

# Queensland Department of Agriculture and Stock



Dairy cows on improved pasture at Cooran

**Annual Report  
1962-63**

**Presented to Parliament By Command**

# ORGANISATION OF THE DEPARTMENT AS AT 30th JUNE, 1963

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**Marketing Branch—**

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# REPORT OF THE DEPARTMENT OF AGRICULTURE AND STOCK FOR THE YEAR 1962-63

To the Honourable the Minister for Agriculture and Forestry

Dear Sir,

I have the honour to submit herewith the Annual Report of the Department of Agriculture and Stock for the year ended June 30, 1963. An overall review of the various primary industries is given first, and a summary of the operations of the various Branches of the Department follows.

Yours faithfully,

W. A. T. SUMMERVILLE,  
Director-General.

## GENERAL REVIEW

Irregular rains made the season a patchy one for Queensland primary producers. Generally, all rains were late, delaying plantings and causing fodder shortages early in the season. However, prospects were much brighter in autumn and early winter.

Despite periods of severe stress, seasonal conditions in the pastoral industry at the close of the year were, in general, the best for a decade.

The first quarter ended with drought in the Peninsula, Charters Towers and Townsville areas, parts of the central and Longreach districts and in the south-west. Good, fairly general rains in late December and early January brought relief over a wide area and replenished depleted surface waters. Except on the northern coast, which enjoyed normal monsoon rains, hot and dry conditions followed the falls of early January. These conditions brought a return to drought and near-drought in parts of the north-west and central districts.

Heavy flood rains fell over wide areas of the State in March, causing widespread river rises with flooding in the central and south-western river systems. These rains produced abundant pasture growth.

The season was, however, a difficult one for both winter and summer grain production. Severe frosts last August and September affected all varieties of wheat. Damage in some crops was as high as 80 per cent., and it is estimated that these frosts cost the State at least 20 per cent. of the total wheat crop.

In some districts, including the Burnett and parts of the Darling Downs, the season was regarded as the worst for summer cropping programmes ever experienced. Rain groups were separated by extremely hot and dry intervals that had a damaging effect on growing crops. Not one crop came through unscathed. Lack of spring rains delayed plantings of cotton, peanuts and summer grains. Crop failures were common, but the March rains saved many from complete loss. The late rains prolonged the growing season of pastures, and, except for isolated pockets, there was abundant feed at the end of the year.

### BEEF CATTLE

For the beef industry, the season was a mixed one. In the north, it was better than usual, and prospects were good at the beginning of winter. But in central and southern districts, the rains were patchy. Some properties entered the winter with good feed reserves, but others were faced with shortages of both feed and water. Lack of winter rain in southern and central districts limited winter croppings, and there will be practically no crop fattening. Prospects are bright in the Channel Country, where the late floods filled the channels.

Beef cattle numbers were the highest recorded in Queensland since March, 1957. In 1962-63, beef cattle numbers rose by 140,000 to a total of 6,030,000 at March 31. This represents an increase of 2.4 per cent. in the year. Southern Queensland herds increased by 90,000; in central Queensland the increase was 29,000; and in northern Queensland 21,000.

Plans for the further development of brigalow lands for cattle production were advanced during the year. Agreement was reached between the State and Commonwealth Governments on conditions under which the Commonwealth will make loan funds available. Over the next 5 years,

£7,250,000 will be made available to develop 4½ million acres in the Fitzroy Basin, including 1¼ million acres of brigalow and associated scrub country. Surveys have indicated that the carrying capacity of the area could be increased from 115,000 cattle to 330,000 by scrub clearing and pasture improvement.

It is estimated that 163 new holdings, each capable of carrying 800 head of adult cattle, can be provided. Already 45 new holdings have been allotted to new settlers and these properties are being developed. Besides providing extension services to landholders, the Department is developing a research station within the area.

Construction of the extensive network of bitumen-sealed roads for the transport of stock is proceeding. The Gulf and Channel country are the principal areas being served in the initial stages. This phase involves the construction of 927 miles of roads connecting the major stock raising areas to rail loading points.

When completed, the so-called "beef roads" will give graziers a facility to move the right beast to the right place at the right time. But the roads will bring even greater benefits than this to the beef industry. They will enable graziers, through improved pastoral management based on modern planning, to develop safe expansion of their production. In their planning, graziers will have the firm assurance that cattle can be moved when and as necessary.

In the central and northern beef regions, recent technology has demonstrated practical and economic methods for dry season management. There is widespread interest in such practices as early weaning, supplementary feeding of weaners in winter, and the segregation of cattle by classes.

Improved management opens the way for the younger turnoff of store cattle, enabling breeders to take advantage of the demand by fatteners for earlier turnoff of stores. The fear of heavy drought losses has been a barrier to this policy in the past. However, recent trials have demonstrated the efficiency of improvements in breeder herd management.

Beef production methods in southern Queensland have been notable for the expansion in crop fattening. This has been combined with the tactical use of grain supplements to finish cattle at the end of crop programmes.

### THE SHEEP INDUSTRY

The sheep country ended the year with sound seasonal conditions after experiencing drought until Christmas and heavy rain and serious flooding in March. By the end of June, however, a general drying-off of pastures presented a State-wide bush fire hazard. The pasture and water position should permit good lambings and bulky, increased-weight fleeces.

Drought conditions in the far north, except for Winton, in the central districts and the far south-west during the first half of the year made supplementary feeding and mulga pushing necessary to save the flocks. Widespread rains in the Christmas-New Year period gave relief, but drought patches remained on the Darling Downs and Central Highlands until well into the third quarter. General disruption of communications and delays to shearing and crutching followed the March floods. Food relief work revealed the need for more adequate roof identification of station properties.



**Plate 1: Bagging the female parent of grain sorghum in preparation for the making of new hybrid crosses at the Hermitage Research Station.**



**Plate 2: Cattle being used in feed lot trials at the Husbandry Research Station at Rocklea.**

Wool sales in 1962-63 realised slightly more than £61½ million for 780,211 bales. The wool clip was 7,214 bales higher than in the previous year, an increase of 0.93 per cent. The return was almost £6½ million more, an increase of 11.68 per cent. The average price was 60.56d. a lb. compared with 54.64d. in 1961-62. Wool quality reflected the drought conditions of the first half of the year, with end-of-year fleeces showing some deterioration from heavy rain.

Japan remained the leading buyer. Other prominent buyers, in order of purchases, were: Great Britain, France, Italy, U.S.A., Germany, Belgium-Luxembourg and Russia.

