Bearded) ...	ditto	17 ,,	27 Oct.	163	bearded	2	...	light ...	fine tough	40	little ...	31	good
139	Robbin's Rust-proof	ditto	17 ,,	5 Nov.	172	bald ...	½	...	medium	strong ...	50	,, ...	40	,,

139A	Blount's Lambrigg and Saxon Fife	ditto	...	17	„	16	„	183	„	...	free	...	much	...	„	...	50	„	...	27	hard
140	Tourmaline	ditto	...	17	„	12	„	179	„	...	traces	...	„	...	medium		50	medium		29	flinty
140A	Ballarat Spring	ditto	...	17	„	15	„	182	„	...	3	...	„	...	„		48	„		22	good
141	Oakshott's Champion	ditto	...	17	„	12	„	179	„	...	3	...	„	...	„		54	little	...	45	„
141A	Amethyst...	ditto	...	17	„	17	„	184	semi-bearded		free	...	„	...	„		42	„	...	20	flinty
142	Lava	ditto	...	17	„	17	„	184	bald	...	„	much	...	,	...		49	„	...	18	medium
142A	Boutcher's Velvet	ditto	...	17	„	29	„	196	...		½	...	...	...	...		...	...		...	...
143	Bearded Herrison	ditto	...	17	„	10	„	177	bearded		½	much	...	much	...	strong	...	54	little ...	...	medium
143A	Blount's Lambrigg	ditto	...	17	„	...		...	bald	...	...	fairly	...	medium		„	...	48	„ ...	...	flinty, not good
144	White's Champion	ditto	...	17	„	15	Nov.	182	...		1	...		...		...		...	...	...	...
144A	Thomas' Rust-proof	ditto	...	17	„	25	„	192	bald	...	8	medium		medium		medium		48	little ...	36	good
145	Ward's Prolific	ditto	...	17	„	3	„	170	„	...	traces	...		slight	...	strong	...	45	„ ...	47	medium
147	Blount's Fife	...		17	„	17	„	184	„	...	free	medium		„	...	„	...	...	„ ...	31	hard
148	Farmer's Friend...	...		17	„	3	„	170	„	...	6	„		much	...	„	...	42	much ...	33	o d
149	Bellevue Talavera	...		17	„	17	„	184	„	...	7	much	...	medium		medium		48	little ...	...	...
150	Steer's Early Purple Straw ...	...		17	„	3	„	170	„	...	6	„	...	much	...	strong	...	45	much ...	36	ood
151	Victorian Defiance	...		17	„	3	„	170	„	...	2	„	...	slight	...	„	...	39	little ...	31	flinty
152	Improved Fife	...		17	„	16	„	183	„	...	free	„	...	„	...	„	...	45	„ ...	27	medium
153	King's Jubilee	...		17	„	25	Oct.	161	„	...	3	medium		„	...	weak	...	45	„ ...	31	good
154	Allora Spring	...		17	„	7	Nov.	174	„	...	2	„		„	...	medium		45	much ...	...	„
155	Queensland Defiance	...		17	„	14	„	181	„	...	2	„		„	...	strong	...	48	little ...	33	medium
157	Lazistan	...		17	„	5	„	172	bearded		1	much	...	„	...	medium		43	„ ...	22	good red
158	Fill Bag	...		17	„	5	„	172	bald	...	5	„	...	much	...	strong	...	21	„ ...	22	good
159	Velvet Chaff	...		17	„	13	„	180	„	...	6	„	...	medium		„	...	2	...	27	„
160	Cape	...		17	„	0	„	177		...		„	...	much	...	„	...	45	...	31	„

TABLE No. 1—RESULTS in DETAIL of WHEAT EXPERIMENTS at ROMA, 1894—*continued.*

No. of Plat.	Name of Variety.	Seed obtained from	When Sown.	When Ripe.	Days of Growth.	Bald or Bearded.	Rustiness (Scale, 1—10).	Tillers (much or little).	CHARACTER OF STRAW.			Shells (much or little).	Yield per Acre (bushels).	Milling Quality.
									Flag.	Strength.	Height (inches).			
161	Anglo-Australian	...	17 May	14 Nov.	181	bearded	3	much ...	much ...	strong ...	45	much ...	22	good
162	Medeah	...	17 „	10 „	177	„ ...	free	little ...	medium	medium	48	little ...	29	hard
163	Smith's Nonpariel	...	17 „	10 „	177	bald ...		much ...	„	strong ...	51	„ ...	18	good
164	Square-headed Sicilian (Tourmaline)	...	17 „	16 „	183	„ ...	free	medium	slight ...	„ ...	49	„ ...	24	hard
165	White Cytherè	...	17 „	9 „	176	bearded	3	„	„ ...	weak ...	45	„ ...	15	medium
166	Australian Glory	...	17 „	7 „	174	bald ...	3	much ...	much ...	strong ...	45	„ ...	33	good
167	Bega	...	17 „	15 „	182	„ ...	traces	„ ...	medium	„ ...	52	„ ...	24	„
168	Mummy	...	17 „	12 „	179	„ ...	1	medium	„	„ ...	54	„ ...	27	flinty
169	Jordan's	...	17 „	15 „	182	„ ...	8	much ...	much ...	„ ...	48	„ ...	29	good
170	White Lammas	...	17 „	13 „	180	„ ...	3	medium	slight ...	medium	53	„ ...	36	„
171	Ward's White	...	17 „	7 „	174	„ ...	traces	„	„ ...	strong ...	48	„ ...	31	flinty
172	Red Californian	...	17 „	9 „	176	„ ...	3	„	„ ...	„ ...	42	„ ...	20	good
173	Mexican Spring	...	17 „	9 „	176	„ ...	1	„	„ ...	„ ...	42	„ ...	31	„
174	Early Japanese	...	17 „	10 „	177	bearded	4	...	much ...	weak ...	42	„ ...	13	„
175	Freeling	...	17 „	12 „	179	bald ...	1	much ...	medium	strong ...	51	much ...	22	„
176	Algerian	...	17 „	10 „	177	bearded	1	„ ...	light ...	„ ...	54	little ...	20	flinty
177	Red Provence	...	17 „	13 „	180	bald ...	2	„ ...	medium	weak ...	45	„ ...	29	fair
178	Jacinth	...	17 „	7 „	174	„ ...	2	„ ...	„	strong ...	45	medium	31	good

179	Sicilian Baart	...		17	,,	10	,,	177	bearded	free	medium	slight ...	medium	48	little ...	22	hard
180	Tourmaline (Square-headed Red)	...		17	,,	10	,,	177	bald ...	,,	...	...	...	48	...	...	...
181	Early Para	...		17	,,	1	,,	168	,, ...	1	medium	slight ...	weak ...	48	little ...	36	good
182	White Naples	...		17	,,	14	,,	181	,, ...	7	much ...	much ...	medium	50	,, ...	20	medium
183	Broderick	...		17	,,	16	,,	183	,, ...	7	,, ...	slight ...	strong ...	50	medium	25	good
184	Purple Straw	...		17	,,	14	,,	181	,, ...	6	,, ...	much ...	,, ...	50	shells ...	22	,,
185	Town and Country	...		17	,,	13	,,	180	,, ...	1	,, ...	medium	,, ...	50	little ...	22	medium
186	White Essex	...		17	,,	13	,,	180	,, ...	3	...	,,	,, ...	51	shells ...	36	good
187	Brown-eared Mummy	...		17	,,	9	,,	176	bearded	2	medium	,,	,, ...	57	little ...	29	flinty
188	Niagara	...		17	,,	13	,,	180	bald ...	free	little ...	slight ...	medium	42	much ...	34	fair red
189	Australian Club	...		17	,,	9	,,	176	,, ...	2	much ...	much ...	strong ...	45	shells ...	31	good
190	Blount's No. 10	...		17	,,	10	,,	177	,, ...	2	,, ...	medium	medium	45	medium	40	,,
191	Manitoba	...		17	,,	15	,,	182	,, ...	free	,, ...	slight ...	strong ...	48	little ...	27	medium
192	Sea Foam	...		17	,,	9	,,	176	,, ...	½	...	...	...	45	...	...	...
193	Hudson's Early Purple Straw	...		17	,,	5	,,	172	,, ...	6	much ...	much ...	strong ...	45	shells ...	36	good
194	Summer Club	...		17	,,	18	,,	185	,, ...	traces	,, ...	medium	,, ...	36	medium	18	medium
195	White Hogan	...		17	,,	16	,,	183	,, ...	8	,, ...	much ...	,, ...	...	little ...	31	good
196	African	Mr. Crookey, Q. ...		17	,,	8	,,	175	bearded	1	...	, ...	medium	42	,, ...	25	,,
197	White Fife	...		17	,,	16	,,	183	bald ...	1	much ...	medium	,,	...	not liable	29	,,
198	Australian Wonder	...		17	,,	13	,,	180	,, ...	1	medium		strong ...	48	little ...	27	,,
199	Fluorspar	...		17	,,	19	,,	186	,, ...	1	much ...	,,	,, ...	...	,, ...	...	...
200	Steinwedel	...		17	,,	5	,,	172	,, ...	6	,, ...	,,	medium	48	much ...	27	good
201	Belotourka	...		17	,,	13	,,	180	bearded	traces	medium	much ...	strong ...	56	little ...	29	flinty
202	Quartz	...		17	,,	4	,,	171	,,	3	much ...	medium	,, ...	44	medium	45	fair

THE ROMA WHEATS

Rust Freedom.—Probably not one of our sorts absolutely escaped rust contamination. Our examinations of the different stations was necessarily made at considerable intervals of time, so that rust may have appeared upon the apparently rust-free varieties, only to be cast off with the dead leaves incidental to the development of the plant. The following sorts had throughout the season this practical freedom from rust:—Marshall's 29, Blount's Lambrigg × Saxon Fife, Amethyst, Lava, Galatian Summer, Sicilian Baart, Tourmaline, Niagara, Manitoba.

The Highly Rust-resistant.—The sorts showing "traces" or "slight traces" of rust, by which are meant minute rust colonies seen sparingly here and there, mostly on the lower leaves of the plant, are named in the list as under. These varieties are most likely as reliably rust-resistant as those which have been distinguished as rust-free. The wheats showing only traces of rust number 22, and are as follows:—Battlefield, Blount's Lambrigg, Buckley's Rust-proof, Hercules, Improved Baart, Manitoba, Marshall's 3, 4, 6, 8, 9, 11, 17, 19, 21, 36, Marshall's Prolific, Summer Club, Tunnack, White Tuscan (?), Ward's White, Wheaton's Rust-proof.

The sorts next in order in point of rust freedom—namely, those marked in the schedule 1 and ½, number 29, as follows:—African, Allora Spring, Australian Wonder, Bearded Herrison, Boutcher's Velvet, Canning Downs, Early Para, Fluorspar, Gore's Indian, Indian Early, Indian Pearl, Inglis' Battlefield, Inglis' Rust-proof, Leak's, Marshall's 7, 10, 15, 22, 24, 33, 35, 37, Marshall's Success, No. 1 Bearded, Robbin's Rust-proof, Talavera, Town and Country, White Essex, White Fife. This list is practically interesting, because it includes a number of familiar varieties like African, Allora Spring, Belotourka, and Canning Downs, which furnish a standard by which the grower of these old sorts may judge of the rust-resistant powers of the unfamiliar ones, which make up such a large part of our list.

Rust-liable Wheats.—Of no less interest to the practical man than the foregoing disease-resisting wheats are those which, according to the testimony of our experiments, succumb most readily to the rust contagion. To learn the sorts one ought to avoid is a necessary preliminary to securing really desirable varieties. The total number of varieties marked 5 and over for rust susceptibility is fifteen. The list is as follows:—Bellevue Talavera, Broderick, Cape, Farmer's Friend, Fill Bag, Hudson's Early Purple Straw, Jordan's, Pringle's No. 5, Purple Straw, Steere's Early Purple Straw, Steinwedel, Thomas' Rust-proof, Velvet Chaff, White Hogan, White Naples. It is interesting to note that at least seven of these rust-liable wheats are undoubted members of the Purple Straw family of Australian wheats.

FARRER'S CROSSBREDS

Plats 67-139, inclusive, at Roma, and plats 42-143, inclusive of the Allora experiments, were occupied by crossbred wheats originated by Mr. Wm. Farrer, of Lambrigg, Queanbeyan, New South Wales. These crossbreds are, from the standpoint of the experimenter, of very great interest, but as yet they are of interest only to the experimenter. All are nameless, and want that fixedness of type which only years of cultivation, with accompanying rigorous selection to a type, can give. In growth individual plants show resemblances to both parents, and well-nigh all gradations between the two. We are very hopeful of these new wheats. They promise to furnish to Australian wheatfields a much-needed infusion of new blood, and many have already shown valuable qualities, such as rust resistance and quality in a high degree. Their practical usefulness to wheat-growers will only become apparent when these varying tendencies have been cut off by careful selection.

THE ALLORA EXPERIMENTS.

The Allora experiments in wheat cultivation were carried out upon a portion of the farm of Mr. Andrew Rickert, located about four miles east of the Allora township. The land used for the trials was a very fertile alluvium, having a considerable admixture of the volcanic "black soil" characteristic of the Darling Downs country. What has been said of the conditions of the Roma experiment applies in almost every particular to the Allora trial. The seed was sown 22nd-24th May, in rows, as before, one foot apart, and these received two dressings with the hoe, sufficient to hold the weeds in check. The sequel showed that a portion of the ground used in the Allora trial was really too fertile for the wheat plant. The straw upon this over-rich area grew tall and feeble, supporting imperfectly developed ears, carrying only pinched grain. Later a storm brought this feeble growth to the ground, where the varieties soon became an undistinguishable mass of half-rotten vegetation. This fact explains the paucity, in details, of the first fourteen varieties of the series as shown in Table No. 2. Aside from this mishap all the circumstances of soil and season were favourable to the crop. Rust was fully as prevalent here as at Roma, and the opportunities for infecting the crop were almost identical with those obtaining there. The following table (No. 2) gives the essential facts of the experiment excepting the yield per acre, which in the case of the Allora experiment was not calculated.

Table No. 2—Results in Detail of Wheat Experiments at Allora, 1894.

No. of Plat.	Name of Variety.	Seed obtained from	When Sown.	When Ripe.	Days of Growth.	Bald or Bearded.	Rustiness (Scale, 1—10).	Tillers (much or little).	Character of Straw.			Shells (much or little).	Milling Quality.
									Flag.	Strength.	Height (inches).		
1	Ambrose's Standup	Hume Black, England	22 May	very lat	...	bald ...	5	much ...	much ...	coarse and strong	...	...	good
2	American Pearl (Allora Spring)	Mr. McPherson, Q. ...	22 ,,	...	...	,, ...	6	little ...	little ...	medium strong	...	little ...	
3	Marshall's No. 3	Richard Marshall, S.A.	22 ,,	...	...	,, ...	1	medium ...	much ...	medium	...	,, ...	,,
4	Ditto 31	ditto	22 ,,	...	...	,, ...	2	much ...	,, ...	,,	54	,, ...	,,
5	Ditto 8	ditto	22 ,,	...	...	,, ...	2	...	...	strong ...	54	...	,,
6	Inglis' Rust-proof	J. M. Inglis, S.A. ...	22 ,,	...	...	,, ...	5	much ...	much ...	,, ...	48	...	,,
7	Venning's	A. Venning, S.A. ...	22 ,,	24 Nov.	186	,, ...	1	little ...	...	medium	54	little ...	medium
8	Marshall's No. 3 White ...	R. Marshall, S.A. ...	22 ,,	...	...	,, ...	1	...	much ...	,,	60	...	good
9	Inglis' Success	J. M. Inglis, S.A. ...	22 ,,	...	...	,, ...	1	...	,, ...	strong ...	54	...	...
10	Battlefield	ditto	...	...	...	,, ...	1	little ...	medium	medium	57	...	good
11	Marshall's No. 33	R. Marshall, S.A. ...	22 May	...	...	,, ...	1	much ...	,,	weak ...	54	...	medium
12	Ditto 8	ditto ...	22 ,,	...	...	,, ...	1	medium ...	,,	strong ...	54	...	good
13	Ditto 10	ditto ...	22 ,,	...	...	,, ...	1	much ...	,,	medium	54	...	medium
14	Buckley's Rust-proof ...	ditto ...	22 ,,	...	...	,, ...	1	,, ...	,,	strong ...	57	...	,,
15	Marshall's No. 3 Purple ...	ditto ...	22 ,,	24 Nov.	186	,, ...	1	medium ...	medium to light	medium	54	little ...	good
16	Ditto 9	ditto ...	22 ,,	25 ,,	187	,, ...	2	much ...	light ...	strong ...	57	,, ...	medium
17	Hercules	ditto ...	22 ,,	25 ,,	187	,, ...	½	,, ...	,, ...	,, ...	57	,, ...	,,

18	Marshall's No. 4	ditto ...	22 ,,	25 ,,	187	,, ...	1	,, ...	,, ...	,, ...	57	,, ...	good
19	Ditto 7	ditto ...	22 ,,	26 ,,	188	,, ...	1	,, ...	medium	,, ...	57	,, ...	,,
20	Ditto 11	ditto ...	22 ,,	28 ,,	190	,, ...	1	,, ...	,,	medium	54	,, ...	medium
21	Ward's White	ditto ...	22 ,,	26 ,,	188	,, ...	½	medium ...	light ...	strong ...	54	,, ...	,,
22	Marshall's No. 6	ditto ...	22 ,,	28 ,,	190	,, ...	2	much ...	medium	medium	58	,, ...	good
23	Leak's	ditto ...	22 ,,	26 ,,	188	,, ...	1	,, ...	,,	strong ...	60	,, ...	fair
24	King's Purple Straw ...	Geo. Inglis, S.A. ...	22 ,,	26 ,,	188	,, ...	5	fair	,,	weak ...	54	,, ...	good
25	Old Red Straw	ditto ...	22 ,,	24 ,,	186	,, ...	6	well	,,	strong ...	60	,, ...	,,
26	Unknown	ditto ...	22 ,,	22 ,,	184	bearded	6	non-tillering	light ...	weak ...	54	,, ...	...
27	King's Bearded	ditto, ...	22 ,,	22 ,,	184	,, ...	3	much ...	much ...	medium	54	much ...	good
28	No. 1 Bearded	ditto ...	22 ,,	19 ,,	181	,, ...	5	medium ...	,, ...	strong ...	48	,, ...	,,
29	King's Pearl	ditto ...	22 ,,	24 ,,	186	bald ...	2	non-tillering	little ...	weak ...	54	holds well	...
30	White Essex	ditto ...	22 ,,	26 ,,	188	,, ...	4	fairly ...	medium	medium	60	,,	good
31	White Tuscan	Dr. Cobb, N.S.W. ...	22 ,,	27 ,,	189	,, ...	4	,, ...	,,	strong ...	60	,,	,,
32	Ditto	Geo. Inglis, S.A. ...	22 ,,	26 ,,	188	,, ...	4	,, ...	,,	,, ...	60	,,	,,
33	Blount's Lambrigg	ditto ...	22 ,,	7 Dec.	199	,, ...	1	,, ...	,,	,, ...	60	,,	not good
34	Belotourka	ditto ...	22 ,,	26 Nov.	188	bearded	1	medium ...	much ...	,, ...	64	,,	flinty
35	Improved Baart (Allora Spring)	ditto ...	22 ,,	23 ,,	185	bald ...	3	,, ...	light ...	,, ...	51	much ...	good
36	Excelsior	ditto ...	22 ,,	24 ,,	186	,, ...	5	above medium	medium	,, ...	58	little ...	,,
37	Wheaton's Rust-proof ...	ditto ...	22 ,,	26 ,,	188	,, ...	free	medium ...	light ...	medium	54	,, ...	medium
38	Galland's Hybrid	ditto ...	22 ,,	6 Dec.	198	bearded	1	fairly ...	,, ...	strong ...	62	...	not good
39	King's Beauty	ditto ...	22 ,,	22 Nov.	184	,, ...	8	,, ...	medium	medium	46	holds well	good
40	Talavera	ditto ...	22 ,,	...	...	bald ...	5	,, ...	light ...	,, ...	50	little ...	,,
145	Marshall's No. 3 Purple ...	R. Marshall, S.A. ...	22 ,,	22 Nov.	184	,, ...	1	much ...	much ...	,, ...	54	,,	,,

TABLE No. 2—RESULTS in DETAIL of WHEAT EXPERIMENTS at ALLORA, 1894—*continued*.

Name of Plat.	Name of Variety.	Seed obtained from	When Sown.	When Ripe.	Days of Growth.	Bald or Bearded.	Rustiness (Scale, 1—10).	Tillers (much or little).	CHARACTER OF STRAW.			Shells (much or little).	Milling Quality.
									Flag.	Strength.	Height (inches).		
146	Marshall's No. 9	R. Marshall, S.A. ...	22 May	22 Nov.	184	bald ...	2	much ...	light ...	strong ...	57	little ...	medium
147	Ditto 10	ditto ...	22 ,,	22 ,,	184	,, ...	2	,, ...	,, ...	,, ...	55	,, ...	,,
148	Ditto 7	ditto ...	22 ,,	24 ,,	186	,, ...	1	,, ...	,, ...	,, ...	57	,, ...	good
149	Buckley's Rust-proof ...	...	22 ,,	27 ,,	189	,, ...	0	medium ...	,, ...	very strong	54	,, ...	medium
157	Gore's Indian No. 1 ...	...	22 ,,	20 ,,	182	bearded	1	fairly ...	,, ...	weak ...	27	,, ...	fair
158	Ditto 2 ...	...	22 ,,	20 ,,	182	,, ...	...	,, ...	,, ...	,, ...	27	,, ...	,,
159	Canning Downs Rust-resistant	...	22 ,,	21 ,,	183	,, ...	3	but little ...	,, ...	,, ...	30	,, ...	good
160	African	...	22 ,,	25 ,,	187	,, ...	5	,, ...	medium	medium	48	,, ...	,,
161	Indian Pearl	...	22 ,,	21 ,,	183	bald ...	traces	,, ...	light ...	weak ...	27	,, ...	medium
162	Indian Early	...	22 ,,	21 ,,	183	,, ...	1	,, ...	,, ...	,, ...	27	,, ...	,,
163	Tardent's Blue	H. Tardent, Roma ...	22 ,,	29 ,,	191	,, ...	2	well ...	medium	strong ...	60	,, ...	fair
164	Allora Spring	...	22 ,,	23 ,,	185	,, ...	2	medium ...	light ...	medium	51	medium	good
166	King's Jubilee	...	22 ,,	20 ,,	182	,, ...	5	,, ...	,, ...	weak ...	51	little ...	,,
167	Ward's White	...	22 ,,	23 ,,	185	,, ...	free	much ...	,, ...	fairly strong	51	,, ...	flinty
168	Thomas' Rust-proof ...	...	22 ,,	30 ,,	192	,, ...	1	medium ...	medium	medium	51	,, ...	good
169	Victorian Defiance	...	22 ,,	23 ,,	185	,, ...	free	much ...	,, ...	strong	52	,, ...	flinty
170	Cape	...	22 ,,	24 ,,	186	,, ...	4	,, ...	much ...	,, ...	54	,, ...	good

171	*Australian Wonder...* ...	...	22	,,	23	,,	185	,, ...	traces	medium ...	medium	,, ...	52	,, ...	,,
172	*Australian Glory*	...	22	,,	24	,,	186	,, ...	8	much ...	much ...	,, ...	54	medium	,,
173	Cook's	...	22	,,	2	Dec.	194	,, ...	3	medium ...	light ...	,, ...	52	little ...	,,
174	Red Californian	...	22	,,	24	Nov.	186	,, ...	3	,, ...	,, ...	,, ...	48	,, ...	,,
175	White Cytheré	...	22	,,	25	,,	187	bearded	4	,, ...	,, ...	weak ...	48	,, ...	medium
176	Mexican Spring	...	22	,,	24	,,	186	bald ...	6	,, ...	,, ...	strong ...	48	,, ...	good
177	Jacinth	...	22	,,	24	,,	186	,, ...	6	much ...	medium	,, ...	58	medium	,,
178	Quartz...	...	22	,,	24	,,	186	bearded	5	,, ...	,,	,, ...	56	little ...	fair
179	Red Provence	...	22	,,	4	Dec.	196	bald ...	5	medium ...	,,	weak ...	54	,, ...	,,
180	Tourmaline (Square-headed Sicilian)	...	22	,,	25	Nov.	187	,, ...	free	,, ...	light ...	strong ...	56	,, ...	good
181	White Hogan...	...	22	,,	4	Dec.	196	,, ...	9	much ...	much ...	,, ...	58	,, ...	,,
182	Fill Bag	...	22	,,	26	Nov.	188	,, ...	9	,, ...	,, ...	,, ...	58	,, ...	,,
183	White Lammas	...	22	,,	2	Dec.	194	,, ...	5	medium ...	light ...	medium	58	,, ...	,,
184	Blount's Fife...	...	22	,,	6	,,	198	,, ...	traces	,, ...	,, ...	strong ...	54	,, ...	...
185	Algerian	...	22	,,	26	Nov.	188	bearded	,,	,, ...	,, ...	medium	48	,, ...	flinty
186	Square-headed (Tourmaline) Sicilian	...	22	,,	25	,,	187	bald ...	free	,, ...	,, ...	strong ...	56	,, ...	hard
187	Sicilian Baart	...	22	,,	25	,,	187	bearded	,,	,, ...	,, ...	medium	56	,, ...	,,
188	Mummy	...	22	,,	26	,,	188	,, ...	1	,, ...	,, ...	strong ...	62	medium	flinty
189	Polish	...	22	,,	26	,,	188	,, ...	traces	little ...	medium	,, ...	60	little ...	coarse, flinty
190	D'Arblay's Hungarian ...	...	22	,,	7	Dec.	199	,, ...	2	much ...	,,	,, ...	54	medium	...
196A	Indian A.	...	22	,,	24	Nov.	186	bald ...	3	,, ...	,,	,, ...	34	,,	...
210A	Unknown	...	22	,,	26	,,	188	,, ...	4	medium ...	,,	fair ...	48	,,	...
212	Hercules	R. Marshall, S.A. ...	24	,,	25	,,	185	,, ...	1	much ...	light ...	strong ...	57	little ...	medium
213	Marshall's No. 4	...	24	,,	25	,,	185	,, ...	traces	,, ...	,, ...	,, ...	57	,, ...	good

TABLE No. 2—RESULTS in DETAIL of WHEAT EXPERIMENTS at ALLORA, 1894—*continued.*

Name of Plat.	Name of Variety.	Seed obtained from	When Sown.	When Ripe.	Days of Growth.	Bald or Bearded.	Rustiness (Scale, 1—10).	Tillers (much or little).	CHARACTER OF STRAW.			Shells (much or little).	Milling Quality.
									Flag.	Strength.	Height (inches).		
214	Steinwedel's No. 5	Mr. Berthoud, N.S.W.	24 May	26 Nov.	186	bearded	4	medium ...	medium	strong ...	54	medium	good
215	Purple Straw	ditto ...	24 ,,	26 ,,	186	bald ...	9	much ...	much ...	,, ...	57	,,	,,
216	Steinwedel's Selected ...	ditto ...	24 ,,	26 ,,	186	,, ...	9	medium ...	,, ...	,, ...	52	much ...	,,
217	Thomas' Rust-proof ...	ditto ...	24 ,,	30 ,,	190	,, ...	traces	,, ...	medium	medium	54	little ...	,,
218	Inglis' Inoculated Steinwedel No. 1	ditto ...	24 ,,	26 ,,	186	,, ...	,,	,, ...	light ...	strong ...	52	medium	,,
219	Murray River	ditto ...	24 ,,	3 Dec.	193	,, ...	,,	,, ...	,, ...	,, ...	54	little ...	,,
220	Broderick		24 ,,	30 Nov.	190	,, ...	2	much ...	,, ...	,, ...	54	medium	,,
221	Improved Fife	...	24 ,,	5 Dec.	195	,, ...	traces	,, ...	,, ...	,, ...	56	little ...	medium
222	Russian	...	24 ,,	3 ,,	193	bearded	2	medium ...	,, ...	medium	54	medium	,,
223	Fluorspar	...	24 ,,	4 ,,	194	bald ...	free	much ...	medium	strong ...	58	little ...	,,
224	Summer Club	...	24 ,,	30 Nov.	190	,, ...	traces	,, ...	,,	,, ...	60	,, ...	,,
225	Steer's Early Purple Straw	...	24 ,,	24 ,,	184	,, ...	8	,, ...	much ...	,, ...	58	medium	good
226	Hudson's Early Purple Straw	...	24 ,,	24 ,,	184	,, ...	9	,, ...	,, ...	,, ...	58	,,	,,
227	Purple Straw	Mr. Berthoud, N.S.W.	24 ,,	24 ,,	184	,, ...	9	,, ...	,, ...	,, ...	58	,,	,,
228	Early Para	...	24 ,,	23 ,,	183	,, ...	3	medium ...	light ...	weak to medium	54	little ...	,,
229	White Fife	...	24 ,,	5 Dec.	195	,, ...	1	much ...	medium	medium	58	,, ...	,,
230	Bellevue Talavera	...	24 ,,	5 ,,	195	,, ...	4	,, ...	,,	,,	58	,, ...	,,

231	*Australian Club*	...	24	,,	24 Nov.	184	,, ...	7	,, ...	much ...	strong ...	58	medium	,,
232	*Smith's Nonpareil*	...	24	,,	30 ,,	190	,, ...	1	,, ...	medium	,, ...	58	little ...	,,
233	Freeling	...	24	,,	30 ,,	190	,, ...	traces	,, ...	,,	,, ...	58	much ...	,,
234	Town and Country	...	24	,,	3 Dec.	193	,, ...	1	,, ...	,,	,, ...	58	little ...	medium
235	Velvet Chaff	...	24	,,	30 Nov.	190	,, ...	3	,, ...	,,	,, ...	58	,, ...	good
236	Blount's No. 10	...	24	,,	26 ,,	186	,, ...	8	,, ...	,,	medium	58	medium	,,
237	Manitoba	...	24	,,	3 Dec.	193	,, ...	traces	,, ...	light ...	strong ...	56	little ...	medium
238	Lazistan	...	24	,,	26 Nov.	186	bearded	2	,, ...	,, ...	medium	51	,, ...	good, red
239	Bega	...	24	,,	5 Dec.	195	bald ...	2	,, ...	medium	strong ...	56	,, ...	good
240	Fultz	...	24	,,	4 ,,	194	,, ...	2	medium ...	,,	,, ...	56	much ...	,,
241	Jordan's	...	24	,,	30 Nov.	190	,, ...	6	much ...	much ...	,, ...	58	little ...	,,
242	Anglo-Australian	...	24	,,	6 Dec.	196	bearded	2	,, ...	,, ...	,, ...	58	...	,,
243	White Naples	...	24	,,	30 Nov.	190	bald ...	5	,, ...	,, ...	medium	60	little ...	medium
244	Medeah	...	24	,,	25 ,,	185	bearded	traces	medium ...	little ...	,, ...	56	,, ...	hard
245	Queensland Defiance ...	...	24	,,	5 Dec.	195	bald ...	2	light ...	medium	strong ...	57	,, ...	medium

THE ALLORA WHEATS.

Rust Freedom.—Seven varieties made their growth, so far as could be seen by us, with perfect freedom from rust contagion, namely:—Buckley's Rust-proof, Fluorspar, Sicilian Baart, Tourmaline, Victorian Defiance, Ward's White, and Wheaton's Rust-proof.

The Highly Rust-resistant.—The group of wheats in the Allora experiment having rust-resisting powers in a very high degree without attaining to absolute freedom from the disease number thirty-two. These are marked in the columns of the table headed "rustiness," "traces," and "1," the numeral indicating a small but noticeable increase in rustiness compared with those which show no more than traces of the disease. The following is the list:—Algerian, Australian Wonder, Belotourka, Blount's Lambrigg, Blount's Fife, Freeling, Galland's Hybrid, Gore's Indian, Indian Early, Indian Pearl, Inglis' Battlefield, Inglis' Inoculated Steinwedel, Inglis' Success, Leak's, Manitoba, Medeah, Marshall's 3, 4, 7, 8, 10, 11, 36, Mummy, Murray River, Polish, Smith's Nonpariel, Summer Club, Thomas' Rust-proof, Town and Country, Venning's, White Fife.

Rust-liable Wheats.—Twenty-seven of these Allora wheats succumbed more or less completely to the rust disease. The list of those marked 5 and over in the column of rustiness is as follows:—African, Allora Spring, Ambrose's Standup, Australian Club, Australian Glory, Blount's No. 10, Excelsior, Fill Bag, Hudson's Early Purple Straw, Jordan's, Inglis' Rust-proof, Jacinth, King's Beauty, King's Jubilee, King's Purple Straw, Mexican Spring, Old Red Straw, Purple Straw, Quartz, Red Provence, Selected Steinwedel, Steere's Early Purple Straw, No. 1 Bearded, Talavera, White Hogan, White Lammas, White Naples. It will surprise many to notice in this "black list" such ordinarily reliable sorts as African, Allora Spring, and Talavera classed in our summing-up of the Roma experiments among the number enjoying a large immunity from rustiness. These sorts are not rust-resistant in the true sense of that phrase. By virtue of their early and rapid growth they *escape* rust in the majority of cases, but if this natural habit of growth is from any cause interfered with they succumb readily to the disease. At Allora these wheats grew in a very rich soil, which induced a rank growth of soft, slow-maturing straw, in which the rust-spores found a ready lodgment, and all conditions necessary to their development. It is interesting and practically useful to notice also the strong showing made again by wheats belonging to the Australian group of Purple Straws. No fewer than eight members of this family are conspicuous in this list by reason of the havoc rust made with them.

SUMMARY.

A comparison of the results obtained at the two stations is not altogether satisfactory, because precisely the same varieties were not grown at both. Nevertheless, as a large number of the wheats grown at Roma were also under examination at Allora, it will confirm, in the minds of most people, the testimony furnished by one set of experiments if it is shown that the same facts are repeated in the other. Arranging in one group all those showing rust marks, indicated by

1 and under, we have the following varieties, which at both stations have shown the highest rust-resistant power:—Australian Wonder, Blount's Lambrigg, Buckley's Rust-proof, Fluorspar, Gore's Indian, Improved Baart, Indian Early, Indian Pearl, Inglis' Battlefield, Leak's, Manitoba, Marshall's 3, 4, 7, 8, 10, 11, 15, 22, 24, 33, 35, 36, 37, Marshall's Success, Sicilian Baart, Summer Club, Tourmaline, Town and Country, Ward's White, Wheaton's Rust-proof, White Fife. This list represents wheats that are well worthy of the attention of Queensland wheat-growers. A good many, perhaps a majority, have objectionable qualities—lateness in coming to maturity, flinty structure of grain, &c., but several, notably Marshall's Nos. 3, 4, and 10, Buckley's Rust-proof, Wheaton's Rust-proof, and Summer Club are among the new wheats that are very promising. The tables will give the curious reader much information concerning these promising sorts. Again, the rust-liable sorts of both experiments, meaning those sorts marked 5 and over in the tables, are of interest in illustrating rust susceptibility in an aggravated way. Altogether seven of these rust-liable sorts common to both experiments are found as under:—Fill Bag, Hudson's Early Purple Straw, Jordan's, Purple Straw, Steere's Early Purple Straw, Steinwedel, White Naples.

The reader who still doubts the special constitutional ability of certain varieties, named above, to resist successfully rust contagion is invited to note the peculiar behaviour of contiguous sorts as shown in the tables. He will there see the record of varieties uninjured by rust, and often showing no signs of the disease, growing side by side with others that were rotten with it in all their parts. These facts can have only one meaning, to wit, that very great differences exist in what may be called the capacity of wheats for the rust disease. It follows from this that we have only to prove by selection or hybridization, rust-resistant power and other valuable qualities in wheat, and induce the cultivation of such approved sorts, to secure the wheat-growing community, in a great measure, against the annual loss that now overtakes it through the ravages of the rust disease. This is the work that has been undertaken in these experiments. If faithfully followed up, along the lines on which they have so far been carried, they will give to the farmers wheats which not only resist rust, but which give a grain better and more nutritious than any that they have hitherto grown.

THE SPRINGSURE WHEATS.

The experimental wheats referred to in this caption were grown upon the farm of Alex. McLaughlin, located about eight miles by the road from the township of Springsure. The soil of the experiment was a very fertile black soil, which had been in cultivation to farm crops some years before. All told twenty-five varieties, named as hereinafter, were tested at this station:—

African
Australian Wonder
Bellevue Talavera
Belotourka
Blount's Fife
Cytheré White
Canning Downs
Early Para
Fluorspar
Gore's Indian
Improved Fife
Indian Club
Indian Early
Indian Pearl

Jacinth
King's Jubilee
Lazistan
Leak's
Manitoba
Mexican Spring
Medeah
Sicilian Baart
Tourmaline
Victorian Defiance
Ward's White.

Sowing was done on 1st May. Most of the varieties were ploughed in, and certainly the excellent stand obtained justified this practice. The season was in all respects excellent for the wheat crop in this district, and to the very last an unchecked growth was made by our experimental sorts. There was apparently no rust in this section last season, certainly the closest scrutiny, of all the sorts and of the cereal crops of the neighbourhood failed to reveal a single rust colony. This is all the more remarkable from the fact that several of the wheats—African, Jacinth, and King's Jubilee—are almost certain to show rust colonies even during seasons not reckoned rusty. It is difficult to report upon varieties which, as in the present instance, all do well. Some—like King's Jubilee, Canning Downs, Early Para, and Gore's Indian—came to the ground early through inherent weakness in their straw and others were too late in ripening, but all matured good, and many large, crops. At the time of my last visit, while the wheats were in full ear, I estimated the average yield of all the sorts at nearly 40 bushels per acre. By actual trial of small areas and calculations made therefrom the yield of the more productive sorts was shown to be slightly under 50 bushels per acre. The sorts which in the course of this experiment did best, all things considered, were African, Australian Wonder, Indian Pearl, Jacinth, Leak's, Mexican Spring, and Victorian Defiance.

The Springsure district is certain at no distant day to rank with the best wheat-growing sections of the colony.

THE CLERMONT WHEATS.

The experiments at Clermont were conducted on the farm of Mr. A. Madge, distant from Clermont about two miles. The soil in use was a low-lying tract of clay loam of excellent quality. Twenty-six varieties, named as follows, were here planted :—

African
Allora Spring
Australian Wonder
Bellevue Talavera
Belotourka
Blount's Fife
Canning Downs
Cytheré White
Early Para
Fluorspar
Gore's Indian
Imperial Fife
Indian Early
Indian Pearl
Indian Club
Jacinth
King's Jubilee
Lazistan
Leak's Manitoba
Medeah
Mummy
Sicilian
Baart
Tourmaline
Victorian Defiance
Ward's White

Rust was somewhat prevalent among these wheats, although the actual loss sustained through it was small. Allora Spring, Jacinth, King's Jubilee, and Lazistan were the principal sufferers from rust at

Clermont. A late visitation of frost wrought considerable damage to several of the forward sorts, among which were Allora Spring, Canning Downs, Indian Early, Indian Club, and Mexican Spring. It is not unlikely that fuller experience with wheat-growing in this district will show cultivators that the date of the present seeding—early May—is too soon for these quick-maturing varieties. The sorts which from the facts of this experiment seem of greatest promise to the district are African, Allora Spring, Canning Downs, Indian Club, Indian Pearl, Jacinth, and Mexican Spring.