Late in 1962, the Commonwealth Government passed a Wool Industry Bill to create the Australian Wool Board, a move of the greatest importance in all phases of the industry. This body controls the Australian Wool Bureau, the Wool Research Committee and the Australian Wool Testing Authority. The Board will be obliged to set up a Marketing Committee. Membership of the new board consists of a chairman, 5 woolgrower representatives, 3 members with special qualifications and 1 Commonwealth Government representative. Another woolgrower member has yet to be appointed.

World manufacture and demand for man-made fibres is bringing increased competition to the wool industry. The acrylic fibres are providing wool with more competition than are any of the other synthetics. Producers expect to increase still further their share of the fibre market at the expense of wool, relying on continued promotion and possibly reduced prices to increase demand. Wool industry leaders are alive to the necessity to meet this challenge.

A plan to improve the preparation of the Australian wool clip was issued in March. This plan involves setting out the qualifications for, and the registration of wool-classes; the introduction of stencil branding of bales classed by registered classers; and inspection to maintain classing standards. Provision is made for the deregistration of classers as the penalty for inferior classing.

Slaughtering of mutton sheep by Queensland meatworks in 1962-63 was 1,065,000 head, a drop of 18.7 per cent. on slaughterings for the previous year. Lamb slaughterings totalled 281,700, a decline of 8.2 per cent. on those in 1961-62.

### DAIRYING

Dairying districts had their best seasonal conditions for several years. As a result, butter production was slightly higher than in the previous year, while cheese production increased substantially. Dairy cattle numbers fell by 15,000 to a total of 1,193,000 at March 31. This was 1.2 per cent. fewer than at the end of March, 1962.

In Britain, the marketing position for the sale of butter exports was easier than it has been for several years. This was largely the result of the decision, in 1961, of several major exporting countries to regulate the quantities released on the British market. The Australian export quota, initially fixed at 62,000 tons, was raised to 65,100 tons during the year.

The British Government decided to suspend the 15s. per cwt. preference duty on butter from Commonwealth countries. This was done after conferring with representatives of the dairying countries which agreed with the decision, on the British Government's giving assurances to protect their interests. These conditions provided for an Australian quota of not less than that existing at the time of the removal of the duty. It also provided for consultation each year on the allocation of imports into Britain, and that milk production for manufactured products should not be encouraged in Britain.

Because of the continuing rise in cheese production in Australia in recent years, action has been taken to reduce production. The Queensland cheese industry, in common with that of other States, voluntarily decided to reduce production by 10 per cent. during the coming year. The industry is disturbed by the inadequacy of cold storage within Australia due to the high production and the need to control the quantities released on to export markets.

Progress was made in the construction of dairy plants in several Asian countries. This followed negotiations between the Australian Dairy Produce Board and Asian countries. These plants will use Australian butter oil and milk powder in the manufacture of reconstituted milk products.

Faced with a serious marketing problem, largely brought about by the uncertain export situation for surplus butter and cheese, the dairy industry is leaning more heavily on the Department for technical advice and guidance. The industry is increasingly seeking aid on problems connected with the diversification of the products it manufactures, and on improving dairy produce quality. In the Department's extension work on product quality, emphasis has been directed strongly

towards the basic need for high quality milk and cream. Special attention has been paid to improving milking machine hygiene and encouraging the greater use of farm refrigeration.

Generally, production levels on Queensland dairy farms are not capable of being raised spectacularly, but steady progress can be made. However, such progress will depend quite largely on the use by farmers of the information supplied by herd production records. These records not only reveal the yield of each cow in the herd, but also enable owners to identify bulls capable of raising, genetically, the production level of their herds. Proper use of records can rapidly improve herd management.

Research activities within the dairy industry have been intensified. This has been made possible by a levy on all butter and cheese produced in Australia which is subsidised on a £ for £ basis by the Commonwealth Government. The funds are being applied to both farm and manufacturing research.

The Gympie factory of the Wide Bay Co-operative Dairy Association branched out into the manufacture of industrial and edible casein during the year. This is the second Queensland dairy factory to be equipped for casein manufacture. The other, which began casein production in 1960, is at Maleny. Tanker collection of bulk milk from farms was extended to five districts.

The major extension function of the year was the Farmers' Festival at Toowoomba, which attracted nearly 10,000 farmers. The support given to the Department's extension programmes in the dairying districts has been greatly stimulated by the Dairy Extension Advisory Committees. The main function of these committees is to foster the more general adoption of better farming practices. The joint planning and participation in extension activities by the staff of the Department and leaders of the dairy industry has been mainly responsible for the heartening progress in securing the general support of the industry.

The noteworthy trend of the last year has been the growing interest in artificial insemination. The commencement of operations by the Wacol A.I. Centre and the availability of cheaper semen have stimulated this interest. Progeny testing in the Jersey and A.I.S. breeds has produced several bulls that can be commended as A.I. proven. Semen from these bulls is being eagerly sought by dairy farmers. There are at present eight A.I. distribution centres in Queensland and four others are in the advanced planning stage.

Interest in the critical examination of production methods, especially in the merits of various crop sequences, is high in the arable farming dairying districts. The use of legumes for forage in late summer and autumn, followed by cereals in winter, has been demonstrated as a sequence capable of greatly increasing output in districts depending on crops for dairying. Producer organisations have joined in the promotion of these methods with such enthusiasm that the value of Department-producer co-operation in extension is abundantly clear.

Recruitment of graduate staff became easier during the year, but the shortage of diplomats for field service in the dairy industry is still acute.

### CROPS

Spectacular developments in international sugar trading in the past year enabled the acquisition of a record tonnage and the payment of a record price to producers. The absence of quotas under the International Sugar Agreement and a general shortage of world sugar supplies for the free market permitted the unrestricted acquisition of every available ton of Queensland sugar from net assigned areas.

The 1962 crop yielded 1,770,000 tons of 94 net titre sugar, of which 1,100,000 tons went to seven overseas countries. This is the first time that more than 1,000,000 tons of sugar have been exported for any one season's crop.

The effect of the shortage of supplies, caused by the tremendous drop in Cuban production and aggravated by disappointing beet crops in Europe, rapidly strengthened world market quotations. Prices in London rose from 23s. sterling per cwt. in March, 1962, to a new record of 101s. sterling per cwt. in May. Quotations have now receded to a more realistic level, but prices are expected to remain buoyant until the end of 1964 at least.

Much of the 1962 crop was inevitably sold during the period of low quotations, but sales at the higher prices were sufficient to give a record return for No. 1 Pool sugar. With the addition of the proceeds from more than 500,000 tons of excess sugar, a sum of £84,500,000 was distributed among Queensland sugar producers from the season's trading.

With the early renewal of an effective International Sugar Agreement still uncertain, and in the light of the world sugar situation, the Queensland Government has appointed a Committee of Inquiry to explore the possibilities of permanent expansion of the Queensland sugar industry. The Committee's investigations are proceeding.



Plate 3: Light mixed brigalow scrub being cleared by means of two tractors and a heavy chain.

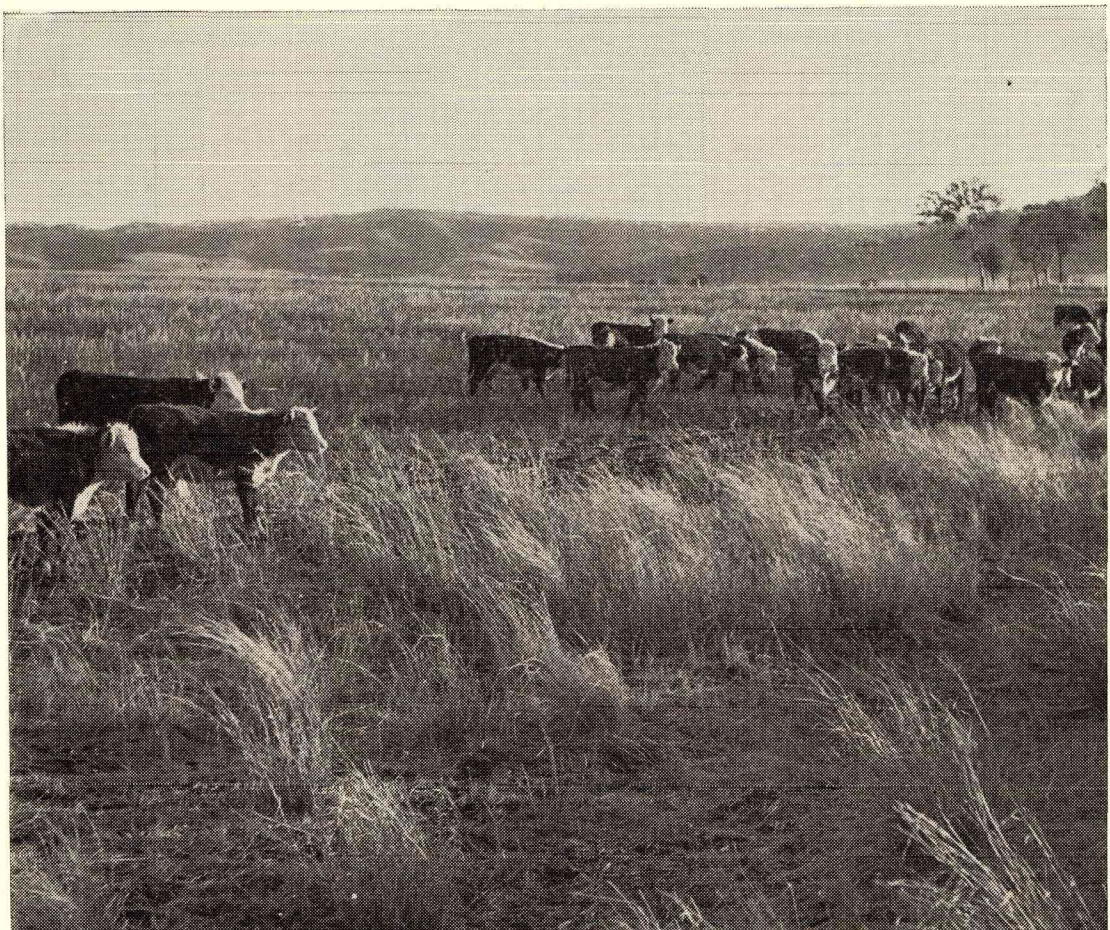


Plate 4: Cattle grazing an experimental oat crop at the "Brian Pastures" Pasture Research Station at Gayndah.

In the meantime the Sugar Board has announced that it will accept up to 2,000,000 tons of actual sugar from the 1964 crop. Pending the outcome of the Inquiry Committee, the Central Sugar Cane Prices Board has agreed to special measures to allow the 1964 target to be attained from presently assigned areas.

Late in 1962, arrangements were made with the British Government for an extension of the British Commonwealth Sugar Agreement until the end of 1970. Sugar industry prospects give rise to speculation. Industry leaders are keeping a close watch on the situation and preparations are being made to cope with possible contingencies inherent in such an unsettled sugar market.

The wheat industry was subjected to two unexpected setbacks last season. Severe frosts in August and September reduced the yield by at least 20 per cent. In addition to these unfortunate losses, the New South Wales bred variety, Mengavi, which made up about 50 per cent. of the Queensland plantings, was attacked by rust. Fortunately, climatic conditions in most districts militated against severe rust development, and losses were only about 20 per cent. in this variety. Other standard varieties were generally untroubled by rust.

While the total yield of 18,000,000 bus. was greater than for many years, it is estimated that, but for the depredations of rust and frost, the State production might well have reached 25,000,000 bus.

Mengavi is now suspect because of its newly developed rust susceptibility, but the industry still has a reliable performer in Spica. It is expected, too, that Gala and Gamenya will gain wider recognition and use. The variety Kenora is still most suited to the northern and western wheat districts.

The wheat crop competition field championship went to a Darling Downs crop of Spica, and the reserve championship to a crop of Kenora in the Central Highlands. The only Darling Downs crop that featured in the bushel of wheat competition, however, was one that followed a lucerne rotation. All the other prize-winners in this section came from the brigalow soils.

The main producing areas of grain sorghum were troubled by summer drought, mice, army worms and midge. Crop failures were common, and where stock were available, grazing was employed to give some return. The March rains, which saved many crops from total loss, unfortunately led to much regrowth and difficulties in harvesting.

Uninformed prejudice against hybrid sorghum grain quality is resulting in price differentials in favour of standard varieties. This is unfortunate, as quality—or protein content—of both hybrid sorghum and standard varieties is controlled by the fertility of the particular farm on which the crop is produced. Levels of protein content of hybrid sorghum can be just as high as in the older standard varieties.

The maize season was most adverse in all producing districts. Large areas intended for grain were ultimately ploughed in, grazed off, or cut for silage. In the main producing areas of the South Burnett, dry weather produced a level of crop failure rarely experienced in this district. More than 10 per cent. was not harvested, and crops harvested produced only 50 per cent. of expected yields.

An interesting and positive development in this industry is the continued expansion of maize acreages on the heavy soils of the Darling Downs. The crops have performed surprisingly well despite the harsh summer conditions. As Queensland research findings into the control of zinc deficiency disorders in linseed have proved equally effective in controlling a similar disorder in maize on these heavy soils, satisfactory expansion can be expected in these areas.