The Clermont district is, in point of soil and climate, undoubtedly a first-class wheat country; particularly the rich, open downs country seen about Capella, and extending, with various interruptions, beyond Springsure, is the very perfection of wheat-growing country.

THE HUGHENDEN WHEATS.

The list of varieties grown at Hughenden is the Clermont list, with Cytheré White added, and Ward's Prolific substituted for Victorian Defiance. The Hughenden district is one of deficient rainfall. Agriculture here rarely succeeds without irrigation, made possible by the abundant supplies of water obtained at shallow depths along the valley of the Flinders River. For this reason our experimental wheats, which were grown without artificial watering, awakened considerable interest among those conversant with the agricultural facts of this district. The wheats were grown upon the farm of Mr. Thos. Cox, located on the Flinders a few miles from Hughenden township. They were sown early in May, the moist ground bringing them into speedy growth. About the middle of June a considerable rainfall was experienced in the district, 3·10 inches having been recorded in Hughenden. At the time of my visit, late in September, about twelve varieties were ripening, really fine crops, although no rain had been experienced since the heavy downpour of June. This seems to show how very little rain is required for the development of full crops of wheat where suitable varieties are used, and *the ground is in good condition at the time of seeding*. Late ripening varieties here, and generally in the West, it will not be worth while to attempt without or with irrigation. The quick-growing Indian wheats and the various Spring varieties are the sorts that in Western Queensland will give not only quick, but sure and profitable returns to the grower. Rust was fairly prevalent at Hughenden the past season, although the damage done by it was slight. The following are the sorts which in the light of this experiment seem well suited to the district about Hughenden:—African, Allora Spring, Canning Downs, Gore's Indian, Indian Early, Indian Pearl, Mexican Spring.

So far as the best lands of the Hughenden district are concerned—the flat lands following the watercourses—the only question of wheat culture is associated with the scant rainfall. What is really wanted here is a persistent effort at wheat-growing carried on for a number of years in the open plains country lying beyond the influence of the streams. A trial here with two or three of the sorts recommended above, although no more than an acre or two of ground should be used, would in three years measureably decide the problem of wheat production in the Hughenden district.

THE HERBERTON WHEATS

A portion of the farm of Mr. John Newell, located about nine miles from Herberton, was placed at the disposal of the Department of Agriculture for the purposes of this experiment. The rich, red, chocolate soil here used was originally covered with a dense tropical growth of vine scrub. This soil was really too fertile for our purpose; certainly it was not such as the experienced wheat-grower would be likely to select for the growth of wheat. The list of varieties grown at Herberton is identical with that of the Hughenden wheats. At Herberton rust was very prevalent, and in addition a peculiar blight, which attacked the full-grown wheat, blackening the ears and bringing the grain to naught. It transpired in this experiment that those sorts which were most resistant to rust escaped the blight best. This blight promises to be a real and permanent evil to wheat-growers of this section of Queensland. The following are the varieties which did best, and hence, so far as this trial goes, seem best suited to the district:—Leak's, Medeah, Mummy, Sicilian Baart, Tourmaline, and Ward's White. A very large part of the remaining sorts were more or less completely ruined by rust or blight, one or both combined. The Sicilian Baart and Mummy made an enormous and healthy growth in the rich scrub soil of our experimental area. Nevertheless, I do not believe that the Herberton district is a natural wheat-growing section, meaning by this phrase a country in which farmers generally will find it profitable to give to wheat-growing a large place in their operations. Despite the altitude of much of the land of this district, tropical influences are dominant in the climate during several months of every year.

Chapter II.

WHEAT-GROWING, FACTS AND OPINIONS.

The development of wheat-growing in Queensland has been slow to tediousness. The statistics of wheat production in the colony reach back to 1867, when 2,657 acres were in cultivation. In 1894 the total area of wheat amounted to no more than 28,997 acres. This is substantial gain, but compared with the development of wheat culture in Argentina and the United States it seems almost trivial.* That this slow movement is not due to any niggardliness on the part of Nature in responding to the efforts of cultivators, all the facts show. In the last sixteen years Queensland has ten times stood at the head of the Australasian colonies in the yield of wheat per acre; and only three times has she been the lowest on the list, while the average yield of the Queensland wheatfields during this period is nearly five bushels per acre above the average of the other four colonies for the same time. Wheat-growing in Queensland has not progressed by leaps and bounds, for the same reasons that farming in general has not advanced at a rapid pace. The counter attractions of squatting and mining have been too great for the would-be farmer, and then how few of our colonists have been farmers!

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*In 1889 Argentina produced 526,000 tons of wheat, of which 22,806 tons were exported. In 1894 2,154,000 tons were produced, of which 1,608,249 tons were exported. From Melbourne *Argus*:—"This is progress which fairly baffles the imagination."

Area of Queensland ... 427,838,080 acres.
Population 421,297
Wheat Lands reaped for grain (1894) 28,997 "

Region of hopeful wheat culture
Area of successful " "
Wheat experiments 1894
The numbers indicate the average annual rainfall in inches.

TORRES STRAIT
THURSDAY I.
PRINCE of WALES I.
Port Kennedy
Somerset
C. York
CAPE YORK PENINSULA
Batavia R.
Port Musgrave
C. Grenville
Duyfhen R.
GULF OF CARPENTARIA
Princess Charlotte Bay
Kennedy R.
Normanby R.
Lookout Pt
C. Bedford
COOKTOWN
Mitchell R.
Maytown
WELLESLEY ISLANDS
MORNINGTON I.
Staaten R.
Island Pt
Port Douglas
Trinity Bay
C. Grafton
CAIRNS
Gilbert R.
Thornborough
44.05
Herbert
Mourilyan Harbr
Burketown
Leichhardt R.
Normanton
Flinders R.
Norman R.
NORMANTON-CROYDON RAILWAY
Croydon
Georgetown
Rockingham Bay
Cardwell
HINCHINBROOK I.
Gregory R.
Dungeness
Ingham
Halifax Bay
Gilberton
Cleveland Bay
TOWNSVILLE
C. Bowling Green
Upstart Bay
Camooweal
Leichhardt R.
Stanley R.
CHARTERS TOWERS
BOWEN
Port Denison
Ravenswood
Dutton R.
22.10
HUGHENDEN
NORTHERN RAILWY
Cape R.
WHITSUNDAY I.
C. Conway
Repulse Bay
Bowen R.
Pioneer R.
MACKAY RY.
MACKAY
Cloncurry
Urandangi
Georgina R.
Burke R.
Belyando R.
C. Palmerston
Broad Sound
Shoal Water B.
Nebo
QUEENSLAND
Winton
Muttaburra
Boulia
Aramac
29.63
Clermont
St Lawrence
Capella
Fitzroy R.
ROCKHAMPTON
Keppel Bay
24.95
Emerald
Barcaldine
Longreach
Alice R.
CENTRAL RAILWY
Cometville
C. Capricorn
CURTIS I.
Mt Morgan
Gladstone
Port Curtis
Isisford
25.09
Blackall
Springsure
26.62
Mayne R.
Diamantina R.
Thomson R.
Barcoo R.
Dawson R.
Mulligan R.
Eyre C.
Tambo
28.22
Bauhinia
Barfle C.
BUNDABERG
Hervey B.
Sandy C.
Windorah
Birdsville
Adavale
27.73
Taroom
Mt Perry
Burnett R.
Gayndah
31.82
MARYBOROUGH
Wide R.
Double Island Pt
GREAT SANDY I.
Noosa Hd
SOUTH AUSTRALIA
Warburton R.
Cooper's C.
The Barcoo R.
Charleville
Mitchell
SOUTHERN AND WESTERN
25.95
30.52
Roma
Chinchilla
Nanango
GYMPIE
Tewantin
Brisbane R.
Moreton B.
Surat
Condamine R.
Dalby
26.76
TOOWOOMBA
BRISBANE
IPSWICH
Oontoo
Wilson R.
Cooper's C.
Thargomindah
Eulo
Cunnamulla
24.07
St George
27.43
Leyburn
WARWICK
Goondiwindi
Southport
Pt Danger
Stanthorpe
WALLANGARRA
Bulloo R.
Hungerford
Wooroorooka
NEW SOUTH WALES
LAKE EYRE

138 141 144 147 150 153

Scale of Miles

Gov. Litho. Office
Brisbane, Q.

OUR WHEAT LANDS.

The wheat experiments herein detailed have an interest for the general public far beyond the particular purposes for which they were originally planned. The attentive reader will not fail to notice that at four out of six of the stations practically all of the numerous sorts planted—the lowest number in use at any station was twenty-five—succeeded, giving large, often extraordinary crops, free from disease. Even at the two stations where the failure of particular sorts was recorded, the facts indicate with sufficient clearness that certain classes, the Indian and Spring wheats at Hughenden, and the durums and poulards with the hardiest of the soft wheats at Herberton, will succeed well, at these points, in general cultivation. The mere success of numerous sorts is, of course, of small moment. In few wheat-growing districts are half-a-dozen varieties known in common field cultivation. The significance of these successful experiments is seen in the evidence they furnish of a peculiar suitableness in the soil and climate of a large portion of the colony, to the growth of wheat. How extensive the Queensland wheat lands are may be inferred from the fact that our experiments ranged over something like 800 miles of country, North and South, while extending inland, in the case of one station, over 300 miles. Three years ago the writer published* a map showing the regions of "hopeful wheat culture" in Queensland, with that portion of country roughly indicated, in which wheat was successfully grown. It was then thought by many that this map drew heavily upon the credulity of the readers of the pamphlet. Since the date of the publication of the bulletin referred to (September, 1892) more than one-half of the hopeful or suspected area has, by the spread of wheat cultivation, become the region of proved suitableness to the wheat plant, while the region of "hopeful wheat culture" has been greatly extended. (See accompanying map.)

THE MAP EXPLAINED.

The portion of the map covered by the horizontal ruling alone, is meant to indicate that section of the colony in which conditions of soil and climate seem suitable to successful wheat-growing. Enough experiments have been tried upon different parts of this great region to indicate as much without proving it. Again, the vertical and horizontal lines together are meant to cover the region of successful wheat farming. When, as in the region under consideration, wheat has been successfully grown in all directions about it for many years, it is not presuming or illogical to speak of such country in its entirety as wheat land. Again, a wheat soil can be nothing less than good land. There are few farm crops that are more exacting of the soil than wheat. It takes from the land the best of its constituent elements and those substances most difficult to replace. For this reason we mean, by wheat land, good land always. A very large portion of the area pointed out on this map as a wheat country consists of very poor land, but much is also good land, and upon this fertile soil alone is profitable wheat culture possible.

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* See Bulletin No. 19—"Wheat-growing in Queensland."

THE FUTURE OF WHEAT-GROWING.

The subjoined table shows how small our present accomplishments in wheat-growing are, even when compared with present needs. It is here shown that in the past four years our farmers have grown less than one-fifth of the wheat actually consumed in the colony.

TABLE No. 3.

SHOWING QUEENSLAND'S ANNUAL PRODUCTION AND IMPORTATION OF WHEAT AND FLOUR FOR SIXTEEN YEARS.

Year.	Wheat Grown.	Importations.			Bushels Imported to each Bushel Grown.
		Wheat.	Flour.	Total Wheat and equivalent of Flour in Wheat.*	
	Bushels.	Bushels.	Tons.	Bushels.	
1879 ...	29,259	18,433	21,988	1,117,833	38
1880 ...	223,243	31,196	24,723	1,267,346	$5\frac{6}{10}$
1881 ...	39,612	321	22,319	1,116,271	27
1882 ...	145,752	47,166	27,398	1,417,066	$9\frac{9}{10}$
1883 ...	42,842	12,140	27,253	1,374,790	32
1884 ...	195,725	25,880	38,431	1,947,430	$9\frac{7}{10}$
1885 ...	51,508	10,297	33,820	1,701,297	33
1886 ...	21,221	19,364	36,451	1,841,914	86
1887 ...	182,308	53,101	44,202	2,263,101	12
1888 ...	8,263	16,719	39,994	2,016,419	244
1889 ...	134,335	109,588	41,371	2,178,138	16
1890 ...	207,990	326,484	41,122	2,382,584	11
1891 ...	392,309	261,086	33,433	1,932,736	$4\frac{9}{10}$
1892 ...	462,583	269,487	36,324	2,085,687	$4\frac{5}{10}$
1893 ...	413,094	372,559	34,188	2,081,959	5
1894 ...	545,734	415,734	34,004	2,115,934	$3\frac{8}{10}$

* The millers' figures of 50 bushels of wheat to the ton of flour are used in this computation.

The disparity between opportunities and actual accomplishments in wheat-growing come out strikingly in a review of the data upon which our map of the wheat lands of the colony is based. We call to mind the millions of acres of the Darling Downs, among the best wheat lands in the world, now profitlessly employed in supporting less than one sheep to the acre, and the similar areas of the Peak Downs, and of the great stretches of fertile plains west of Roma and Barcaldine, all unsurpassed wheat soils, but like the Darling Downs, given over to stock-keeping. The process of converting these stock ranges into wheatfields is already well under way. The largest wheat-growers in the colony to-day are the squatters. The extensive wheat-growing of the Messrs. King, of Gowrie, Macansh, of Canning Downs, and Messrs. Gore, of Yandilla, is finding imitators in many different places, particularly amongst the small grazing farmers. This process is sure to go on, because *there is more profit in fifteen bushels of wheat raised than in the proceeds of one sheep or one-fifth of a bullock.* It is a suggestive fact that those gentlemen who, on the Darling Downs and elsewhere, begun extensive wheat-growing a few years ago have, in nearly every instance, and in face of the abnormally low price of wheat, kept steadily at the business, gradually enlarging their operations, and finding it, as more than one has confessed to me, the one profitable part of the year's operations. Wheat-growing in this colony offers many attractions to enterprising young men of moderate means.

Modern wheat-growing is almost the one branch of farming that admits of large operations carried on with something of the precision of the factory. Wheat-growing is a white man's work. Machinery figures in every operation connected with it. The ploughing, the sowing, reaping, and threshing are all the work of brain-directed iron fingers. How long Queensland farming will rest under the imputation of supplying the bread to only one in five of the mouths of its people remains to be seen. We firmly believe that within the next decade, and with no more than the stimulus of existing prices, Queensland will not only meet her own requirements of bread grain, but that she will add to wool, meat, and sugar, wheat for export.

DOES WHEAT-GROWING PAY?

We reply, not when the price drops below a half-crown per bushel. It may be doubted if wheat anywhere can be profitably produced when the price goes below this figure. The following figures are given as the cost of producing one acre of wheat in Queensland under the two systems of harvesting in vogue in the colony—that is, where the stripper or harvester are used to gather the crop:—

COST OF PRODUCING ONE ACRE OF WHEAT.

With the Stripper.		With the Harvester.	
	s. *d.*		*s.* *d.*
2 Ploughings	11 0	2 Ploughings	11 0
3 Harrowings	2 0	3 Harrowings	2 0
Seed and sowing	3 0	Seed and sowing	3 0
Stripping and winnowing ...	10 0	Cutting and binding	5 0
		Stacking	4 0
		Threshing (1s. 8d. per bag) ...	6 3
Total	£1 6 0	Total	£1 11 3

Per contra, 18·8 bushels of wheat (Queensland average, 1894) at 2s. 6d. per bushel = £2 7s.

Profit per acre: With stripper, 21s.; with harvester, 15s. 9d.

To the account of cost must be added the rent of ground, taxes if any, and the cost of hauling the grain to markets, items that vary with different localities. The above items are, we are satisfied, sufficiently liberal to cover nearly every ordinary circumstance of wheat-growing in the colony. Upon the light lands about Roma most likely several of the items of this statement of cost are put much too high. The cost of ploughing would, again, be greatly reduced where double or treble furrow ploughs were used, while to the farmer owning his own machinery good wages would be possible in harvesting at much lower rates than those given. The tables are sufficiently accurate, however, to show that, after allowing for the price of seed and for the use of machinery, good wages for himself and teams, there is still left a fair profit to the Queensland grower, at the low price named, upon every bushel of wheat that he raises. We might, without distorting facts, add to the credit side of the account the stock feed which the growing wheat often furnishes, and the value of the straw—often a considerable

item—yielded by the crop, and thus increase a favourable showing. Moreover wheat, at this writing, brings over 3s. instead of the half-crown upon which these estimates are based.

OBJECTIONS ANSWERED.

Criticism of Queensland as a wheat-growing country is nearly always levelled at the climate, rarely at the soil. It is said that we have droughts that often ruin the crop. To this it is only necessary to reply that Queensland has had six consecutive good wheat crops, beginning with 1889. In the Warwick district, the oldest wheat-growing section of the colony, there has been only one actual failure from drought in twenty years, although the crop has been shortened in a few instances by dry weather. There are few wheat countries that can match this wonderful record of good seasons and resultant large crops.

Again, we are told that the flour made from Queensland wheat will not keep. This is not a matter that, for the present at least, concerns Queensland cultivators much. In the minds of wheat-growers it will appear sufficient that millers want his wheat, have been wanting it for years, and are willing to give the best market price for it. Doubtless in wet seasons badly stacked, damp grain has been disappointing to consumers, and will be so again. It should also be remembered that long-keeping flours are a matter of much less importance now than formerly. The great mass of Queensland's bread-eaters live convenient to railways and other means of quick transportation, which make it unnecessary to keep flour any great length of time.

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

Queensland. [July, 1895.

DEPARTMENT OF AGRICULTURE, BRISBANE.

BULLETIN No. 7.

SECOND SERIES.

THE

USE OF MAIZE AS HUMAN FOOD.

INTRODUCTORY ARTICLE BY E. M. SHELTON, M.Sc.,

Instructor in Agriculture.

RECIPES SELECTED BY MRS. SHELTON.

BRISBANE:

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

1895.

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THE USE OF MAIZE AS HUMAN FOOD.

E. M. SHELTON, M.Sc., INSTRUCTOR IN AGRICULTURE.

THE dietary importance of Indian corn (maize) has never been appreciated by the Australian colonists. Maizemeal is used in Queensland to a limited extent for porridge, and corn starch or maizena—for use in puddings and various forms of dessert—is imported in considerable quantities; but beyond this, maize and its products cut a small figure as articles of human diet. This is all the more surprising in view of the large interest that Queensland has in the annual crop of Indian corn. Except sugar-cane only, maize is the most important crop grown in Queensland. About one-half of all the cultivated land of the colony is devoted to maize cultivation. The average yield per acre (25·8 bushels in 1894) is high—higher, in fact, than that obtained in the greatest of maize-growing countries, the United States of America; while in respect to the total yield Queensland ranks second among the Australian colonies. There are, therefore, special reasons for calling the attention of Queensland people to the numerous uses in human dietaries to which their greatest grain crop may be put. Moreover, maize is one of the most fluctuating of farm crops in respect to price. Often for months at a time the abundant crop is practically unmarketable, or when saleable it fetches a price which barely meets the cost of delivering at the market. In the meantime the bread of the colony is made from wheat, four-fifths of which is grown abroad. An increased use of maize as human food, then, will inevitably tend to diminish the glut of maize in the markets, and stop the outgo of money for foreign wheat.

There is another and even more important reason why Queensland people should learn the use of the various preparations of maize as food—their palatableness and high nutritive value. Our people have only to become acquainted with such examples of maize foods as green corn, the various forms of bread and cake into which maizemeal is so readily moulded, to appreciate their great usefulness. Indian corn has proved itself sufficient as bread food for the requirements of human existence under nearly every climatic condition. It is commonly said that maize foods only meet the wants of inhabitants of cold countries. Observation, however, does not bear out this theoretical view of the uses of maize. In the southern States of America and in the Mexican States, both nearly torrid climates, maize forms the staple bread grain of the labouring classes. In the southern States of America the maize is commonly used with pork, another theoretical heat-producing food, and it is yet to be shown that injurious results to consumers grow out of the use of these foods. The experience of many years seems to show conclusively that maize is a widely useful food, "fully equal in value as a food to any of the cereals," as a late American writer puts it.

COMPOSITION OF MAIZE.

We introduce this theme by a quotation from an article on "The Food Values of Maize," written by Dr. H. W. Wiley, chemist of the United States Department of Agriculture :—

"Food, to be perfect, must give to the body all the necessary constituents to supply tissues for its growth and to take the place of the waste of tissue, which is a necessary attendant on the functions of life. That article of food which is best calculated to supply the wants above mentioned would be of necessity the most valuable for food purposes. In general, we may say of foods that they should be fat-producers, muscle-producers, bone-producers, and, most of all, blood-producers, since it is through the blood that the tissues of the body are nourished. * * *

"As fat-producers are generally reckoned the starches and sugars which the food contains, the albuminoids which are taken in food are supposed to serve chiefly for the nourishment of the muscular tissues and to supply the nitrogenous principles of the blood. In the ash constituents of the food are found those mineral substances which are necessary to supply the tissues of bone, such as phosphoric acid and lime, which are its chief constituents. The fats of food are supposed to be pre-eminently the source of animal heat, furnishing the same by their combustion in the different parts of the body under the action of the oxygen of the air."

The table of analysis of leading cereal grains given below, and taken from the Report of the Chemist of the United States Department of Agriculture, serves to show the chemical relations which maize sustains to other bread grains. The reader may here see at a glance the value of the different foods, based upon the digestible food elements which they contain :—

—	Hulled Oats.	Wheat.	Rye.	Barley.	Maize.
Water	6·93	10·27	8·67	6·53	10·04
Ash	2·15	1·84	2·09	2·89	1·52
Oil or Fat	8·14	2·16	1·94	2·68	5·20
Digestible Carbohydrates ...	67·09	71·98	74·52	72·77	70·69
Crude Carbohydrates ...	1·38	1·80	1·46	3·80	2·09
Albuminoids	14·31	11·95	11·32	11·33	10·46

Dr. Wiley, commenting on this table, says :—"As indicated by the above analysis, maize is fully equal in value as a food to any of the cereals, making up in its contents of fat any deficiency which may be noticed in its nitrogenous matters and digestible carbohydrates. This conclusion, however, as to the food value of maize does not rest alone upon the comparison of analytical data. The long years of use of this article, by man and beast, has shown its high character. Whether to be used as food for producing muscle for labour, or as a means for fattening animals, it has been found to be of superior value to any of the other cereals produced in the United States," or, we may add, Queensland.

PRACTICAL SUGGESTIONS

A principal reason for the indifference of colonial cooks and consumers, to maize, is due to the faulty manner in which the meal is ordinarily prepared, to say nothing of the subsequent cooking. In grinding maize, millers follow the fashion set in wheat flours, and grind the maize to the condition of a fine powder. Cooking quickly converts this maize flour into a sticky, pasty mass, which is both unpalatable and indigestible. Maize should be ground into an even and rather coarse meal—not flour—which, when cooked, gives the light granular bread and cakes seen in maize-consuming countries. The best varieties of maize for meal are the early "Flint" kinds, of which a good example is the "Tuscarora" variety. White corn is also much used for this purpose, the white meal being preferred by many. But whatever variety is employed it should always be first thoroughly kiln-dried, a process which gives not only a better and more uniform meal, but one that keeps well. If the millers could be persuaded to thoroughly kiln-dry maize, as a preliminary to grinding, afterwards removing the germ from the grain, the old difficulty in Queensland with rancid meal would disappear.

ACKNOWLEDGMENTS.

The recipes given in this Bulletin are selections made by Mrs. Shelton, who has been able to carefully test nearly all. A considerable number are formulas of her own; but the largest proportion have been taken from the works of Mrs. Rorer, and from "Health in the Household," by S. W. Dodds; "Practical Cooking and Dinner Giving," Mrs. M. F. Henderson; the "Kansas Home Cook Book," and various agricultural publications.

DEFINITIONS.

Certain words, technical in character, used commonly in the recipes, are given as follows:—

Dent Corn.—The soft, generally coarse varieties, having a dent or depression at top of each kernel.

Flint Corn.—The hard, early ripening sorts, having round smooth grain.

Gem Pan.—Iron moulds for small cakes.

Graham Flour.—Wheatmeal, unbolted flour.

Griddle.—Shallow iron pan used for baking cakes.

Indian or Indian Meal.—Maizemeal.

Molasses.—Treacle, syrup.

When quantities of substances in the recipes are given by the "cup," one half-pint is to be understood; the teaspoonful of soda is a level spoonful of that substance.

RECIPES FOR THE USE OF MAIZE.

PORRIDGE, MUSH, ETC.

Cornmeal Mush.

Put a quart of water on the fire to boil. Stir a pint of cold milk with one pint of cornmeal and one teaspoonful of salt. When the water boils pour in the mixture gradually, stirring all well together. Let it boil for half an hour, stirring often, to prevent it from burning.

Cornmeal Mush.

Put 2 quarts of cold water in a boiler that will hold at least 4 or 6 quarts. Add a tablespoonful of salt. As soon as water comes to a boiling point stir as much yellow meal as will nicely sink into water. Let the meal run between the fingers of the left hand while you stir with the right.

Meal absorbs more water at some seasons than at others, so the exact quantity can never be told, but as long as the meal sinks in the water add more, but the minute you see it floating on the surface, stop, no matter how thin the mush appears.

Stir from the bottom and side of the pot. Then place it on an iron rest or asbestos plate, which will insure its not scorching. Let it cook for at least one hour, better two. Remember that the most thorough cooking of all starchy foods is very important.

It is now ready to serve hot with milk. If you wish to fry, turn it out at once into square moulds.

Philadelphia Scrapple.

Take one hog's head and set of feet. Thoroughly scald and thoroughly scrub. Put them into a large kettle. Cover with cold water and cook slowly for about 2 hours, or until meat will fall from the bones. Now remove carefully all the bones and allow the mixture to stand until perfectly cold, so that the fat can be taken from the surface. Put on the fire and stir it until the meat is broken into small pieces. Then add tablespoonful of salt, teaspoonful of pepper, and as soon as it comes to boiling point add sufficient cornmeal, same as for mush, until you have it the consistency of mush. Remove the kettle to the back part of the stove, where it should cook slowly for 2 hours. Stir frequently. Turn into square pans and stand away to cool.

This can be fried the same as mush. Seasoning of thyme and sweet marjoram may be used.

Fried Mush.

Cut the mush into slices about $\frac{1}{3}$ inch in thickness. Have ready a large square pan, the bottom well covered with smoking hot fat. This may be of oil, dripping, or lard. Let it fry quickly on one side, then turn and fry on the other. To be palatable and good, mush must be quickly fried so that the grease will not penetrate, and it must be nicely browned over the entire surface. Serve hot with butter or syrup.

Fried Corn Mush for Breakfast.

Many slice the mush when cold, and simply *sauté* it in a little hot lard. But as some cooks seem to have as great success in simple dishes as in elaborate ones, I shall consider this as at least one of the little successes taught me by a French cook. Of course, the mush is made by sprinkling the cornmeal into boiling salted water. It is thoroughly cooked and made the day before wanted. When cold it is sliced, each slice dipped in beaten eggs (salted) and bread or biscuit crumbs, and fried in boiling hot lard. One should try this to know the superiority in the manner of cooking.

Maizemeal Griddle Cakes.

Take equal parts of sweet and sour milk; a tablespoonful of sour cream; a teaspoonful of salt; a tablespoonful of sugar. Stir in first a handful of maizemeal, and then a handful of flour, until the batter is thick enough to bake, and turn nicely on an oiled griddle. Sweeten the milk with soda well mashed and beaten in thoroughly. When baked they should be perfectly light and tender. If sticky add an egg well beaten. If all sour milk is used, one or two eggs will be necessary. These are nice, eaten with sausage, pork chops, or beef steak, moistened with a little of the meat gravy, or they can be eaten with syrup.

Green Corn Griddle Cakes.

One pint grated green corn; 2 eggs, yolks and whites separate; 2 tablespoonfuls sweet milk or cream; 2 tablespoonfuls flour, or enough to thicken a little. Mix together the corn, yolks, and milk, and add the flour (Graham or white), just enough to bind all together; better test a little on the griddle before baking, as too much flour spoils the cakes. Whip and stir in the whites, beating thoroughly, then bake on a hot griddle, well oiled. Have a good even fire, and bake in small cakes, easily turned.

Maizemeal Griddle Cakes.

Two cups coarse cornmeal; 2 cups sour milk or buttermilk; 1 egg; 1 tablespoonful Graham flour; 1 teaspoonful soda, dissolved in boiling water. Make a batter of the meal, milk, egg, and flour; if it is too thick add a little milk. Then stir in the dissolved soda, beat well, and bake immediately on a hot griddle; do not scorch the cakes.

Syrup for Cakes.

One teacupful sugar to $\frac{1}{2}$ cupful water. Boil together; brown sugar is best, but a little tinned syrup added to the white sugar syrup gives a pleasant flavour, or fruit syrups can be used, thickened a little, or jellies and jams.

CORN CAKE, MUFFINS, ETC.

Bachelor's Johnny Cake.

Three cups cornmeal; 1 cup Graham flour; 3 cups new milk; 1 tablespoonful sugar; 1 teaspoonful soda, dissolved in boiling water. Time, 20 to 30 minutes. Mix the meal, flour, and milk over night, and set the batter where it will keep moderately warm but will not sour. In the morning add the sugar and the dissolved soda, and beat hard. Pour into two pans well oiled, and bake for breakfast; the cakes should not be more than an inch thick when done. It will require a hot oven, and 20 to 30 minutes.

Corn Cake.

Two cups cornmeal; 1 cup flour, Graham or white; $1\frac{1}{2}$ cups sweet milk; $\frac{1}{2}$ cup sweet cream; 1 teaspoonful soda dissolved in boiling water; 2 teaspoonfuls cream tartar. Time, 20 to 30 minutes. Mix together the meal, flour, milk, cream, and soda, and beat well. See that the oven is hot, then add the cream tartar and beat very thoroughly. Dip immediately into gem pans well oiled, or pour into two small bread pans, and bake 20 minutes. The batter should be about as stiff as will drop from a spoon, but rather too soft to mould with the hands. If it is too thin add a little meal; if too thick add more milk. The coarser the cornmeal the more milk will be required. If new milk is used for mixing, no cream will be needed.

NOTE.—Successful with sour milk and soda, leaving out cream tartar; dessertspoonful sugar and little salt; bake in gem pans. Excellent where flour is substituted for the maizemeal.

Kentucky Corn Cake.

Take, say 2 cups of cornmeal, and half scald by stirring into it a cup of boiling water; then add cold water or cold sweet milk, to form a batter as stiff as can be stirred with a spoon; beat very thoroughly. Spread it two-thirds of an inch thick on an oiled griddle, and bake 10 to 15 minutes, or till the bottom is well browned; then remove the griddle from the top of the stove, place it in a moderate oven, on the topmost grate, and let it bake from 30 to 40 minutes, longer if mixed with water. If more convenient, you may dispense with the griddle, pour the batter into a bread pan, and bake it in the oven 40 to 50 minutes.

Corn Custard.

One pint (heaping) cornmeal; 2 tablespoonfuls white flour; 1 quart sour milk, or buttermilk; 3 eggs, yolks and whites separate; 2 teaspoonfuls soda, dissolved in boiling water. Time, 20 minutes. See that the oven is just right; then stir together the meal, flour, milk, and beaten yolks. When these are well mixed add the dissolved soda, and the whites cut to a stiff froth, and beat hard. Pour into two pans, well oiled, and bake immediately. The bread should not be more than an inch in thickness when done; it should bake in about 20 minutes.

Graham and Corn Muffins.

Two full cups cornmeal; 1 cup Graham flour; 1 cup sweet milk; 2 cups boiling water; 1 egg. Time, 20 minutes. Pour the boiling water into the meal, and stir well; let the mixture stand till lukewarm. Then add the cup of milk, or enough to form a batter about as stiff as will drop from the spoon, and beat well. Set this in a warm place 2 hours, then break in the egg, and beat hard. Dip into hot gem pans, well oiled, and bake 20 minutes in a brisk oven.

Potato and Corn Muffins.

One cup cold mashed potato; 1 cup sweet milk; 1 egg, well beaten; 1 cup cornmeal, or enough for gem batter. Time, 20 to 30 minutes. Soften the potato with the milk, working out all the lumps, then stir in cornmeal till the batter is just thick enough to drop easily from the spoon; add the whipped egg, and beat hard. Drop into hot gem pans, oiled, and bake in an even oven 20 to 30 minutes.

Rice and Corn Bread.

One and a-half cups cold boiled rice; 2 cups sour milk; 1 egg, well beaten; 1 teaspoonful soda, dissolved in boiling water; 3 cups coarse cornmeal, or enough to make a tolerably soft gem batter. Time, 30 minutes. Soften the rice with the milk, and mash all the lumps; add the beaten egg, and enough of the cornmeal to form a thin batter. Stir well; then add more meal, enough to make a batter just stiff enough to mould with the hands; add also the dissolved soda, and beat hard. Form into small oval cakes, say 3 inches long and $1\frac{1}{2}$ inches in thickness, and bake in a hot oven 30 minutes.

Johnny Cake.

Two or 3 eggs beat well; 2 cups sour milk or buttermilk; 1 cup sweet milk; 2 tablespoonfuls of sugar; 2 tablespoonfuls of sour cream or dripping; 1 level teaspoonful soda, after it is mashed fine; $\frac{3}{4}$ lb. maizemeal. Sweet milk can be used in the above recipe, or all sour milk, if more convenient.

Johnny Cake.

Put 1 pint of yellow meal into a bowl, and pour over sufficient boiling water to scald. The meal must be moist, not wet. Add tablespoonful of dripping. Moisten teaspoonful of baking-soda in one of warm water. Rub until thoroughly dissolved. Stir this into a pint of buttermilk or thick sour milk. Add it to the meal. Mix thoroughly. Bake in a quick oven in a shallow pan for about 45 minutes.

Corn Dodgers.

Put 2 cups of cornmeal (that from white corn preferred) into a bowl. Pour over it sufficient boiling water to scald, being exceedingly careful to just moisten the meal and to stir all the time. Add to the meal while hot a tablespoonful of dripping. When the meal is cool add 1 egg beaten until quite light, 2 tablespoonfuls of milk, and a teaspoonful of salt. Mix and bake in a large baking pan by spoonfuls. For instance, put the spoonful down, and smooth it until it looks like a small griddle cake. Bake until brown on both sides. These, if properly cooked, make the sweetest of all corn breads.

Cornmeal Scones.

Put 2 cups of cornmeal into a bowl. Add a tablespoonful of sugar, a teaspoonful of salt, 2 teaspoonfuls of baking-powder, and mix it well together. Add a large tablespoonful of butter. With your hands rub it into the flour. Add to this sufficient cold milk to make a batter that will drop, not pour, from the spoon. Bake on a griddle in muffin rings, same as you would ordinary muffins.

MAIZEMEAL BREAD

Corn Bread.

On account of the absence of gluten in corn, it cannot be well made into loaf bread; again, to be palatable and easy of digestion, corn must be well cooked; from lack of knowledge of these facts few people make a perfect and wholesome corn loaf. If these directions are carefully followed, good, sweet and attractive bread will be the result.

First, put 1 quart of cold water in a kettle; at first boil, add 1 tablespoonful salt, and sufficient yellow meal to make a mush. Follow directions for mush-making. Cook 1 hour. At sponging time scald 1 pint milk; when lukewarm add 1 cup good yeast, or one dissolved compressed cake; then wheat flour to make a sponge. Beat well; now your mush should be just lukewarm, add it gradually to the sponge, and if too thick, add warm water. Cover and stand aside overnight. In morning, knead lightly, using wheat flour; beat rather than knead; add, if you like, 2 tablespoonfuls sugar, turn into pans 8 inches long, 4 or 5 inches wide, and when light and double its bulk bake in a moderate oven 1 hour. This will cut down like light wheat bread, will be moist and delicious. Baking-powder may be used instead of yeast, and bread made up quickly; but must be baked full time, and in single loaves.

Boston Brown Bread.

Mix 2 cups ryemeal, 2 cups yellow maizemeal, and 1 teaspoonful salt. Dissolve 1 teaspoonful soda in 2 tablespoonfuls warm water, add it to $1\frac{1}{2}$ pints sour milk or buttermilk, then add 1 cup molasses. Mix and pour it on the meal, and beat a moment, turn into a well-greased two-quart brown bread mould, put on lid and steam 5 hours. Warm by placing it uncovered in the oven for 20 minutes.

Hot Corn Bread.

Scald as before directed, 1 quart meal, add to it while hot a large tablespoonful butter. Beat, without separating, 2 eggs. Dissolve 1 teaspoonful of soda in 2 tablespoonfuls warm water, then add it to 1 pint sour milk or buttermilk; add to meal, beat; add eggs, 1 teaspoonful salt, and bake in shallow pans 40 minutes. (Good.)

Wheaten and Indian Bread.

Two and a half cups coarse cornmeal—"Flint" preferred; 1 cup Graham flour; $2\frac{1}{2}$ cups sour milk or buttermilk; $1\frac{1}{3}$ teaspoonsful soda dissolved in boiling water. Time, $2\frac{1}{2}$ hours. Form a batter of the meal, flour, and milk, then add the dissolved soda and beat well; pour immediately into a shallow pan previously oiled, cover, and steam $2\frac{1}{2}$ hours; you must not uncover till done. Brown a few mnutes in the oven and send to the table. This bread is better mixed an hour or two beforehand, and the batter set in a warm place; the soda should be added, with thorough beating, the last thing before placing it in the steamer.

Wheaten and Indian Bread.

Three cups coarse cornmeal—"Flint" is best; $1\frac{1}{2}$ cups Graham flour; 1 cup sour milk or buttermilk; $\frac{1}{3}$ cup pure molasses, or sugar; 1 teaspoonful soda dissolved in boiling water; enough boiling water to scald the cornmeal and form a stiff batter. Time, 3 hours. Scald the cornmeal the night before, forming a batter as stiff as can be stirred with a spoon, and set it in a moderately warm place. In the morning stir in the Graham flour and molasses (or sugar) and the cup of milk, or enough to form a batter that will pour. Set where it will not be very warm, lest it should sour. Three hours before dinner add the dissolved soda, and beat hard. Turn the batter into an oiled pan, cover, and set in the steamer. Keep the water at a fast boil and steam 3 hours, then brown 10 to 15 minutes in the oven.

Rye, Wheat and Indian.

One and a half cups coarse meal—"Flint" is best; 1 cup unbolted rye meal; $\frac{1}{2}$ cup Graham flour; 3 cups sour milk or buttermilk; 1 tablespoonful sugar; $1\frac{1}{2}$ teaspoonfuls soda, dissolved in boiling water. Time, 4 hours. Make a batter of the above ingredients and beat very thoroughly. Then pour it into an oiled pan, tin or earthen, leaving room to swell; cover and set immediately in the steamer. Keep the water constantly boiling, and steam 4 hours without uncovering. When done place in the oven, and brown 10 minutes before sending to the table. If preferred, the sugar may be omitted. This bread may be served without browning, as a pudding, with fruit sauce or lemon sauce. If eaten as a pudding a cup of seeded raisins may be added before steaming.

Third Bread.

The third bread of New England is made of equal parts of rye, maize, and white flour. Take 1 quart of each kind of flour; 1 cup of yeast; 1 teaspoonful of salt; $\frac{1}{2}$ cup of brown sugar or molasses, and mix the whole well together with a quart of warm water. Let the dough rise overnight; in the morning knead lightly and shape into loaves. Let the loaves rise $\frac{3}{4}$ hour, and bake the bread in a slow bread oven for $1\frac{1}{4}$ hour, or longer.

Togus Bread.

Three cups of sweet milk,
One cup of sour;
Three cups of maizemeal,
One cup of flour;
Of soda sufficient a teaspoon to fill;
The same of salt will season it well;
A cup of molasses will make it quite sweet;
And a very good dish for a Queenslander to eat.
Steam 3 hours.

PUDDINGS.

Baked Indian Pudding.

One quart of sweet milk; 1 cup of (scant) cornmeal; ½ teaspoonful salt; 2 tablespoonfuls sugar; 2 eggs, yolks and whites separate; time, 1½ hour; slow oven. Heat the milk to a boil and stir in the cornmeal; if coarse is used, make the measure scant. Let the batter stand till cold, then beat the yolks and sugar together, and stir them into it; add also the whites whipped to a stiff froth, and beat hard. Pour it into a pudding dish, set this inside a shallow pan of boiling water, and bake, covered, 1 hour, or until the pudding has the proper consistency. Serve warm or cold, with cream, fruit, or lemon sauce, or it is good without a dressing. Some make with less eggs—3 eggs to 2 quarts of milk.

Baked Indian Pudding.

One quart sweet milk, boiling hot; 1 cup cold milk; 1 cup coarse cornmeal—"Flint" preferred; ½ cup pure molasses, or pure syrup; time, 1½ hour; slow oven. Pour the hot milk over the meal, and stir till there are no lumps. Then add the molasses, or syrup, with thorough beating, pour the batter into a small but deep dish, and place in the oven within a dripping pan containing boiling water. Cover and bake, stirring the pudding from the bottom several times the first half-hour; at the end of that time stir in the cup of cold milk—some use cold water—and bake in a slow oven 1 hour longer.

Indian Pudding with Fruit.

Three pints sweet milk; 1 cup rather coarse cornmeal; 1 cup sifted Graham flour; 1½ cups raisins, seeded and finely chopped; 2 tablespoonfuls sugar; 3 eggs, yolks and whites separate; 1 teaspoonful soda, dissolved in boiling water; 2 teaspoonfuls cream of tartar, sifted through the flour. Time 1 hour, moderate oven. Scald a pint of the milk, and wet the meal with it; stir well to prevent lumping. Let the mixture stand till lukewarm; while it is cooling, make a batter with the flour and another pint of the cold milk, and when the scalded meal is cool enough, stir the two batters together. Then heat the remaining pint to a boil, beat the yolks, whip in the sugar, and stir into these, little by little, the hot milk; pour this custard into the mixed batter, add the whites whipped to a stiff froth, and beat very hard. Lastly, put in the fruit, previously dredged with a portion of the flour, and mix thoroughly. Pour all into a pudding dish, set this in a shallow pan of boiling water, and bake, covered, in a moderate oven. Stir once from the bottom, as the pudding begins to thicken; and continue the cooking about an hour. Serve with cream, fruit, or lemon sauce. Seedless raisins, or currants, may be substituted for the sweet fruit in this pudding; they cook sooner, and are very good.

Steamed Indian Pudding.

Two cups sour milk, 1 cup sour cream, 2 cups coarse cornmeal, 1 cup Graham flour, unsifted, ½ cup sugar, 1½ teaspoonfuls soda, dissolved in boiling water. Time, 2 hours. Meal that is made from white or yellow "Flint" corn, and rather coarsely ground, is best in all steamed breads, or steamed Indian puddings. Mix together the meal, flour, milk, cream and sugar, stirring all to a smooth batter; then add the dissolved soda, and beat thoroughly. These cornmeal puddings are always better for being well beaten. Pour immediately into an oiled pan or mould, filling it not quite full; then cover, and steam 2 hours, keeping the water at a fast boil; the steamer should not be opened till the pudding is done. Serve with mock cream, fruit sauce, stewed plums, or lemon sauce; or a soft custard may be used as a dressing.

Steamed Indian Pudding.

Three cups sour milk, or buttermilk; 2 cups coarse cornmeal; 1 cup Graham flour, unsifted; 1 cup currants, or seedless raisins; ½ cup finely powdered beef suet; 2 tablespoonfuls pure molasses, or pure syrup; 1½ teaspoonfuls soda, dissolved in boiling water. Time, 2½ hours. Dredge the sweet fruit with a little of the flour; if currants are used pick them carefully over, and then wash and dry before dredging. Stir together the meal, flour, suet, milk, and molasses, and beat well; then add the dissolved soda, and beat very thoroughly; stir in lastly the fruit, mixing it evenly through the batter, and pour all into a round pan, well oiled; you must not fill it quite full. Set this in a steamer; cover with an inverted pie-pan, and steam 2½ hours. Serve warm with fruit sauce, tart fruit, or lemon sauce; the latter makes an excellent dressing.

This, and all steamed Indian puddings, may be warmed over, and served at the next meal, or the next day; dip the remnant quickly into cold water; lay it in a pie-pan with another turned over it, and then place in the oven long enough to get thoroughly hot all through. It will be quite as good as at first.

NOTE.—Baked maize puddings are much improved by the addition of a level teaspoonful of salt and tablespoonful of butter; syrup instead of sugar can be used in the recipes given above for baked puddings, and improves the flavour. If syrup is not used season with a little cinnamon or nutmeg.

CORN AS A VEGETABLE.

Green corn, though usually ranked among vegetables, is, strictly speaking, a grain in the immature state, and like the other grains it may be eaten with either fruits or vegetables. The only thing about it that interferes with digestion is the hull, which with a little care may practically be got rid of.

Boiled Green Corn.

The best corn for table use is the evergreen; that known as "Stowell's" is a good variety. If you cannot get the evergreen the white "Flint" is good. Select ears that are well filled, but young and tender; if the right age, the milk should spurt out in a jet when the grain is pierced with the finger nail. Green corn should, if possible, be cooked and eaten the day it is gathered, as it loses its sweetness in a few hours. Start in boiling water, not too much, as it wastes the sweetness, and boil from 20 to 25 minutes. When done, drop the ears into a basin of cold water; this makes the hulls tender and the corn white; in two or three minutes lift them out, lay in a tureen, cover, and send to the table. Before eating, split the rows with a sharp knife, cutting only the surface of the grains; this is done by drawing the knife through each row of corn lengthwise, beginning at the larger end of the ear. Splitting the grains allows the kernels to escape from the hulls leaving the latter on the cob. If preferred, you may split the grains and scrape out with a knife before eating.

Stewed Green Corn.

Select corn that is young enough to scrape easily from the cob; after splitting the grains with a sharp knife and scraping out the pulp, put it into a stew-pan or porcelain kettle, add a little boiling water and set it over the fire where it will cook rapidly. Stir constantly to keep it from sticking, and stew 10 minutes or until done. Season with butter, pepper, and salt, and a little cream or milk.

Canned Corn.

To prepare it for the table put it into a clean porcelain kettle, cover closely to prevent its juices from evaporating, and place over a moderate fire until it is thoroughly heated through; it must not boil. Add cream, or a little butter, pepper and salt to taste; dish and serve.

Corn and Tomatoes.

Peel and slice the tomatoes, and cook slowly ½ hour. Then prepare the corn as follows, having it young and tender:—With a thin, sharp knife shave off the tip ends of the grains, and throw them away. Then slice the rest very thin, until most of the corn, say three-fourths of it, is removed from the cob, and with a dull knife scrape out the remainder. Put it in with the cooked tomatoes, and stew rather slowly ½ hour, stirring occasionally to prevent sticking; then dish.

Another way is to take equal quantities of sliced tomatoes and corn cut from the cob, and stew them together 30 to 40 minutes; the heat must be moderate.

Succotash.

Boil white beans—Limas are best—until they are soft, but not broken; have water enough when done to make them rather juicy. Select good sweet corn, young and tender, cut it from the cob, not too closely, and scrape out what remains with a dull knife. Add the corn to the beans, two parts of the former to one of the latter, and stew over a moderate fire 20 to 30 minutes Stir occasionally, and see that the mixture does not scorch. Another way to prepare this dish is to boil string beans (the wax beans are best for this purpose) until they are nearly tender; it will take about 1½ hour. Then add the cut corn, and cook ½ hour. In making succotash dried beans can be used, but those fresh from the garden are better; and in the absence of fresh green corn, canned corn may be substituted. Cook this very little, say 10 minutes, after adding it to the beans.

Roasted Green Corn.

Remove the husks and silk, and lay the ears on the grate in a hot oven, or you may roast over hot coals or before the fire.

Stewed Dried Corn.

Soak in a closed vessel overnight, in water enough to cover the corn. Cook it in the same water, simmering slowly 15 or 20 minutes; it must not boil; then dish for the table.

To Dry Corn.

Take young tender ears, cut from cob, being sure to cut grains at least twice, besides scraping the milk well from the cob. Put in pans, and place in hot oven until well scalded, but not burned; then spread on cloths or plates, and put in hot sun, and immediately before putting away in paper bags heat well again in oven.

Corn Oysters.

One pint grated green corn; 1 egg well beaten; 1 small teacup flour, ½ cup butter, salt and pepper to taste. Fried in lard or butter on a griddle.

POPCORN.*

To Pop Popcorn.

The corn should be well dried, or it will not pop easily. Place in a corn-popper or frying-pan just enough corn to cover the bottom of pan. Do not put where fire is hottest at first. When it begins to pop put over brisk heat and shake the pan well till all is popped out white.

Popcorn Balls.

Pop the corn and put a half-bushel of it in a large pan, leaving out all that is not nicely popped. In a kettle place 1 lb. of white sugar with a little water, and boil till it candies; then remove it from the fire, and pour into it 6 or 7 tablespoons of thick gum solution, made by pouring boiling water on gum-arabic, and letting it stand overnight. Now dip the mixture on different parts of the corn, lifting it up and mixing it till it is all saturated with the candy. Then with the hands mould it into balls, being quick, lest it sets before you get through. This will make about 100 balls.

Crystallized Popcorn.

Boil a teacup of granulated sugar, 3 tablespoonfuls of water, and 1 tablespoonful of butter. When a hard ball can be formed of a little dropped in cold water, throw in 3 quarts of nicely popped corn and stir briskly till each kernel is well coated.

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* Ordinary sweet or field maize will not "pop." Only the real popcorn can be used as above.

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

Queensland.

DEPARTMENT OF AGRICULTURE, BRISBANE.

GUMMING OF CANE;

BEING A REPORT OF AN INQUIRY INTO THE ORIGIN AND NATURE OF A DISEASE AFFECTING THE SUGAR-CANE IN THE WIDE BAY AND BURNETT DISTRICTS.

BY

HENRY TRYON,

ENTOMOLOGIST.

Copies can be obtained free by 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.

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HEDVIG LEVON

BY

GEORGE DE CARLE

June 1892

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require the expenditure of much time, whilst they have served to delay the preparation of this report, have not been attended by any positive results.

The inquiry, of which this report is an outcome, as well as a cognate one in which I am engaged, has made me acquainted with the better methods of cane cultivation, but has also rendered obvious many instances where these methods have been departed from. But it has not come within the scope of this report to take cognisance of these except in so far as they might be expected to influence either the occurrence or virulence of the disease. Silence therefore must not in this case be regarded as signifying approval.

In dealing with the subject, moreover, I have confined my remarks to phenomena witnessed as occurring in the Wide Bay and Burnett districts, and to my interpretation of them. This has been because my inquiry has specially related to this part of the colony. But it must not be inferred that the disease does not occur in other parts of the colony. Such an inference would be incorrect. It is believed, however, that the conclusions that I have arrived at will apply in their case also.

In conclusion, I may be permitted to confess my obligations to the numerous planters and cane-farmers who, without exception, have used every effort to facilitate this inquiry, and who on no occasion have withheld information that in its interests I have felt compelled to solicit. Especially in this connection I may mention Mr. A. P. Barton, of Mon Repos; Mr. R. H. Blisset, of Goodwood; the Colonial Sugar Refining Company; Messrs. Crau Bros.; Mr. W. G. Farquhar, of The Hummock; Messrs. Gibson Bros., of Bingera; Mr. D. McKellar, of Cowal; Mr. E. M. Long, of Habana, Mackay; Messrs. Young Bros., of Fairymead; and the various experts in their employ.

HENRY TRYON,
Entomologist.

Department of Agriculture, June, 1895.

GUMMING OF CANE.

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HISTORY OF THE OCCURRENCE OF THE DISEASE.

ALTHOUGH the fact of the occurrence of the gumming disease in the cane of the Wide Bay and Burnett Districts had only been generally made known about the time of my visit to them—*i.e.*, in October, 1894—there is abundant evidence to show that it was no novelty, although formerly, it neither occurred so widely nor was so virulent in its attacks as subsequently was the case.

Mr. Robert Cran stated that he had a distinct recollection of having seen a yellow exudation (*i.e.*, the so-called gum—so characteristic a feature in the disease) at the cut ends of cane several years since, and on more than one occasion; but he could not, when making the statement, locate these occurrences, either with respect to time or place. And he remarked, too: that in 1892 he noticed the cane tops going off in a manner characteristic of the disease, at the Island Plantation, Maryborough. Mr. McGuigan, the resident manager of the latter estate, also informed me that he had observed the presence of gum on cutting the cane across, in the Maryborough district ten years since. This was in Rappoe cane, but it was, however, not affected then to the extent it has been since. This occurrence was preceded by an exceptionally cold and wet winter that was possibly protracted. The "gum" at the time he regarded as glucose, and did not appreciate its significance. A similar manifestation was noticed by him on a plantation on the north side of the Burnett River. He also stated that other farmers, who were at the time growing small areas of cane in the Maryborough district, also remarked a like occurrence, as they had since informed him.

With reference to its early manifestation in the Burnett district, the testimony of Mr. W. G. Farquhar may be mentioned. This was that he had good grounds for believing that the disease occurred at least three years since at the Hummock Plantation; and that the cane was even worse affected then than in 1894, and much havoc was occasioned by an apparently identical agency. Mr. C. Faulkener again remarked, that his cane commenced to fail four or five years since, and that he was, at the time of my visit, of opinion that this was owing to the occurrence of the gumming disease, the presence of which he recognised in his cane as soon as he obtained the "Agricultural Gazette of New South Wales," in which Dr. Cobb's report on the subject was printed. Mr. H. O. Nott, of Windermere, also stated that he had noticed something unusual in the cane during the past two years, similar external symptoms being presented to those which are now known to be characteristic of the disease. This testimony was corroborated by that of another witness, who informed me that some two years since difficulties were experienced at Windermere in manufacturing the sugar such as are now known to occur when the disease prevails.

With regard to the Gregory River district, Mr. R. H. Blisset, of Goodwood Plantation, deposed that in 1892-3 he had noticed there a

a disease in cane having symptoms identical with those found in "gumming cane"; and on visiting the particular stools referred to, in 1894, I found it affected by the disease here treated of, and in a very marked manner; and I further discovered that the progeny of this cane derived from it in 1892, and raised in another district, likewise manifested its presence.

With regard to the Isis Scrub district, Mr. William Cran informed me that, after conference with other planters there, he was quite convinced that the gumming disease had been present there ever since planting had been commenced. His observation especially referred to the South Isis portion of the scrub. A Maryborough correspondent also stated that he had seen "gummed sets" that had been forwarded from that district in October, 1892.

The accuracy of these testimonies has been generally shown when inquiry has been made into the history of affected crops and the stage of development of disease that they have severally exhibited noted, and especially in those instances afforded by diseased cane occurring on not especially ill-drained land. Moreover, one is led to infer from such observations and inquiries, not only that the gumming disease is "no new thing," as has been remarked, but also that there has been a certain amount of succession in the times at which it has manifested itself in different districts, explicable when one learns how the cane grown in one has supplied the "sets" for that grown in another.

With reference to the Bingera and South Kolan districts, Mr. William Gibson stated that it certainly had not come under his observation that the disease had occurred there previous to 1894, neither had it been related to him that such had been the case. He also added that the supposition that, though occurring in the district, it had hitherto escaped his attention was scarcely tenable, since for some years past it had been his custom to systematically inspect cane not only in the field but also after it had been cut. It may be also added that the comparatively few instances in which it was noted in these districts were such as to suggest an exclusively spontaneous origin as the explanation of their occurrence, the disease being confined to quite isolated circumscribed spots in a large area and the derivation of the cane exhibiting it not being, in any one instance, from an unhealthy stock.

In about August, 1894, or even earlier, the disease commenced to be recognised on several plantations where its presence had not been previously remarked; and as time went on, to become more and more pronounced, especially as the cane developed increased succulence. In some instances a stand of cane that was being cut for "sets" in September, and appeared perfectly healthy at the time, within two weeks of this event showed the characteristic exudation in such part as had been left standing. A significant note of warning of what was happening was, however, sounded by the *Maryborough Chronicle*, of Saturday, 21st October, in the following passage:—"It appears that, owing to the over-richness of the Isis Scrub soil for sugar-cane, combined with the excessive wet weather experienced this year, there has been produced in the juice an excess of glucose, which unfortunately retards the granulation of the proper saccharine matter. The result is, we understand, that the vacuum-pan boiling process occupies about seven hours, as against three or four previously, and the matter would have been still more serious but for the aid of the old Mary River

juice—[Derived from cane that was and has remained healthy.—H. T.] —which is mixed with the new juice of the Isis in the proportion of one of the Mary to two of the Isis. This overcomes the refractory nature of the glucose, though not without a loss of time." Elsewhere in this report it is shown that this difficulty in the manufacture of sugar referred to is exactly what is experienced when juice from diseased cane is being put through.

CHARACTERISTIC FEATURES.

The characteristic features of the disease may be now briefly described, that it may be recognised by those whose cane may hereafter be visited by it, although those on whose plantations it occurs are by no means all familiar with its appearance.

Young Plant Cane.—When the presence of the disease has been determined by the use of sets derived from a badly "gummed" crop, some of them will fail after having emitted attenuated shoots, that fail to reach the surface. Others will give rise to slender and weakly plants, which apparently struggle to survive, whilst a few will develop foliage with the individual leaves narrower and more irregular in size than if they were healthy, with the central ones yellow-green and more or less crinkled and contorted, with, at times, the central leaves interlaced in a tangled mass. A few of these leaves, again, especially the inner ones, may exhibit bright rust-red streaks in their tissue, and this may constitute a conspicuous feature. If any such plant is cut longitudinally through the point of growth, it will be generally observed that the central shoot beyond where it joins the cane proper, instead of arising in a straight, erect manner, is more or less bent and contorted, its upward tendency having been apparently hindered. Moreover, the young cane itself, immediately below the shoot, will present one or more cavities, each containing a semi-fluid tenacious pale-brown substance.

Should the "sets" be the progeny of a crop of cane affected but slightly by the disease, nothing very abnormal may be noticed until the cane proper has commenced to form. Then, although the bulk of the plants will appear well-grown and perfectly healthy, others, though at first fully developed, will evince the presence of the affection in varying degree. The first symptom in a plant of its occurrence will then probably be afforded by a thin pale longitudinal stripe arising in one of the outer leaves, in which the green colouration being discharged may gradually be giving place to brown. If this plant is divided by a longitudinal cut through its growing apex, nothing abnormal may yet be recognised. A plant in which the disease has made further progress will exhibit brown stripes of dead tissue along one side of the central nerve, or along the margins of the outermost leaves, whilst on two or three of the inner one will have appeared elongated rust-red streaks. If this plant be cut as before, very marked changes will be noticed in the tissue immediately below the growing apex. These are afforded by the presence of several cavities having ill-defined walls partly filled with an odorous yellowish substance of the consistence of pus, as well as of spots where the external tissue is becoming soft and brown to mark the site where subsequent ones may arise. These cavities occur in the intervals between nodes, whilst the denser tissue of which these latter are composed may exhibit—in small number—specks, or thread-like lines of a red colour. When still further advanced we

may have a strong, healthy-looking plant, with a stem measuring some 2 feet 6 inches in heighth from the ground to where the green foliage commences. In this several of the outer leaves, and the central ones as well, have longitudinal brown stripes or bands of dead tissue extending for the greater part of their length; and, as will be seen by a longitudinal cut, the joints or internodes immediately below the apex, to a distance of from 1 to 2 inches, are quite hollowed out, and there is considerable discolouration and softening of the tissue generally and incipient decay, both in them and in the nodes also. In such a plant the central shoot, now almost dead, may readily be pulled out. After this stage has been reached no further growth takes place at the apex, and little or no more cane is produced. Some of the lateral eyes may, however, shoot out, and the growing energy of the plant be transferred to them; but it henceforth remains stunted. In each case, moreover, these features are accompanied by the above-mentioned evidences of checked growth of the central shoot. If in any of these plants which have evinced the symptoms described, the stem be cleanly cut across, and it be put aside so that its surface will not dry, bright tear-like droplets of a greyish-white or yellow opaque sticky fluid will arise from some of the pores that stud its surface.

Mature Plant Cane.—The disease may appear at any period in the growth of the cane, and even when it is fourteen or more months old; but these late manifestations probably generally arise when the malady is of spontaneous origin. The following descriptions will serve to illustrate the appearance presented by the mature plant at three different stages in the development of the malady. In the first instance the central leaves are quite normal in appearance, and perfectly green and turgid, but the lateral leaves are marked by broad brown longitudinal bands of dead tissue, the lowermost having evidently prematurely died. The eyes on that part of the stem from which the leaves have naturally fallen have shot out, and the slender shoots thus formed are already dead; the uppermost eyes, however, are still alive, and have not as yet sprouted. On making a longitudinal cut through the growing apex, areas of soft brown decaying tissue are observable in the tissue of the joints immediately below it.

In a plant in which the disease is further developed, the central shoot is still green, though somewhat pale; but many of the lateral leaves have the brown bands previously referred to. On making a section through the apex, in addition to the discoloured tissue, a small cavity filled with a soft gum-like odorous matter is noticeable, about 2 inches below it, on one side. The buds that have sprouted are more numerous than in the foregoing instance, and the lower shoots too are already dead.

As an illustration of a still furthur advance in the progress of the malady, a plant may exhibit the following symptoms:—The central shoot and leaves are already quite dead, though still flaccid, and readily yield to a slight pull. There occurs also in those, on either side of it, that are still partly green, a brown band of dead tissue, proceeding along each margin; this band widens in the case of the outer leaves, whilst the outermost of all are all involved in it, being quite dead. The cane itself, instead of exhibiting that yellowish colour indicative of the fact that it is already ripe, is of a dull bright-green colour above; nearer the ground it is clouded, with the same hue, but at the extreme base evinces little unusual in this respect. All the buds

except these situate lowest on the cane have sprouted, some having given rise to peculiar elongated slender shoots; beneath the leaf-sheaths the buds are already dead or apparently dying. On making the usual longtitudinal incision, the growing apex will be found to be in an advanced stage of decay, with its tissue in course of being "broken down." Below it, occur one or two cavities, larger than those remarked in the previous instance, occupied wholly or in part by the same offensive tenacious gumming opaque substance. The face of the cut will also, after a while, assume a rusty yellow hue, and the tissue will then be observed to be watery and translucent here and there. On cutting any of these canes across, small bright droplets of a canary-yellow thick adhesive substance will arise from the pores distributed over the surface of the section, and in many instances will run together and coalesce. When the disease is advanced to the stage above described, some of the buds within an inch or so of the decaying summit of the shoot, may shoot out and develop a tuft of narrow leaves; but no furthur growth takes place in the cane itself, though the latter may be some time before it actually dies.

Young Ratoons.—The following is a description of a characteristic example of a young ratoon sucker affected by the disease. The central unfolded leaves are still flaccid, but pale brown; and the green colour is apparently quite discharged from them except on one side towards the base, though here and there, on holding one of these internal leaves to the light, a little green is still discernible. The partly unfolded leaves exhibit for the most part in each case a pale-brown band all along one side, whilst a yellowish stripe, indicative of this feature being about to arise, may occur on the other; otherwise these leaves are still quite green. But the more external leaves have brown bands of dead tissue along each side of the central nerve, and these may extend to their tips. In addition some of the leaves exhibit the presence of the irregular bright rust-red streaks previously referred to. The changes observable in the tissue immediately below the growing apex, remarked as being noticeable in the case of the young cane plants, also occur in the young ratoons, checked development is also evinced, and there is the same manifestation of "gum" on cutting the cane across.

These are the appearances presented by Rappoe canes grown upon good soil, and not subject to adverse meteorological conditions. There are variations, however, presented within definite limits, and these are espccially met with, when to the changes produced by the disease are superadded those occasioned by frost, drought, excessive wet, poverty of soil, or indifferent cultivation. Somewhat different appearances are also found in varieties of cane other than the Rappoe. However, the leading features mentioned are always recognisable.

The amount of the gummy substance that exudes from the surface when the cane is cut across is also varying in amount as well as in colour, ranging in the latter respect from yellowish-white to pronounced canary yellow. The extent to which it occurs, as well as its copiousness, depends on the degree in which the disease affects the plant under consideration, but the latter also on the juiciness and succulence of the stem tissue. And these latter features being especially developed in well-grown plant-cane, growing upon rich soil, robust cane plants may exhibit this "gum" in greater abundance than

others. Similarly the presence of the gum is more readily discernible during the prevalence of humid and warm weather, such as is conducive to the development of sap rather than to the augmentation in density of that which already occurs. For a similar reason plant-cane may manifest its presence to a greater extent than ratoon. When, again, this gumming disease has as yet affected a plant in but a slight degree, the exudation of gum may be some time before it arises, and then only appear at two or three points on the cut surface of the stem.

All the canes that arise from a single stool may not be affected simultaneously and to an equal extent. As an instance of this, the following occurrences were remarked in the case of an affected plant:— All the canes had been checked by cold when they had experienced from six to seven months' growth, otherwise the plant was remarkably robust. Three of them had the central shoot, and several of the lateral ones already dead. A fourth had the leaves as well as the central shoot quite green, and all of these canes exuded droplets of gummy substance when their stems were cut across. A fifth cane —the stoutest of all—was entirely wanting in the gummy exudate, as was seen when after lopping off its top and allowing it to remain still connected with the ground, none of this gum was observable even after the lapse of some hours. In addition to these five canes, there were several suckers, some of which had formed cane, and were almost as high as the stalks that surrounded them. These, however, even when arising alongside gummy canes, were themselves apparently quite free from disease, as no "gum" emanated from their cut ends. Eventually the entire plant may manifest pronounced indications of the presence of the disease. It may also be remarked in connection with this varying extent to which the malady is manifested that some difference in the degree to which it is developed characterises the special variety which the cane suffering from the disease represents. Thus, in the case of Louzier cane, its presence is far less pronounced than in Rappoe or Meera.

The significance of this gum in relation to the disease has been shown by the eminent vegetable pathologist of New South Wales, Dr. N. A. Cobb; and I may be permitted to quote the following lucid statement, concerning its occurrence, published by him:—

"The gum which thus oozes out in such quantities, if allowed to do so, at last becomes dry, owing to the evaporation of its water. In this state it appears as bright yellow stains on the end of the cutting. Sometimes the gum oozes out in a state so nearly dry that it hardens as it issues from the fibres into a yellow, coiled-up, hair-like body, and inasmuch as each fibre gives rise to one such body, all the fibres together originate a yellow, mossy appearance on the end of the cutting.

"If another stalk, which is apparently sound, be taken from a stool in which one or more stalks have been already blighted by gumming, as above described, such stalk will be found to exhibit the same symptoms, except that the cavities and rottenness at the base of the arrow are wanting. Moreover, if other stalks be removed from stools of cane standing near by in the same field, but which, as yet, show no outward symptons of this disease, the chances are that some of them will also be found to be more or less gummed.

"In some cases the amount of gum is so small as to ooze out in but a trifling quantity, to be detected only with a magnifying glass. Finally, the quantity of gum may be so small as not to ooze out at all; in such cases a good microscope is necessary to demonstrate that the gum is present.

"Although I have applied the name of gum to this yellow substance, I do not mean thereby to imply that it belongs to the class of substances by chemists named gum."

CAUSE, ORIGIN, AND DISSEMINATION

The immediate cause of this gumming disease, and how it originates and has originated on the plantations, and how it spreads, or is disseminated, may now be considered.

Cause.—The disease is originated in the plant by the presence of the gummy substance previously referred to within its tissue. It may be predisposed to disease, what has been referred to as a special pathological receptivity may previously exist, but this gummy substance is the *fons et origo mali*, that without which it cannot be. The following remarks concerning this "gum" will afford an insight into its nature, as well as the means of understanding its relation to the malady under consideration. The occurrence of the gum within the tissue of the cane in the first instance is not general but local, as will be seen by examining, by aid of a microscope, a thin transverse slice cut from the stalk of a diseased cane. "The gum" to again quote Dr. Cobb, "except in certain cases, is confined to the fibres, in fact to the sap vessels, these latter being plugged up with gum. A cross-section of a healthy fibre shows the sap vessels as empty spaces, the sap having flowed out in the course of cutting the section; a cross-section of a gummed cane (fibre) on the other hand, shows the sap vessels to be filled with yellow granular matter, in other words, gum. This confinement of the gum to the sap vessels is one of the most striking microscopic features of gummed cane. In advanced cases, and in the more tender tissues at the top of the cane, the gum is not so local in its distribution; it may under such circumstances be found outside the fibres.

"Lenses of high power show the gum to be swarming with microbes of the form known as bacilli. When the gum is fresh and yellow in appearance, the microbes are all of one kind. This microbe appears to be one not hitherto described, and I propose to call it *Bacillus vascularum*, in consequence of its occurrence in the *vessels* of the sugar-cane. Each microbe has about it a small amount of gummy matter, which is a product of its growth. The gum described above as issuing from the sap vessels of the cane has, therefore, two component parts—namely, microbes and a viscous gummy matter. This gummy matter appears to be a new substance, and to it I have applied the name *vasculin*. . . . . What are the relations between these microbes and the disease here called gumming? This question is simple, but its answer is necessarily complicated. What we wish mainly to know is, whether the microbes are the cause of the disease. As a result of hundreds of careful examinations, I am able to say that the disease, gumming, as described, never occurs without the yellow matter in the sap vessels.

"The result of even a much greater number of examinations made with equal care showed that the yellow gummy matter never occurred without the microbes; indeed it is very evident that the gum is a

product of the growth of the microbes. This leads to the conclusion that the disease never occurs without the microbes being present; and it may be added that many cases were examined in which, in spite of long and careful search, none but the merest traces of other foreign organisms could be found. This is very strong evidence that the microbes are the cause of the disease, but it does not amount to proof. We may indeed say that if the injurious results of the disease follow solely from the plugging up of the sap-vessels, then the injury is due primarily to *Bacillus vascularum;* but, after all, this is only a qualified statement."

Dr. Cobb also shows how these microbes can be isolated and made to develop in a medium outside the sugar-cane; and he describes the method by which they may readily be recognised. The experiments made by him in this connection have, moreover, all been repeated during the progress of this inquiry.

In order to demonstrate the fact of the relation of these bacilli to the disease being that of cause and effect, it is required that it should be possible to produce the disease in healthy cane plants by introducing them into the tissues or vessels of the latter. In the memoir to which reference is above made, Dr. Cobb explains the procedure to be adopted with a view to accomplish this result; but it does not appear therefrom that at the time he penned his remarks he had succeeded in thus artificially inducing the disease, and satisfying the required condition. It has, however, as I understand from Dr. Cobb, been since reported to him that this result has been accomplished by another investigator in New South Wales, who has been experimenting along the lines that he has laid down. Personally I also have failed to produce the disease in healthy plants by the method of inoculation with the pure culture of the bacillus. Failure, however, to accomplish this result may be explicable in my case, by the simple nature of the apparatus at my disposal for the work, and the inherent difficulties which will be always associated with it, being taken into consideration. However, in addition to the reasons advanced by Dr. Cobb for regarding the *Bacillus vascularum* as being the cause of the gumming disease, may be mentioned the readiness with which every feature connected with its occurrence may be explained on such an hypothesis. I may also add that, in a new potato disease that I have lately reported upon, and which I have had an opportunity for reinvestigating in the course of this inquiry, microbes, scarcely distinguishable from those which are met with in diseased sugar-cane, and which I have designated *Bacillus vascularum solani*, occur under precisely the same circumstances—*i.e.*, clogging up the vessels of the stems, roots, and rhizomes, and, in the initial stages of the disease, nowhere else; and that seedling examples of another solanaceous plant—viz., the tomato—raised in soil in which these microbes have been liberated, develop a disease apparently quite similar to that which the potato plants, from which they have been derived, present, which, amongst other features of resemblance that it shares, has these identical potato microbes clogging up its vessels also. So that the connection between the microbes and the occurrence of the disease with which they are associated in both of these plants is that of cause and effect; and, therefore, in the case of the *Bacillus vascularum* of the sugar-cane and its disease, a similar connection is not only possible but also in the highest degree probable.

Spontaneous Occurrence.—There can be but little doubt but that in many instances in which the disease was met with during the course of this inspection, it had originated spontaneously. Thus in several plantations where no seed-cane had been received from without for several years, and in which the particular plot under consideration was the progeny of cane which itself presented no indications of the presence of the disease, nor of having been diseased, isolated patches of affected cane would be found occurring with more or less circumscribed limits. These patches were invariably on undrained land, and frequently marked the site of depressions, or afforded other evidence —consisting in the actual presence of wetness, or in indications of the local influence of a low temperature that were present—that the spots were thay occurred needed draining. In them this spontaneous origin was the only explanation of its occurrence. In one of these cases the stools had attained the age of as many as ten years, the standing crop being ninth ratoon; and in this the supposition that the disease had been originally induced by the use of unhealthy sets, and had remained latent for this length of time without injury or deteriorating the successive crops in a marked manner, could not be reasonably entertained, especially since there was no evidence that any such deterioration or injury had transpired. Similarly the disease was often found occurring in younger but in still old ratoon crops. In such instances, moreover, the cane had become fully developed in spite of the presence of the disease, an event which is infrequently observable when the presence of the latter may be reasonably attributed to the employment of unhealthy seed-cane.

Such spontaneous occurrence might be explained on two suppositions. According to the first, microbes present in the ground might have gained access to the tissues of the growing plant through one or other channels available for such a purpose, as there is evidence that microbes do do, in the case of the bacterial diseases of other plants, and had so originated disease; and, on the second supposition, microbes normally present in the tissue of the cane-plant, having been influenced by certain special conditions of environment, had been induced to increase greatly, and at the same time manifest pathogenic properties.

That the bacteria which are invariably associated with gumming disease may live and multiply in the soil is at least probable seeing that when isolated from the cane plant they may be made to do so in a cultivation medium containing Agar agar, meat infusion, peptone, and common salt, and may also be shown to do so on other substances. However, an attempt made to artificially produce the disease in a healthy cane plant by growing it in sterilised soil in which these bacteria had been sown was barren of result, though in this fact there was no conclusive evidence that such might not happen when the conditions of the experiment were somewhat modified.

Again, on making a microscopical examination of the juices of a number of canes derived from apparently perfectly healthy crops, expressed with special precautions immediately on their being procured, bacteria were almost invariably present in very small numbers, and these presented the external features, and the same behaviour when staining reagents were employed, as do those which constitute the gum in diseased cane. The means for investigating their precise relations or of absolutely determining the identity between them has not, however, been at my disposal. But should they prove identical, their increase

and physiological modification, in the event of special meteorological conditions obtaining, so that from commensals in different plant organisms they might become disease-producing germs, are quite intelligible, and so also one of the modes in which the gumming disease might spontaneously originate. Bacteria, as is well known, admit of their functions being altered artificially, and amongst the agents employed in effecting such changes are especially temperature and sunlight, and those special ones that are resorted to in the effecting artificially immunity from the attacks of pernicious species by permanently modifying the virulence of others of the same class, as is done in the manufacture of attenuated viruses and vaccines. And the eminent chemist, Dr. Percy Frankland, has indeed stated the grounds on which it may be assumed that bacteria occurring under natural conditions do so modify. "If such numerous bacterial varieties" (he writes) "can be artificially induced in the laboratory, it is surely highly probable—in fact, all but certain—that similar modifications have been and are still continually arising amongst the bacteria growing amidst natural surroundings. This anticipation is fully borne out by the direct examination of the bacterial forms occurring in nature. It is a most striking and significant fact that in the case of almost any micro-organism that has received special attention on account of some particular property that it possesses—*e.g.*, pathogenic power—a careful examination of the natural habitat of such an organism has almost invariably led to the discovery of one and often many other bacteria resembling the particular one in question, in almost every respect, but differing in one or more details." He then proceeds, after stating that the bacillus of anthrax disease may and frequently does reside in the soil, to cite the case of a bacillus indistinguishable from that of anthrax in all save that it lacks its disease-producing properties that has been found in the same location by Messrs. Hueppe and Cartwright Wood, and in fact which is so closely related to it otherwise that it is practicable to employ it, as is done with attenuated anthrax virus itself, for conferring immunity by inoculation. And he also alludes to the accompaniment of Lœffler's diphtheria bacillus in the throat, by a second bacillus "almost indistinguishable from it in all but its having no toxic effect on animals."—*Bacteriology in its Relation to Chemical Science.*

In another section of this Report the subject of climatic conditions in their relation to this gumming disease has been dealt with, and it is there shown that the disease has arisen in the canefields after exceptional meteorological events. Are these, therefore, such as to modify a non-pathogenic organism occurring in cane juice, or possibly in the soil in which the cane is grown, into one possessing disease-producing properties? The data necessary for dealing with this question are not yet forthcoming, meanwhile it may be remarked that, it is in this connection that the researches in connection with the bacillus of the cane disease which Professor Rougier of the Pasteur Bacteriological Institute of Sydney stated, during his recent visit to Queensland, that he proposed to inaugurate, will have especial interest.

As showing that climatic conditions may have some influence in determining both the presence and virulence of this cane disease, it is within my experience that in many instances young ratoons are showing no signs of the presence of the disease, notwithstanding they have sprung from stools which yield a badly-gummed plant crop.

And this is explicable by the occurrence of climatic conditions quite the reverse of those which are thought to have contributed to the presence of the disease in the first instance, and which formerly obtained.

Artificial Propagation.—It is an established fact in connection with this gumming disease that pieces of affected cane, when used for "sets," give rise to it in the resulting crop. The malady may be sooner or later in manifesting its presence, but, as a rule, its occurrence may be depended upon. Should the sets be badly gummed, however, no crop at all is obtained, as, though they may emit slender sprouts, these soon cease to be further developed. These facts have been demonstrated experimentally both at Windermere and Fairymead, and they explain in great measure the present distribution of the disease. When an affected crop was noticed, it was seldom that its origin could not be traced to the use of "plants" in which there was a history of the disease, or that it was not growing where the disease might not be expected to spontaneously arise. Similarly, when a plantation was discovered in which no disease occurred—as, for instance, those of Irrawarrah, Yarra Yarra, Ferney, Cowal, and others in the Mary River Valley—it was found that drainage had been resorted to, the crops from which the seed cane had been procured were perfectly healthy, or that no seed cane had been used except such as had been yielded by local healthy crops. Many instances could be adduced of this method of propagating the disease, and even just prior to my visit a considerable amount of unhealthy cane had been distributed from one Maryborough centre to be used for starting fresh cane plots. In many cases, having observed a stand of diseased cane, and not discovering any explanation of its occurrence in local conditions of growth, a visit was afterwards made to the plantation whence the seed-cane from which this was raised had been derived, when it was invariably found that the original stock was also diseased, and that other stands of cane which it had also served to originate were similarly affected. In one case, however, it was noticed that a plot of cane in which the disease was remarked for the first time in 1893 had supplied at the same time two sets of plants, and that one of these taken to a distance had given rise to a diseased crop, that was conspicuous on a farm where no other cane was affected, and the other, planted near at hand, had yielded an apparently healthy crop, as had also a supply of sets in turn derived from it. It might be presumed in this case, however, that the two original sets had been obtained from different portions of the plot in which the disease afterwards showed itself. When the disease appeared upon dry ridges, and no cane plants had been procured from beyond the plantation for several years, it was generally found that it was also present in some low-lying spots, where it had evidently originated spontaneously at an earlier date, and that its occurrence in one situation had led, through the use of local sets, to its manifestation in the other.