Hybrid strains are continuing to grow in popularity and reliability, with some changing preferences in actual strains as the search for improved grain quality continues.

A successful cropping season for peanuts in the main producing area of the South Burnett is largely dependent on early planting rains to allow a sufficient spread of planting times. This permits the necessary cultivation and harvesting procedures to proceed smoothly and averts labour problems.

Planting rains were much delayed in the last season. This resulted in reduced plantings and a considerable increase in the percentage of the Red Spanish variety. In addition, pre-planting cultivation was not possible in the dry spring, and weeds were unusually troublesome in the crop.

Wherever pre-emergence weed control techniques were applied at the right time, using 2,4-D at 2 lb. to the acre, weed control was effective.

Unseasonably dry weather following planting also threatened to destroy the crop, but the heavy rains in mid-March retrieved this situation. Diseases which were prevalent this season reduced yields, severely in some crops, while the humid conditions during harvest in May caused loss of quality in nuts being cured in windrows.

The cotton season was generally unfavourable. Late planting rains delayed sowing in most districts and virtually no rain-grown crops were planted on the Darling Downs. The total area sown exceeded 21,000 acres, and a yield of 6,000 bales of lint is expected. Irrigated crops accounted

for 1,500 acres, mainly in the Dawson Valley, but there were 200 acres on two Darling Downs properties. Specialised attention to cultivation and insect control has enabled growers at Brookstead and Laidley to harvest 1,750 lb. of seed cotton an acre, despite losses from boll rots aggravated by the late wet season.

Breeding work has been intensified in a project aimed at increasing fibre length to meet spinners' demands. The pure seed production scheme is being revised to permit closer collaboration with plant breeders. Miller is still the most widely grown variety, but it is hoped to replace it with new varieties such as Dixie King, D and PL smoothleaf, and Fox 4. Mechanical harvesting and bulk handling are continuing to increase despite increased leaf content and reduced grades. This has raised new ginning problems which may require specialised study.

The Mareeba-Dimbulah district is firmly established as the major tobacco-growing region in Queensland. Of the 17,000 acres under crop last season, 12,000 were in the Mareeba-Dimbulah district. The Bundaberg and Inglewood districts have not expanded, but there are prospects of expansion in the Dumaresq River area in the southern border tobacco growing district. Production expanded in the Beerwah district to more than 1,000 acres. The acreage in the Burdekin area has declined and, following unsatisfactory sales this year, the acreage seems certain to decline in the coming season.

Yields per acre vary markedly, and are unsatisfactory in the Beerwah and Bundaberg districts. In these, yields are in the region of 600 to 800 lb. an acre, compared with 1,000 lb. or more in other districts. At various times, varieties, climate and soil have been considered responsible for the lower yields. Investigations aimed at clarifying the position will be commenced in the coming season. Overall, leaf miner and blue mould were the major problems, with Rhizoctonia stem rot and barn rot troublesome in most areas. Research on pest, disease and nutritional problems is being continued.

There was great variation in the prices paid at tobacco sales, but a distinct buyer preference for leaf from the Mareeba-Dimbulah area was evident. A world record price of 291d. a lb. was paid at Mareeba, with the average of the first two sales there 147.9d. a lb. The average price for Burdekin-Ingham leaf was 104.1d. a lb., with many crops failing to cover production costs. Furthermore, 48.1 per cent. of the offering did not sell. Leaf from the Innot Hot Springs area sold at 120.168d. a lb., and the average at the first Brisbane sales was 136.6d. Leaf from the Dumaresq River and coastal areas sold more readily than that from the Macintyre Brook area. The total clearance in Queensland to June 30 was 5,787 tons which realised £6,996,366.

Production of apples in the Granite Belt in 1962-63 is estimated at 1,500,000 bushels, exceeding by 100,000 bus. the previous all-time record of 1961-62. With increasing production, overseas export has assumed considerable importance in the economy of the apple industry. As in previous years, Granny Smith was the principal variety exported. Cool storage space is taxed to capacity in spite of an increase in available space to hold approximately 470,000 bus.

New plantings continue, with a sharp increase to 762 acres for the year, Delicious and Jonathan being the predominant varieties planted. It is probable that production will reach 2,000,000 bus. by 1967.

The 1962-63 pear crop is estimated at 60,000 bus. of which 13,000 bus. of Packham's Triumph have been exported. Low prices received this year, doubts as to the future of exports, and canning setbacks are expected to halt, at least temporarily, the rapid expansion in acreage of the last 6-7 years.

Pineapple production in 1962-63 reached 71,000 tons, representing a marked increase over 1961-62 which was the lowest for several years. Factory intake amounted to 55,500 tons. This represents a further reduction in fresh fruit sales and it appears that the canned product is gradually taking the place of the fresh fruit on Australian markets.

The increase in production was largely the result of the substantially increased acreage planted following the recovery in cannery prices which reached £40 per ton in 1961.

The trend is towards larger individual areas, an increase in annual farm output and reduced labour costs, with the object of reducing the margin of profit necessary for economic survival. Production along these lines is leading to more standardised cultural methods, greater control of cropping and more stabilized acreages.

Favourable weather conditions, in spite of some wind damage in certain districts, have led to a small increase in banana production which is estimated at 700,000 bus. for 1962-63. The increased production in Queensland and New South Wales has brought marketing problems which have led to new developments in packaging. Smaller containers, such as the bushel case, and the cluster pack in cartons, have proved of distinct benefit to the industry.

Efforts are still being made to devise ways and means of promoting greater sales on local and southern markets. The possibilities of overseas export have been explored, particularly with a view to the Japanese market, but