From these considerations it is abundantly evident that considerable judgment and care should be exercised in the selection of cane for planting. If possible, the crop from which it is to be selected should be inspected, and if its occurrence be not noticed owing to the presence of the usual external symptoms already described, which

may readily happen, especially if the cane has been affected by frost, the more suspicious stalks should be cut across, but left still standing and connected with the stools from which they arise. The tops which have been removed should also be cut through longitudinally and examined. On revisiting the cut but standing cane after some time has elapsed, the characteristic droplets of "gum" may be found to have exuded, under the influence of root pressure, from the cut ends, though possibly only two or three are discernible. Had a portion of this cane been cut off in the first instance, the trained eye might have seen that the severed fibre ends were suspiciously yellow tinged. The presence of gum in this stand of cane will thus have been established, and the project to utilise it for furnishing seed cane should be abandoned. It may happen, however, that notwithstanding the disease is present, it may still remain undetected after this inspection. It will be therefore necessary to examine the cane after it has been cut, and before it has been divided into sets. At this stage, again, disease, if present, though it may have previously been undiscerned, may reveal its presence. But even notwithstanding these precautions, it may still remain in the cane thus far prepared for plants. The sets therefore as they are cut should one by one be viewed with a suspicious eye, whilst the heaps into which these are thrown should also claim attention. Yet the gum disease may even now lurk amongst them, and such an event may often happen. The sets therefore should now be laid between damped megass in order that they may "sweat," to employ a vulgarism, and then one by one be re-examined. Several methods may be resorted to for accomplishing this so-called "sweating," and they will readily occur, to those especially who are familiar with the habitual procedure of laying down cane sets in other countries. A method advocated by the Colonial Sugar Company for accomplishing the discovery of gummed sets, and which has much to recommend it, is thus referred to in a recent circular issued by it:—"It may be mentioned here (it states) that a well-known farmer and mill proprietor on the Richmond River successfuly guards against the planting of gummed cane by putting the cuttings together in a heap about 2 feet high, covering with trash, and throwing some water over the trash. After having been kept for about three days in this way, the plants are closely examined just before planting, when many of them are often found to show signs of gum—yellow spots on the surface of the cut—which could not be discovered directly or some hours after cutting. Thus tons of bad cuttings have been picked out which otherwise would have spoiled the stand of the cane. Such or similar precautious might be the saving of many a crop."

An endeavour has been made to discover a ready means of testing suspected cane for the presence of "gum" by use of a chemical reagent applied to the expressed juice; but except when it exists in such quantity as will render it probable that its presence will have been previously revealed, the reactions which gum exhibits when occurring in the juice too nearly resemble those occasioned by ordinary plant albumen to admit of their being employed for the purpose of diagnosis. Similarly, in employing the microscope with this object in view, microbes very closely resembling those associated with the disease will be found frequently in cane in every other respect perfectly healthy, and are not, therefore, characteristic of the disease

unless they occur in profusion, when probably the presence of the disease which they indicate will have been discovered by readier means than that consisting in the use of this instrument for research.

Soil Infection.—The presence of the disease may in some instances be possibly accounted for by soil contamination occasioned by the neighbourhood of an already affected plant; or by the germs having remained alive in the soil after a diseased plant has been rooted out; or, again, by having been infected by the tops of diseased canes that have remained upon the land whether the cane refuse has been fired or not. No facts, however, were obtained that might point to the probability of such having been the origin of the disease in any one instance; and an attempt to infect a healthy cane plant, and a healthy set, through the soil in which they grew, failed. The matter is, however, of some importance, as the expediency of replanting lands on which gummed cane has grown in some measure hinges upon it. Data would, however, doubtless be obtainable in the older gum-infested districts of New South Wales that might be expected to throw light upon this question.

Persistence in the Plant.—In the case of ratoon cane, its manifestation may often be explained by the fact of the disease having been present in the cane crop that preceded it, and from its having persisted in the stool. It is, however, in some instances of immediate spontaneous origin in ratoon as in plant cane, a fact which seems to be indicated by the circumstance that occasionally a diseased ratoon crop has followed a plant crop in which no disease could be detected. On the other hand, as previously remarked, a ratoon crop may show little or no gum, whereas the plant crop that preceded it was badly affected. This spontaneous amelioration is probably due to improved climatic and soil conditions. But usually when the disease in the ratoon cane is to be accounted for by the persistence of disease in the stock from which it springs, great injury results; it is stunted, little cane is formed, and in fact the latter is scarcely worth harvesting.

ITS INJURY TO THE CANE PLANT.

The affect produced by the gumming disease upon the cane plant may be regarded from two points of view. In the first instance we may consider its influence upon the development of the cane proper, and its effect upon the exercise by the plant of its vital functions. And we may again inquire what changes it produces in its chemical nature, on the relative amount of juice and fibre, and on the composition of the former with especial reference to its saccharine richness.

I. In describing the features characteristic of the presence of the disease, it has been stated that when its presence is the result of the employment of badly "gummed" sets or cuttings, it may even happen that no permanent growth whatever is obtained; in some of the plants, the buds not having sprouted at all, or, if so, having given rise to delicate shoots that die soon after they have emerged above the surface of the ground. Others, again, may result in shoots that attain a foot or two in height, and then die back, having first given origin to young apparently healthy secondary shoots at their bases. Others, again, may give rise to what for some time seem to be healthy plants, but these eventually also succumb. In other instances the disease may first be noticed

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when a foot or two of cane has been already formed, and then the growing apex being destroyed, lateral shoots are developed to take its place. The development of these seem to exhaust the energies of the plant, which remains stunted, has many shoots of different size, much dead foliage, but little or no cane for the mill. Much the same happens in the case of ratoon as in that of plant cane, and the extent of injury in both cases depends upon the extent to which the disease is prevalent in the cane plot. If it should occur throughout the latter, little or no return for the expenditure that has been incurred may be expected; but on the other hand, as usually happens, a "dead loss." In other cases the amount of injury will depend upon the stage in growth at which the plant has arrived when the disease exerts its full influence, for little or no cane is formed after the growing apex is destroyed, and its vital energies are transferred to the shoots which arise from the eyes to partly take on its functions. This may happen at any period in the growth of the plant. The event, however, seems to be delayed when the cane is grown upon good soil, and is well cultivated. Then no marked injury may result till it has fully developed, and those plants that surround it and are still healthy have their cane ripe and ready for crushing. In this case, too, neither the weight of the cane nor its juiciness seems to be impaired by the disease. The duration of its life is, however, practically determined, so that it will not persist till the next season, should it be desired to allow the crop of which it forms part to "stand over." If it be allowed to remain, the shoots that arise from its eyes seem, in growing, to be continually diminishing both the juiciness and lusciousness of its stem tissue. Should it be removed it will probably be succeeded by suckers that early evince the presence of the disease, and in great part shortly cease to grow. It may be stated, however, that after the disease has shown itself, plots containing scores of acres may be rendered valueless; in other cases the yield of cane may be greatly diminished and such as is obtainable may be less suitable for the mill; whilst in others, though the yield be little affected, undesirable alterations in the composition of the juice supervene.

II. What, then, are the changes effected in the cane juice by this gumming disease? These, it is usually held, are considerable, and to consist, amongst other things, in the diminished yield of cane-sugar and the increased yield of fruit sugar. Indeed, it is the general opinion amongst mill proprietors that this is what usually happens; but such also is the effect produced by protracted cold weather and the consequent retardation of the ripening of the cane. The effect of this influence, it may be said, is, however, practically lost sight of when the analyses of two canes that have been both subjected to the same meteorological conditions, and, except that one is healthy and the other diseased, are precisely similar. But even with these it may be fairly alleged that in the case of the diseased cane uncongenial weather would exert a greater influence than it would upon the healthy cane, and that should the canes not have experienced such, this difference would not exist. It is therefore important that in the event of a comparison being instituted, to ascertain beforehand if any such uncongenial weather has been experienced, and has affected the canes subjected to examination. Recognising this, an endeavour was made to find cane that showed no indications of having been checked by cold, was well-grown, was mature, but some of which was

diseased and the other healthy. After some trouble I was successful in finding such. This was plant Rappoe cane, growing in a reddish finely-divided sandy loam, being portion of an undrained forest ridge, bounding what was originally scrub country on the Bingera Estate. Stalks of this cane when examined by me presented no evidence of having been retarded in their development or otherwise affected by cold weather. The internodes or joints had suffered no shortening at any point in the length of the canes, and on nearing the summit of the latter—as seen by making a longitudinal section—they regularly decreased both in length and breadth. From this plot of cane Mr. C. Müller, the chemist employed by Messrs. Gibson Brothers and Howe, selected, at my request, diseased cane, and cane that was apparently quite free from it, and made analyses, with the following results :—

ANALYSES OF CANE (RAPPOE).

COMPARISONS OF DISEASED AND NOT DISEASED CANE SAMPLES TAKEN FROM THE SAME FIELD.

—	I. APPARENTLY SOUND CANE.			II. DISEASED CANE (GUM).		
	Top Part.	Middle and Under Part.	Top Part after Boiling.	Top Part.	Middle and Under Part.	Top Part after Boiling.
Degree Beaumé ...	11·3	12·1	11·9	11·0	11·5	11·8
Specific Gravity ...	1·0837	1·0904	1·0882	1·0810	1·0846	1·0873
Total Solids ...	20·1	21·6	21·1	19·5	20·3	20·9
Sucrose	18·1	20·0	18·8	17·3	18·9	18·0
Glucose	0·20	0·21	0·23	0·17	0·16	0·24
Glucose Ratio ...	1·1	1·05	1·22	0·98	0·84	1·33
Solids not Sugar...	1·8	1·39	2·07	2·03	1·24	2·66
Coefficient of purity	90·0	92·5	89·10	88·7	93·1	86·1
SAME IN TERMS OF TOTAL SOLIDS.						
Sucrose	90·049	92·592	89·099	88·718	93·103	86·124
Glucose	0·995	0·972	1·090	0·871	0·788	1·148
Solids not Sugar...	8·955	6·435	9·810	10·410	6·108	12·727

Mr. Müller remarks on the results that he has obtained as follows:—"It will be seen (from the analysis of the diseased and sound cane) that the effect of the 'gum,' if any, is very slight. The high coefficient of purity and the very low quantity of glucose in the diseased cane is again strange. The gummed juice has possibly the property of preventing to a certain extent the action of alkaline copper solution [and so the correct estimation of the glucose—H.T.]. Further trials will show whether this supposition is correct. It will be observed, moreover, that the effect of the gum in diminishing the amount of sucrose is little if at all marked. Such results are intelligible when the chemistry of the gum itself is looked into."

SUGAR MANUFACTURE AND THE DISEASE.

In endeavouring to ascertain the effect of the gumming disease on the cane juice in the mill and on the separation in the process of manufacture of the sugar that this contains, great difficulty has been experienced, since everywhere canes affected by frost as well as those subjected to gumming disease were being crushed at the same time, and their juices comingled, and in fact in many cases the abnormal

occurrences that were attributed to gumming disease were partly due to the presence of juice derived from canes that had been injured by the former of these agencies.

It is believed that in the case of the gumming disease any ill-effects that may arise from the presence of the so-called "gum," whose development is such a characteristic symptom of the disease, are to a large extent purely mechanical.

That it hinders the extraction of the juice by the mills has not been ascertained. Mr. C. Müller has, however, stated that he has observed that "gummed cane," on being cut across, often exhibits more sucrose in the form of crystals (apparent owing to the light that they reflect) than does healthy cane, and he suggests that gumming may therefore hinder sugar extraction with the juice at the mills, since this occurrence indicates that in affected cane there is more sugar difficult of extraction without heavy maceration than in non-affected cane, for in the case of sugar this, when once crystallised, dissolves with comparative difficulty in cane juice to any extent without the addition of both water and heat. I do not, however, find much in this suggestion, for assuming that gummed cane when cut exhibits more numerous crystals of sugar than healthy cane does--which I do not, however, admit—this amount of cane sugar occurring on the cut surfaces of the stalk, as compared with the total sucrose within the latter, would be relatively small, and it would not have time to crystallize out upon the fragments to which the cane was reduced by the mills

The gum in the juice, however, without doubt hinders, as a whole, the process of sugar manufacture. In serving as an additional impurity in the juice, it makes the separation of the dissolved and suspended organic matter by the clarifiers not only more difficult but also necessarily more protracted, and the juice is regarded by the operator as not being so "good" as it would otherwise be. The same remark applies to the subsiders. When arrived at the triple effets, and when using both the same temperature and the same vacuum as for ordinary juice, longer time is taken in bringing it down to the required density. The same occurs again in the vacuum pan, where additional difficulties are experienced. The liquor has there to be subjected to a higher temperature than would be otherwise necessary for the same vacuum, since the presence of the gum renders the masse dense and heavier to move. The process, also, at this stage is often greatly protracted, since the sugar is slow to grain at the density at which graining usually takes place—a result apparently due both to the mechanical and chemical influences of the gum, some of the sugar being dissolved by derivatives from the gum formed under the special physical conditions which obtain, and others being enmeshed in the gum substance itself. The liquor, also, in the presence of so much gum becomes unduly sticky and adhesive, and in part coagulates on the coils, where it may form hard lumps which may subsequently be detached and become free. This effect is not simply the result of undue concentration, since when the pressure of steam in the coils is lowered, and their temperature therefore lowered also, less of those lumps are formed. Though, too, such lumps as become free in the liquor may be removed when the massecuite is passed into the centrifugals, the smaller particles may remain and appear as the brown specks, so often noticeable in sugars derived from working "gummed" cane. These lumps, it may be remarked, have usually the colour of yellow candy, but may be darker.

They have been found by Mr. R. Gardiner, chemist at Mon Repos, to contain 56 per cent. of sugar and 23·4 per cent. of matter precipitated from their aqueous solution by alcohol—*i.e.*, "gum." Again, it may be added that the lower-grade sugars are found to be inferior and more difficult to separate from the jellies than usually happens, to require also additional washing in the centrifugals, and a greater proportion of them is redissolved than usually happens, and so finds its way into the final molasses, and so is loosed when these are discarded.

All this involves extra fuel, labour, time, and so monetary expenditure, with the ultimate possibility of some depreciation in the value of the manufactured article. One may, however, conclude that when the mill managers bring to bear on the treatment of juice from "gummy cane" that great skill and technical ability with which in many cases they are possessed, all this difficulty alluded to will be removed. It would seem that greater attention might be bestowed upon the process of clarification. Dr. Cobb has stated that "there is good reason to believe that this lack of clarification is not due to a failure to precipitate all the vasculine ('gum'), but to a failure to precipitate the microbes." To me, however, it seems that the gum or vasculine and the microbes are practically one and the same from the manufacturer's point of view, and that the removal or failure to remove one connotes the removal or failure to remove the other. Further, that the bacteria and "gum" considered as one are so much albuminoid matter—non-coagulable by heat—that has to be regarded as additional to that albuminoid matter of this character that occurs in greater or less amount in all cane-juices, but especially prevails in the juice derived from sugar-cane grown upon heavy and wet soils. And it is to be observed that the juice which has recently passed from the clarifiers, as well as the liquor from the effets and the massecuite from the pan, gives the chemical reactions characteristic of the presence of "gum," and that as these become denser and denser so is this reaction more pronounced and the gum present in greater amount. This is especially well seen by using alcohol, as demonstrated to me by Mr. R. Gardiner—a reagent that, whilst precipitating "gum," and albuminoids generally not coagulable by heat, fails to throw down the viscid glucate of lime, and therefore distinguishes between them and it when occurring together in the syrups or massecuite. It may be also remarked in this connection also that the solution of "gum" or vasculine having a neutral reaction, it may be readily understood how it may be still present unrecognised in the juice of the clarifiers when this, by the addition of lime, has been rendered slightly alkaline, and thus it may be permitted to pass on and occur in the juice throughout the subsequent stages in the process of the sugar manufacture. Moreover, should the juice be allowed to pass to the subsiders acid, as is sometimes done, especially when newlandite (phosphoric acid) is employed in defæcation, it may still contain "gum," as all of the latter substance that is present cannot be precipitated in an acid solution, and such as may have been already thrown down may, by the acid, become redissolved. Mr. C. Müller, of Bingera, has suggested the possible feasibility of removing the "gum" by means of an iron salt, and, indeed, has, as he states, resorted to the method for a single day with very fair results.

To conclude this theme, it may be mentioned, as partly corroborative of my contention, that the difficulties arising in sugar manufacture from using the juice of "gummed" cane seem to be to a considerable extent overcome by passing the juice from the clarifiers through bag filters, as is done at Windermere, and, as far as I could observe, almost wholly by the adoption of the lime-sucrate process that has been brought to such perfection at the hands of Mr. John Cran, at Millaquin. If, moreover, all that is accomplished by the Dammezes and Schollmeyer's process of Electrical Purification that is claimed for it actually results from its employment, a great measure of success might attend its use also in coping with the difficulties which are here alluded to.

VARIETIES OF SUGAR-CANE IN THEIR RELATION TO THE DISEASE.

By far the greater proportion of cane met with in both the Burnett and Wide Bay districts belongs to the variety spoken of as Rappoe, or Rose Bamboo; indeed, on the majority of estates it is this variety that is exclusively grown. The gumming disease which affects this cane is therefore verbally associated with it in such a manner as to suggest the inference that it were entirely a feature of Rappoe, whereas as a matter of fact the same malady is met with amongst many other varieties of cane also.

Amongst those in which it was found occurring in the course of this inspection were Louzier or White Bamboo (at Mackay), Djiœnig-Djiœnig, Rappoe or Rose Bamboo, Striped Singapore, Mauritius, or Striped Guingham, and Meera. In addition to these Lahina may be mentioned, on the testimony of Mr. McGuigan, of the Island Plantation.

The sugar-canes found to be quite free from its presence were Elephant or Tanna,* Malabar, Daniel Dupont (the *Bamboo brancheuse rayée* of Mauritius), Cheribon or Outamite, and China. Other varieties which did not present instances of its occurrence were "Creole"† and Black Java, but the apparent immunity that they exhibited was probably due to the fact that their cultivation was restricted to certain plantations.

In addition to these, a number of varieties were observed, but these were either cultivated on too small a scale to admit of their being regarded as exhibiting evidence of freedom from disease, or they were not in a condition suitable for its manifestation owing to their cane having been but recently removed. In this category may be included Bourbon, Big Yellow, Singapore Yellow or Yellow Mauritius, Salangore, "South Sea Island cane," Caledonian, Caledonian Yellows (three varieties), Big Tanna (a green cane), Tschiemie, Troeboe, Chigaca (? Black Java), Old Ribbon (? Big Ribbon), and several others occurring in nurseries in connection with plantations. It is, however, thought that one or more of these

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* In October, 1894, Mr. Edward W. Knox, General Manager, Colonial Sugar Refining Company, wrote—"Only a few days ago we received news from the Tweed that the Tanna cane shows signs of disease there." It must be admitted, however, that that cane has never been found by me to evince any symptom of the presence of the disease, and an isolated reported instance of the latter's occurring in this variety, as also this intimation of its attacking this variety at the Tweed River, needs confirmation.

† Not the "Canne Créole" of Mauritius.

varieties, when given extended trial, will be found to remain immune, as for example Salangore, and the old Ribbon cane (? Big Ribbon) originally imported by Captain Hope.*

This difference in the varieties of cane with respect to their receptivity of disease is very marked. Thus, on more than one occasion, it was remarked that should any one of the naturally immune canes be found growing within the limits of a patch of affected Rappoe it would, nevertheless, itself escape the disease. A good illustration of this occurred on the farm of Mr. E. Perske, a resident of Doolbi. Here, at one spot occurred both Rappoe and Meera, both diseased, and scattered amongst the stools of these varieties, isolated plants of Malabar cane, Elephant cane, and Cheribon, all perfectly healthy.

Whether there are any constant structural differences, or difference of chemical constitution, that distinguish the canes of these two classes may be profitably considered. At the outset, however, it may be remarked that, with the exception of the data arrived at by Stenhouse, Paruit, d'Esmery, G. Ville, and Payen, and furnished by A. Delteil in his "La Canne à Sucren," pp. 20-5, and which are obviously insufficient for the purpose in view, and a few others also, no exact and ultimate analyses of sugar-canes appear to have been made, or, if so, published, and so the means for instituting the comparison do not exist; such analyses, moreover, as are obtainable here have been prepared with the object of estimating the relative amounts of sucrose and non-crystallisable sugar, and the proportion which the former bears to the total amount of solids that the juice contains, and so assisting the farmer to realise the degree of success his operations have attained unto; and—by the same and further procedure—helping the manufacturer to adjust the process for its extraction, and to check this in its different stages and in its final result. But the ascertainment of the fundamental distinctions on which the differences observable, as well as others, depend, with the ultimate object of controlling them, is either regarded as being supererogatory, or has to be necessarily postponed by reason of the continuous attention on the part of the chemical staff which the manufacturing process itself entails. In an inquiry of this kind, particulars to be gained from such a special investigation as this would be of the utmost importance, and might profitably engage the attention of an Experiment Station.

In the light of the mill analyses to hand, it would appear that all the canes mentioned as those in which the disease was noticeable are especially rich in saccharine contents, being all *par excellence* "sugar-canes." The following figures indicate the percentage of sucrose in what may be regarded as first crushing juices:†—Louzier or White Bamboo, 15·24 to 16·26 (September) for Mackay; Rappoe, 16·3

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* No reference has been made to "Moore's Purple," a cane that has a very high reputation in the neighbouring colony, both as a sugar producer and as being more or less, if not absolutely, free from disease. This is because I am personally unacquainted with it, although it is believed it had been recently supplied at the time of my visit to the Isis Scrub district to the contractors there of the Colonial Sugar Refining Company. Of this variety Mr. Alexander Meston, the well-known planter of New South Wales, writes of this cane, as follows:—"It certainly looks as healthy as a plant could look. It stands at the top of the whole cane family for sugar. No one of the others come near it. It would not be surprising if the Colonial Sugar Refining Company instruct all their constituents to plant nothing else." Having then such a reputation, its good qualities might be further assayed in this colony.

† It is needless to remark that no absolute comparisons can be drawn between these different values; plant and ratoons being used of different age, and grown under different conditions, and analysed at different times of the year by different experts.

(average season's crushing at a plantation, Woongarra Scrub) to 20·22 (first ratoon cane from drained scrub land, Bingera, October); Striped Singapore, 20·6 (plant cane, Millbank); Meera, 16·93 (first ratoon, Mackay, March); Striped Meera, 17 (Mackay). It is well known also that Lahina and Mauritius or Striped Guingham are especially rich in crystallisable sugar; and of Djiœnig-Djiœnig it was remarked by Mr. W. Gibson, of Bingera, that it was formerly said that there was only one sweeter cane on this plantation, namely Chigaca [a cane closely resembling Black Java—H. T.].

This special development of sucrose is noteworthy in view of the fact that C. A. Baber, Superintendent of Agriculture, Leeward Islands, an acknowledged authority in matters relating to the sugar-cane, has suggested, as the possible explanation of the origin of a disease that has affected the staple variety of cane grown there—*i.e.*, Bourbon—a too close attention to effecting improvement in a one-sided manner—viz., in developing the saccharine richness of the juice, without simultaneous regard to the necessity of securing immunity from disease; stating that, whereas the Bourbon originally came from the coast of Malabar in India, it had been so altered by the influences to which it had been subjected in the Leeward Islands, that plants of this variety from there could not be re-established in their original home; just as, in a similar manner, the native Bourbon cane in India had been so improved when carefully tended about the peasants' houses, that it had developed into an edible cane, having a thin rind and tissues filled with sweet juice, and had, in fact, become a special variety which rapidly succumbed if planted out.*

This opinion is entitled to very great respect, but whether it embodies a correct theory of the origin of cane diseases can only be decided by an appeal to statistics which are not available in Queensland; neither is it possible to decide if it is applicable, and if so to what extent, to the gumming disease under consideration. It may be remarked, however, that the canes that have been found to be free from disease in Queensland are included in both the poor-in-sugar and rich-in-sugar categories: Daniel Dupont, or *Bamboo brancheuse rayée*, having a sucrose percentage of 15·94 to 16·94, and a coefficient of purity of 85·73 to 85·80 (plant cane, Mackay, August); whereas in Elephant cane, or Black Tanna, the cane sugar is (*a*) 12·66 (plant cane, July, Mackay), and (*b*) 13·57 (ratoon cane, July, Mackay), with coefficients of purity 79·23 corresponding to (*b*), and 83·01 corresponding to (*a*). In Green Tanna, or Malabar,† the cane sugar is 13·80 and the coefficient of purity 81·86 in plant cane, Mackay, July; and in first ratoon cane, Mackay, July, these values are 14·60 and and 97·77 respectively; and in Cheribon, or Outamite, the cane sugar is 14·27 and the coefficient of purity 79·54 in plant cane, Mackay; and China cane, again, is so low in its sugar content as to be, for this and other reasons, discarded for mill purposes.

Again, it was noticeable that the canes grown upon the best lands were those in which the disease was most pronounced. The canes

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* In this connection it may be remarked that when, in 1875, the disease popularly designated Rust "ran through the sugar cane in Queensland, and for that year almost annihilated the crop, reducing the total amount of sugar produced to about two-sevenths of what it had been in the previous season" [Ling Roth], this same Bourbon cane, which at that time constituted the great bulk of the crop, had not participated in this improved condition to which Mr. Baber refers, being quite exceptionally low in its sugar content.

† A Malabar cane received from the Isis Scrub yielded, however, 17·692 per cent. of crystallisable sugar, as I am informed by Mr. John Cran, of Millaquin.

in these instances, however, though yielding the larger amount of sugar per acre, would be probably individually poorer in sugar than would such as grew on land less fertile and having a less forcing tendency. On one plantation, again, it was noticeable that the disease did not occur in the cane which, by analysis, showed the larger amount of sugar, but in that which showed the lesser percentage—but then the latter was grown upon undrained land. Again, on another plantation where the disease was noticed to be very pronounced, though it seemed to have originated at a comparatively recent date, the percentage value of the cane in crystallisable sugar had apparently gradually decreased during the preceding years, as inferred from the figures relating to the density of the juice. Thus in 1891, 1892, 1893, and 1894 the density was respectively 10·51 degrees B., 10·33 degrees B., 10·16 degrees B., and 9·11 degrees B. These figures, though interesting, lose much of their significance, since it is not possible to state the proportion of plant cane crushed during the different seasons; but of course the density would decrease directly as this amount. The effect of the long-continued winter of 1894 has also to be taken into consideration as an important factor in lowering the density of the juice of cane crushed during that season. On the whole, however, it seems probable that in the case of this particular plantation the density, and so the saccharine richness, of the juice has for some years past suffered a gradual declension, brought about by impoverishment of the soil by continuous cropping. Though then no decision can be arrived at regarding this suggested connection between the gumming disease and the saccharine richness of the cane, it must be admitted that the occurrence of such a connection is intelligible from the fact of the disease being invariably accompanied by the presence and development in prodigious numbers of bacteria, and from the consideration that the existence and increase of such organisms are not only promoted but also often dependent upon the degree to which certain constituents prevail in the media in or upon which they occur—a matter readily capable of being demonstrated. Susceptible and immune varieties of cane might further be compared from a chemical standpoint also in other particulars relating to their composition, but in the absence of precise and ample data the improbability of arriving at reliable conclusions deters venture into such an interesting province of inquiry.

Again, when we compare the different varieties of cane according to the relative amounts of glucose and sugar that their juice contains, we find that the former body is present in Cheribon, Elephant cane, and Malabar, three immune varieties, in much greater amount than it is in the susceptible canes:—Meera, Rappoe, Striped Singapore, Mauritius Guingham, White Bamboo, &c.; but, again, Daniel Dupont, an immune cane, is to be ranked with the susceptible canes when regarded from this point of view, as it contains little glucose in proportion to its sucrose. So also with regard to the coefficient of purity presented by immune and susceptible varieties.

The varieties of cane also exhibit much difference in structural detail, a difference from which it results that the stems of some are much harder than those of others, as, for instance, the immune canes Daniel Dupont, Elephant or Black Tanna, Malabar or Green Tanna, and China cane. On the other hand, most of the canes especially

affected by the disease are soft, as, for instance, Rappoe and Meera; but the immune cane Ouatamite or Cheribon, is comparatively soft, and the little affected Black Java is especially so. The fibrous qualities of the cane, or amount of cellulose that they contain, again greatly vary in the different varieties. Here, again, the immune canes are, as a rule, fibrous, and the susceptible ones otherwise. Thus the proportion between the fibre or cellulose and the matters removable by pressure and evaporation are in Daniel Dupont 1 : 5·3 (ratoons) and 1 : 6 (plant); in Elephant or Black Tanna, 1 : 6·8 (ratoons), 1 : 5·5 (plant); in Green Tanna or Malabar, 1 : 5 (plant and ratoon); whereas amongst susceptible canes we have Meera with 1 : 6·1 (ratoons), and 1 : 7·8 (plant); in Cloudy Gingham, 1 : 7·5 (plant and ratoons), and in Rappoe 1 : 7·3 (30 analyses Woongarra Scrub); but then Cheribon or Ouatamite is a specially juicy cane, the proportion between cellulose and juice being 1 : 9 in plant cane and 1 : 7 in ratoon cane (Isis Scrub and Mackay.)* It cannot therefore be affirmed that the juicy canes are those that are exclusively susceptible to disease.

Again, the different varieties of cane may be considered from still another point of view—*i.e.*, that afforded by their behaviour under cultivation, regard being had in each case not only to their peculiar vital manifestations, but also to the nature of the environment that they severally affect. Here again absence of data renders it impossible to definitely state what are the peculiarities of the different varieties of cane considered from this point of view, much less establish any connection between them and the presence of disease. Rappoe as a type of the susceptible canes possesses great longevity. At Tege Tege Plantation, on the Kolan River, some of the stools of this variety are said to be fifteen years of age, and to be still growing where originally established; but Cheribon or Ouatamite, as a type of the immune varieties, has been known to live similarly fourteen years at Mackay. In both instances the canes had been subjected of late to neglect. In 1894, also, ten-year-old cane (9th ratoons), representing the varieties Daniel Dupont White Bamboo and Rappoe, was seen forming a part of the standing crop, in three different plantations respectively, as evidence of the powers of endurance of immune and susceptible varieties.

It would appear, however, that there is a well-defined difference between these two classes of cane when we come to compare their power of withstanding adverse meteorological conditions and of tolerating ill-drained and wet soils. The immune varieties are pre-eminent in this respect, especially Black Tanna or Elephant cane, Green Tanna or Malabar—a sport of the preceding—China cane, and to a less extent Cheribon and Daniel Dupont. Of these, however, Cheribon is affected by frost, but not nearly to the extent Rappoe cane is, whilst Louzier is even more intolerant than it. These two last-mentioned varieties, as well as all the other susceptible canes, are injured by being drawn on ill-drained land, Lahinia, it is stated, ceasing to sucker under this circumstance. On whatever peculiarity in their nature this superiority over other canes depends has not been ascertained, but in Daniel Dupont it is accompanied by a great root development and its wide mat-like expansion. The Tannas, again, are

* These values are, except when stated otherwise, the result of single determinations.

specially deep-rooting varieties. China cane, which is the only variety of *Saccharum sinense* grown in Queensland, seems to have reverted towards the condition of a wild and uncultivated plant, and may be more resistant in consequence, in which respect it may resemble the canes—with numerous small erect stalks—grown in Jamaica sometimes, for forage purposes, which, owing to their resistance to a low temperature, have been recommended for planting in high and low latitudes. On the other hand, susceptible canes such as Rappoe, Meera, Djioenig-Djioenig and others are very intolerant of both wet and cold.

In dealing with cultivation and its influence on the occurrence and virulence of the gumming disease, considerable stress is laid on the question of drainage, it being shown that the disease arises spontaneously—generally, if not exclusively—on ill-drained areas. This proposition, therefore, gains support from the experience that these canes which can tolerate wet land are not subject to the disease, whilst it especially prevails amongst those varieties which are not endowed with this character.

Note.—It may be opportune to remark here on the great dearth of systematic information that exists amongst sugar-planters concerning the different varieties of sugar-cane and their potentialities. Even the nomenclature of the canes grown in Queensland is in a state of great confusion, the same cane being known under several different names, and in some instances a single designation applied to two or more varieties. This is a matter to which I had hoped to have on this occasion given some attention, but for the present must defer entering upon so promising a topic. Even as it is, through not being able to group the different synonyms, I have had in some instances to omit important particulars. It would, however, surprise some growers of cane in the Wide Bay district to be informed that there are already found growing in their midst about forty different kinds, and amongst these some of considerable promise which they have not as yet brought to any extent under cultivation. It has, however, to be ascertained in the case of every one of these varieties what climatic ocnditions, what classes of soil and of land are the most suitable for its growth, whether under cultivation it improves or degenerates, and to what extent it presents the different features on which its success as a sugar plant depends; how and in what degree these become modified by special conditions of environment, and how they can be developed. Such information may, it is considered, be possessed by few, but it is not a matter of common knowledge, nor is it likely to become such unless special means are taken to accomplish this end; and yet it is in the ascertainment of these and other particulars and their application, that the future success of sugar-cane culture largely depends.

THE QUESTION OF CANE DETERIORATION.

There is an opinion widely entertained that the gumming disease is the outcome of the continuous propagation and cultivation of the varieties of cane, in which the disease has now become manifest, during a long succession of years, in one sugar-growing country, whereby the constitutions of these canes have become impaired and their power of withstanding disease proportionately weakened. And according to the views of a section of those who share this belief, this degeneracy has

been hastened by the predominance of adverse meteorological conditions, and imperfect methods of cultivation. Again, some restrict the operation of these causes to Rappoe or Rose Bamboo cane only.

Of these reputed influences, the latter or secondary ones are treated of in another portion of this report; the former or primary one has now to be considered. Its existence is thus alluded to by a well-known planter of New South Wales, Mr. Alexander Meston:—"With regard to diseased canes (he writes, *Clarence and Richmond Examiner*) I am perfectly satisfied that their time is up, and they will die right out. It is now eighteen years since I imported the Grey Fiji, and with the exception of Old Ribbon and China, none of the other varieties have run one-third as long. Of thirty different sorts, I never knew one of them take a disease that ever recovered." Again, the *Sugar Journal* gives expression to similar views in the following words:—"We venture to assert, as we have done before, that some deficiency in cultivation and constant breeding of one variety is the first cause (of the disease). The cane, *physically weak, or wanting in something*, falls a victim to a long cold winter, want of sun, and other unfavourable conditions, and develops disease, which, unless properly dealt with, becomes absolutely destructive of the cane itself. The effects of a long wet autumn in the Mackay district were shown in the rust of the year 1875, when the *physically unsound* Bourbon fell a victim, in three nights, in all parts of the district, to the disease." —*Op. cit.*, vol. 3, pp. 193-4, 15th October, 1894.

In the West Indies the Bourbon, which is there regarded as a splendid cane, and which in Demerara has been found to be the variety by far the best suited for the soil and other conditions of the colony as a sugar-producing plant, is now suffering from a disease that is at present causing considerable concern, and this cane has been cultivated there continuously for a great number of years.

In Java in 1885 the disease known as "Sereh," which had already appeared in 1879-80, spread rapidly over almost the entire island.

In Mauritius a disease affected their White Cane in 1850, and other visitations have helped to destroy their Penang cane or Salan gore, their Scambine, their Belouquet, and their Rose Bamboo. And then, again, there is the failure of the Bourbon in Queensland, to which the above extract relates.

This deterioration, it is affirmed, is brought about by resorting to what is regarded as an unnatural mode of propagation, the use of cuttings instead of seeds, or by the employment of cuttings derived from non-vigorous plants, or such as are otherwise unsuitable for use owing to some special defectiveness, as, for instance, in cane substance.

In cutting all the stalks from a stock or rhizome while the leaves are still green, as is done when the crop is harvested, it is reasonably assumed that the latter is deprived of the plant constituents which would otherwise be transferred to it if this cane were suffered to remain till the foliage was naturally dead. The stool is in consequence impoverished, and any suckers or shoots which it subsequently gives rise to will therefore suffer, and when they come to be used as "plants" these will have inherited the acquired impairment, and this by continuous propagation will become intensified until in

course of time a special pathological receptivity is developed, and they are the prey of disease. This explanation of the manner in which the deterioration is brought about will, however, only apply when ration cane is used for propagation, and not when, as usually is the case in Queensland, plant cane is used for sets. Again, it is affirmed that by transferring a variety of cane from its natural habitat—*i.e.*, where it has arisen in the course of seminal generation to another, an effect is produced comparable to the equatorial ænemia which arises in human beings, who, having been reared in a temperate, become residents of a torrid region. Or, further, that in developing the sucrose content and other desirable qualities of the cane, we hinder accidentally and in consequence, or by reason of neglect, the maintenance, much less the increased prominence of those features which enable it to withstand unfavourable conditions, and the incursion of disease.

On the quality of the cane used for "sets" may also depend this gradual loss of vigour or its reverse. It has been stated that at Reunin when "tops" are used exclusively for sets, the cane so produced will give good returns for ten or fifteen years, when the yield dwindles and the cane must be replaced by another variety. Whereas when the body of the cane is exclusively employed for this purpose it has been found that after twelve or fourteen years no decrease in the yield has been apparent. ["Sugar Cultivation in Reunin," *Sugar Journal*, 1894.] It is not, however, explicitly stated that the impairment of the cane in this case was attended by the advent of a diseased condition, but the probability of such an event is highly probable. A. Delteil states, in writing on the use of the entire stem for sets:—"On n'a jamais constaté la dégénerescence de la canne à la Havanne, oùl'on plante depuis longtemps les mêmes espèces la canne Blanche et la canne Rouge d' Otahiti. Cette immunité ne serait-elle pas due au mode de bouturage."—*La Canne à Sucre*, p. 46. How this deterioration may be brought about under the circumstances mentioned, may be readily inferred when the difference between "top plants" and others are taken into consideration. The consequence of using sets derived from sickly, badly-grown, or old cane, in producing plants constitutionally weak, is too obvious a result to be here insisted upon.

However, it may be questioned whether by the employment of cuttings we are adopting a mode of propagation which is wholly unnatural. For it is an undoubted fact that closely analagous modes of increase are habitually found occurring amongst members of several orders of plants when growing in their natural habitats. It must, however, be admitted that in their case this mode of increase is an alternate one, generation by the medium of seeds being also met with. It may also be alleged that propagation by cuttings is habitually resorted to by horticulturists without disease supervening in the case of quite a number of plants, stems or rhizomes (undergrowth stems) being employed for this purpose. Even in the case of the sugar-cane we are confronted with such instances of that of the Crystalline variety of Cuba, a justly esteemed cane which is said to have been grown there for the last hundred years, propagated in the usual manner, and yet not affected by disease. Then there is the above testimony regarding the canes of Havana. On the other hand we have in the case of a cane quite recently sent out from Kew Gardens, and known in Queensland as "Kewensis," a seedling that has, according to Mr. E. W. Knox,

developed symptoms of gumming disease in New South Wales, where also recent importations from New Guinea, as the same authority also informs us, have been similarly affected.