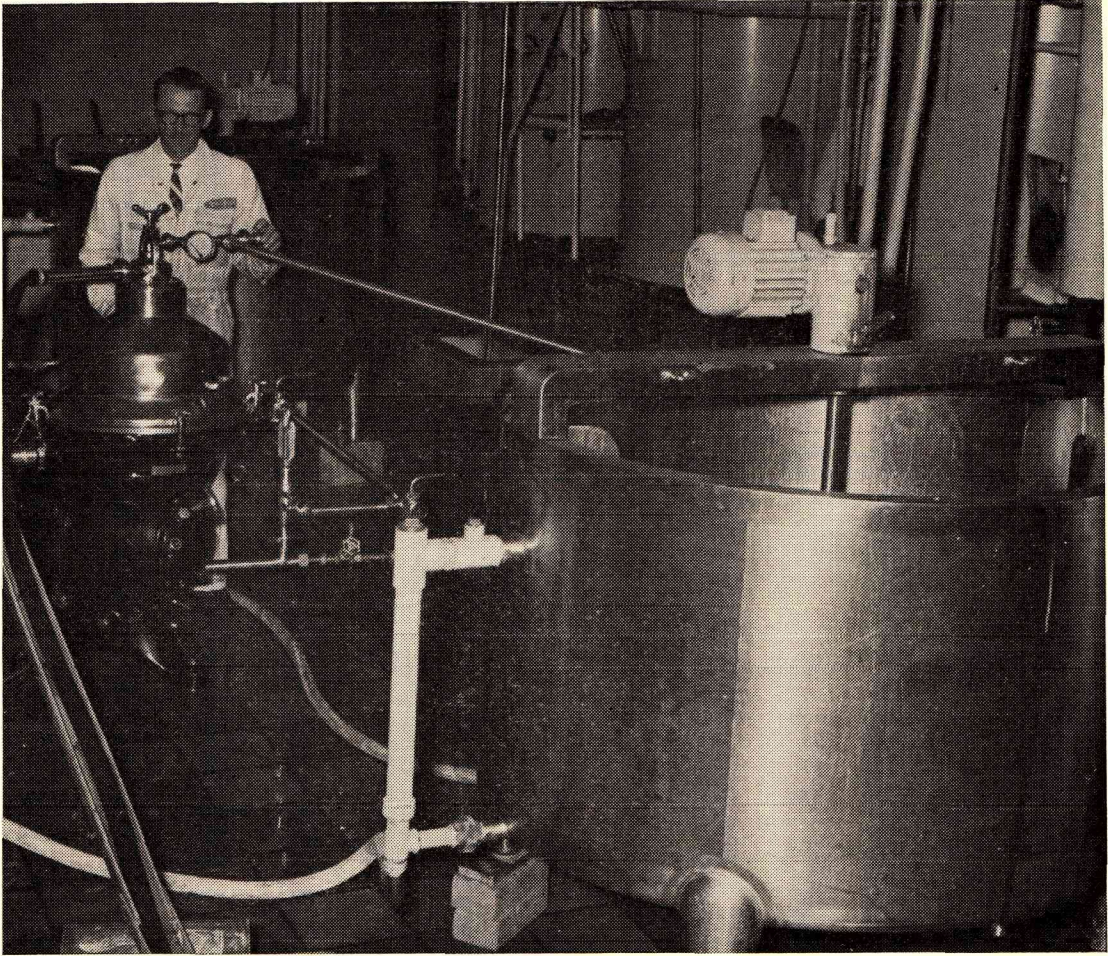
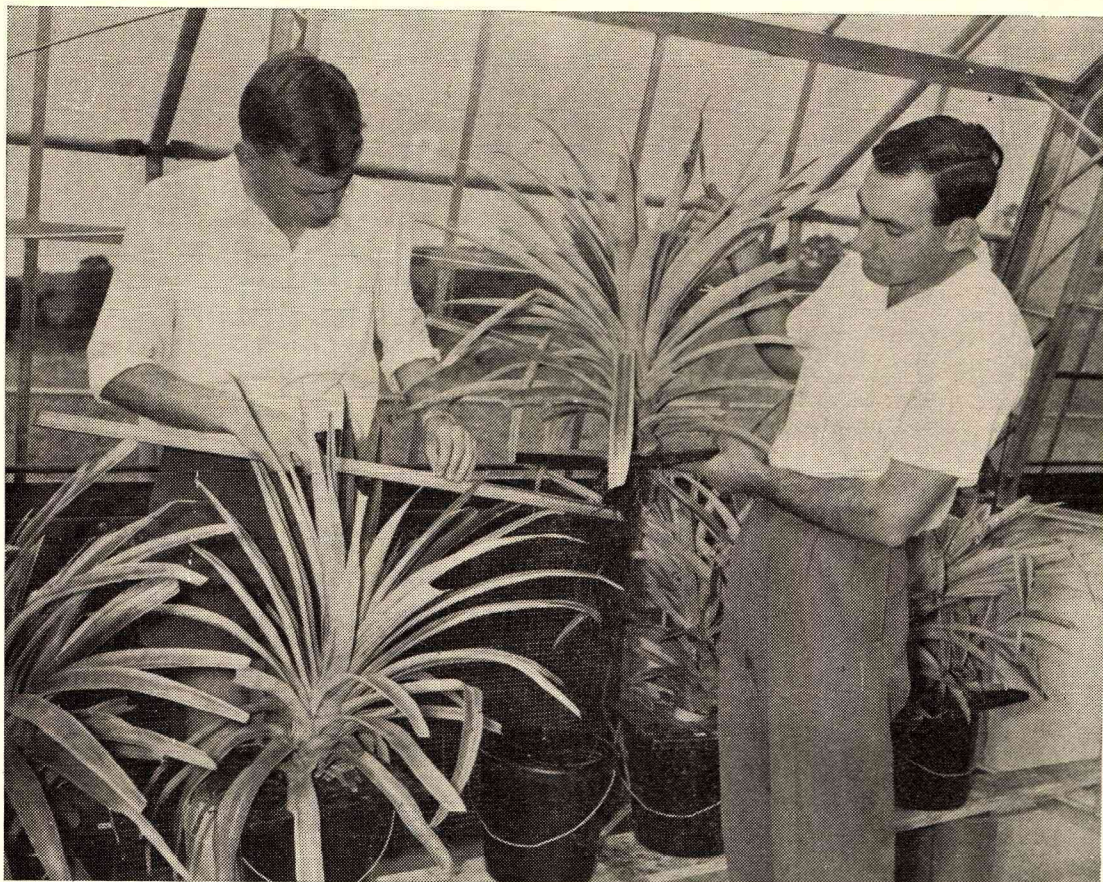


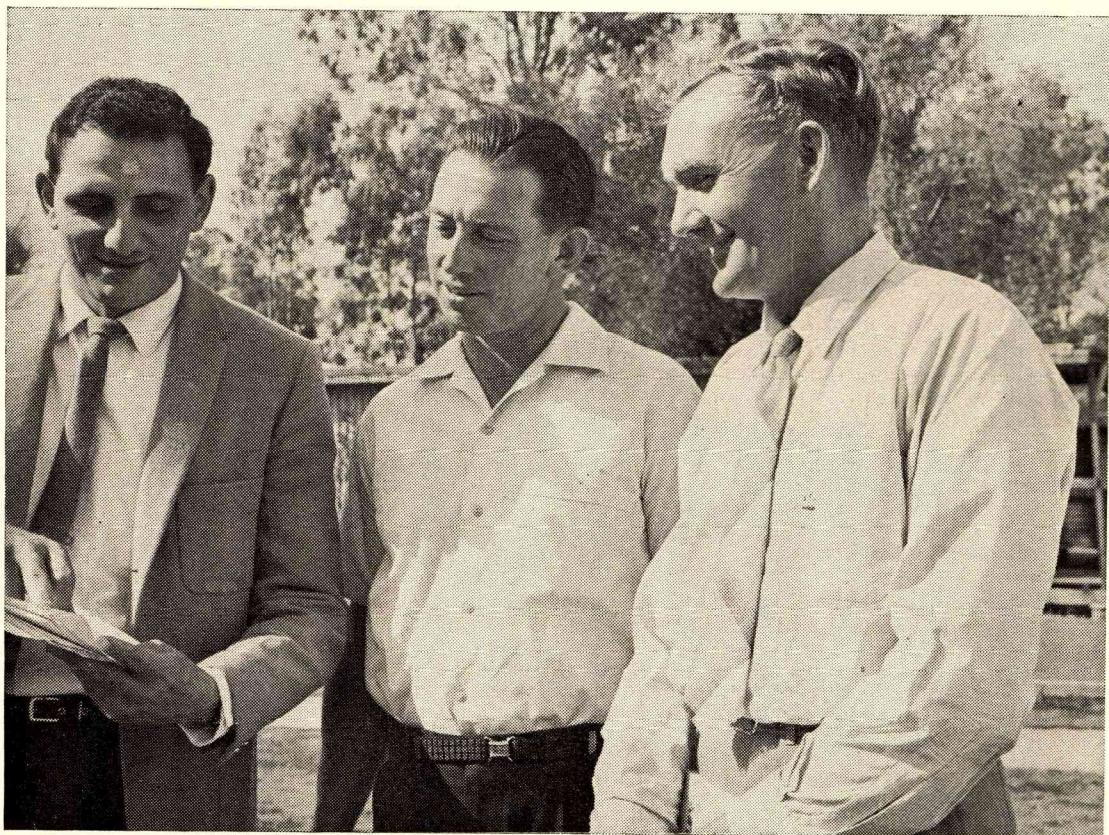
Plate 5: Equipment used for the purification of butter-oil from weed taint.



Plate 6: Removing a sample of wool for fleece testing.



**Plate 7: Horticultural officers taking growth measurements of pineapples which have been grown in artificial cultures at the Pineapple Research Station at Nambour.**



**Plate 8: Mr. S. S. Doumany, Agricultural Economist, Q.D.A.S., Toowoomba, discusses farm budgeting with orchardists, Mr. W. T. Brooks, Bapaume, and Mr. J. R. Jones, Mount Tully.**

quarantine restrictions are still the main obstacle. However, in recent months exporters have shown interest in the possibilities of obtaining supplies of bananas for overseas consumption. One small trial shipment to Canada is planned for the end of June 1963.

Production of papaws in 1962-63 is estimated at 700,000 bus., which is only a slight increase over the previous year's.

The 1962-63 citrus crop totalled 840,000 bus., comprising 480,000 bus. of oranges and 200,000 bus. of mandarins. There was a substantial drop in mandarin production, particularly of Ellendale and Glen Retreat, with a sharp increase in Meyer lemon, grapefruit and Seville orange, though the total quantities are small. Further overseas shipments have been made from Mundubbera and some other districts, principally to Asian countries. In some consignments quality was not up to export standard and some rejections took place. Though still rather limited, those markets promise to provide a useful outlet for some of the Queensland citrus crop.

Production of strawberries in 1962-63 again exceeded 3,000,000 lb., from approximately 350 acres. Of this quantity 2,200,000 lb. were processed. Production is largely confined to the South Moreton and North Coast districts, and the crop is grown mostly in small unit areas. Larger scale production, however, has been successfully undertaken on several properties in the Redlands district.

Tomatoes marketed in 1962-63 totalled about 2,000,000 half-bushel cases, at least half of which came from the Bowen and Burdekin districts.

Southern markets provide the largest outlet for the winter crop and are the virtual mainstay of the Bowen-Burdekin tomato industry. Large scale production methods have led to a steady increase in the volume of production which is now somewhat more than sufficient to meet the demand. Exporters have evinced some interest in the possible export of Bowen tomatoes to Asian countries but to date no substantial shipments have been undertaken. Nevertheless, export may be considered as a possible future outlet for increased production.

Production of green beans in 1962-63 reached 1,200,000 bus. This is probably a record for this State, which is becoming increasingly important as a supplier of green beans during the winter months.

There has been a large-proportioned increase in ginger production from 350 tons in 1961-62 to 620 tons in 1962-63. The present area of 120 acres is expected to increase to at least 150 acres in the 1963 planting season.

The interest of stock-owners in pasture improvement was maintained at a high level. It is estimated that approximately 300,000 acres of new pastures were sown this year, including 130,000 in the Upper Dawson River catchment. The total area under sown pastures in Queensland is estimated to be more than 3,000,000 acres compared with 1,800,000 acres in 1956. It can be expected that the development of the remaining brigalow lands and the use of Townsville lucerne in coastal and subcoastal open forest lands will add a further 60,000,000 acres to the State's improved pastures.

Valuable assistance in the pasture research programme has come from industry and company funds. Assisting bodies include the Australian Cattle and Beef Research Committee, the Australian Meat Board, the Wool Research Committee, the Australian Dairy Research Committee, Shell Chemical (Aust.) Pty. Ltd., and A.C.F. and Shirleys Fertilizers Ltd. Financial assistance in pasture extension work has been received also from the Commonwealth Extension Services Grant and to a lesser extent from the Dairy Industry Extension Grant.

Shortage of seed of proven legumes and grasses, and consequent high prices have severely limited the expansion of improved pastures in recent years. Stock-owners have shown ingenuity and ability in developing harvesting cleaning and planting equipment. Seed shortage is rapidly being overcome with several buffel grass varieties, green panic, Townsville lucerne and Tinaroo glycine. The position should also improve for other promising legumes such as sirato, stylo, various glycine varieties and *Dolichos lablab*.

Some 200,000 acres of sown pastures were established in the cattle country during the year, mainly in the brigalow scrub lands. It is estimated that approximately 50,000,000 acres of forest country receiving more than 25 in. of rain a year and situated north of Bundaberg can be improved by the establishment of Townsville lucerne in native pastures. Wherever improved pastures involving legumes are established,

graziers report increased carrying capacity and a faster rate of turn-off. This can amount to a saving of 12 months or more in the time required for fattening.

Keen interest is being maintained by sheepmen in pasture improvement in gidgee and brigalow areas and in sections of the forest country. Interest is also high in the establishment of pastures on pushed mulga country where a mixture of good ground feed and the valuable mulga top feed would be of great value. Buffel is the grass species that is making the greatest contribution to pasture improvement in the sheep country.