It may be inquired if it be a fact that the varieties of cane that have been proved to be susceptible to the disease, have been long under cultivation in Queensland or New South Wales? In the case of two of them—viz., "Kewensis," and the New Guinea varieties, like it, recently introduced by the Queensland Department of Agriculture, and which are reputed to have manifested its presence—the reply as above stated must be in the negative.

Of the other varieties in which the disease has manifested itself it may be remarked that all, with one exception, were growing in the colony, if not in the Wide Bay district, at least as early as 1875, although also at that date were growing on the Mary River and elsewhere three of the apparently immune varieties—viz., Cheribon, Malabar, and China. Of the canes subsequently introduced the disease shows itself in Louzier (at Mackay); whilst Daniel Dupont (*Bamboo brancheuse rayée*), Green Dupont (*Bamboo brancheuse blanche*), Black Tanna, or Elephant cane (possibly, however, established prior to 1875), escape its attacks.

In addition to these there are many canes, both amongst those introduced prior to 1875 and those since, concerning which no information can now be given regarding their liability, or otherwise, to be affected by this malady; either because they are grown on too small a scale and are quite exceptionally met with, or because they have been lost sight of since their introduction. Amongst those which have been in the colony for twenty years and upwards, and to which this remark applies, are Bourbon, Salangore or Penang cane, Caledonian Yellow, Big Yellow, Little Yellow (a sport of the Violet Ribbon, or Striped Mauritius Guingham), Big Tanna, Tschiemie, or Shemei, and the old Ribbon cane; whilst the lost canes include Axboe, Ardjoens, Belouquet, Canteng, Kœnig, Kuku Soei, Kuku Son, Nelt, Passavoewan Rhi, and several others which it is believed were once growing at the Government Farm at Oxley Creek and subsequently in the Brisbane Botanical Gardens (*vide* "Catalogue of Plants, Brisbane Botanic Gardens," p. 122, Brisbane, 1885).

Amongst those canes which appear to be immune may be mentioned a Meera-like one named Creole (a designation which it is believed is applied in the West Indies to the China, and in Mauritius to a greenish-white variety). This cane was introduced by the Board of Inquiry appointed in February, 1875, "to inquire into the causes of diseases affecting live stock and plants," during 1876, through the agency of one of its members, Mr. Angus Mackay; the original two plants being the only canes that survived the collection of varieties made in America and the West Indies, and brought to Queensland by Mr. Mackay. These were at first grown in Mr. Mackay's own garden, and from the two plants others were raised at the Government Garden at St. Helena, under the direction of Mr. McDonald, by whom the variety was distributed. This Creole cane, which by some is regarded as identical with Meera, though it is usually a less bright cane and has a different habit of growth, was observed to be already cultivated to some extent at Knockeroe, Isis Scrub, Mr. A. C. Walker, the owner of that plantation, having originally obtained cuttings from St. Helena

plants, which he grew at Bingera until 1882. At the time of my visit about 15 acres of it were found growing there, a portion—first ratoons—having yielded at the rate of 30 tons per acre. This Creole cane had in some places been cut back by frost, and some of it had been planted in a low-lying situation; notwithstanding, however, it had not developed any symptoms of disease. This instance is mentioned since it affords an example of cane propagated in the ordinary manner for nearly twenty years, and grown under unfavourable conditions, and yet manifesting no symptoms of disease; whereas its close ally, the ordinary Meera, is one of the worst to be affected. At Goodwood a portion of a field measuring about 21 acres of Meera cane was pointed out as not having been attacked by gumming, notwithstanding the lower 7 acres were ill-drained. It may, however, transpire that this cane was in reality Creole, and had the same origin as that referred to as being grown by Mr. Walker, at Knockeroe.

Different canes may, however, not be all affected to a similar extent by continuous propagation from one original stock. Thus the Ribbon cane, which had perhaps been grown in the colony as long as had the Bourbon variety in 1875, was quite free from the presence of the so-called rust, which proved then so fatal to the former as well as to the Violet Ribbon (Striped Guingham) and its sport.

If, however, continuous propagation from one stock has resulted in the presence of disease, the cane where it occurs should manifest some symptoms of accumulated weakness and general lack of condition on the existence of which the disease—on this theory as to its origin—must depend. And further, where this impairment of vitality might be most expected, there also the disease should occur. It is therefore not without interest to consider how far the Rappoe, or Rose Bamboo, cane complies with this requirement. Twenty years since Rappoe cane was grown on several of the plantations along the banks of the Mary River, and also in those of Southern Queensland, but usually to the extent of a few stools only. In 1874 Mr. M. Canny, of Inveragh Plantation, Mary River, procured a shipload from the North (? Java), supplying Mr. J. Clark, of Eton Vale, with 30 tons and others with less amounts. They, as well as Mr. Canny himself, used it for the purpose of replacing the Bourbon, which in that year had been killed by rust. From the same source was derived the Rappoe of the older plantations of the Burnett River, where it replaced Big Yellow and Black Java, as those varieties had the Bourbon cane. From Maryborough also it was introduced to Mackay by Mr. Cumming, though probably it already occurred there in small amount, being noticed at the Pioneer Plantation (Mr. Spiller) in 1875. It was soon found to be a remarkably healthy cane, and one possessing many other desirable qualities. It was one of the canes which did not take rust.

In endeavouring to arrive at a correct judgment on the question of the deterioration of a variety of cane owing to continuous propagation from one original stock, one has to be careful to eliminate the action in the same direction of a gradually impoverished soil. Several cane-growers to whom the matter was submitted were free to confess that any deterioration that they had noticed might reasonably be attributed to such a cause. A few expressed the opinion that the cane had deteriorated in a manner or to an extent that could not be thus accounted for, whilst others were decidedly averse to the conclusion that it had deteriorated at all.

Mr. J. Clark, of Eton Vale, who has had thirty years' experience in cane-growing on the Mary River, being the first to sell cane grown in that district, and who, as we have seen, early made the acquaintance of the Rappoe variety, stated that it presented no signs of deterioration whatever; it still yielded from 12 to 40 tons per acre of cane. No decrease was noticeable in the density of the juice, and it could still "stand over" as well as formerly. In his case no cane has been introduced from outside for the purpose of being used as "set" during the last fifteen years.

Mr. James Cran, junr., of Iindah, stated that from his experience on the Mary River he would not conclude that the Rappoe cane was deteriorating. He had recently planted this variety there on virgin scrub land [at Sandhay's], and the yield was exceedingly heavy—not less in fact than it would have been in the early days of cane-growing; in fact, the cane was altogether as good as he had ever seen when grown under similar circumstances. In this case the "sets" had been procured from a plantation, Iindah, which had been for a great number of years under cultivation. At the Woongarra Scrub the individual canes were, as a general rule, he thought, certainly shorter and less robust than were those of Rappoe in years gone by. The Rappoe arrowed also in a capricious manner. Some ten years back it arrowed even to a greater extent in the Woongarra Scrub district than it had during the late season. Arrowing, he thought, was influenced by prevailing meteorological conditions.

Mr. R. H. Blisset, of Goodwood Plantation, Gregory River, stated that there was no evidence from which one might conclude that the Rappoe cane was deteriorating. Virgin soil seemed to give as good a return as at any previous time. Recently 12 acres of plant cane grown in the neighbourhood, two years and three months old, on new land, yielded at the rate of 88 tons per acre exclusive of an additional four or five tons, that had died from "natural causes," left upon the ground. He had seen Rappoe canes that attained a length of from 28 to 30 feet as recently as 1893. The cane had not arrowed to a greater extent during the 1894 season than during the previous years; but arrowing he regarded as a sign of early ripening, and as depending on some exceptional meteorological condition, and not as being an indication of deterioration. He had not tested the capacity of the cane to stand over until recent years, but lately he had done so with very good results, no great amount of dead cane occurring. With regard to weight of cane per acre, the land under cultivation was yielding less cane, as might be expected, but then the cane itself was now denser, contained more sucrose, and this was more readily manufactured than in former years.

M. A. C. Walker, of Knockeroe, Isis Scrub, stated that the Rappoe cane when grown upon virgin soil gave as good crops as ever it did. It had not arrowed on his estate during 1894. He had only seen a single arrow on the plantation of 900 acres. The cane could also "stand over" as well as in former years. In 1893 he had a stand over crop yielding at the rate of from 80 to 90 tons per acre, with scarcely a dead stock in it.

Mr. W. Gibson, of Bingera, and who acts as plantation superintendent there, stated that he did not think that the Rappoe cane was deteriorating. In fact, the plant cane which was being cut there now was superior to that which was grown in the earlier days, amongst

other features being larger; the barrel of the cane was better than formerly. He was aware that the tendency to arrow had been regarded as an indication of deterioration. He had, however, himself been led to attribute arrowing to the occurrence of exceptional climatic conditions, such as were afforded by extremes of either wet or drought. At Hemmant, also, fifteen years since, he had noticed that the cane would arrow where the land was dry and sandy and nowhere else on the plantation. Arrowing had occurred in about one-third of the Bingera Estate during the last season. He had not found that the ability of the Rappoe cane to "stand over" or persist from one season to another had been diminished until the present season, but in this there had occurred exceptional circumstances to account for this exceptional occurrence. There had been about six weeks of dry weather during which great heat prevailed, immediately after the crushing season of 1893, and then, again, some of the cane at Bingera which had to be left standing had been several years planted. The cane, again, was not found to be becoming less rich in sugar than it had been formerly; in fact, the reverse was the case. This season it was richer than ever it had been.

Mr. Noakes, a planter resident in the Woongarra Scrub, and who had been growing cane himself for the last fourteen years, but whose experience in agriculture there dates back twenty-two years, stated also that he was not of opinion that the Rappoe cane had not deteriorated, and that when it was planted in new land it seemed to yield as good returns as during any previous time. The density of the juice had declined during the past season, as compared with the previous ones, but there had been no gradual falling off in this respect.

Other planters likewise affirmed that they saw no indication of any deterioration on the part of the Rappoe cane.

To quote the view held by another description of witness, I may refer to the opinion expressed by Mr. C. Müller, the able analytical chemist of the Bingera Plantation. He stated that he had tested at least twenty different kinds of canes grown on the estate in experimental plots—in some instances to the extent of from one to two acres—and he had come to the conclusion, as the outcome of his investigation, that Rappoe still remained the best cane of them all from the point of view afforded by the coefficient of purity of its juice.

Contrary testimony was, however, likewise obtained, and from those whose judgment, like that of the witnesses who have above spoken, is entitled to very great consideration.

Mr. E. Young, of Fairymead, stated that his opinion was that the Rappoe cane was generally and continuously deteriorating. In years gone by it was noticeable that the saccharine content of the cane was generally higher than it is now, as shown by the polariscope. The density of the juice was also higher. That yielded by the juice of a whole field had been as high as 12 degrees B. Moreover, the plant now was tending to become shorter lived, a feature that appeared to be evinced by its frequent arrowing. Arrowing seemed to be the last event in the life of the plant—an indication that it had arrived at its term of life. Formerly an "arrow" was quite a curiosity, especially in the case of cane grown upon rich scrub soil. In fact, it might be said that Rappoe generally did not arrow*. Now it arrowed commonly.

* The cane, growing on the sandy flat near the river wharf at Fairymead, arrowed badly ten years since.—Mr. McGuigan.

This shortness in the term of life of the plant even rendered it highly inexpedient to leave cane in the ground from one season to another as a stand-over crop. In fact, it had been found necessary to interdict the practice of permitting this, in the case of cane grown in particular plots, simply on account of the growth of arrows in undue proportion in these plots. There are, however, other agencies which operate to prevent the standing cane persisting from one season to another, such as are afforded by the occurrence of either frost or flood, which, checking its growth, cause it to assume a general stunted appearance, and the tissue, having become dense, to gradually fail. No analyses have been made of the Fairymead soils with the express object of discovering whether they have become impoverished or not. One field, however, of alluvial forest land can be pointed out which with replanting has been ten years in crop to Rappoe cane; no manure has been applied to it, and yet it has yielded an average of quite 40 tons of cane per acre. This indicates that the lands at Fairymead have considerable staying power, and are not quickly exhausted.

Mr. Farquhar, of the Hummock Plantation, stated that it was not possible to get the weight of cane per acre that was formerly procurable, even from virgin land, and that this depreciation of the yield of cane seemed to have been more occasioned by the general deterioration of the plant itself than by impoverishment of the soil. Slightly more arrowing was noticeable than formerly. In former years he had cut cane that had been allowed to stand for three years, and found little ultimately dead; and one then could rely on this stand-over cane for early crushing. But now, if the cane was permitted to remain standing from one season to another, the chances were greatly in favour of a diminished yield. Allowing cane to stand over now was, in fact, a risky procedure. This might be due to deterioration of the plant, or, as suggested, to this gumming disease, which, though present, might not be recognised.

Mr. H. O. Nott, of Windermere, Woongarra Scrub, stated that he was sure the Rappoe cane was deteriorating. For now, when it was grown upon virgin soil, one did not get either the length or robustness of stalk that one formerly did. The number of canes per stool in plant cane now varied from twelve to thirteen, formerly there were as many as twenty. Formerly, 20 feet of stalk was common in twelve month old ratoons, and he had known as great a length as 32 feet. Now, a growth of 8 feet in from twenty to twenty-two months, even in the case of plant cane, was considered good. Moreover, the weight of cane per acre from virgin soil was not what it had been. He could not say whether the general yield of sugar of the cane had lessened. Until three seasons ago he scarcely remembered to have ever seen an arrow; now, if the plants were mature, nearly the whole plantation arrowed. He did not notice any indication of soil deterioration. At Windermere it was 14 feet deep, and could be ploughed to a depth of one foot. In fact, he considered the soil there inexhaustible, provided it was subjected to the ameliorating influence of the air.

Mr. McGuigan, resident manager of the Island Plantation, Mary River, stated again that he was of opinion that the Rappoe cane was deteriorating. This could be seen by its behaviour when it was grown upon virgin soil, for in this case its yield per acre grew from year to year gradually less. The stalk, moreover, presented less solidity of

structure, and the density of the juice was lower. They were also less numerous per stool than formerly, and had individually a smaller girth. He could not state whether its ability to "stand over" had been lessened. For some years past the cane had arrowed to a large extent, especially in the sandy flats, and much more so than in former years.

Finally, some few cane-growers, who were interrogated on this question of cane deterioration, instanced the fact of its having been severely affected by the cold winter that had been experienced as an indication that its constitution had already become impaired previous to being subjected to this influence. It was pointed out, however, that on several plantations, where the constitutional weakness, should this theory be correct, must be very pronounced, since the effect of frost had been most severely felt, no symptons whatever of the presence of the gumming disease existed.

All, however, agreed that the Rappoe cane had not been affected by any disease other than that designated gumming, nor had it been visited by plant-eating insects to any marked extent, both of which events might have attended any general impairment of the vigour of the plant.

Again on plantations, where cane-deterioration, as a consequence of planting one variety of cane and propagating continuously from one stock, might have been expected to have been especially marked, and where there were unmistakeable signs—other than such as consisted in the presence of disease—that this deterioration had taken place, the gumming malady was found to be absent. As, for instance, in the case of the Ferney, Irrawarrah, and Yarra Yarra Plantations, of the Mary River, alluded to below.

Should the Rappoe cane have generally deteriorated, it is evident, from the existence of such conflicting testimonies regarding the fact of such an occurrence, that this degeneration cannot have been very marked. Should, however, its vigour have been impaired in certain districts only, it cannot be held as accounting for the origin of a disease whose range of occurrence extends far beyond them.

The solution of this question at my hands would necessitate the discussion of a large array of special data relating to the work of the plantations during many years—data which are not now obtainable. I may therefore be excused from pronouncing an opinion on the subject. That the question, however, is of great importance must be generally admitted, since the method of coping with this cane disease is largely involved in a correct solution thereof.

NATURAL CONDITIONS IN THEIR RELATION TO THE DISEASE.

A.—Locality and Soil.

In pursuing this inquiry, it was soon evident that neither the position nor aspect of the plantations, nor the nature of the soil in which the cane grew, bore any certain relation to the occurrence of the disease. It might be met with upon the top of a spur, or along the slope of a hill, or in areas of depression, upon extensive table-lands, on river flats, on ridges and in gullies; in fact, the contour of the land seemed to exert no determining influence in this respect, especially in those instances in which the presence of the disease could not be accounted for by the use of unhealthy "sets," except

when circumstances were favourable for the presence of ill-drained spots, where the disease was generally rampant, whatsoever the nature of this contour might be. Thus it was observed, and often evidently for this latter reason only, more frequently than elsewhere on the level undrained alluvial canefields bordering the various river courses, especially where depressions, in which undue cold prevailed, occurred in them, and whether these often extensive flats had originally supported either a scrub or a forest vegetation.

Such situations having again, in many cases, formerly served as the repositories of exceeding fertile alluviums, that from time to time had been added to by flood waters, it also resulted that the disease was generally remarked as occurring in cane grown upon the most fertile soils. But it not only occurred in such as grew in these dark-coloured rich alluvial loams, but was also met with in the sugar-cane occurring in the bright-red or chocolate-brown basaltic soils, such as are so conspicuous a feature in the Woongarra, Gregory, and Isis Scrub districts; and not only in the cane growing in these deep soils, but also in that raised upon shallow deposits of yellowish-brown clay-loam. New lands, with all their pristine richness still unimpared, did not afford a preponderance of instances of its occurrence, nor did the fact of the soil having been impoverished by continuous cropping for many years seem again to have any influence on its occurrence. Thus several of the older plantations in the upper reaches of the Mary River, that had received no fresh cane from without for several years, had been unvisited by it, especially those that were well drained. Under the same circumstances, plantations, the soil of which was comparatively poor, exhibited no symptoms of its presence, as for instance the naturally well-drained Irrawarrah and Yarra Yarra estates, especially when like these they also had refrained from being beholden for seed cane to other plantations. And still furtner, the richest cane lands might be found to be free from it, as happened in great measure at Bingera, and in the case of several of the farms of the Isis Scrub.

The physical nature and general texture of the soil again seemed to exert no special influence on its occurrence. Rocky and stony plantations, soils in which no stone occurred, sandy soils, light or heavy clay-loams, absorbent soil or those that were otherwise, each with perhaps equal frequency, exhibited instances of the occurrence of the disease, or they did not.

So, too, when the chemical constitution of the soil was looked into, no connection between the extent to which one or other element prevailed, and the occurrence or virulence of the disease could be established. In illustration of this statement, the chemical nature of some of the soils wherein diseased cane was observed to grow may be generally noticed. For instance, reference may be made to the typical bright-red or chocolate-brown basaltic soils of Woongarra and elsewhere, containing from 6 to 12 per cent. of alumina, from 37 to 48 per cent. of sand and insoluble silica, from 11 to 14 per cent. of iron, from 3 to 4 per cent. of potash, from 2 to 3 per cent. of phosphoric acid, from 1 to 1·5 per cent. of lime, and—in the case of recent scrub-land—some 4 per cent. of nitrogen. Then may be mentioned the light-coloured alluvial sandy clay-loams forming the banks of the Mary River, which, though rich in clay containing from 4 to 6 per cent. of alumina, and also well endowed with sand and

insoluble silicates, yielding from 70 to 83 per cent. of them, contain a smaller proportion of iron than the soils last mentioned—*i.e.*, from 3 to 4 per cent., from 3 to 6 per cent. of potash, from 0·1 to 0·4 per cent. of phosphoric acid, from 0·4 to 0·7 per cent. of lime (Ca. 0.) and traces of manganese. Again, there is the black sandy alluvial soil in some "pockets" along the banks of the Burnett River containing only 1 per cent. of alumina, but 76 per cent. of sand and insoluble silicates, 3 per cent. of iron, 1 per cent. of potash, 0·17 per cent. of phosphoric acid, and 0·7 per cent. of lime. Then we have in some instances a yellowish clay-loam passing into clay at a depth of about 2 feet, characteristic of some of the forest land adjoining scrubs, upon which cane is also grown, with further differences again in its elementary constituents, as foreshadowed by its general physical nature.

B.—Climate.

We may now consider the subject of climate in relation to the gumming disease, it being freely stated in some quarters that it has been directly due to adverse meteorological conditions that have obtained during the last two seasons or so, or that, if having been immediately occasioned through the operation of other causes, its spread and virulence have been in some way connected with the occurrence of such climatic features. Thus the able general manager of the Colonial Sugar Refining Company, Mr. E. W. Knox, has recently expressed the opinion that "the disease is caused by combination of unfavourable seasons and bad cultivation," remarking that "the last few years have been exceedingly wet."

The consideration of climate in this connection involves reference to facts relating not only to rainfall, but also to light, temperature, and humidity; and in endeavouring to ascertain the influence of such a factor we are confronted with the initial difficulty arising from having but meagre data whereon to base conclusions, and from possessing little precise information regarding the direct effect of meteorological conditions acting separately or in combination on vegetation generally, or even upon any single plant, as, for instance, the sugar-cane. The valuable climatological tables issued by the Meteorological Department do not extend further back than July, 1893, and even these contain no statistics relating to sunshine at all, nor to ground temperature, as exhibited in the districts embraced in this Report, such as might be expected to throw important light on the problem before us just as they undoubtedly would on others relating to agriculture also. Again, we may recognise the effects of drought, and also those due to either excessive wet or cold, on vegetation; but we have little or no knowledge of the course of events of the life of the plant affected leading up to the changes perceived or of those further modifications which these inaugurate, and especially are we uninformed if these take the form of specific diseases. But it is of course evident that the gumming disease is manifestly distinct in its leading characteristics from the changes themselves usually ascribed to any of these meteorological features.

There is every reason to believe, however, that there are effects produced by climate upon the sugar-cane which, though they are not of the nature of disease, may reasonably be assumed to influence the virulence, or even the manifestation of it, when the so-called "seeds

of disease" are already present. Thus as the outcome of experiments made by Dr. Petermann, of Gemblous, which, though relating to the beet, may be taken as applying to the sugar-cane also, it would appear that the prevalence of bright weather has a direct influence upon the development of sucrose in sugar-yielding plants, he having stated that provided the temperature is adequate for sustaining growth, the quantity of cane sugar is proportionate to the amount of sunlight occurring. Again, with regard to temperature, there are grounds also for stating that the amount of sucrose that the cane plant when arrived at a certain age, contains largely depends upon the degree of temperature to which it is exposed, and more so than it does on its degree of maturity in respect to its age or the successive seasonal changes that it has experienced. But we have also, it may be remarked, to distinguish between the effects of warm weather accompanied by other conditions suitable for plant growth—such as rain, heavy dew, and fog—and warm weather unattended by such; since during progress of active vegetation, sucrose is transformed into other carbohydrates to be utilised in the building up of plant tissue, in a similar manner to what takes place in the case of starch in other vegetables, and therefore the amount in which it occurs may suffer decrement, or in other words, the same degree of warmth may result in varying degrees of saccharine richness. There is little doubt but that the chemical composition of the cane varies, also, in other respects in addition to those that involve its saccharine content, since there is an intimate relation subsisting between the relative amounts in which the carbohydrates, albuminates, and other series of bodies occur in individual plants. This variability is especially participated in by the fluids circulating in and otherwise occupying the tissues and the bodies which they hold in solution; and, in the case of a disease whose development is attended by the growth of bacteria, it may be well understood how any circumstance influencing the composition of the medium in which these develop may also influence the character of a disease that is so closely connected with their presence and increase. Of course the chemical constitution of the sugar-cane plant varies within certain limits according to the chemical nature of the soil (including in this expression that alteration induced by the application of manure) in which it is grown; but insomuch as the gumming disease occurs in cane raised upon soils very different in both their physical and chemical natures—that is, in plants varying as the outcome of this circumstance, if the presence or virulence of the disease is in any way influenced by some modification arising in the chemical nature of the plant itself, that modification must be ascribed to some cause of general operation, such as may be assumed to be afforded by special meteorological conditions. Now, as a matter of fact, sugar-canes affected by this gumming disease do differ from a chemical point of view from those that are healthy, as shown by the analyses of J. Maricot, quoted by P. Bonâme, the well-known Director of the Agronomic Station of Mauritius—[*Vide* Revue Agricole, August, 1894, p. 183]—in other respects than those that might arise from the presence of the gummy matter itself, as well as of the bacteria and their products: the ashes of the diseased cane containing especially an excess of salts of chlorine and phosphorus.

The very growth, also, of the cane plant itself is dependent on the fact that the temperature of the air that surrounds it does not fall

below a certain limit; it demanding the existence of a certain temperature in order that tissue development may proceed. This limit, in the light of the investigations conducted by B. E. Kirkham, of the Louisiana Observatory, it would appear, is about 60 degrees Fahr. It will, however, be found to vary for different varieties of cane, just as it does for separate species of other plants, differing less from one another than do they; as, for example, the species of duck-weed or *Lemna*. [*Vide* H. B. Guppy "On the Habits of *Lemna minor*, *L. gibba*, and *L. polyrhiza*," Journ. Lin. Soc., vol. xxx., pp. 323-330, 1894.] It will again vary for the same variety in different countries, seeing that the sugar-cane plant lends itself so readily to acclimation—that is to say, accommodates itself to the altered conditions of climate associated with change of habitat. Now, everywhere in the Wide Bay and Burnett districts, the cane grown during 1894 showed evidences of having been unduly arrested in its growth, even when the effects of excessive cold were not marked by more characteristic symptoms, as happened in the case of the occurrence of large areas of frosted cane. Again, influences that tend to check the growth of plants, or to otherwise impair their vitality, even when they are not immediately discernible by their effects, afford the circumstances favourable for the encroachment of disease. Amongst these influences meteorological conditions may be regarded as especially potent ones; and not only will the plant suffer from excessive cold, humidity, and dryness, especially if these conditions be unduly protracted, but will also be profoundly affected by sudden and great changes, whether in the temperature or in the hygrometric state of the surrounding atmosphere.

In what has been above stated, the direct influence on the plant itself of certain adverse meteorological conditions has been exclusively dwelt upon. It must be borne in mind, however, that there are others that act immediately on the soil, and so render it unsuitable for the support of the plant. This, therefore, they injure in an indirect manner, as happens in the case of excessive rainfall. But this fact is too obvious to be further dwelt upon in these preliminary remarks.

In proceeding to consider if the sugar-cane growing in the Wide Bay and Burnett districts, and evincing the presence of the gumming disease, has been subjected to exceptional weather during 1893-94, one has to recognise the fact that the published data concerning the climate of these districts relate only to a brief period, a circumstance that renders it almost impossible to recognise what should be regarded as the normal type of weather that should prevail from one month to another, and so any departure therefrom. It should be borne in mind also that in these districts there is always considerable local variation in climate, due to the special physical features presented by the different plantations themselves, as well as to their different relative positions and environment. This is especially the case with temperature, a fact that is even noticeable when one regards so circumscribed an area as the Woongarra Scrub at Bundaberg, where great capriciousness of climate is experienced, not always, however, to be accounted for by considerations relating to local configurations, and which moreover varies from one season to another.

Rainfall.—With regard to the rainfall, we find that that of January in each year was almost similar, though unusual in amount,

there having fallen from 14 and 15 inches at Woongarra, 20 and 23 inches at Bundaberg, 10 and 11 inches at Isis Scrub, and 17 and 18 inches at Maryborough; but, whereas in 1893 there were thirteen wet days, both at Bundaberg and Maryborough the amount of rain that fell in this month of the following year was distributed over twenty-six days at the former, and twenty-two days at the latter place. Again, in 1893, there was a phenomenal rainfall for the month of February: 50 inches (?) at Woongarra, 32 inches at Bundaberg, 40 inches at Isis Scrub, and 30 inches at Maryborough; it having rained this month on twenty-two days at Bundaberg, and on twenty-five days at the last-mentioned locality. In 1894, on the other hand, the rainfall for February was unusually small, for during that month but little over 2 inches fell at Woongarra, 3 to 4 inches only at Bundaberg, the same amount at Isis Scrub, and 4 inches at Maryborough; and even this amount was partly inoperative through being spread over many days—viz., nine at Bundaberg, and thirteen at Maryborough. The average rainfall at Woongarra during February for nine years is 11 inches. Such an excess of wet weather during this month in 1893, as also the unusual dryness of 1894, must have prejudicially affected the cane, for February is especially a month in which considerable growth takes place, and therefore any departure from normal climatic conditions such as is mentioned might be expected to impair then its healthy development. Again must be mentioned the somewhat excessive rainfall for June, 1893—nearly 12 inches at Woongarra, nearly 15 inches at Bundaberg, and nearly 12 inches at Maryborough, there being fifteen wet days during this month at Bundaberg, and thirteen in the last-mentioned locality. The average rainfall for this month at Woongarra is between 2 and 3 inches, and a larger amount than this then is prejudicial, seeing that it is conducive to growth that cannot but be checked in the following month, the coldest in the year. The comparative drought which obtained in December, 1893, may again be remarked: $2\frac{1}{2}$ inches of rain falling at Woongarra, little over 1 inch at Bundaberg, where it was distributed over four days; the same amount at Isis Scrub, and only about $\frac{1}{3}$ inch at Maryborough. December is, however, always a more or less dry month, but during 1893-94 the cane was doubtless prejudicially affected by the drought occurrence, taken in conjunction with the unusual rainfall of January, 1894. Again, taken as a whole, 1893 was an excessively wet year, no less than 93 inches of rain falling at Windemere, 93 inches at Bundaberg, 97 inches at Isis Scrub, and 87 inches at Maryborough; and in 1894 the rainfall, when regard is had to the first six months of the year, was above the average.

A marked feature, however, in the rainfall of both the Wide Bay and Burnett districts was the very uneven manner in which the total amount was distributed amongst the different months of both 1893 and 1894, though this is not an exceptional feature in the local climate. It must, however, be borne in mind that the distribution of the annual rainfall has a great deal to do with the yield of the crop—regarded both from the point of view of weight of cane as well as of its saccharine richness. The unparalleled results obtained in Louisiana, in 1890, were generally attributed to the even distribution that characterised the rainfall there during the growing months of that year. What the cane plant requires is an equable rainfall during the summer months—*i.e.*, when its growth is taking place—or in

other words, a preponderance of effective as distinguished from non-effective precipitation. And this is just that which the cane plant in the districts under notice during 1893-4 failed to experience.

Temperature.—The general trend of the seasons, as marked by the continuous fall of the temperature from February to July, and its subsequent elevation, was little if at all interrupted either in 1893 or 1894, though in the latter year this elevation was both gradual and deferred.

In 1893, July was, as has been just remarked, the coldest month, the mean minimum temperature for that month being, at Maryborough, 40·8 degrees Fahr., the thermometer also reaching then its lowest limit for the year, and registering 37 degrees Fahr. The same statement applies also to Bundaberg, the mean minimum temperature being, however, there 50·9 degrees Fahr., and the extreme minimum 44·8 degrees Fahr.

It must be borne in mind, however, that these shade temperatures should be regarded as average ones for the district, and also that, though on a plantation the general temperature may not fall below the lower of the limits mentioned, there may be spots upon it often of considerable area, where it may reach the freezing point—a circumstance due to local peculiarities, and especially to the occurrences of ill-drained depressions.

In 1894, July was again the coldest month of the year; but at Maryborough the mean minimum temperature for that month did not quite equal that of the previous year for the same, being 43·3 degrees Fahr., but the extreme minimum was lower, being 35·6 degrees Fahr. The winter at Bundaberg also was colder during this year than during 1893, the mean minimum temperature being 46·7 degrees Fahr., and the extreme minimum 39·6 degrees Fahr.

In both 1893 and 1894, again, not only was there in July the occurrence of the low temperatures mentioned, but during this month the range of temperature exhibited was unusually great, being as much as 40 degrees Fahr. at Bundaberg and 41 degrees Fahr. at Maryborough in 1893, and 39 degrees Fahr. at both places in 1894. In both years also there was but little rain in this month, but, as has been already stated, in June, 1893, upwards of 14 inches were registered at Bundaberg and 12 inches at Maryborough.

This June rainfall being distributed in both places over several days, even though the mean temperature of the month was little above the lower limit of temperature for cane development—*i.e.*, 60 degrees Fahr.—it would start growth afresh in the plants, and so render them more liable to suffer from the low temperature as well as the great range of temperature that prevailed in July, than if they had remained in a comparative dormant condition. Again, in September of both years, the cane was similarly subjected to a great lack of uniformity in temperature, the range of extreme temperatures for the month being, at Maryborough, 42 degrees Fahr. in 1893, and nearly 46 degrees Fahr. in 1894; and 38 degrees Fahr. for 1893, and 38·5 degrees Fahr. in 1894, in Bundaberg.

It may be mentioned, as corroborative of the facts mentioned regarding the low temperature experienced in 1894, that in visiting the plantations in October of that year, its effects on the cane were everywhere indicated by most unmistakable symptoms; such, for instance, as those of "frosting." In some parts of the Woongarra Scrub this injury was of general occurrence; but in others, and throughout the cane-

growing districts of the Burnett and Mary Rivers generally, the more marked ill-effects were found to be confined to circumscribed areas. It must, however, be borne in mind that areas of so-called frosted cane must not be regarded as coterminous with areas of low temperature; for the effect of the latter condition on the cane-plant depends, amongst other things, upon the stage of growth at which it has arrived. Thus, when the surrounding country is covered with hoar-frost, cane-growing adjacent to it may not have suffered from the low temperature which this occurrence indicates. This will especially be the case when an abundance of foliage has been formed to serve to impede the rapid cooling of the surface by heat radiation, &c., on which the attainment of so low a temperature depends; whereas cane not similarly protected, through having made less leafy growth, though exposed to the same temperature, will visibly suffer.

In considering this question of temperature, mention has only been made of the occurrence of cold weather. The spread and development of the disease seems, however, to have been specially influenced by it, whereas such does not appear to have happened as the outcome of the occurrence of warm weather. However, during the prevalence of warm weather, and especially if it be accompanied by a generous rainfall—that is, if conditions highly favourable to the growth of cane plant obtain, there may be a great development of "gum" noticeable; but this is due to the largely augmentated circulation of sap accompanying this increase of tissue, whilst it does not necessarily indicate an increase in the prevalence or virulence of the affection. Similarly a decrease in the development of gum that is noticeable when opposite conditions succeed, does not denote a lessened virulence. On the other hand, it must not be assumed from what has been alleged, that the prevalence of cold weather is the cause of the disease, but that the disease having arisen in the plant the occurrence of cold weather favours its development, and co-operates with it in exerting destructive changes.

During the visit that was made to the Burnett and Wide Bay districts for the purpose of this inquiry, diseased cane was noticed in which there was no trace of the ill-effect due to low temperature, not only on examining the leaves, but also the stems, that had lengthened with an almost uniform regularity; and, again, cane badly affected by frost was noticed in several instances, especially on the Kolan, on the Gregory, and on the Upper Mary Rivers, where patient search failed to reveal any symptom characteristic of the presence of disease.

Absence of Sunshine.—With regard to the degree of prevalence of that which so largely determines the amount of sugar which the cane plant shall contain, and so therefore the relative development of the other component elements of the juice—the carbo-hydrates related to sugar—that is to say, sunshine, no precise information is available, as sunshine recorders do not yet form part of the instrumental equipment of our meteorological stations. Some information, however, may be derived from consulting the records relating to the number of wet days and to the degree of cloud development contained in the meteorological tables issued by the Weather Bureau, since, as is obvious, the amount of sunshine for each month will vary inversely as the number*

* It is assumed that the rainfall is equally divided between night and day; but, of course, the conclusions relating to the extent to which the sky is overcast apply to the whole twenty-four hours.

of wet days occurring therein, and as the degree of cloudiness experienced, the mean diurnal cloud development being taken as a measure of the latter. But as we are concerned with the reverse condition, the summing of these will afford an insight into the meteorological conditions sought, with the following results:—During the last six months of 1893 the absence of sunlight was especially marked in August, November, and December. It was, however, a more marked feature in January and March of the following year, though April was also lacking in this respect. July was, however, the brightest month. These remarks apply equally to Bundaberg and to Maryborough. In the former district, however, the absence of sunshine both in 1893 and 1894 were somewhat more marked. It does not, however, seem practicable to draw any positive conclusions with regard to the gumming disease from these findings. The matter, however has been discussed, seeing that the absence of sunshine and its occurrence are thought possibly to have some connection. The nature of this connection has already been hinted at (*vide* p. 16), and it may be observed that the subject has already engaged the attention of the *Sugar Journal*, as well as that of Mr. John Cran, of Millaquin.

Before dismissing the subject of the influence of adverse meteorological conditions, it may be permitted to adduce the testimony of well-known planters of considerable local experience in both the Wide Bay and Bundaberg districts regarding the occurrence of very exceptional weather during the season of 1894.

Excessive and long Protracted Cold and Wet Weather.—Mr. C. Faulkener, of Woodlands, Woongarra Scrub, stated that cane on his farm growing from stools, from which a crop had been taken in November-December, 1893, was cut down by frost during the first week in June, and that at the latter end of the following month there were eleven nights in succession during which sharp frosts occurred, the ploughed land being on two occasions rendered quite white. Mr. Faulkener also stated that the last two seasons had been exceedingly wet ones.

Mr. Farquhar, of the Hummock Plantation, whose local experience extends back to 1865, stated that the winter that had passed had been unusually protracted, and both the rainfall and cold exceptionally pronounced. Also, that though the frosts did not appear earlier than June and later than August, they were not only severe but were experienced during several successive nights.

Mr. Noakes, who has resided twenty-two years in the Woongarra district, was again very emphatic in pronouncing the winter of 1894 as being exceptionally cold. He had never previously had a "sour" (*i.e.*, frost-bitten) cane upon the farm, the cold not having been sufficiently severe to affect the plant in this way. [It must, however, be borne in mind that the frost has shown itself to be very capricious in its occurrence in the Woongarra district, frost as severe at that occurring there in 1894, having been previously experience at a distance of a few miles only from this plantation.—H.T.]

Mr. James Cran, having in view the meteorological conditions that had obtained, not only in the Woongarra Scrub, but also on the Mary River, stated that the winter of 1894 had been long protracted, and that excessive rainfall had fallen during the autumn months. Towards the end of it, moreover, frosts quite exceptional in their severity have been experienced, both at Dun Craggan and at Mon

Repos; and not only this had happened, but there was also a general low temperature of the soil itself. The first, indeed, cut back a large proportion of the cane on these estates, and that which was not so affected was evidently constitutionally weakened by the occurrence of so much cold weather; and such cane might be expected to be more readily affected by disease than that whose vitality was unimpaired. Similar conditions, though less pronounced, had occurred in previous years—*i.e.*, a cold autumn combined with absence of rain at the time, but wet weather shortly afterwards. On these occasions, however, there was no frost experienced, and so only a temporary stunting of the cane, and no permanent injury was produced.

With regard to the Bundaberg district, similar testimony was given by Mr. E. Young, Mr. Gaylard, and several others.

Mr. W. Gibson, who has resided at Bingera for the last eleven years, and who is a very close observer of natural phenomena, stated that there had been an excessive rainfall during the growth of the cane that was being cut, and that the cold season had been protracted to a greater extent than had happened during the twenty-five years of his Queensland experience as a cane-grower. In the vicinity of his house it had happened that on single occasions in previous winters the minimum temperature had been 2 degrees Fahr. lower than ever it had been during the past winter; but this had happened for two consecutive nights only, whereas during this last winter a general low temperature had persisted for several weeks together. During the year 1887, in which the two nights of excessive cold referred to occurred, the cane suffered more severely from frost than it did during the past winter, and much more of it had been cut back; but during the latter, so protracted had been the duration of cold weather, that until the middle of September there had been little or no growth in the cane plants, everything being at a standstill.* In fact, slight frost had been experienced in the district even until the middle of this month—*i.e.*, November. In short, the continuous cold weather, succeeding an excessive rainfall, had been quite a phenomenal occurrence.

In referring to the meteorological conditions that had obtained at the Isis Scrub, Mr. W. Cran spoke especially of the abnormal rainfall, and of the abnormally cold and protracted winter of 1894, and of these as having much to do with the gumming disease in the district. Others resident there gave similar testimony; Mr. A. C. Walker, who has been growing sugar-cane in the Isis Scrub since 1882, stating that so long-continued a winter as that of 1893 had never previously been experienced in the district, and that, though in former years the rainfall had been as copious, this had not been accompanied by nearly such severe weather as had occurred during the past season.

Similarly adverse meteorological conditions were again remarked as having been experienced both on the Gregory and Mary Rivers. Mr. R. H. Blisset, of Goodwood, in speaking of those obtaining in the former district, stated that during the last winter the cane had been more severely affected by frost than during any previous year. Mr. P. O. Kelly, of Ferney, who has been farming at one spot on the Mary River since 1863, also referred to the severe cold of the past

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* It was noticed at Avondale, in November, that stools of sugar-cane, from which the crop had been taken three months previously, had not ratooned more freely than others from which the crop had been removed but three weeks. Such was the retarding influence on growth of the protracted winter.—H.T.

winter, and of the injury that it had occasioned to his cane, though this had been limited in amount, and confined to that grown in the deeper gullies of his estate. Mr. H. M. Hall, of Aurora, and Mr. A. McKellar, of Cowal, Mount Bauple, both careful observers of meteorological phenomena, were again equally emphatic in testifying to the occurrence of an exceptionally wet and cold winter.

Before dismissing this subject, allusion may be made to an opinion that seemed to have found favour with a few—that the gumming disease existing in the cane prior to the advent of the severe winter lead to the latter exerting a far greater prejudicial influence on it, and marking its occurrence by more pronounced symptoms than would have happened if the cane were previously healthy. In other words, that, instead of injury associated with the occurrence of uncongenial weather favouring the development of the disease, the disease itself had determined the injury which, under the circumstance, would, save for its presence, not have occurred. But previous to the winter of 1894, the presence of the disease was not remarked at all on several plantations where it appeared subsequently as so pronounced a feature, and therefore its advent did not generally precede that of this adverse meteorological condition. Again, the presence of cane badly affected by frost was noticeable by me where no evidence whatever of the presence of the disease could be detected, even after inspection of the entire plantation where such was the case.

It may be further pointed out that the influence of the special meteorological conditions that have been alluded to as occurring both in the Wide Bay and Burnett districts has doubtless been felt by the cane to a much larger extent than would otherwise be the case owing to the circumstance that the plantations upon which this cane is grown are almost without exception undrained. In fact, it may be asserted that such a conclusion is supported by the very strongest evidence. The subject, however, will be further alluded to in dealing with "Cultivation."

ARTIFICIAL CONDITIONS IN THEIR RELATION TO THE DISEASE.

A.—Cultivation, including Drainage.

In dealing with the subject of cultivation, the topics of seed-cane and cane-planting may be first dealt with. At the outset, then, it may be remarked that it did not appear that the time of year selected for planting in any way influenced the occurrence of the disease; it being noticeable in the spring as well as in the autumn planting—that is, in cane put in from the 1st August onwards, as well as in that planted in January, February, and March—and it appeared to make no difference whether the sets had remained long in sprouting, as would happen with them when sown in August, or come up quickly, as would happen with cane sown in October. The extent to which the seed-bed had been previously prepared was again without influence, the disease manifesting itself equally when this had been brought previously into a state of excellent tilth, to that which occurred when the uncultivated land had merely holes made in it with the mattock for the reception of the plants.

Again, it has been freely asserted that the employment on the part of planters and farmers generally of indifferent cane for seed purposes has been a principal factor in the causation of the disease.

It may, however, be confidently affirmed that those upon whose farms and plantations the disease has occurred, are fully alive to the importance of the use of good seed-cane, and as a matter of practice only make use of that which, according to their lights, appears to be the best. Almost all select "plant cane," though some in choosing cane which has good milling qualities do not eschew seed derived from succulent and strong first ratoons, when the former is not readily obtainable. As a rule, however, in the case of the latter only "top plants" are availed of, whereas the whole of the stalk, except the fibrous butt end, is employed when plant cane is used. Different planters, however, differ in practice regarding the amount of green top that is put into the ground.

But indifferent sets have been employed by farmers who without much capital have taken up new ground for sugar-growing, and who, not having previously arranged for the acquirement of seed, or who have stood in no business relation to older proprietors who might have supplied it, were compelled to derive their plant cane from the plantations at the time when the "crop" was being taken off, and to utilise the discarded tops without any reference to the age or quality of the cane that had yielded them. This has occurred very largely in the case of some of the farmers settled in the Isis Scrub district. But except when they had derived this seed cane from plants in which the gumming disease had existed, their crops were as a rule healthy, though the stand of cane, as might be expected, was not otherwise robust and vigorous. In one case a planter, having difficulty in obtaining good seed, resorted for the purpose to some plant cane that was three years old, which had been twice subjected to fire, and which had also been injured owing to the prevalence of continuous wet weather. And from this three-year-old stand-over cane he procured sets with which he planted no less than 400 acres. Notwithstanding this, the resulting crop was free from disease except in one spot, and here it abutted on a plot of cane in which the malady occurred in a very pronounced manner, and the occurrence of which could be readily accounted for. As a matter of fact, where the disease was found to exist, it occurred in all cane notwithstanding the quality of the seed used; equally in cane sprung from good sets as from bad—that is, in seed so considered, the question of the occurrence of the disease in them not having been raised, though, undoubtedly, this was often present.

Again, some planters resorted to the practice of soaking their seed cane in water immediately prior to its use; but whether they had done so or not appeared to exert no influence upon the occurrence of the disease. The same may be said with regard to deep or shallow planting, the use of holes or open furrows, the application of manures with the seed cane or not, and single or double planting. And so with regard to the different procedures resorted to after the young cane was above ground, and from time to time till it was mature. Notwithstanding also that the cane presented evidence of having responded to good and clean cultivation in a very marked manner, when this had been adopted nothing could be adduced to show that this served in any way to confer immunity on it from the presence of the disease. A field of plant cane (Rappoe) growing on a dark, sandy loam which had been kept well tilled, and estimated to yield 70 tons of cane per acre, might be seen, on the one hand, with the disease

occurring in it; and on the other a plot of the same cane amongst which weeds had been allowed to grow up, the ground to become compact, that had never been trashed, and which would not yield a fifth of this amount, and yet this would be entirely free from its presence; yet again elsewhere quite the opposite of this would obtain. It appeared, however, in some instances where the disease was manifest, that good and generous treatment of the cane had served to arm it against the retarding influence on growth and other incidents inseparable from its presence; whilst on the other hand neglect, by impairing the constitution of the plant, had rendered it less impregnable to its attacks, and so, without having determined its actual presence, lead to this presence being fraught with more baneful consequences than it would otherwise be.

It must, however, be admitted that in some rare instances where the presence of the gumming disease had been remarked, but where it occurred in a very mild form and was little prevalent, cane when well cultivated seemed to undergo a spontaneous recovery, both before it was cut and after this event, when the young ratoons were springing up; but further evidence is needed before it can be definitely certified that this ever happens, or that the spontaneous cure has been permanently effected. But even should such evidence be forthcoming it would still be necessary to distinguish between the effects due to improved climatic conditions, as also to a possible antagonism between the products generated during the pathological changes occasioned by frost and those arising in the course of the disease, and those effects ascribable to purely cultural operations.

The employment of different manures in connection with cane-growing may also be considered in connection with this subject of cultivation, with a view to discover whether it possibly has any connection with the presence of the disease. As a rule, no manure was used with the exception of such as was to be met with where a certain number of stock was kept or as occurred as a by-product in milling or sugar manufacture—viz., such substances as stable manure, cow manure, pig manure, megass, filter-press cake, and ashes. The manures in the market were, however, being also brought into use, especially the Lady Elliot Island guano (containing 60 per cent. phosphoric acid) bone dust, and the various meatworks' manures. These, however, where used, have hitherto for the most part been resorted to more or less by way of experiment. Green manuring, cow-peas being employed, was found to have been adopted at Bingera and at one or two other plantations, but not to any large extent. Where these manures had been employed, and especially such of them as had the reputation of being adapted to the requirements of the cane plant, marked results had been obtained in the improvement of the condition of the latter; but in no instance was it observable that their use had hindered the development of the gumming disease, much less had any one of them shown its ability to confer immunity from its attack. In the case of cane grown under otherwise quite similar conditions, the disease would be found occurring equally in the cane that had been manured, and in that growing on ground to which nothing of the nature of manure had been ever applied. The use of ashes, and especially such as are derived from the combustion of the cane plant itself, might be thought to exert a prejudicial influence on the cane plant, seeing that their employment

in the Wide Bay and Burnett districts is as general as is the distribution of the disease itself. It may, however, be stated that not only may such a connection between the gumming disease and cane ashes be shown from general considerations to be highly improbable, but such a relation also is unlikely to subsist, seeing that the gum disease occurs where the practice of burning the trash and cane tops, after the crop is taken off, is quite an exceptional procedure

With regard to high culture of the cane as a determining influence in connection with the disease, it may be mentioned that instances of such are scarcely to be met with in the districts to which this Report relates. Mr. W. Gibson, of Bingera, however, informed me that he had used quite fifty loads of compost (consisting of filter-press cake, sawdust, and stable manure, combined) to the acre on an area of about fifty acres in extent, and that the cane which grew upon this land evinced no symptom whatever of the disease, though disease occurred in other cane not a quarter of a mile distant therefrom. With especial reference to filter-press cake—and this varies considerably in composition according as newlandite, or phosphoric acid, is used in defecating the cane juice or not—Mr. E. Young, of Fairymead, stated that he had applied it to a good deal of the land on that plantation without producing any prejudicial effect, though he had not used it in greater amount than at the rate of two tons to the acre. And where instances of high culture and the prevalence of disease affecting the cane subjected to it were exceptionally met with, these were afforded by quite small areas, and they were not found to be associated in such a manner as even to suggest that the relationship between them was that of cause and effect. High cultivation, consisting in the employment of an excess of nitrogenous manures, has, however, elsewhere been found to effect the cane prejudically in the event of other diseases being experienced by it, and it has also been found to occasion the death of an undue proportion of cane when this has been allowed to stand over.

That the presence of the disease was not accounted for by any deficiency in humus or organic matter on the part of the soil, such as may be brought about by continuous cultivation and consequent exposure to the oxidising and lixivating agencies ordinarily experienced, was shown by the fact that in the case of some of the older cane-fields, in which this process had been so long in operation as to cause the soils of which they were composed to entirely lose their original colour, no disease had appeared; whereas, on the other hand, it was especially pronounced on new scrub lands naturally rich in humus, and on others in which the original quotum of organic matter present had been largely maintained by the practice of burying the cane refuse instead of burning it, or by the employment of stable or green manure. On the other hand, there was no evidence to show that a wealth in organic matter had any determining influence either on the occurrence or on the virulence of the malady.

An opinion has been expressed that a natural lack of lime in the soil, or a failure on the part of planters to counteract the exhaustion of the latter, with respect to this element during the continuous growth of the cane plant, is in some way responsible for the presence and virulence of the gumming disease. This opinion is based on the fact that in countries where a very large amount of lime, or lime carbonate, is periodically added to the soil, in the course of sugar-cane

cultivation, this gumming disease has not manifested its presence. Chemical analysis, however, shows that the production of sugar does not necessitate a demand on the part of the sugar-cane for this element being made upon the soil to any appreciable extent, and the small amount that is withdrawn to build up the plant itself is returned with the waste and by-products resulting from sugar manufacture, with the addition of the lime specially employed as part of this procedure. Moreover, with the possible exception, perhaps, of some of the soils to be met with along the Mary River—as, for instance, the yellowish-brown, somewhat heavy soil at Iindah, which contains less than ½ per cent. of lime—there is probably everywhere in the cane lands sufficient lime to meet the requirements of the plants in order that they may exhibit strong and vigorous growth. Three samples from the Woongarra Scrub contained 1·015 per cent., 1·122 per cent., and 1·454 per cent., and three from Bingera 0·075 per cent., 0·64 per cent., and 0·72 per cent., respectively.*

There are, however, different places where the addition of lime, in order to secure an improved physical condition of the soil, or to render it suitable for the development and operation of nitrifying organisms might be advisable, but these are by no means of general occurrence. Should, however, the molasses be placed upon the land in order that it may derive benefit from their saline contents, amounting, however, usually to not more than 5 per cent., it will be then necessary to add a large quantity of lime to facilitate the decomposition of the very great amount of non-nitrogenous organic matter of which these molasses are composed, and in order to check the supervention of those changes in them which would render these molasses positively harmful to the cane plant. Experience, however, has usually dictated a more economic way for restoring to the land these salts which the molasses contain, and no instance of the use of the latter for the purpose mentioned has been met with. The above mention of nitrifying organisms suggests the desirability of alluding to other benefits arising from the presence of lime. Not only, then, does it serve to fix the atmospheric nitrogen that has passed through the successive combinations of ammonia and nitric acid owing to their co-operation, but it acts similarly on the nitrogen of the organic nitrogenous bodies yielded to the soil by decaying plant-tissue supplied in manures, and so indirectly to increase the available supply of this essential element in successful cane-growth. And, again, its presence has still another significance due to the fact that, being basic, it combines with acid bodies; for the circumstance of a soil being well supplied with lime or not has much to do with determining the full benefit obtainable from the use of certain manures—*e.g.*, phosphates. Especially is this the case with phosphatic substances. Thus, if lime is abundantly present and the soil is alkaline, the employment of an acid phosphate—*e.g.*, "superphosphate"—is indicated; and if the soil is deficient in this element and acidic, an alkaline one (as, for instance, Lady Elliot Island manure or basic slag) is required. This reference to the special indications for the use of excess of lime in cane-culture will probably be found to explain its employment in countries in which severe liming is resorted to, otherwise in their case the mechanical state of the soil of the plantations

* According to analysis obligingly furnished by Messrs. Nott and Gibson, and made by Mr. C. Müller, chemist, employed at Bingera.

would be injuriously affected to the extent of rendering them unsuitable for cane cultivation, a condition styled "over-liming" being produced. Where, too, a heavy dressing of lime has been proved experimentally to have been followed by apparently favourable results, the increased yield of cane has been accompanied by a decrement in the density of the juice and in the relative quantity of sugar that it contains. But, whilst this danger may be recognised, it may advantageously be borne in mind that the soil requires in all cases to be possessed of more lime than is indicated by the chemical analysis of the plant as denoting its requirement with regard to this element.

The systematic burning of the cane refuse, or trash, that remains in the fields when the crop has been taken off, has been thought by some to influence the occurrence of the gumming disease, owing to the tendency which it is thought this practice has to weaken the constitution of the coming crop by depriving it of the organic matter that it might otherwise derive from this source, especially when this loss is not counteracted by the employment of stable manure or some other suitable substitute. It may, however, be pointed out that the disease under notice also prevails in the Mackay district, where this procedure of burning the trash is by no means general, and is especially developed on a plantation where the practice of ploughing in the trash has been resorted to for a lengthened period. In the Wide Bay and Burnett districts it is found that this destruction of the cane refuse is largely effectual in ridding the plantations of caterpillars and other insects, which, except for the practice, would do considerable damage to the young ratoons. Again, the tops, in which the larger proportion of the organic matter referred to may be assumed to reside, are not incinerated by the fires. Of course, where the disease prevails, the effect of fire would be to destroy a large number of disease germs, which, if burning of trash were not resorted to, might in some instances serve to perpetuate the malady. It must be admitted, however, that the burning of trash, even with this object in view, is condemned by some acknowledged authorities on sugar cultivation.

There is, however, one cultural procedure which there is every reason to believe has a direct influence not only upon the virulence with which the gumming disease manifests itself, but also upon its very occurrence—that is, drainage. It must be admitted, however, that little direct evidence can be adduced, derived from observations made in the Wide Bay and Burnett districts, in support of this opinion, since until recently—that is, until the disease has occurred—scarcely a single planter in these districts has drained his land to any extent, or entered upon this procedure in a systematic manner. The well-known proprietors of the Bingera Estate may be mentioned amongst the more notable exceptions, and although at the time of my inspection the cane grown upon a large area of drained land had been cut and was not in a condition to evince the presence of the disease, should it have been but slightly affected by it. It would, however, have been discovered, it is thought, had it previously shown itself, and been then present to any marked extent. But not only was it not detected as occurring in this drained land by me, but I was assured by Mr. W. Gibson, the farm superintendent, that it had not manifested itself at all, except in one spot, and there there was evidence, afforded by the local development of exceptional features, that further drains were needed. The mill returns of Bingera, which I had an opportunity of examining,

corroborated this statement regarding the general freedom from disease enjoyed by the drained portions of the plantation. On the other hand, in the case of cane growing upon land in the neighbourhood of this drained area, but itself undrained, though otherwise comparable with it, affected cane occurred here and there. This land, however, apparently needed draining far less urgently than originally did that which had been subjected to the operation. Proceeding again from the Bingera Estate proper, towards Kolan, patches of affected cane were here and there found, and in every instance their occurrence marked the site of areas of surface depression and the convergence of watersheds, and the presence of a wet soil and subsoil. Again, in almost every other case where the disease was met with, both in the Wide Bay and Burnett districts, it was decidedly more pronounced on flats and hollows and where the ground was wet and undrained, a conclusion not only founded on extended personal observation on my part, but also agreeing with the general experience of the planters themselves. It may further be added, to avoid the inference from these remarks that low-lying level country hollows and depressions generally are alone those which it is recommended should be drained in view of the occurrence of this disease, that even high ground, such, for instance, as is met with on the first tableland of the Hummock, in the Woongarra Scrub district, and even more or less steep slopes along the face of which dipping rock strata outcrop, are often especially in need of artificial drainage, and that cane grown in such situations may suffer owing to this being so. The absence of drainage where needed not only prejudicially affects the cane plant by its influence upon the soil in which it grows, but it also determines an undue coldness of the atmosphere which, whilst it prevents the plant assimilating whatever nutrient material may be still available in this soil, acts directly upon its tissues so as to favour the commencement and continuance of the disease. Amongst benefits arising from drainage other than the removal of excessive moisture, must be mentioned the part played by it in inducing chemical changes in the soil, and a correspondence between its temperature and that of the atmosphere, and so rendering it congenial to the growth and suitable to the requirements of the plant—results that it accomplishes by the circulation of air, which drainage alone renders possible, within it. And it also renders warmer than it otherwise would be the air immediately in contact with the soil, by removing the surplus water, and therefore avoiding great evaporation at the surface and the withdrawal of heat which this evaporation necessitates. In dealing with the connection between the occurrence of the disease and adverse meteorological condition, it was stated that the prejudicial effects of the latter were more intensified than they would otherwise be, owing to the fact that the plantations were not drained. From the above considerations it is very evident how this might happen, and an inspection of the canefields afforded abundant proof that this absence of drainage had actually brought it about. In view, therefore, of the presence of the disease and its possible extension, one is justified in recommending that drainage be resorted to to a much greater extent than hitherto. Of course this is a more or less costly procedure; but this difficulty, it is submitted, might be overcome if Drainage Trusts on the same lines as the Irrigation Trusts of Victoria were created, the essential principles of which are

advances from the Treasury at low rates of interest and long terms of repayment, or it might be found possible to grant to growers of cane advantages similar to those now accorded to manufacturers of sugar, and on similar terms, drainage being substituted for mill erection. Even if the occurrence of this disease did not suggest the expediency of draining the plantations, in order to mitigate its influence, the adoption of this procedure might be urged on other grounds, for drainage not only enables cane to grow where it would without drainage fail, but it also improves the quality of the cane not only by its direct influence on the plant, but by its enabling the ground to be tilled when otherwise this could not take place. It is therefore found to pay, which is perhaps the most cogent reason why it should be done. In Louisiana, we are told, every well-regulated plantation is now most excellently drained, many thousands of acres being underlain with tile drains. A striking instance of the benefit conferred upon the planter as the outcome of draining, was noticed when visiting Biñgera. Here two large blocks of land were observed apparently quite similar, and only separated by a road. Both had been subjected to precisely the same treatment with respect to cultivation, and cane from the same source and planted at the same time had been grown on each. One block of land had, however, been tile drained, and the other not, with the result, according to information supplied by Mr. W. Gibson, that in the case of the former 25 tons per acre of cane were obtained against 20 tons only secured on the undrained land. Moreover, not only was a greater yield obtained of cane, but this had 2 degrees added to its density, whilst its saccharine content was increased 4 per cent. On the Island Plantation, near Maryborough, were twenty acres of wet sour land that had been tile drained for the last four years, and with reference to the cane that had been grown upon them it was stated by Mr. McGuigan, the resident manager of the plantation, that not only had it been much greater in amount than it would have otherwise been, but the plants had also proved remarkably healthy. Moreover, on inspecting this cane I could detect no indication of the gumming disease. Again, in the case of a plantation on the Gregory River, a patch of cane was observed which, growing in a local depression, had been greatly injured by frost, yet it presented no symptoms of the presence of disease, whereas in the same field, and scarcely more than a stone's throw off, occurred a patch of the same cane which had not been affected by cold in a marked degree, and yet was badly injured by disease. In seeking, however, an explanation of an occurrence which was just the opposite to that which one might expect, it was discovered that the first was included in a well-drained area, whereas the second was grown upon land which had not undergone this treatment.

Mr. P. O'Kelly, of Ferney, Mary River, who has systematically drained his well-tilled farm, and whose cane was found to be quite free from disease, and to have been little injured by either the wet or cold of the late severe winter, stated that the effect of draining had been to render land previously unsuitable for cane capable of yielding a crop in any season ; and in other cases where the land was partially suitable draining had not only rendered the securing of a crop a matter of certainty, but it had also resulted in this being much heavier than it otherwise would be. Even in very poor forest land, he

added, one could also get a crop of cane which, though certainly it was small, yet could always be relied upon. Again, on the farm of Mr. S. Elliot, on the opposite bank of the river Mary, the flats, the soil comprising which is a sandy alluvial loam, which originally on account of their wet nature could not in some seasons allow of the cultivation upon them even of maize—a plant little impatient of a "wet bottom"—had been so modified by thorough drainage that at the time of my visit a crop of first ratoon Rappoe cane, yielding at the rate of 20 tons per acre, had been but a few weeks previously taken off. And in its case, if the gumming disease had been present at all, a very slight development of it had occurred, and this had been restricted to one or two depressed areas that possibly the drainage had failed to benefit.

In conclusion, it may be added that whilst discussing this subject of drainage and its probable influence on the occurrence of the disease, it is the spontaneous origin of the latter that is referred to. What its influence may be on disease that has originated through the use of sets derived from unhealthy plants remains to be shown, as also whether it will deter the disease from asserting itself or not where this cultural proceeding has been resorted to.

NEW VARIETIES AND NEW DISEASES.

A considerable number of those engaged in cane cultivation having seen reason to conclude that Rappoe cane, the principal variety grown, not only in the Wide Bay and Burnett districts, but also in other parts of Queensland, is deteriorating, and is in consequence of this addicted to disease, a desire to obtain cane from other countries to take its place—notwithstanding the eminent degree in which the Rappoe variety in other respects meets the requirements of the local industry—has naturally arisen. This feeling found special expression at a meeting of the Bundaberg Planters' Association, held on 26th October, 1894 (*vide Queenslander*, 3rd November, 1894). In introducing new varieties, however, the planter can be never certain that the end he had in view in doing so himself, or in urging it to be done by others in his behalf, is sure of accomplishment. Whatever the reputation a cane may bring with it from one sugar-growing country, he cannot definitely assert it will sustain in its new home, and when subjected to altered conditions as regards environment. He should therefore regard his work in the light of an experiment, and not embark at once on a big venture. But there are even stronger reasons for enjoining this cautious procedure, for whilst introducing new varieties of cane he may be the means of establishing in our plantations new diseases, the extent of whose injuries he cannot control, which may even jeopardise the existence of the industry in which he is engaged.

The occurrence of a disease, which itself appears to have been introduced from Bourbon in the sugar-cane at Mauritius in 1848, prompted the planters of the latter country to send to Ceylon for a change of cane for the purpose, as has been stated, of regenerating the different species of cane already cultivated there. These canes arrived in November of that year, but meanwhile it had been reported that the canes of Ceylon were ravaged by a special borer, and an opinion had been expressed that it would be dangerous to introduce into Mauritius cane infested with it. The whole ship's cargo was consequently condemned, but owing to the lax manner in which official instructions were carried out, the Ceylon insect was at this time added

to the plagues which the Mauritius planter had to bear, and it had made its presence so severely felt that in 1855 Governor Higginson was constrained to appoint a committee to make it the object of special investigation.* But undeterred by this event, and possibly at first in consequence of it, the Mauritius planters pursued the same tactics. As soon as anything affected their cane, whether this was the outcome of adverse meteorological conditions, bad cultivation, special importation, or what not, they felt a desire to introduce new seed "*pour régénérer les différentes espèces des cannes cultivées dans la colonie*," and no sooner experienced it than cherished and gave effect to it. There has therefore been at Mauritius since 1848, as has been stated by Dr. Kortmann, "a continuous record of disease in all sorts of cane," first one variety then another being affected, and in some instances almost wholly destroyed. In 1850 it was the Canne Blanche that thus suffered, then Penang cane, then Beloquet, and then Bamboo Rosée (our Rappoe), and Scambine were successively the victims of one malady or another. The result of all this is that to-day, though Bamboo Rosée there may, as has been shown by Bonâme (Revue Agricole, viii., 8, p. 183, Aug., 1894), yield, even when diseased, a juice containing as much as 24·3 per cent. of sucrose, a good deal more than half the area under cane is planted with Port Mackay (our Cheribon), which in the Mauritius, as elsewhere, is a variety of very inferior saccharine properties, both when regard is had to the amount of sugar that its juice contains as well as its quotient of purity, being in fact the worst cane grown there when looked at from this point of view. Should the Queensland planters here be compelled by similar events to so largely confine their attention to growing Cheribon, it is doubtful whether the sugar industry could exist.

Jamaica has adopted an opposite policy, preferring to bear the ills it has than seek to regenerate the cane in the manner pursued by Mauritius, for, according to C. A. Barber, Superintendent of Agriculture, "it has been considered necessary there, on account of cane disease, to quarantine Natal, Southern India, Ceylon, Mauritius, Java, and Fiji."

The progress of scientific discovery is continually bringing to light new cane diseases, which ere this have been regarded under the general term "degeneracy," and as illustrating various forms of it, and doubtless additional discoveries in this direction will be the outcome of further research. These are the matter of concern for other sugar-growing countries. But the Queensland planter has not only to guard against injury he knows not of, but also against certain cane diseases whose existence has been already ascertained, and which have been properly characterised. Not to go far afield, we have in Java the notorious "Sereh" disease, the injury effected by which baffles the enterprise of the ablest experts bent on its extermination. We have also a disease there *Het Rood Snob*, which also continues to make progress, and which it was feared by H. van Ingen, in 1893, would occasion considerable loss to the planters. Coming nearer home, we have in British New Guinea what appears to me to be a new cane malady which is very fatal within the limits of its occurrence. This will be again referred to.

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* Rapport du Comité sur le "Borer." Port Louis, December, 1855.

If, further, in the category of disease we include the insect enemies of the sugar-cane, the notorious beetle-borer (*Sphenophorus obscurus*) of New Guinea, Fiji, Sandwich Islands, and elsewhere must likewise claim attention.

That the danger of introducing new diseases into the colony with new varieties of sugar-cane is more than theoretical may be concluded on considering the following instances of such occurrences that have recently come under my notice, and which are to be found referred to in official reports that I have already furnished. Importance of the subject will justify their being described in detail:—In 1893 this Department undertook to introduce samples of the different varieties of cane which were known to occur in British New Guinea, and for this purpose despatched one of its officers, the overseer of the State Nursery, Mackay, in May, 1893, on a visit to the Protectorate. As an outcome of this visit eleven different kinds were brought over, and with the exception of a few examples of each that were retained for observation, the whole collection was distributed equally amongst the contracting parties. And whilst visiting the State Nursery, Mackay, both in September, 1894, and three months later, I found that the New Guinea cane growing there derived from this source exhibited in the case of each variety the occurrence of a cane disease that was not only new to me, and possibly to science, but also sufficiently injurious to claim special attention. Fortunately in this instance it was possible to take steps not only to stay the dissemination of the malady, but also to exterminate it. But insomuch as traders to New Guinea are from time to time making overtures to our planters expressing their willingness to procure them cane from the same country whence this was derived,* and who, it may be fairly anticipated, might not be more careful in their selection than would a responsible Government official, the probability of a second introduction of this cane disease taking place is at least other than remote. It is important, however, that if it does arrive here it may be promptly recognised. A quotation from the report referred to, dated 29th December, 1894, may therefore be appropriately added:—

"*Symptoms.*—The features that it presents are the following:—Briefly stated they consist in the gradual but complete death of the foliage. At first the extreme terminal portion of each leaf changes to a pale-brown colour, wilts, bends over, and becomes hair-like in appearance. Then similar alterations gradually proceed towards their basis until their entire substance becomes involved in decay. When but little developed a narrow pale-brown band is noticeable, passing downwards from the apex of the leaf along each side, and as the disease progresses, this band, step by step, encroaches on the central portion of the leaf-blade on each side of the midrib, and so widens and extends until, with the exception of this portion only, the whole leaf proper is affected; though even prior to this, and the loss of its green colouration, it has become infolded and wilted. The midrib is in turn affected, but is the last to participate in the change, and

* "We learn (writes the *Bundaberg Mail*, of the 9th November, 1894) that negotiations are proceeding for the charter of the schooner 'Morning Light,' owned by Messrs. Manchester and Scott, and commanded by Captain Hugh McIntosh, to proceed to New Guinea on behalf of some of our leading planters for a consignment of sugar-cane. The species intended to be imported is one that has been already favourably reported on, and which will be procured from a plantation adjoining the Fly River, at no great distance from the border of the Dutch territory. The 'Morning Light' is now loading timber for Townsville."

remaining for a time turgid and prominent, stands out in bold relief amongst the discoloured leaf-tissue that surrounds it, and with which its still green colour is in striking contrast. Similar alterations next involve the leaf-sheath, which until now has remained unaltered, until ultimately the whole shoot or cane becomes dead and discoloured. Though the entire foliage of a shoot is almost simultaneously affected, it may be observed that it is the outermost leaves that are so first. A plant again may manifest the disease in every portion of its growth at the same time, or in but one or two shoots or canes only, whilst the malady may successively develop in others which are then apparently unaffected.

"It may display its presence at any period in the growth of the cane, but is more quickly fatal to young plants,* whereas it may remain comparatively dormant in those which are either fully or nearly fully developed. When a mature cane is affected this gradually dies down from its leafy top, succumbing, however, very slowly, and whilst doing so emitting shoots from its lateral buds. Plants in the earliest stage of the disease are not generally to be distinguished from such as are quite healthy, being neither stunted nor in any way abnormally developed, and not manifesting in their foliage either lack or excess of green colouration. On examining the main stem when the disease is first noticeable, no alteration is discernible with the "naked eye" in its tissue, nor are there any evidences of arrested growth. As the malady progresses, however, what appear to be secondary changes supervene, for reddish fibres may then be perceived to traverse the nodes, and a slight alteration of colour to characterise the internodes (joints). This especially happens with that portion of the stem which is beneath the surface during growth. Affected plants, moreover, are endowed with an abundance of roots, though the recently developed ones are perhaps less numerous than they should be.

"The disease is hereditarily transmissible. Thus, in every case in which it was discoverable in young plants, the original stools of cane, belonging to like varieties to those that they represented, and from which they had been derived, were also victimised by it.

"That it is not infectious under ordinary conditions may be presumed from the fact that cane grown alongside that which is diseased may remain entirely healthy, notwithstanding its source or the variety that it represents. On the other hand, it cannot be affirmed, or even safely presumed, that cane afterwards raised in soil in which diseased plants have grown will remain free from it, as the immunity implied in such case has as yet to be demonstrated.

"The following varieties of New Guinea cane were noticed to be subjected to this disease, and, in the case of each one enumerated, it was found that it affected in part both the original plants derived immediately from the Protectorate, and the plants that had been obtained from them by propagation:—*Mahoann* (one only out of six original stools that were alive diseased); 2, *Chenoma*; 3, *Oraya* (one of the canes to be worse affected; two out of seven original stools

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* As an instance of the rapidity that may characterise the development of the full virulence of the disease in the case of plants that are but two or three feet high, it may be stated that on the 30th November the officer in charge at the State Nursery overlooked several rows of young New Guinea "plant cane" (derived by propagation from the original sets received from Kamerunga) in quest of "borers" (Nonagria), and removed the shoots that in evincing any symptoms of decay might appear to be injured by them. Yet by the 17th of the following month the disease had not only already manifested its presence in the case of several stools, but one of these had even virtually entirely died, though the stems were as yet still green.

that remained, diseased); 4, *Arabora*; 5, name undetermined; 6, *Kakeria* (large proportion of original stools diseased); 7, *Mabuan*; 8, *Nave*; 9, *Moo Moo Boku* (these three canes failed to become established at the State Nursery, through disease); 10, condition not ascertained; 11, name not ascertained, but cane badly affected.

"The above-mentioned disease of the cane is quite distinct from the so-called Gumming Disease (a careful inspection of the cane at the State Nursery, in December, 1894, failed to reveal the presence of this anywhere therein), as it is also from Sereh and from Rust (cane freckles), and, in fact, it seems to differ from any cane affection known to the writer."

As a further instance, serving to show how well-founded is the apprehension of danger to the interests of planters, likely to arise from the introduction of cane from without, the following incident may be described:—It has been already remarked that at a meeting of the Bundaberg Planters' Association, held on the 2nd October, 1894, the expression was very generally given of a desire to acquire new cane from some distant cane-growing country, Honolulu and New Guinea being especially mentioned. This desire ultimately took the form of a resolution to the following effect: it being decided "That the Agricultural Department be asked to procure tons of cane from Honolulu of different varieties free from disease, the planters guaranteeing to defray expenses." As the outcome of this, as you are aware, a large shipment of cane arrived in Brisbane, in March of the present year, to the order of this Department, as agents for the Bundaberg Planters' Association. This consignment was accompanied by a guarantee from the consignors, in which it was stated that it was free from disease, but that it could not be affirmed that it was free from cane-destroying insects, as it came from a country in which such were prevalent. The condition of this cane was then inquired into by me, and a report embodying the results of my inquiry submitted. The cane was then forwarded to its destination, but, fortunately, accompanied by a copy of the report in question. In this it was stated as follows:—

"The cane harbours living examples of a destructive beetle-borer (*Sphenophorus obscurus*) which is to be met with in probably not less than 1 per cent of the sets. This particular insect is not known as occurring in the canefields of the colony, but is identical with the one I have already reported as occurring in New Guinea cane, and which I have already also previously brought under your notice as having been met with upon another parcel of Honolulu cane on its arrival at Bundaberg. It is also the sugar-cane pest whose introduction I recently urged the Bundaberg Planters' Association to strenuously oppose.

"The borer in question is a glossy white much wrinkled footless grub, measuring about $\frac{5}{8}$ inch in length, and is the young of a reddish-brown weevil measuring about $\frac{1}{2}$ inch in length.

"In addition to its occurrence in the Sandwich Islands and New Guinea, it is also reported as having been met with in New Ireland, Tahiti, and Fiji.

"The following facts relating to it and its destructive work may profitably be considered in connection with its arrival here:—In 1883 it does not appear to have as yet attacked the sugar-cane growing in the Sandwich Islands, for in a notice of the sugar-cane borers in the

Hawaiian Islands, occurring in the *Hawaiian Planters' Monthly* for July of that year, no mention is made of it. It was met with, however, there shortly afterwards. The Rev. T. Blackburn and D. Sharp, writing in 1885, speak of it as having been already introduced there, and although they did not mention at the time that it attacks sugar-cane, they refer to it as having been observed 'in the stems of bananas on the mountains.' But by 1888 it had assumed the rôle of a sugar-cane pest in the Sandwich Islands plantations, and its destructive work there was now a matter of concern, for in this year it was referred (as we learn from 'Insect Life') by King Kalakau to the United States authorities in economic entomology, who reported that, 'judging from the specimens of sugar-cane received, the damage caused by the beetle must be very great.'

"From the Sandwich Islands it is supposed to have been introduced into Fiji. Mr. A. Koebele, entomologist to the Hawaiian Government, reported to the Secretary for Agriculture, United States of America, in 1892, as follows:—'The most injurious insect upon these islands [referring to the Fiji Group—H.T.] is unquestionably *Sphenophorus obscurus*, Boisd., introduced on sugar-cane some ten years since from the Sandwich Islands, and at the present time infesting nearly all the canefields. At Nausori Mills [Rewa River—H.T.], so Mr. Seeliger informed me, 52 per cent. of the entire cane from some fields is infested with the *Sphenophorus* larvæ, and if we consider that in some instances half of the cane is destroyed by this beetle before reaching maturity, the extent of the injury done can be estimated. . . . No parasites as yet prey upon these larvæ, and unless some are introduced to check the ravages of the beetle, cane-growing will be almost an impossibility in the near future. So numerous is the insect already that within one day along the border of the field at Nausori, under pieces of split cane laid out for bait, eleven children collected no less than 28,800 of the beetles.'

"From another source, a publication issued in the succeeding year,—*i.e.*, 1893, by the Colonial Sugar Refining Company, we learn that 'from Mr. Seeliger's records, kept of the damage alone done in the cane stalks taken for analysis, $18\frac{1}{3}$ per cent. of the whole crop was damaged by the beetles in 1891, and $13\frac{3}{4}$ per cent. in 1892 [after vigorous measures had been meanwhile resorted to, to check its increase—H.T.], which does not include the cane actually destroyed by the beetle and left in the field;' also, that 'these insects, under favourable conditions, multiply at a terrible rate.'

"Destructive insects, when once introduced to a new country, do not, as a rule, render their presence felt for a year or so, and judging from the above quoted experience of the country whence this cane now referred to has been derived, the same may happen here in the case of the beetle-borer under notice, should it become established in our plantations, and that when this has once taken place, the *Sphenophorus* will ultimately exert here ravages as extensive as elsewhere is more than probable. In Fiji, however, and also in Hawaii, a class of labour that cannot be otherwise remuneratively employed is available for collecting the beetles and so checking their increase, which is not the case in this colony.