The development and successful testing of tropical pasture legumes in south-eastern and far northern Queensland have resulted in a minor revolution in the dairying industry in these regions. Farmers are realising that species are now available capable of transforming poor grassland into productive high-quality pasture.

It is estimated that approximately 3,000 acres of these pastures have now been sown, mostly on land that was virtually unproductive. The legumes centro, glycine, desmodium, stylo, sirato and Lotononis are playing their part in this expansion. New grasses have been relatively unimportant in this phase, although makarikari grass and ronpha grass are showing promise for the winter.

Where water can be made available, irrigated pastures are becoming accepted as part of dairy farm practice. Another important development in dairy pasture management is the increasing recognition by the industry that soil fertility is important. The use of fertilizers, especially superphosphate, often in association with nitrogen and molybdenum, is expanding steadily. Virtually no dairy pastures are now sown without superphosphate.

Landholders in many districts are taking a keen interest in protecting their land from soil erosion. A total of 3,000 Queensland farmers have now applied soil conservation measures to a total area of 234,000 acres of eroded cultivation land.

Interest is increasing rapidly. The 437 landholders who began soil conservation programmes during the year represented an increase of 30 per cent. on the previous year's total. The main increases were in the west Darling Downs (107 per cent.), the Burnett (67 per cent.), and north Queensland (185 per cent.).

Community interest in soil conservation work is continuing to increase. In the eastern Darling Downs region, six additional farmers' soil conservation groups were formed. This brings to 150 the number of farmers engaged in community activity in this region. Altogether, they occupy 64,000 acres. A major group was formed at Bell on the western Darling Downs. This group comprises 200 farmers whose holdings amount to 135,000 acres.

Organised group activity is proving an effective method of co-ordinating the planning and implementation of soil conservation measures. Group activity also gives members an insight into the need to attack erosion problems on a catchment basis. There is a high level of enthusiasm in the groups, which have adopted a constructive approach to this important problem.

Prices for pigs were comparatively steady throughout the year, and at levels satisfactory to producers. In the pig industry there is a marked trend towards increased slaughtering in winter and spring. This reflects the greater use being made of grain sorghum and protein meals for pig feeding and the decreasing dependence of the industry on dairy farm by-products. Another noteworthy trend is the increasing number of producers who are diverting a bigger proportion of their profits to piggery and breeding stock improvement.

The isotope committee approved three experiments using radio-active isotopes during the year. These experiments are in the fields of entomology, dairying and horticulture. For breeding purposes, samples of centrosema and stylosanthes were irradiated with X-rays. Monitoring and safety equipment is being assembled.

#### STAFF AND FACILITIES

During the year, 148 officers were appointed to the permanent scientific and technical staff. Resignations and other staff losses amounted to 52 reducing the gain to 96.

The Department's University scholarship scheme is now bringing results. During the year 22 University scholarship-holders completed their degree courses and took up appointment with the Department. Eleven graduated in Agricultural Science, 2 in Pure Science, 7 in Veterinary Science, and 2 in Rural Science.

University scholarships were awarded to 8 students in Veterinary Science, 10 in Agricultural Science, 4 in Pure Science, 1 in Civil Engineering, 1 in Agricultural Economics and 1 in Commerce. In addition 13 diplomate scholarships were awarded to students at the Queensland Agricultural College. These are studying for Diplomas in Agriculture, Horticulture, Animal Husbandry and Dairy Manufactures. University cadetships were awarded to 16 students in Pure Science and 2 in Economics, who will undertake University degree courses on a part-time basis.

Among the officers who retired under the age provisions were Messrs. D. A. Logan, H. H. Hodges, C. G. Williams, R. L. Prest, P. Mitchell and A. C. P. Nurcombe. Each of these officers had given many years of service to the Department, and each had made a worthwhile contribution in the development of Queensland's primary industries.

Higher degrees were obtained by Messrs. L. L. Callow and R. C. Colbran (Ph.D.), L. E. Donaldson (M.V.Sc.), W. A. Smith, R. J. Park, D. S. Teakle and G. W. O'Donnell (M.Sc.). Dr. J. P. Ebersohn was awarded a Doctorate of Philosophy from the University of Witwatersrand, Republic of South Africa.

Nine officers made overseas visits during the year. Mr. C. W. Winders, Officer-in-Charge of Information Services, left in May to examine new developments in agricultural extension in the U.S.A., Britain, and Holland. Mr. A. Winterton, an agronomist working on the tobacco crop, also left in May to examine the tobacco industries in Japan, Canada

and the United States. Study tours of the U.S.A. and Europe were completed by Messrs. W. J. Cartmill, Director Agricultural Chemical Laboratory, and J. H. Smith, Director of Horticulture; and Dr. S. A. Trout, Director, Food Preservation Research Branch. Mr. W. Pont, Research Plant Pathologist, attended a World Tobacco Congress in Southern Rhodesia and also visited other parts of the African Continent on plant disease problems. Messrs. F. Chippendale and A. S. Greasley attended the International Soil Science Conference in New Zealand. Mr. A. C. Peel, Standards Officer, attended as Australian representative the 13th International Seed Testing Association Conference in Lisbon, Portugal.

Two senior officers of the Pathology Branch of the Animal Research Institute, Yeerongpilly, are absent on overseas study leave. They are: Mr. M. D. McGavin, Senior Histopathologist, who is studying at the Michigan State University; and Dr. L. L. Callow, Senior Protozoologist, who is studying at Rice University, Texas. In August, 1962, Mr. R. M. Beames was granted 2½ years' study leave to accept a fellowship at McGill University, Quebec, Canada. Mr. L. E. Donaldson, a Husbandry Officer in the Cattle Husbandry Branch, was granted a Fellowship by the Australian Cattle and Beef Research Committee and is at present undertaking further studies at Cornell University in the U.S.A. The Senior Markets Inspector (Mr. A. J. Crocker) is serving 6 months in Britain and on the Continent on behalf of the Commonwealth Government. He is examining the condition of Australian apples and pears on arrival.

## DIVISION OF PLANT INDUSTRY

More new lands were brought into cultivation and the 1963 planting of winter crops should set a new acreage record. Data from the Bureau of Census and Statistics reveal that the total area of all crops grown in Queensland in 1961-62 was 3,203,213 acres, over 150,000 acres more than the previous year.

Allowing for areas on which two or more crops were grown during the year, the actual area used for crops was 3,153,645 acres. In addition, 571,845 acres lay fallow during the year, making a total of 3,725,490 acres of cultivated land. The area of improved pastures recorded for the year ending March 31 was 2,577,587 acres, an increase of more than 300,000 acres over the previous year.