"At present I am unable to confidently recommend any practicable method for successfully treating the cane plants (cuttings) infested by this beetle-grub, which, whilst effecting its destruction, will be

without injury to the 'sets' themselves, and especially so since their vitality is already impaired as the result of a long sea voyage. Should the cane be picked over with a view to discard worm-eaten or grub-infested plants, even then, in spite of a very close scrutiny, all that which might be described as such is not likeiy to be discerned, for in many instances the only outward symptoms of the presence of the 'borer' are afforded by the existence of the diminutive hole in the rind where the egg has been originally inserted, with or without, in addition to this, a faint-brown discolouration where this has taken place, and a somewhat more pronounced one in that part of the rind also that may happen to cover the mature grub, pupa, or beetle, pending the arrival of the time when the last-mentioned is to emerge.

"Again, it seems that little benefit would be derived from the employment of insecticidal washes, unless such potent ones be employed as would determine the vitality of the plants themselves. The perfect insect, as a correspondent informs me, will withstand submergence in the ordinary lime sugar-cane wash for some considerable time. Moreover, the insect whilst within its tunnel in the plant —at least in these grub-infested stalks that occur in this consignment —is beyond the reach of insecticidal agents that do not pervade also, and so destroy the plant-tissue itself, for as it excavates it fills all that portion of the tunnel which it has lately occupied with macerated fibre closely felted together, and when about to become a pupa or chrysalis protecting itself again in a cocoon of coarse cane fibre wrapped around.

"In conclusion, I may add that the plants appear to have been selected with very great care, and in no instance was one obviously showing injury due to the presence of the *Sphenophorus* observed; but this circumstance, of course, whilst it exonerates from blame those by whom the seed cane has been supplied, increases, as has been already stated, the difficulty of separating the unsound from that which is unaffected."

It may be added that the danger of introducing the same formidable sugar-cane pest from New Guinea is even greater than it is from the Sandwich Islands. In the Annual Report of the Department of Agriculture for 1893-4, Mr. Ebenezer Cowley, overseer of the State Nursery, Kamerunga, in referring to New Guinea sugar-cane, states as follows:—"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"; and in the collections that he secured it is not surprising therefore that the *Sphenophorus*, which as before remarked inhabits New Guinea, occurred; this insect manifesting itself—first in the small portions of the shipment that was retained at Kamerunga, in which its occurrence was proved by myself; and afterwards in the cane that was forwarded to New South Wales, in which its presence was detected by the able entomologist of that colony, Mr. S. Olliff.

How, then, it may be asked, is the risk to be avoided in procuring new varieties of cane? In the first place we must ascertain the diseases and the insect pests that affect sugar-cane in other countries from which importations are contemplated but not already in this; and in the second that the standing crop from which seed cane is to be procured harbours none of them; and we must ascertain this as the result of actual inspection on the part of a responsible expert.

It may, however, be remarked, as already pointed out, that notwithstanding the high reputation that a particular cane may enjoy in one country as the possessor of desirable qualities, it may not retain these qualities when transferred to another; and then, again, the possession of the character of being either a "heavy cropper" or a yielder of juice rich in sugar does not necessarily connote that a variety of sugar-cane is "disease proof," but, as concerns this gumming disease, probably the reverse. Mr. E. W. Knox, general manager of the Colonial Sugar Refinery Company, has stated, in a letter to the *Queenslander*, dated 22nd November, 1894:—"I am at a loss to know where disease-proof canes are to be found;" and he proceeds to add, concerning the very cane to introduce which it has been thought justifiable to incur the risk above described: "In Fiji, we have been compelled to substitute other varieties in many of our fields for the Honolulu *Lahaina*, which formerly gave very good results."

Again, it may be added, it is questionable whether all the beneficial results likely to accrue from the introduction of cane from beyond the colony would not be secured by paying heed to the source of the seed cane now being used, and exercising more judgment in this respect. The different canefields of Queensland, when compared one with another, will be found to exhibit differences of soil and climate (and even in some instances this may be true of the plantations of a single district), as great as those that obtain not infrequently between the cane-growing countries remote from one another or from the colony. Moreover, it is these very differences that determine the desirable qualities in cane that are sought. There is little interchange between these different canefields in the matter of cane plants, and yet it appears from these considerations there should be, with the probability of highly beneficial results accruing, always provided that this change of "seed" does not result in cane diseases of local occurrence being generally disseminated. If new varieties of cane are wanted, numbers are already to be secured. The nurseries of Queensland and New South Wales already contain cane derived from almost every sugar-growing country. If, however, in any emergency cane in great quantities is needed, those who require it will have to go further afield for their supply; but exercise such precaution as is enjoined in a preceding paragraph.

SYSTEMATIC INVESTIGATIONS RELATING TO SUGAR-CANE AND ITS VARIETIES.

Whilst dealing with the topic of cane deterioration, as well as elsewhere, in this report, I have felt reluctantly compelled to remark on the general absence of precise information regarding the respective qualities of the several varieties, and their behaviour under various natural circumstances of growth, as well as under different systems of cultivation. I have also been impressed in the course of this inquiry with the wide difference of opinion that exists amongst cane-growers regarding the correct method of cane cultivation generally, a difference which is exhibited at every stage of that procedure.

This state of things has rendered this investigation very difficult; and it cannot be otherwise than highly detrimental to the progress of this great branch of our agricultural industry, which depends largely upon the adoption of rational as opposed to empirical methods. It is submitted, however, that it may be largely overcome by the institution

of an efficient Sugar-cane Experiment Station, such as exists in almost every country in the world with which Queensland has to compete, and the establishment of which has been loudly called for by that popular organ for the expression of the views of those immediately concerned in the sugar industry of Queensland—the *Sugar Journal.*

In alluding to this urgent requirement, one need only refer, by way of justification for inauguration of such an institution, to some of the information that such a station should be in a position to supply. This might be expected to include particulars concerning—(1) The qualities of the different varieties of sugar-cane and their persistence, deterioration, or improvement under cultivation during the lapse of time; (2) the influence of various soils, the influence of different local climates, and of natural conditions of growth generally, on each of these varieties respectively, and their adaptability to these conditions accordingly; (3) the effects produced by drainage upon different varieties of cane; (4) of different manures; (5) the most suitable time for planting and the best methods of cultivation; (6) the processes to be resorted to for the purpose of improving the qualities of the different canes in cultivation, both with regard to their saccharine richness and also to their time of maturation; (7) the selection of seed cane and sets; and (8) the physical and chemical nature of the soil of plantations and the special treatment suggested by their knowledge.

Such a station might, it is thought, be erected and equipped in the first instance by the Government, and afterwards maintained partly by contributions from the general revenue and partly by assessment of the cane-growers on the basement of acreage under cane. It might be controlled by a board of advice comprised of nominees of the Government and of the planters, which should be responsible to Parliament for the work accomplished. It should, of course, be under the control of a highly capable and efficient director, who, having an intimate knowledge of the requirements of the industry as well as technical training, could initiate and direct the several investigations required to be conducted—with or without the advice of the board of control—and discuss the data obtainable during their progress. He also should be provided with expert assistance, and that of cadets perfecting their education in the technique of scientific agriculture. Attached to the station also there should be a farm or nursery, wherein to raise and cultivate the different varieties of cane, and for field experiments generally, though in their case it would be essential also to engage the co-operation of the proprietors of the different plantations.

In establishing such a station it might be well to profit by the experience of the Louisiana Sugar Experiment Station, under the able direction of Mr. W. C. Stubbs, as well as by that of the equally well-known Java institution and of the Agronomic Station of Mauritius and Reunion.

It may be added that some of this work is already being accomplished by the Colonial Sugar Refining Company, with its well-appointed laboratories and cane nurseries, and at the various mills and sugar manufactories where chemical control is now being resorted to; but the information procured through their agency is naturally largely withheld from the bulk of those engaged in the industry. Moreover, the experiments in their case are generally interrupted during the period

occupied by the crushing season, whereas in the work contemplated it is most essential that the investigations be continuous. Further, the results obtained by a mill under chemical control, and those secured at a sugar-cane experiment station, will be largely complementary, those of the one often serving to check as well as to illustrate those of the other.

RECOMMENDATIONS.

In conclusion, it may be added that, in view of the occurrence of this gumming disease, it seems fitting to recommend as follows :—

1. That ratoon cane in which the disease presents itself be taken out, and the land wherein it has been grown be clean fallowed, or sown with some plant suitable for use as a green manure ; and that isolated stools of affected plant-cane be similarly removed.
2. That in putting land under cane and in replanting, special attention be given to the source and quality of the sets employed, with especial view to ensure their presenting no symptoms of the disease in themselves, their not having been derived from plants in which there is a history of the occurrence of disease, and that they have been grown under circumstances as regards soil, &c., other than those characterising the land that it is intended to replant.
3. That systematic draining with a view to aerate and equalise the temperature of the soil, as well as to remove undue moisture, be more generally adopted on plantations ; and that this procedure be especially resorted to in the case of low-lying situations in which the disease has already occurred.
4. That the risk of introducing new diseases and additional insect pests of sugar-cane to the colony from beyond the limits of Queensland and New South Wales be carefully considered, to the end that it may be avoided.
5. That a well-equipped Sugar-cane Experiment Station, under efficient direction and management, be established, in order that the qualities of different varieties of cane, and the changes produced in them by duration of time under cultivation, by their being grown under special conditions as regards soil and climate, by their being treated with different manures, and by various methods of cultivation, &c., be tested by exact methods.

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

Queensland.

DEPARTMENT OF AGRICULTURE, BRISBANE.

BOTANY BULLETIN No. X.

MAY, 1895.

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.

1895.

PREFATORY NOTICE.

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In issuing the present Bulletin, I take the opportunity afforded of again expressing my thanks to those correspondents in the remote parts of the colony who have so persistently carried on the work of collecting and forwarding to me specimens of the indigenous vegetation with notes on their economic properties. By this means the work of developing our vast flora is being steadily carried on, and the economic as well as the botanical features of the plants recorded.

Being often required to determine the names of plant specimens collected in our neighbouring colony, New Guinea, I intend in future to devote a few separate pages in these Bulletins to record descriptions of the new species, or such notes as may be thought advisable upon the older plants. My list of vernacular names with their botanical equivalents given in "Catalogue of Queensland Plants" having been found of special service to the public, I have in this given an extension of the list.

May, 1895.

F. M. B.

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BOTANY:

CONTRIBUTIONS TO QUEENSLAND FLORA.

Order SIMARUBEÆ.

AILANTHUS, Desf.

A. imberbiflora, var. Macartneyi, *Bail.* (n. var.) A very large tree, exuding from the bark when wounded a copious flow of a colourless, transparent, resinous liquid. The young branchlets and inflorescence more or less covered with a yellowish mealy tomentum. Leaves slender, 6 to 9 in. long including the rather long petiole, but probably much longer on young trees. Leaflets on the leaves near to the inflorescence 3 to 13, narrow-lanceolate, about 3 in. long, membranous, very oblique, the underside pale, on petiolules of 1 to 3 lines. Panicles in the axils near the end of the branchlets (male), slender, about 5 in. long and with few short branches. Flowers singly on pedicels longer than the flowers. Calyx-lobes minute with ciliate margins. Petals glabrous, $1\frac{1}{4}$ lines long, broad-lanceolate, valvate, with thickened margins, the tips slightly inflexed. Stamens scarcely exserted; filaments flexuose, 3 times longer than the rather large nearly globular anthers. The female flowers not seen, but from the panicles of fruit to hand it is probable that the female panicles are much longer than the male; one bearing nearly ripe samaræ measured over 9 in. long, and had two or three rather long branches; the samaræ were usually in clusters of 3, about $2\frac{1}{4}$ in. long and 8 lines broad, membranous, and delicately veined, and were borne upon pedicels of about 1 in. or more.

Hab.: Forest Hill, Mackay, *W Macartney*, January, 1895.

Although stated to be quite glabrous, so far as my observations go *A. imberbiflora*, F. v. M., is always rusty-tomentose on the very young growth; there may, however, be several forms of the tree. The present seems to differ in the more copious flow of resin from its wounded stem, more slender branchlets, and the longer pedicels to its more distantly separated flowers. This form is very likely identical with the trees growing in the scrubs at Brookfield, Brisbane River. The form growing at Rockhampton and Mount Perry has the leaves much crowded at the end of the thick branchlets; the flowers also are more clustered, on shorter pedicels, and the stamens exserted.

Order BURSERACEÆ.

BURSERA, Linn.

B. australasica, *Bail.* Carrot Wood. Inflorescence terminal, or in the upper axils in pyramidal or elongated panicles; flowers in nearly sessile clusters, deep red or purplish, when fully expanded scarcely exceeding 3 lines in diameter. Calyx-lobes green 3 or 4 orbicular. Petals 3 or 4 ovate, deep red or purplish, more than twice as long as the calyx-lobes. Stamens 6, anthers yellow, filaments very short.—Proc. Roy. Soc. Ql. xi.

Hab.: Eumundi.

Order LEGUMINOSÆ.

Tribe PHASEOLEÆ.

GALACTIA, R. Br.

G. varians (sp. nov.) Stems trailing from a thick fusiform root-stock, glabrous, and more or less angular. Leaves very variable in form and size, often near the base reduced to a single oblong leaflet, under 1 in. long, the larger leaves bearing as many as 12 leaflets, alternate or opposite upon the rhachis, nearly sessile, or an odd lower one upon the same leaf, with a petiolule $\frac{1}{2}$-in. long, oblong, 1 to 2 in. long, the largest nearly $\frac{3}{4}$-in. broad, very obtuse at both ends, and prominently reticulate, pale on the under surface. Peduncles terminal, nearly 1 ft. long, flower upon the upper half, distant, singly, on slender pedicels of about 3 lines. Flowers, only a few at the end of the raceme upon the specimen examined, seem to be pale-coloured, somewhat stained with purple, softly hairy on the outside of the petals. Standard nearly orbicular, 5 lines in diameter. Calyx slightly hairy, the two upper lobes combined, the three others very narrow, the middle one much longer than the others. Pod 2 in. long, straight, not flattened. Seeds about 7, smooth, of a grey colour and elegantly reticulate.

Hab.: Coolgarra, *Matthew Butler, J.P.*, who with the specimens sends the following marvellous statement about its medicinal properties:—"On the 24th December last I was sent for to make the will of an old man who was, as he thought, dying of rheumatism. . . . In a fit of abstraction he pulled up the root and ate it. Fancying it gave him relief, he pulled more, boiled it and drank the liquor. Within a week there was a marked change in him, and now (17th March) he is quite well and looks ten years younger. . . . A miner, who has been suffering for over two years from a scrofulous affection, took a decoction of this root for a fortnight, and his skin seems now perfectly clear, and he tells me he feels a new man. . . . I had a slight touch of rheumatism in the leg and tried a decoction of the root, with the result that the pain has gone and the stiffness is wearing away."

Order RUBIACEÆ.

NAUCLEA, Linn.

Flowers crowded in globose peduncled, bracteate, solitary or subpanicled heads. Calyx-tube turbinate or obconic; lobes 5, usually tipped with valvate processes. Corolla elongate-funnel-shaped, throat glabrous; lobes short imbricate. Stamens 5, on the throat of the corolla, filaments none or short or long. Ovary 2-celled; style filiform, stigma capitate, cylindric or submitriform; ovules many pendulous on adnate ascending placentas. Fruit of 2 dehiscent many-seeded cocci. Seeds imbricate, testa winged; embryo clavate in fleshy albumen. Trees or shrubs. Leaves usually large, sessile or petiolated; stipules large, caducous or subpersistent.—*Hook.*, Fl. Brit. Inst. iii. 26.

N. Gordoniana (sp. nov.) (After P. R. Gordon, Chief Inspector of Stock, in recognition of the great interest he has always shown in the indigenous Flora, particularly the fodders, and those supposed deleterious to stock.) An erect tree of about 40 feet, with a rather thin, scaly bark. Leaves elliptic-lanceolate, obtusely acuminate, 4 or 5 in. long, and from $1\frac{1}{2}$ to 2 in. broad at the centre, tapering to a petiole of from $\frac{1}{4}$ to $\frac{1}{2}$ in., the primary veins few and distant, very oblique; the pair of leaves or bracts below the peduncles narrow-lanceolate, 1 to $1\frac{1}{4}$ in. long, and shortly petiolate. Flower-heads

solitary or 3 at the end of the branchlets, globose, and when in flower scarcely attaining 1 in. in diameter, on peduncles of about 1 in. Flowers glabrous. Calyx with very hairy, short, acute lobes. Corolla-tube slender in the lower half, then expanding upwards, lobes short, acute. Stamens 5, the filaments scarcely half as long as the anthers, style glabrous, exserted, stigma capitate. No ripe fruit to hand.

Hab.: Barron River, *E. Cowley*.

This tree is certainly in some respects related to our "Leichhardt-tree," of which there are probably more than one species; it is, however, of more slender habit, and the inflorescence I consider to agree better with the genus *Nauclea*, in which I place it, than with *Sarcocephalus*, the genus to which the common "Leichhardt-tree" belongs.

MORINDA, Linn.

M. jasminoides, *A. Cunn.* The corollas of this plant are, so far as I have observed, usually white, but here we met with heads of flowers which were purple on the outside of the corollas.—Proc. Roy. Soc. Ql. xi.

Hab.: Eumundi.

Order APOCYNACEÆ.

MELODINUS, Forst.

M. Murpe (sp. nov.) A pubescent climbing plant. Leaves 3 to $4\frac{1}{2}$ in. long, elliptic-oblong, rounded at the base, the apex elongated or somewhat abruptly accuminate, petioles very short, margins somewhat wavy, midrib and veins very hairy. Fruit on a stout curved peduncle, about 1 in. long, at or near the ends of the branchlets; oblong, 3 in. long, diameter about $2\frac{1}{4}$ in., pericarp thin, burnt-amber colour and glabrous outside when ripe; the interior spuriously divided into four masses. Seeds imbedded in a very sweet pulp, smooth, dark brown, about 5 lines long, tapering to one end, triangular with the outer side rounded, attached by the centre, the funicle ramifying and forming the divisions of the fruit. Albumen scanty. Embryo occupying nearly the whole length of the seed, the radicle longer than the oblong cotyledons.

Hab.: Russell River. *Mr. E. J. Hancock*, from whom I received the specimens, says that the fruit is eaten by the natives, their name for it being "Murpe."

Order CONVOLVULACEÆ.

IPOMÆA, Linn.

I. Muelleri, *Benth.*, Flora 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. Peduncle shorter or at length longer than the petioles, bearing 1 to 3 flowers on very short pedicels. Bracts very small. Sepal broad, obtuse, or scarcely acuminate, 4 to 5 lines long. Corolla apparently pink, rather above I in. long. Capsule globular, smooth, as long as the calyx. Seeds villous.

Hab.: Boulia, *Dr. W. E. Roth.*

Order VERBENACEÆ.

DICRASTYLES, Drumm.

D. Weddii, (n. sp.) (After Jos. Wedd.) A small erect shrub, clothed with a close white tomentum of branched hairs. Leaves opposite or scattered, linear, obtuse, about ½-in. long, with closely revolute margins. Flowers in compact head-like cymes. Bracts about as long as the calyx, ovate. Calyx nearly 2 lines long, divided to near the base into lanceolate lobes, glabrous on the inside and nearly equal. Corolla longer than the calyx, outside covered by branched hairs, the tube slender in the middle, swelled around the ovary, the upper with 5 blunt lobes, one much longer than the rest, broad and open, woolly in the throat. Stamens, only 2 in all the flowers examined bearing anthers, the others being apparently abortive; filaments longer than the corolla-tube, and hairy. Anthers large with divaricate lobes. Style with 2 long glabrous slender branches, entire portion with long branched hairs like the stamens. Fruit globose, 4-celled, with 1 seed in each cell.

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

Order LAURINEÆ.

CINNAMOMUM, Burm.

C. Oliverii, *Bail.* The Sassfras-tree of the North Coast line. Inflorescence terminal, or in the upper axils, in loose elongated panicles 6 to 8 in. long; flowers in twos or threes at the end of the branchlets, the pedicels about a line long. Flower velvety, cream-coloured, perianth-tube slender, about 2½ lines long, the lobes equal, scarcely as long as the tube, marked by several longitudinal nerves. Stamens 9; the six outer ones about as long as the perianth-lobes, filaments flattened and hairy, the three inner ones short, with prominent glands upon the hairy filaments. Staminodia with sagittate heads and hairy filaments like the stamens. Style and ovary nearly or quite glabrous; stigma dilated. Berry partially sunk in the slightly enlarged calyx-tube from which the lobes have fallen. In the bark of several of these trees we found nodules of two or more inches diameter.—Proc. Roy. Soc. Ql. xi.

Hab.: Eumundi.

Order ORCHIDEÆ.

DENDROBIUM.

D. bigibbum, var. macranthum (n. var.) Stems, leaves, and peduncles the same as in other varieties of this species. Racemes of three large flowers, the sepals and petals of a heliotrope colour, the labellum especially towards the base a rich mauve. Flowers distant. pedicels white 1¼ in. long. Sepals oblong 1½ in. long, 7 lines broad, minutely apiculate, the lateral ones forming but a very short upper basal projection, the spur 4 lines long, compressed, scarcely a line in diameter. Petals rhomboid 1½ in. broad, tapering at the base to a short claw. Labellum more than three parts the length of the sepals, the middle lobe occupying about half its length, very obtuse and over ½-in. broad, the lateral lobes curving around and enclosing the column, the disk with an oblong cushion-like mass, which with the aid of a lens

is found to be formed of several irregular rows of teeth-like processes. Column very short, the side wings reaching to the top or above the anther.

Hab.: Geraldton. The above description is drawn up from a plant now (May) blooming at Bowen Park, and undoubtedly it is the most showy of all Australian orchids, its nearest ally being *D. phalænopsis*, Fitzg.

SPATHOGLOTTIS, Blume.

S. Soutteriana, *Bail.*, Proc. Roy. Soc. Ql. xi. (After William Soutter, who has taken much trouble in collecting plants of this Order from all parts, and cultivating them at Bowen Park.) Leaves crowning the pseudo-bulb 6 or 7, the outer one without lamina, the others increasing in length until the centre one attains a length (including the rather long petiole) of 1½ or 2 feet, width at broadest part about ¾-in., but usually less, tapering to fine points, and to the petioles, and prominently marked by numerous rib-like nerves. Scape slender; raceme about 3 in. long, bearing 8 or 9 light purple flowers. Bracts lanceolate 7 or 8 lines long, pedicels about 1 in. long. Sepals and petals about 5 lines long. Labellum ¾ the length of the other segments of the perianth, articulate to the base of the column close to the lateral lobes. These latter are oblong or slightly spathulate, and somewhat incurved, and on the disk between them at the upper end 2 large, thick, erect, rather spreading glabrous calli; middle lobe with a rather long claw, expanding into a somewhat flabelliform blade, the claw with densely woolly margins. Column much incurved, dilated upwards—presenting, with the anther, an almost hooded appearance.

From the above brief description it will be seen that the present species approaches in many respects the only other Australian species—*S. Paulinæ*, F. v. M. The present species, however, has narrower, more grass-like leaves. The flowers are also much smaller, and different calli.

Hab.: Stony Creek, Cairns-Herberton Railway line. I received a leaf and single bloom in February, 1893, from Mr. L. J. Nugent, and more perfect specimens last October from Mr. E. Cowley, of Kamerunga, and consider it to differ from others sufficient to rank as a distinct species. The beauty of the flowers, and great length of time they continue in bloom, make species of this genus desirable plants for cultivation.

EULOPHIA, R. Br.

E. agrostophylla, *Bail.*, Proc Roy. Soc. Ql. xi. (Name suggested by its grass-like leaves.) Rhizome of irregular form, resembling a ginger rhizome, thick, fleshy, whitish, stained here and there with purple, attaining a length of 4 in. and a breadth of 1⅓ in. Leaf-bearing stem slender, compressed, about 2 lines broad, with 2 long sheathing scales which cover the lower 4 or 5 in., and then 2 grass-like leaves on long petioles, together attaining a length of 2 feet but not over 7 lines broad at the widest part, prominently ribbed, 3 of these much more prominent than the others. Scape 2 feet high, slender; the sheathing scales near the base about 1 in. long, with narrow lanceolate points, the upper ones without the sheathing base, and passing into long narrow bracts like those subtending the flowers; the raceme or flower-bearing portion about 4 or 5 in. Bract ½-in. long, or a little shorter than the slender pedicel. Spur very prominent in the bud. Sepals narrow-lanceolate, appearing in the dry flowers to

have subulate points, 4½ lines long, 3-ribbed. Petals shorter and broader than the sepals, almost apiculate, 3-ribbed with branching veinlets. Labellum long as the petals of 3 blunt lobes, the middle one broader than long, the lateral ones occupying half the length of the labellum, all prominently marked by numerous branching veins which start from 3 or 4 strong raised ribs on the disk, margins slightly undulate. Column about half as long as the sepals, the dorsal lobe bearing the anther as in *E. venosa*—rather long and ovate. Pollen-masses 2, nearly globular. Capsule oval, about the size of a small gooseberry, and prominently ribbed.

Hab.: On sandy land, in shady localities of the Mackay district.—*L. J. Nugent.*

CLEISOSTOMA, Blume.

C. Nugentii, *Bail.*, Proc. Roy. Soc. Ql. xi. (After the discoverer, L. J. Nugent.) Stems short, covered by the prominently ribbed bases of fallen leaves, live leaves 2 or 3, distichous, linear-lanceolate, 1 to 2 in. long, and from 3 to 6 lines broad, sharply keeled, the longitudinal nerves only seen in the dry or partially dry state; all much blotched with deep-red or purple on the specimens examined. Racemes spike-like, erect, often longer than the leaves. Bracts small but the lower empty one rather larger than those subtending the flower, and somewhat spreading or recurved. Flowers small, numerous, on very short pedicels. Sepals somewhat spathulate, 1 line long, incurved, greenish towards the tips, the lateral ones adnate to the basal projection of the column. Petals shorter and broader than the sepals, with thick midrib but no longitudinal veins, greenish and incurved. Labellum white, as long as the petals, the basal pouch not quite so broad but as long as the rest of the labellum, with no internal appendage; the lateral lobes very short with coloured margins, embracing the column; scale in front of the saccate end or middle lobe membranous. Column short, with broad green, ciliate wings. Anther-lid purple. Pollen-masses 2, nearly spherical; caudicle bipartite. Capsule not seen. In some respects this plant resembles an *Ornithochilus*, and probably upon further examination it may have to be placed in that genus.

Hab.: Black Gin's Leap, a mountain about 16 miles north of Mackay, *L. J. Nugent.*

C. congesta, *Bail.*, Proc. Roy. Soc. Ql. xi. Stems short, the longest seen under 2. in. long, the lower part covered by the ribbed scarious bases of fallen leaves. Leaves 2 to 5 straight, linear-oblong, obtuse-acuminate, base more or less cuneate, the longest about 1½ in. long and about 3 lines broad, the veins in the live leaf obscure from the coriaceous nature of the leaf, but both the longitudinal ribs and cross veinlets plainly visible in the dried specimens. Peduncle usually shorter than the leaves, with 1 or 2 scarious sheathing bracts at the base, and 1-2 or none between these and those subtending the flowers. Flowers cream-coloured crowded at the apex forming a head but opening one at a time. Bracts broad, fleshy, pointed, segments of flowers all incurved, resembling those of some of our small-flowered *Dendrobiums*. Pedicels 3 lines long. Sepals broad-lanceolate about 3 lines long. Petals narrow-linear shorter than the sepals. Labellum long as the sepals, the lateral lobes long and broad, the middle lobe reduced to a truncate end to the labellum, the whole upper surface covered with a dense short white wool, the central scale broad with

ciliate margins and recurved coloured point. Spur broad, obtuse, stained with yellow and red, plate at orifice transverse. Column white, semi-terete, scarcely one-third the length of the sepals. Pollen-masses oval, yellow. Capsule slender, $2\frac{1}{2}$ in. long.

Hab.: Cairns, *L. J. Nugent.*

Order SCITAMINÆE.

ALPINIA, Linn.

A. cærulea, var. Arundelliana, *Bail.*, Proc. Roy. Soc. Ql. xi. This variety is much smaller than the common form, the margin of the leaves are wavy, and the labellum of the flower, besides being small, is of a rosy-red colour. The fruit only differs in its smaller size. Although difficult to describe in words, the distinction between these two forms is very evident when seen in the scrubs growing side by side, as they do in this locality.

Hab.: Eumundi. This variety is named after Mr. E. H. Arundell, a resident of the district, who has rendered much assistance towards collecting specimens of the Eumundi plants.

Order AMARYLLIDEÆ.

CRINUM, Linn.

C. Douglasii, *Bail.* (n. sp.) A handsome plant, in general appearance before sending up its flower-scape reminding one of a *Furcræa*. It does not seem to form a columnar stem like *C. asiaticum*. Leaves numerous, deep-green, about $2\frac{1}{2}$ ft. long and 4 or 5 in. broad, tapering from above the middle to a sowewhat blunt point, the longitudinal nerves numerous, crossed by horizontal veins, which, from being very prominent, give a tesselated appearance to the upper face of the leaf. Scape somewhat compressed, and darkly mottled, about as long as the leaves, bearing an umbel of about 20 flowers on rather thick pedicels, which are about as long as the ovaries, the involucral bracts membranous, about $4\frac{1}{2}$ in. long, and $\frac{3}{4}$-in. broad at the base. Perianth-tube about $5\frac{1}{2}$ in. long and scarcely exceeding $2\frac{1}{2}$ lines in diameter. Segments of the limb shortly pointed, $3\frac{1}{2}$ in. long, those representing the sepals rather the longest and broadest, $\frac{1}{2}$-in. wide in the broadest part; the margins of these are also undulate, and give a frilled or crenulate appearance; the margins of the inner segments have smooth, not wavy, margins. Filaments about $\frac{3}{4}$ the length of the segments, slender, purplish red except towards the base; anthers very slender, $\frac{1}{2}$-in. long. Style as long as the segments, purplish except near the base. Stigma of 3 short fringed lobes.

Hab.: The plant from which the above description has been drawn up is now (January) flowering in Mr. L. A. Bernays's garden, Brisbane. It was received by that gentleman two or three years ago from the Hon. John Douglas, Thursday Island. It seems to me quite distinct from any named species of the genus, so at Mr. Bernays's request I have named it in honour of his friend.

Order PANDANACEÆ.

FREYCINETIA, Gaudich.

F. Gaudichaudii, *R. Br.* Specimens of this species, bearing the female inflorescence were obtained for the first time so far south, its previously recorded southern habitat being Rockhampton; and no male inflorescence has so far been met with in Australia.

The bracts on the specimens collected were nearly white and very deciduous, the outer ones not exceeding 2 in. in length, the innermost ones much smaller, very narrow, and quite membranous.—Proc. Roy. Soc. Ql. xi.

Hab.: Eumundi.

F. excelsa, *F. v. M.* Specimens of the male inflorescence of this species were obtained. The outer bracts are nearly as long as the leaves, which they resemble except for their broad coloured sheathing bases, which surround the base of the inflorescence. The other bracts are collected into three bundles and are, except for their green tips, of a deep red colour, and form a star of three rays several inches in diameter, bearing in its centre the spike of stamens, the filaments of which are short, and bear pale-coloured 2-celled obtuse anthers.—Proc. Roy. Soc. Ql. xi.

Hab.: Eumundi.

Order NAIADEÆ.

POTAMOGETON, Linn.

P. pectinatus, *Linn.* Stems very slender, repeatedly dichotomous. Leaves all submerged, very narrow-linear, 2 to 3 in. long, 1-nerved, most of them dilated at the base into a rather long sheath, which is scarious at the edge and often projecting at the top into 2 small scarious lobes, the sheathing stipules of the other species wanting, or rarely sheathing the base of the peduncle. Peduncles usually bearing several clusters of 2 or 3 flowers at some distance from each other, forming a slender interrupted spike, rarely reduced to a single terminal cluster. Nutlets of *P. obtusifolius* or rather smaller.—Flora Austr. vii. 173.

Hab.: Still waters, Jimbour, *C. J. Gwyther.*

Order LICHENES.

(This Lichen list has been prepared for me by our local lichenologist, Mr. John Shirley.)

The following plants, determined by Dr. Jean Müller, of Geneva, are reported by him as natives of Queensland.

PYRENOCARPEÆ.

(Mull. Arg. Consp. Syst. Lich. Nov. Zeal., p. 15.)

Tribe DERMATOCARPEÆ, Mull. Arg. Pyrenoc. Cub., p. 377.

DERMATOCARPON, Mull. Arg. Pyrenoc. Cub., p. 377.

D. miniatum, *Th. M. Fries,* Arct., p. 253. Thallus simple, firm, coriaceous, peltate, umbilicato-affixed, large, expanded, rotundato-lobate to undulate or crenate-lobate, smooth or minutely albo-pruinose, granulate, under surface smooth or rugulose, fulvous; apothecia minute, very numerous, embedded; epithecium slightly elevated, brown; spores 8, colourless, oblong or ellipsoid, simple, 15-18 x 6-10 μ.

Syn.: *Lecidea miniata,* L.

Hab.: On rocks, Toowoomba, *Hartmann.*

TRIBE PYRENULÆ, Mull. Arg. Pyr. Cub., p. 381.

SUBTRIBE VERRUCARIÆ, Mull. Arg. Lich. Gen., p. 73.

ARTHOPYRENIA, Mull. Arg. L.B., 612.

SECTION EUARTHOPYRENIA.

A. atomaria, *Mull. Arg.* Toowoomba, *Hartmann.* Thallus cinerascent, thin; apothecia very minute, subglobose, emerso-sessile, somewhat shining: epithecium umbilicate; perithecium dimidiate; spores 8, fuscous, broadly oblong, 1-septate.

SECTION MESOPYRENIA.

A. oculata, *Mull. Arg.* Thallus shining white, very thin, from smooth to powdery; apothecia ·6 mm., elato-convex, clothed by the thallus, then nude and almost black, vertex minutely impresso-ostiolate, and commonly minutely oculate with a vestige of the thallus; perithecium deficient or thin at the base, and obtuse at the angles; paraphyses connected; spores 2-seriate, 8, 14-16 x 7-8 μ, ovoid, equally 2-4-locular.

Hab.: On bark, by *Dr. C. Knight.*

A. fallacior, *Mull. Arg.* Thallus indicated by a white halo, usually evanescent, margin effuse, not at all nigro-limitate, destitute of melagonidia; apothecia ·6 mm. wide, scattered, innate-sessile, orbicular and elliptical, deplanate hemispherical, wholly and thinly thalline-velate, and greyish-black; perithecium black, dimidiate; paraphyses numerous, capillary, loosely connected; asci cylindrical-ellipsoid; spores 8, 2-seriate, 18-20 x $4\frac{1}{2}$-$5\frac{1}{2}$ μ, broadly dactyloid, 2-locular.—*Dr. C. Knight*, No. 109.

SECTION ACROCORDIA.

A. limitans, *Mull. Arg.* Thallus thin, cinereous, or argillaceous, or olivaceous, maculate, bordered by a nigro-fuscous line; apothecia ·5-·8 mm., base innate, apex nude, black, shining, depresso-hemispherical; base complete; spores 8, 1-serial, 25-30 x 8-15 μ, straight or incurved, 1-septate.

Syn.: *Verrucaria limitans*, Nyl. in Flora, 1866, p. 295.—*Dr. C. Knight*, Nos. 26, 47-9, 321.

A. consobrina, *Mull. Arg.* Thallus very thin, or indicated by white spots; apothecia rather prominent; perithecium entire, black, or attenuate or almost colourless beneath; spores colourless, ellipsoid, 1-septate, 23-32 x 9-11 μ; paraphyses slender, crowded.

Syn.: *Verrucaria consobrina*, Nyl., Lich. Nov. Cal.

Hab.: On bark, *Dr. C. Knight*, No. 325.

SECTION ANISOMERIDIUM.

A. extans, *Mull. Arg.* Thallus pallid argillaceo-albid, thinly submacular, shining; apothecia ·6 mm., black, nude, emerso-hemispherical, at length the vertex papillate; perithecium slightly depresso-globose, base complete; spores 8, obovoid, 23-25 x 10-13 μ, base acute, 2-locular, inferior loculus shorter and narrower.

Hab.: On bark, by *Dr. C. Knight*, No. 43.

PORINA (Ach.), Mull. Arg. L. B., 644.

* Spores 20-35 μ long, 3-5 μ wide.

P. africana, *Mull. Arg.*, is *P. limitata*, C. K.

P. tetraceræ (Ach.), *Mull. Arg.* Thallus cinereous to luteo-fuscous, smoothish or subrugulose; apothecia in glabrous verrucæ, apex nude, shining, subpapillate, ostiola pallid or fuscescent; spores fusiform, 7-septate, 25-30 x 7-8 μ.

Syn.: *Verrucaria nana*, Stirton, Bail., No. 785.

P. variegata, *Fee.* Thallus green, smooth, margined by a thick black hypothalline line; apothecia as in *P. tetraceræ*, but smaller and more slender, and usually with obscure brown or blackish ostiola; spores 42 x 5-6 μ, 7-septate.

Hab.: Trinity Bay, *Sayer.*

P. rudis, *Mull. Arg.* Syn.: *P. mastoidea*, var. *rudis*, M.A., Lich. Fl. Qd., p. 170.

P. internigrans, *M.A.* Thallus as in *P. mastoidea* (Ach.), Mull. Arg. Spores 9-septate, 70-100 x 15 μ. Nylander in Lich. Andam., p. 19, calls this a subspecies of *P. mastoidea.*

Hab.: Trinity Bay, *Sayer.*

P. glauca, *Mull. Arg.* Thallus plumbeo-glaucous, thin and smooth, shining, at length readily desquamescing; apothecia ·8 mm. wide, about one-third emergent, nano-subhemispherical, concolorous, gradually sloping to the encircling thallus, vertex fulvescent, usually nigro-ostiolate; spores 8, very robust, 80-95 x 10-20 μ, 7-13-septate.

Hab.: Trinity Bay, *Sayer.*

P. subargillacea, v. nigrata, *Mull. Arg.* Apothecia placed in a black maculiform hypothallus, the thallus having fallen away. Perithecia dimidiate.

Hab.: Toowoomba, on bark, *Hartmann.*

P. rhaphidospora, *Mull. Arg.* Syn.: *Verrucaria rhaphispora*, C.K.

PHYLLOPORINA, Mull. Arg., Lich. Epiphyll., No. 50.

Thallus everywhere crustaceous; gonidia phyllactidial; apothecia angiocarpous, simple; paraphyses capillary, not anastomosing; spores hyaline, transversely divided.

P. epiphylla (Nyl.), *Mull. Arg.* Junior plagulæ suborbicular, argillaceo—or flavido—virent, usually confluent in broad patches, closely adnate, but readily peeling off; apothecia ·3 mm., deplanate-conical, or at length convex-conical, usually thalline clothed and concolorous, but at times somewhat golden in colour; vertex occasionally fusco-nudate, base broad, truncate, within hyaline; paraphyses numerous, free, capillary; spores 8, 7-septate, 24-38 x 3-4½ μ.

Hab.: Bellenden-Ker, *Bailey*, No. 483, pro. p.

POLYBLASTIA, Th. M. Fries, Polyb., n. 8.

P. gregantula, *Mull. Arg.* Thallus white, farinulent, very thin; apothecia commonly 2-4 clustered, and partly irregularly confluent in greyish spots, black, depresso-conical, base clothed, ·5 mm. wide, above

rather nude, base nigro-dilatate; perithecium with base complete; asci 2-spored; spores 38 x 14 μ; locelli in 8 series, with 4 cells in each central row. Almost resembles a *Tomasellia*.

Hab.: On bark, *Dr. C. Knight*, No. 298.

P. geminella, *Mull. Arg.* Thallus within the bark, showing as a very thin cretaceo-subfarinose frosting, or evanescent; perithecia ·3-·4 mm. wide, depresso-spherical, slightly emergent and strongly pulveraceo-velate, apex very minutely or not at all papillate, within pale; asci 2-spored, obovoid-cylindrical; spores hyaline, 25-50 x 16-20 μ.—L.B. 47. *Dr. C. Knight*, without number.

MICROTHELIA, Körb. Syst., p. 372.

* Spores 2-locular.

M. obovata, *Mull. Arg.* Syn.: *Pyrenula obovata*, Shirley, Lich. Flora Qd., p. 176.

M. brisbanensis, *Mull. Arg.* Thallus albo-testaceous, very thin, smooth; apothecia ·8 mm. wide, black, smaller ones flattish, then hemispherical and emersed, nude, subopaque; perithecium with flattened base, the lower margins produced, very attenuate below the nucleus; spores 2-seriate in ascus, 8, 23-25 x 8-10 μ, finally nigro-fuscous, oblong-obovoid, 2-locular; loculi equal or the lower one shorter and narrower.

Hab.: On bark, *Shirley*, No. 1566.

** Spores 4-locular.

M. alba, *Mull. Arg.* Thallus whitish-green, very thin and smooth; apothecia ·5-·6 mm., when young small and with a greyish layer overspread, at length blackish and broadly hemispherical; perithecium at length subglobose, base truncate, beneath the nucleus wanting or very thin; paraphyses connected; spores 8, 2-seriate in ascus, 25-30 x 9-10 μ, oblong-ellipsoid or obovoid, equally 2-4-locular.

Hab.: On bark, *Dr. C. Knight*, without number.

M. queenslandiæ, *Mull. Arg.* Thallus very thin, smooth, farinulent or hardly visible; apothecia ·8-1 mm., finally nudate-nigrate, hemispherical; perithecium subplane and dilatate at the base, beneath the nucleus complete but thin; spores 8, 2-seriate, oblong-ellipsoid, 40-48 x 14-17 μ, equally 2-4-locular.

Hab.: On bark, by *Dr. C. Knight*, Nos. 5, 29, 56.

M. subgregans, *Mull. Arg.* Thallus white, very thin, subfarinulent or wanting; apothecia ·4 mm., globose, emerging to about one-fourth the height, apex nudate, black, rotundate-obtuse, solitary or 2-5 in groups; perithecium everywhere complete; spores 2-4, 40-50 x 15-20 μ, oblong-ellipsoid, equally 2-locular, or the loculi again towards the extremity divided, when the ultimate loculi are much smaller than the intermediate ones.

Hab.: On bark, *Dr. C. Knight*, No. 315.

M. Shirleyana, *Mull. Arg.* Thallus formed of smooth brown spots; apothecia ·6-·8 mm., scattered or 2-3 confluent in groups, black, half or more immersed, nano-hemispherical or conical-hemispherical, obsoletely thalline-velate, about the middle angulose-dilatate, beneath

complete and the base moderately convex; spores in two series in asci, 8, oblong-ellipsoid, at both ends obtuse, 4-locular, from hyaline to fuscous, 12-15 x 5-6 μ, dissepiments at length deeply fuscous.

Hab.: On bark, *Shirley*, No. 1776.

PYRENULA, Stitz. Flecht., p. 148.

1. Spores 4-locular.

A. Perithecium hemispherical, below subulate-dilatate, base incomplete or very thin.

P. velatior, *Mull. Arg.* Thallus with pallid argillaceous epidermis, smooth, bordered by a broad cæruleo-nigrescent zone; apothecia depresso-hemispherical, ·6 mm. wide, thalline-velate, slightly emergent; perithecium thick, black, base wanting; paraphyses free; spores 8, 1-seriate, 14-15 x 5-6 μ, fusiform-ellipsoid, 4-locular.

Hab.: Trinity Bay, *Sayer*.

P. oxyspora, *Mull. Arg.* Thallus rufo-fuscous, maculate; apothecia ·7 mm. wide, deplanate pyramidal, semi-emersed, above nude, black, rather shining, vertex neither umbonate nor umbilicate; perithecium dimidiate, or base very thin and complete, below alate-dilatate; spores 8, 1-seriate, fusiform, at both ends abruptly acuminate, 4-locular, between the loculi slightly constricted, 18-23 x 7-8 μ.

Hab.: Trinity Bay, *Sayer*.

B. Perithecium sub-conico-hemispherical, beneath complete.

P. indusiata, *Mull. Arg.* Thallus glaucous, very smooth, oleose-nitidous; apothecia immersed, conical-hemispherical, vertex slightly emergent, clothed by the subpellucid thallus, at length glauco-nigricant, nigro-perforate; perithecium with thick complete base, beneath convex; spores 8, generally in 1 series, from hyaline to fuscous, at both ends obtuse, 4-locular, 12-15 x 5-6½ μ.

Hab.: On bark, *Shirley*, No. 1878.

C. Perithecium subglobose, base complete. 1. Spores 13-20 μ long.

P. subcongruens, *Mull. Arg.* Thallus barely visible, whitish, farinulent, usually evanescent, hypothallus with the cortex brownish, maculiform; apothecia to 1 mm., about one-third innate, emergent part hemispherical, obtuse, sordid black, opaque, at length shining above; perithecium complete not winged; spores 8, 1-seriate, 13-15 x 7-8½ μ, broadly ellipsoid, at both ends broadly rotundate obtuse, 4-locular. Near *P. finitima*, Mull. Arg.

Hab: On bark, *Dr. C. Knight*, Nos. 121, 123, 135, 147.

P. Bonplandiæ, *Fee.* Thallus levigate and equal; apothecia ·6 mm., in great part emersed, hemispherical, nude, black, rather shining; base broad, flat, not attenuate; spores 8, in narrow asci, usually in one series, globose-ellipsoid, 14-16 x 8-11 μ, 4-locular, terminal loculi small.—L.B. 894.

Syn.: *P. dispersa*, Mull. Arg.; *P. aspistea*, Ach.

Hab: On bark, Trinity Bay, *Sayer*.

P. microcarpoides, *Mull. Arg.* Thallus pure white, thin, smooth, rimulose; apothecia black, semi-emersed, globose or depresso-globose, the nude portion black, shining, hemispherical; perithecium complete, the base moderately thin; spores 8, oblong-ellipsoid, at both ends obtuse, 4-locular, 16 x 7 μ.

Hab. On bark, *Shirley*, No. 1872.

P. porinoides, *Ach.* Thallus whitish, nigro-limitate; apothecia wholly immersed, ·4 mm. wide, globose, everywhere black, vertex nigro-ostiolate; perithecium black and thick; paraphyses capillary, free; asci linear, 1-seriate, 6-8 spored; spores 16 x 7 μ, 4-locular.—L.B. 901.

Syn.: *P. mollis*, Fee.

Hab.: On bark, *Shirley*, Nos. 1869 and 1880.

2. Spores 20-40 μ long.

P. mastophorizans, *Mull. Arg.* Thallus olivaceous, smoothish apothecia globose, black, apex nude and shining, shortly emergent from thick hemispherical thalline protuberances, truncate, concolorous with thallus, and smooth or slightly gibbose unequal; spores 8, 4-locular, 25-34 x 10-14 μ.

Hab.: On bark, *Bailey*, No. 499, pro. p.

P. pinguis, var. emergens, *Mull. Arg.* Syn.: *Verrucaria punctella*, var. *exstans*, Nyl.; *P. punctella*, var. *emergens*, M.A., Lich. Parag., No. 246. Differs from the type in the apothecia, which are enclosed in thalline protuberances, being often at length denudate and slightly emergent; spores 22-38 x 10-16 μ.

Hab.: On bark, *Dr. C. Knight*, Nos. 125, 138, 142.

P. adacta, var. cinerascens, *Mull. Arg.* Thallus pallid or cinerascent, at length the surface leprose-sorediose.

Hab.: On bark, *Shirley*, Nos. 1642 and 1647.

P. sexlocularis, *Mull. Arg.* Thallus pallid or pallid-flavescent, determinate by an obscure line or indeterminate, maculate; spores 6-locular, 22-32 x 9-11 μ. Syn.: *V. subvariolosa*, C.K.

Hab.: On bark, *Dr. C. Knight*, Nos. 44, 52.

ANTHRACOTHECIUM, Mass. Compar., p. 49.

Section I.—Euanthracothecium, Mull. Arg. L.B. 1265.

* Spores 30-80 μ long.

A. aurantium, *Mull. Arg.* Syn.: *Verrucaria aurantia*, Eschw.

Hab.: On bark, *Dr. C. Knight*, No. 124; *Shirley*, Nos 1775, 1881.

** Spores 20-30 μ long, from 4-locular to parenchymatous, cells fewer in ranks than the preceding, usually about 4.

A. denudatum, *Mull. Arg.* Thallus resembles that of *A. confine*, white or whitish, thin, opaque, obscurely margined; apothecia mastoid, prominent, denudate, ostiola punctiform, black, ·3-·5 mm.; spores 8, fuscescent, ellipsoid, 8-12 loculate, with 4 cells in a row, 11-20 x 7-11 μ.

Hab.: Toowoomba, *Hartmann*.

A. denudatum, var. ochrotropum, *Mull. Arg.* Thallus or maculæ of the thallus ochraceo-aurantiacous or ochraceo-rubent, or ochraceo-albid, the colour deeper around the apothecia.

Hab.: Trinity Bay, *Sayer*.

Section II.—Porinastrum, Mull. Arg. L.B. 1266.

A. oligosporum, *Mull. Arg.* Given by a typographical error in Vic. Naturalist, No. 4, p. 95, as *A. strigosporum*.

Hab.: Herbert River, *H. A. Wickham*.

SUBTRIBE TRYPETHELIEÆ, Mull. Arg. Pyr. Cub., p. 376.

TOMASELLIA, Mass., Flora, 1856, p. 283.

T. queenslandica, *Mull. Arg.* Thallus, with fulvescent or subfuscescent pallid epidermis, macular, thin; stromata variously oblongate, convex, black, ·8 mm. wide, formed from apothecia usually closely connate; at the sides moderately undulate, wholly nude; ostiola very fine, slightly depressed, white; perithecium with complete base; paraphyses loosely connected, firm; spores in narrow asci, 1-seriate, 8, 20 x 7 μ, ellipsoid-fusiform, equally bilocular.

Hab.: On bark, *Dr. C. Knight*, No. 46.

TRYPETHELIUM, Trev., Syn. Gen. Tryp., p. 19.

T. tropicum, var. nigratum, *Mull. Arg.* Thallus black.

Hab.: Bellenden-Ker, on branches, *Bailey*, No. 539, pr. p.

T. infuscatum, *Mull. Arg.* Thallus pallid, very thin, smooth; stromata nigro-fuscous, opaque, sublinear-oblong, angulose, anastomosing, slightly or not at all emergent, above flattish, within rather pallid, many fruited; apothecia black, entire, lower part thin, the upper thick and often in part connate, ·3-·4 mm. wide; ostiola reaching the surface of the stromata as brown punctures, circled with a pallid ring; paraphyses loosely connected; spores 8, in asci irregularly biseriate, 27-30 x 10 μ, 4-locular.

Hab.: On bark, Bellenden-Ker, *Bailey*, No. 599.

T. virgineum, *Mull. Arg.* Thallus rufescent-fuscous, macular, very thin, smooth; stromata nano-hemispherical, somewhat regularly orbicular, here and there geminate or ternately confluent or solitary, outwardly and inwardly white, smooth, rather shining, minutely nigro-ostiolate; ostiola small, slightly depressed; perithecium black, below thin; paraphyses loosely connected; asci biseriate, 8-spored; spores 36-40 x 10-11 μ, fusiform, 9-11-locular.

Hab.: On bark, *Dr. C. Knight*, No. 351.

MELANOTHECA, Fee, Ess. Suppl, p. 70.

M. oxyspora, *Mull. Arg.* Wholly as regards thallus and apothecia similar to *M. achariana*, Fee, but spores much larger, 29-37 x 11-15 μ, broadly fusiform, and subcuspidate acuminate, not at both ends rotundate obtuse. Even in their juvenile hyaline state the spores are at both ends acuminate.

Hab.: On bark, *Dr. C. Knight*, No. 127.

M. cruenta, *Mull. Arg.* Syn.: *M. rubra*, C. Knight.

Hab.: Ithaca Creek, Bellenden-Ker, *Bailey*, Nos. 539, 783.

M. rubescens, *C. K.* Syn.: *Microthelia Shirleyana*, Mull. Arg.

Hab.: Sankey's Scrub, *Shirley*, No. 1776.

BOITARIA, Mass., Misc. Lich., p. 12.

B. umbilicata, *Mull. Arg.* Syn.: *Trypethelium umbilicatum*, C. K.

Hab.: On bark, *Hartmann*, Toowoomba.

SUBTRIBE PLEUROTHELIEÆ, Mull. Arg. Pyr. Cub., p. 387.

PLEUROTREMA, Mull. Arg., Pyr. Cub., p. 388.

P. pyrenuloides, *Mull. Arg.* Thallus with fulvescent whitish epidermis, macular, thin, smooth; apothecia usually nude, emergent, ·6-·7 mm. wide, sub-hemispherical, orbicular or in part slightly elongate, black, opaque, minutely ostiolate, in all parts shining; perithecium with base complete, but commonly attenuate; nucleus oblique or occasionally horizontal; paraphyses connected; spores 8, 1-seriate, ellipsoid-subfusiform, 28-32 x 8-11 μ, equally bilocular.

Hab.: On bark, *Dr. C. Knight*, Nos. 49 and 314.

SUBTRIBE ASTROTHELIEÆ, Mull. Arg. Pyr. Cub., p. 382.

PARMENTARIA, Fee Meth., p. 24.

* Spores large, 2 in ascus.

P. subastroidea, *Mull. Arg.* Thallus glauco-pallid, smooth, shining; apothecia roseate, similar to those of *P. astroidea*, Fee, prominent, above nude, black, separate, globose-pyriform, ostiola small, brown; perithecium complete, sub-horizontal; spores 2, brown, 160 x 35 μ, closely parenchymatous.

Hab.: On bark, *Shirley*, No. 1863.

P. subastroidea, var. subsimplex, *Mull Arg.* Perithecia almost wholly solitary and similar to those of *Pleurothelium australiense*, but here and there astroid-clustered, but colour of thallus, &c., wholly as in the type.

Hab.: On bark, *Shirley*, No. 1878.

P. toowoombensis, *Mull. Arg.*, Lich. Exot. hb. Vindeb, No. 51.

Hab.: Toowoomba, *Hartmann*, No. 51.

P. interlatens, *Mull, Arg.* Thallus indicated by flavid pallescent spots; apothecia indicated outwardly by pallid or fuscescent or finally blackish ostiola; perithecium entire, black, ·5-·9 mm. wide, usually connate in twos; spores 2, fuscous, oblong, parenchymatous, 85-160 x 30-55 μ.

Hab.: On bark, *Shirley*, Nos, 1769, 1868, pr. p.

P. grossa. *Mull. Arg.* Thallus fulvescent-pallid, cartilagineous, smooth, reticulately rugose; areolar for the greater part, ampullaceo-tuberculiform and fertile, bearing apothecia immersed at the apex or side, or profoundly covered, 2 mm. wide, within white; apothecia often conjoined in threes, sub-horizontal and slightly nudate, or solitary and variously immersed, wholly black; spores 2, 110-115 x 30-35 μ, copiously multicellular.

Hab.: On bark, *Dr. C. Knight*, No. 100.

Order FUNGI.

MUTINUS, *Fries.*

M. pentagonus, *Bail.*(sp.nov.) (Name referring to 5-angled receptacle.) Stem prominently 5-angled, about $\frac{3}{4}$ in. in diameter, salmon-coloured, wrinkled between the angles, length from top of volva to base of the spore-bearing portion $2\frac{1}{2}$ in., this latter conical but showing the angles, 1 in. long, terminated by a flattened salmon-coloured

sporeless beak. Sporiferous pulp dark olive. Volva smooth, white, pitcher-shaped, about 2 in. long, and 1 in. wide at the base. Mycelium consisting of a few delicate threads. (Fig. about natural size.)

Hab.: On a flower border in a Brisbane garden. Fœtid, but very beautiful; only a single specimen found.

M. annulatus, *Bail.* (sp. now.). (Spore-bearing portion ringed.) Entire length including volva 2½ in. Receptacle terete, diameter at base about 2½ lines, from thence tapering to a pervious apex of about ½ line diameter. Spore-bearing portion annulated, nearly one-half the entire length of receptacle, red-ochre-coloured; sporeless portion pure white. Volva globose, white, about 5 lines in diameter, shortly splitting into irregular lobes. (Fig. about natural size.)

Hab.: Amongst decaying vegetable matter at Eumundi, *Bailey* and *Simmonds.*

The only specimen met with was lost in forwarding to Dr. M. C. Cooke. The above description is from notes and sketch of plant made at the time. The nearest allied species is *M. Watsoni*, Berk.

M. Watsoni, *Berk.*, in Cooke's Handbook of Austr. Fungi, 213. About 2½ in. high, spore-bearing portion conical, one-fourth the length of the entire receptacle, minutely veined, red, about ¼-inch diameter at the base, pervious at the apex.—*Cooke l.c.*

Hab.: On the ground, Burnett River, *Watson.*

M. papuasius, *Kalch.*, in Cooke's Handbook of Austr. Fungi, 214. About 3-4 in. high. Receptacle thin and slender (3-4 mm. diam.), pallid. Spore-bearing portion ovate-conical or somewhat pear-shaped, thicker than the stem, even, black.—*Cooke l.c.*

Hab.: On the ground, Rockhampton, *A. Thozet.*

M. discolor, *Kalch.*, in Cooke's Handbook of Austr. Fungi, 214. Stem cylindrical, orange; spore-bearing portion one-sixth of the whole receptacle, broad, thimble-shaped, lower margin extruded, free, adnate above to the stem; apex at first closed, then pervious, yellowish-grey, or at length turning black, delicately reticulately rugose.—*Cooke l.c.*

Hab.: On the ground, *Wigton.*

GEASTER, Mich.

G. limbatus, *Fries.* Bordered Geaster. Outer peridium coriaceous, expanded, multifid; interior slightly constricted, and then swollen at the base, without any groove round the top of the peduncle, into which it passes gradually; mouth fimbriato-pilose, depressed, rather acute.—*Cooke*, in British Fungi.

Hab.: Gladfield, *C. J. Gwyther.*

USTILAGO, Pers.

U. sorghi, *Link.* Pori black or dark brown, roughly pulverulent, spores globose, oblong, often angular, 5-9½ x 4-5½, furnished with a smooth, yellowish-olive-brown epispore; promycelium cylindrical, constricted near the base, sporidioles numerous, oblong.

Hab.: Gladfield, on inflorescence of sorghum, *C. J. Gwyther.*

PHYLLOSTICTA, Pers.

P. circumscissa, *Cooke.* Shot-hole Fungus. On both surfaces; spots orbicular, rufous-brown, at length falling out and leaving round holes; perithecia few, minute, innate; sporules elliptic, 8 x 2 μ.

Hab.: On cherry leaves at Accommodation Creek, and on apricot leaves in other localities.

PHOMA, Fries.

P. bambusina, *Speg.*

Hab.: On stalks of a seedling sugar-cane growing at Bowen Park.

CAMAROSPORIUM, Schultz.

Perithecia erumpent, simple, often papillate. Sporules ovoid-oblong or fusoid, 2 or many septate, muriform, coloured.—*Cooke,* Austr. Fungi, 355.

C. punctiforme, *Cke. and Mass.* (sp. nov.). Perithecia gregarious, minute, punctiform, papillate, black, just visible to the naked eye. Sporules ovoid or oblong, obtuse, cruciately or muriformly septate, not contracted, fuliginous, 15-18 x 10 μ.

Hab.: On fruits of a saltbush.

ASCHERSONIA, Mont.

A. oxyspora, *Berk.*, Sacc. Syll., iii., 3321. Stroma floccosely expanded at the base, slightly cylindrical, waxy, depressed (2 mil. diam.), peach-coloured, or flesh-coloured. Cells few, irregular, large, convolute. Sporules oblong, 10-15 μ long, finely apiculate at each extremity.

Hab.: On leaves of *Cinnamomum Oliveri,* determined by Dr. C. M. Cooke.

GLŒOSPORIUM, Mont.

G. palmarum, *Cke. and Mass.* (sp. nov.). Spots orbicular or elliptical (1 c. m), tawny or brown, darker at the periphery; pustules small, erumpent, at length pulverulent. Conidia elliptical, hyaline, continuous 12-14 x 5-6 μ. Basidia rather long and distinct, flexuous, hyaline.

Hab.: On leaflets of *Archontophœnix Cunninghamii* at Eumundi.

G. cinnamomi, *Cke. and Mass.* (sp. nov.). Spots suborbicular, sometimes bullate, rarely confluent hypophyllous, causing the leaves to become flaccid. Pustules gregarious, tawny, minute, at length pulverulent. Conidia elliptical, hyaline, 12-15 x 4 μ, on distinct basidia.

Hab.: On leaves of *Cinnamomum Oliveri* at Eumundi. Very destructive to the foliage.

G. periculosum, *Cke. and Mass.* Pustules occupying the whole or part of the surface of the ripe fruit, forming sulphur-coloured nodules beneath the cuticle ($\frac{1}{2}$-m. diam.). sporules elliptic-oblong, straight or curved, continuous obtuse at the ends, hyaline, 14-15 x 4 μ. The entire fruit penetrated with stout and branched hyphæ reaching to 6-8 μ diam. Sporophores cylindrical, 6-8 x 2 μ.

Hab.: Infesting the fruit of *Rhodomyrtus macrocarpa* at Cairns, which if eaten in this state is considered to cause blindness and at times death. This is a matter worthy of the attention of our medical men.

FUSARIUM, Link.

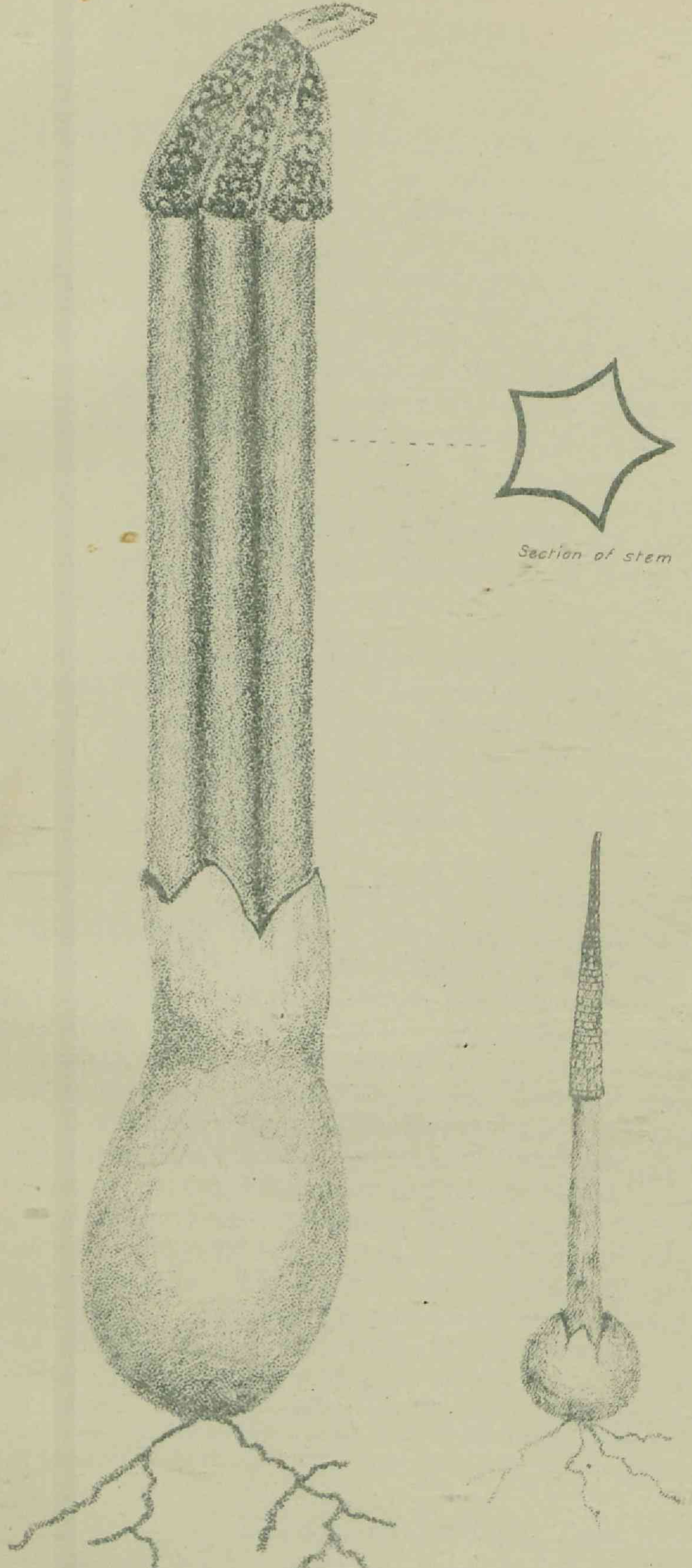
F. heterosporum, *Link.* Sporodochia orange, erumpent diffluent; conidia conglutinate, slender, curved, fusiform, very acute and pale-coloured.

Hab.: On ears of wheat from Herberton.

EPICOCCUM, Link.

E. micropus, *Corda.* Small-stemmed *Epicoccum.* Sporodochia gregarious, effuse, blackish; stroma subglobose, afterwards depressed, reddish-brown; basidia emergent, clavate, transversely septate, brown; conidia spherico-tetrahedrus, base depressed, sessile or very shortly pedicellate, glabrous, brown, impellucid, 22-23 μ diam.

Hab.: On the foliage of young oaks, Brisbane Gardens. In Europe and America this fungus is met with on decomposing vegetable matter.



Mutinus pentagonus, *Bail.* Mutinus annulatus, *Bail.*

ADDITIONS TO THE FLORA OF NEW GUINEA.

As may naturally be supposed, from being the nearest Government Botanist to New Guinea, I am frequently being called upon to determine plant specimens from there. It is my intention, therefore, in future to publish at the end of the Botany Bulletins the descriptions of all new species; also such notes upon the older ones as may be deemed advisable whenever plant specimens from that colony reach me.

SPECIMENS OF PLANTS COLLECTED BY MR. W. E. ARMIT, IN MARCH, 1894, ON MOUNT DAYMAN, N.E. COAST OF NEW GUINEA.

Besides the two new species now described, Mr. Armit's collection contained specimens of *Vitis cordata*, Wall.; *Potentilla anserina*, Linn.; *Uncaria appendiculata*, Benth.; *Moschosma polystachyum*, Benth.; *Hymenophyllum tunbridgense*, var. *exsertum*, Bail.; *Trichomanes parviflorum*, Poir.; *Lindsæa concinna*, J. Sm.; *Hypolepis tenuifolia*, Bernh.; *Polypodium serpens*, Forst.; and *Dawsonia superba*, Grev.

OLEARIA, Moench.

O. monticola (n. sp.) Branchlets clothed with a greyish or brownish tomentum. Leaves elliptical, 2 to 3 in. long, 1½ to 2 in. broad; on petiolès of 4 or 5 lines, scattered, with minute gland-like distant-teeth along the margins, upper surface almost glabrous, underside densely tomentose. Flower-heads in dense pedunculate corymbs, in the upper axils often forming broad terminal panicles. Involucre 4 lines in diameter, the bracts linear, hairy, unequal. Rays of the female florets about 3 lines long, and 1 line broad, contracted towards each end, 3-toothed, the colour and number to each head could not be determined from the specimens sent, being so much broken. Disk florets with 5-narrow hairy lobes, anthers with minute somewhat blunt points at the base. Style-lobes rather long and curled in the ray-florets, shorter and not so spreading in the disk-florets. Achenes hairy. Pappus of about 20 nearly equal brownish bri-tles.

Hab.: Mount Dayman, N.E. coast of New Guinea. Collected by Wm. E. Armit, March, 1894. Probably the *Olearia* with elliptic leaves mentioned by Baron Mueller as occurring on the crest of the Owen Stanley Range is the nearest ally of the present species. *See* Trans. Roy. Soc. of Vic., vol. I., part II, page 10.

RHODODENDRON, Linn.

R. Armitii, *Bail.* (n. sp.) A dichotomously branched shrub with a whitish bark. Leaves scattered, but appearing whorled at the ends of the branches from their near proximity to each other, oval, coriaceous, 3 or 4 in. long, and about 2 in. wide, more or less covered on the underside with ferruginous scales which become silvery with age.

Petioles 3 to 6 lines long, stout, rough, with ferruginous scales, which latter are very dense upon the young shoots. Flowers about eight in a head or sessile umbel [white touched with sea-shell pink.—*Armit*]. Bracteal scales broad, covered with short hairs, but much broken in the specimens to hand, very deciduous; bracteoles narrow-linear, expanding at the extremities, longer than the pedicels, hairy. Pedicels about 1 in. long, clothed with similar scales to those upon the petioles. Calyx oblique, small, broad at the base, tapering to pointed teeth, with ciliate margins, becoming reflexed. Corolla-tube curved or nearly straight, about $2\frac{1}{2}$ in. long, scarcely exceeding 3 lines broad, slightly expanded under the limb, nearly glabrous outside, but hairy within, limb of five broad lobes, the fully expanded flower with a diameter of 2 in. Stamens 10, filaments clothed with short hairs in the lower half. Anthers oblong, about $2\frac{1}{2}$ lines long, exserted. Styles long as the stamens, ovary 5-celled, very hairy, like the lower portions of filaments and style; stigma peltate. Capsule not to hand. Amongst New Guinea species, the present seems nearest allied to *R. Carringtoniæ*, F. v. M.

Hab.: Mt. Dayman, N.E. coast of New Guinea, at an elevation of 8,900 ft. Collected by Wm. E. Armit, March, 1894.

VERNACULAR NAMES WITH THEIR BOTANICAL EQUIVALENTS.

(*Continued from pages 97 to 104 in Catalogue of the Indigenous and Naturalised Plants of Queensland.*)

ABILL—Aboriginal name at the Barron River for *Pygeum Turnerianum.*

BAGOOL—Aboriginal name at the Barron River for *Cryptocarya insignis.*

BALLY GUM—*Litsea reticulata.*

BAN-BAN—Aboriginal name at the Endeavour River for *Modecca australis.*

BARAGARA—Aboriginal name for *Alphitonia excelsa.*

BARROR—Aboriginal name at Rockhampton for *Careya australis.*

BISHOP'S WEED—An European name for *Ammi majus.*

BLACK CURRANT TREE, of Walsh River—*Antidesma Ghœsembilla.*

BOINJEN—Aboriginal name at the Barron River for *Acanthus ilicifolius.*

BOOBARCHOO—Aboriginal name for *Tristania suaveolens*, var. *glabrescens.*

BOOLERCHU—Aboriginal name for *Tristania suaveolens.*

BOONA (Bloodwood)—*Eucalyptus corymbosa.*

BOORAL—Aboriginal name at the Mitchell for *Persoonia falcata.*

BOREE—Aboriginal name for *Acacia homalophylla*, also *A. pendula.*

CAMPHOR-TREE, Queensland—*Cinnamomum Oliveri.*

CARROT-WOOD, of Eumundi—*Bursera australasica.*

CATTLE-BUSH, of Downs country—*Atalaya hemiglauca.*

COOBIABY—Aboriginal name on the Cloncurry for the Leichhardt-tree, *Sarcocephalus cordatus.*

COOHOY or CONKIE NUT—Aboriginal name at the Russell River for *Cryptocarya Palmerstonii.*

COOLIBAR (Gum-tree)—*Eucalyptus microtheca.*

COOTCHEE—Aboriginal name at Boulia for *Sporobolus actinocladus.*

CURRANT, of Fraser's Island—*Leptomeria acida.*

CURRUNGUL or TEAK—*Dissiliaria baloghioides.*

DAALGAAL—Aboriginal name at the Barron River for *Podocarpus elata.*

DANDELION, of Europe—*Taraxacum Dens-leonis.*

DEVIL'S or TIGER'S CLAW—A name given by some for the naturalised plant, *Martynia diandra.*

DIN-DIN—Aboriginal name at the Barron River for *Rhodamnia trinervia*, var. *spongiosa.*

DURANDOOL—Aboriginal name at the Barron River for *Loranthus dictyophlebus.*

ELEMI-TREE, of Queensland—*Canarium Muelleri.*

FRENCH BEAN FUNGUS—*Glœosporium Lindemuthianum.*

GALBRA—Aboriginal name at the Barron River for *Amorphophallus Galbra.*

GELLMERRA—Aboriginal name at the Barron River for *Cryptocarya australis.*

GIDYA—Aboriginal name at Charters Towers for *Acacia salicina*, var. *varians*; other parts, *A. homalophylla.*

GILLOWARA—Aboriginal name at the Barron River for *Cleistanthus Cunninghamii.*

GNORPIN—An aboriginal name for *Eucalyptus robusta.*

GOLD-SPANGLED-WOOD—*Cardwellia sublimis.*

GOORIGEN—Aboriginal name at the Barron River for *Lycopodium Clarœ.*

GO-ONJE—An aboriginal name on the Cloncurry for *Careya australis.*

GREEN-LIGHT FUNGUS—*Hiatula Wynniæ.*

GUIABA or GYABI—Aboriginal name at the Barron River for *Dioscorea transversa.*

GUNTHA-MARRAH—Aboriginal name on the Cloncurry for *Careya australis.*

JAMBOLLA—Aboriginal name at the Barron River for the inflorescence of *Amorphophallus Galbra.*

JIL-LEER, or Gutta-percha tree of Gulf country—*Excæcaria parvifolia.*

JINBUL—An aboriginal name for *Eucalyptus microtheca.*

KAVOR-KAVOR—Aboriginal name at Rockhampton for *Timonius Rumphii.*

KIMBARRA—An aboriginal name for *Eucalyptus robusta.*

KOOMBARRA—An aboriginal name for *Persoonia media.*

KURANDA—Aboriginal name at the Barron River for *Helmholtzia acorifolia.*

KURLEAH—An aboriginal name for *Eucalyptus microtheca.*

KURRA-GURRA—An aboriginal name for Scribbly Gum, *Eucalyptus hæmastoma.*

KUNKERBERRY—Aboriginal name on the Cloncurry for *Carissa ovata.*

LESSER CLOVER—*Trifolium procumbens=T. minus* of Eng. Bot.

MIDJIN-GOORA-NOORAN—Aboriginal name for *Myrtus tenuifolia.*

MAAPA—Aboriginal name at the Barron River for *Epipogum nutans.*

MALLBAN—Aboriginal name at the Barron River for *Aphananthe philippinensis.*

MARAGUIGI—Aboriginal name at the Barron River for *Cupania flagelliformis.*

MEDIC BURR—The European plant *Medicago denticulata.*

MEE-MEE—An aboriginal name for *Myoporum acuminatum.*

MILLGAR—Aboriginal name at the Barron River for *Wrightia Millgar.*

MINKIE—Aboriginal name at the Barron River for *Ophiorrhiza australiana.*

MOOIMOOI—Aboriginal name at the Barron River for *Lycopodium phlegmaria.*

MOGIORE—An aboriginal name on the Cloncurry for *Maba humilis.*

MOOTUKA—Aboriginal name at the Barron River for *Lucuma galactoxylon.*

MOORAY—Aboriginal name at the Barron River for *Pittosporum rubiginosum.*

MUNTEUPIN—An aboriginal name for *Petalostigma quadriloculare.*

MUNGARA—An aboriginal name for *Eucalyptus tereticornis.*

MUNGEROO—Aboriginal name at Boulia for *Cyperus esculentus.*

MURPE—Aboriginal name at the Russell River for *Melodinus Murpe.*

NANCHEE—Aboriginal name at the Mitchell River for *Persoonia falcata.*

OOLPANJE—Aboriginal name on the Mitchell River for the Leichhardt-tree, *Sarcocephalus cordatus.*

OOTCHO—Aboriginal name at the Mitchell River for *Careya australis.*

PEPPER GRAPE—*Vitis opaca.*

POISON-TREE, SCRUB—*Excæcaria Dallachyana.*

POMERA—An aboriginal name for the honeysuckle tree, *Banksia integrifolia.*

POODGEE POODGERA—An aboriginal name for *Mallotus philippinensis.*

RUSSELL RIVER GRASS—*Paspalum Galmarra.*

RUSTY GUM—*Angophora lanceolata.*

SALSIFY or SALSAFY, of Europe—*Trayopogon porrifolium.*

SAPISTAN or DOGSDUGS—*Cordia myxa.*

SATINWOOD, of Cairns—*Dysoxylon Pettigrewianum.*

SATINWOOD, of Eumundi—*Backhousia citriodora.*

SHOT-HOLE FUNGUS—*Phyllosticta circumscissa.*

SHUTTLE-COCK FLOWER—*Homalium circumpinnatum.*

SILKWOOD—*Cupania sericolignis.*

SWIZZLE STICK, of Rockhampton—*Timonius Rumphii.*

TALLOW-WOOD—*Eucalyptus microcorys.*

TANDEROO—An aboriginal name for *Eucalyptus sideroplloia*

TCHEERGUN—An aboriginal name for Blackbutt, *Eucalyptus pilularis.*
TCHOONCHEE—An aboriginal name for *Avicennia officinalis.*
TEEWEEREE—Aboriginal name at the Barron River for *Tetracera Cowleyana.*
TEN-TEN—Aboriginal name at the Barron River for *Melastoma malabathricum.*
THANKOIN—An aboriginal name on the Cloncurry for *Maba humilis.*
THARR-GIBBERAH—Aboriginal name at Cloncurry for *Santalum lanceolatum.*
THURKOO—Aboriginal name at Cloncurry for *Clerodendron floribundum.*
TIGER'S or DEVIL'S CLAW—*Martynia diandra.*
TILL—Aboriginal name at Moreton Bay for *Endiandra sicbera.*
TOBACCO MOULD—*Peronospora hyoscyami.*
TOBACCO PIPE FUNGUS—*Cyphella longipes.*
TOBACCO PLANT, of Fraser's Island—*Hibiscus tiliaceus.*
TOI—An aboriginal name for Blackbutt, *Eucalyptus pilularis.*
TOKA—Aboriginal name at Rockhampton for the Leichhardt-tree, *Sarcocephalus cordatus.*
TOMATO-BLIGHT FUNGUS—*Macrosporium Tomato.*
TOOLOOKAR—A native name for *Angophora lanceolata.*
URARA—An aboriginal name for Spotted Gum, *Eucalyptus maculata.*
WAI-GEN—Aboriginal name at the Barron River for *Desmodium dependens.*
WHITLOW GRASS—An English name for species of *Draba.*
WITOOKA—Aboriginal name at Boulia for *Boerhaavia diffusa.*
WONGALI—Aboriginal name at the Barron River for *Chilocarpus australis.*
WONKARA—Aboriginal name at Port Curtis for *Eucalyptus tessellaris.*
YEDGENGEN—Aboriginal name at the Barron River for *Psychotria Dallachiana.*

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