These figures represent the highest acreage under cultivation and the largest area of improved pastures recorded in Queensland. The expansion in cropping has taken place mainly in the grain crops, wheat and grain sorghum, and hay and green fodder crops.

The increase in the area under lucerne is noteworthy, the 172,171 acres for 1961-62 being 22,500 acres more than the previous year. Research workers at the Brian Pastures Pasture Research Station near Gayndah have established that beef cattle can make much better use of dry, poor quality native pasture when it is grazed with a small area of lucerne.

Among the fruit crops, the development of the apple growing industry is interesting. In 1961-62, apple trees occupied the largest acreage of any fruit crop in Queensland, with 7,815 acres of bearing trees and 3,761 acres of young trees. The industry is wholly located in the Granite Belt. The export market has been successfully exploited and it is believed that growers can hold and further develop this outlet.

### RESEARCH FACILITIES

The new system of operating regional research stations under a Research Stations Board has proved satisfactory. It is clear that this new system will enable better direction and co-ordination of research programmes in plant industry. Of major significance is the opportunity the station committees provide for close liaison between research and extension officers. These committees also facilitate co-operation between Plant Industry officers and those of the Divisions of Animal Industry and Dairying.

The Queensland Wheat Research Institute at Toowoomba, built with funds accumulated from growers' levies under the Wheat Research Act 1957, was occupied by officers of this Division in August 1962. The supervising committee, the Queensland Wheat Industry Research Committee, comprises 3 representatives of growers, and one representative each from the University of Queensland and the Queensland Department of Agriculture and Stock. The 3 major lines of investigation being pursued concern investigations into wheat root rots, soil fertility problems, and the establishment and maintenance of pasture leys.

Work on pastures and forages for beef cattle was expanded at the Brian Pastures Pasture Research Station. Programmes are co-ordinated with those of officers of the Division of Animal Industry and of C.S.I.R.O.'s Division of Tropical Pastures.

Research and extension programmes in tobacco growing, financed by the Tobacco Industry Trust Account, were continued. Unfortunately, tobacco produced along the Macintyre Brook in southern Queensland and in the Lower Burdekin Irrigation Settlement has failed to find favour with buyers

in recent years. Prospects suggest that the industry will decline to a very low level, if not disappear, in these areas. The future of tobacco investigations on the Inglewood and Millaroo Research Stations will have to be reviewed to meet this new situation.

The Entomological Research Laboratory at Indooroopilly is now operating. Facilities are being developed at this centre for a number of other Branches. Special glasshouses are being erected for the Agricultural Chemical Laboratory and Plant Pathology Branches. It is also anticipated that a glasshouse for Commonwealth Quarantine will be built in 1963-64. It is hoped that a building for the Botany Section can be commenced soon. Botany is now housed in an overcrowded, old building in the Botanic Gardens which is quite unsuitable.

Laboratory units of the Agricultural Chemical Laboratory were occupied by qualified staff at the Millaroo Research Station, Mareeba, and the South Johnstone Research Station. These units will provide urgently needed analytical services to assist research and extension officers in north Queensland. The Pineapple Research Laboratory on the Maroochy Horticultural Research Station was completed. A full-scale programme, with particular emphasis on soil fertility and pineapple root development, was commenced. The Applethorpe Horticultural Research Station, formerly directed by C.S.I.R.O.'s Division of Plant Industry, was placed under the control of this Department. Arrangements have been made to erect a new office-laboratory building for staff, not only of the Horticulture Branch, but also of the Plant Pathology and Entomology Sections.

### EXTENSION

Advisory committee activities were continued vigorously. Officers of this Division are associated with such committees on tobacco, wheat, dairy pastures and forages, vegetables, deciduous fruit, pineapples, bananas, and beef cattle pastures and forages.

The expansion in the area of cultivated land is throwing a heavier burden on the extension services especially, increasing the demand for staff, transport, and equipment.

Divisional officers continued to benefit from training at special extension courses. A number of officers attended important conferences on brigalow development held at Miles and Biloela. Officers also co-operated with the Commonwealth Development Bank in a well-attended school at Dalby of graziers and other people interested in brigalow development.

### STAFF

A total of 21 officers was lost for various reasons. New graduate staff consisting of 23 males was appointed. Of these 10 received their University training with the assistance of the scholarship scheme and four through the Departmental cadetship system. Fourteen officers were appointed to the extension staff. Two of these were holders of the diplomat scholarships awarded to students of the Queensland Agricultural College. In 1963, 4 students were awarded University scholarships in Agricultural Science and one, who is destined for the Soil Conservation Branch, in Civil Engineering. Five students at the Queensland Agricultural College hold Departmental Diplomat Scholarships. Eleven cadets were appointed to undertake Pure Science Degree courses at the University of Queensland on a part-time basis.

## AGRICULTURE BRANCH

## AGRONOMY

The highlights of the past season were the damaging frosts in August and September, the severe rust losses in some Mengavi crops, especially in the Central Highlands, the good overall performance of the Queensland-bred variety Spica, and the success of zinc sulphate sprays on both winter and summer crops.

*Wheat.*—Seasonal conditions in 1962 were conducive to the build up of stem rust infection in a number of the major growing areas. Mengavi, which is susceptible to a new rust race, disappointed in many regions, especially the Central Highlands. In other areas, where it escaped infection, it continued to yield well. Spica, although susceptible to an earlier race, showed a high degree of field tolerance to rust and proved to be the most reliable variety throughout the State. Results of five regional trials are given in Table 1. It should be noted that Gabo and Mengavi were completely destroyed by rust in the Capella trial.

TABLE 1  
RESULTS OF 5 DISTRICT WHEAT VARIETAL TRIALS, 1962  
Yields in Bushels per Acre

Variety	District					Average
	Capella	Biloela	Wandoan	Gatton	Allora	
Gala .. .. .	16.0	Not tested	24.5	53.0	49.5	35.7
Spica .. .. .	22.6	30.3	21.1	53.7	48.2	35.2
Gamenya .. .	21.0	25.4	26.5	50.0	51.5	34.9
Kenora .. ..	22.1	27.7	23.8	47.9	50.9	34.5
Festival .. .	19.1	25.5	20.9	44.0	45.2	30.9
Mengavi .. .	0.0	26.5	28.9	41.8	39.8	27.4
Gabo .. .. .	0.0	18.9	26.7	36.7	42.7	25.0

At Hermitage Research Station, the centre of the Department's wheat plant breeding programme, the slow, mid-season and quick maturing varietal trials were repeated. Windebri (37.1 bus. per acre) and Winglen (33.7 bus.) gave highest grain yields and provided good grazings under the conditions existing in the slow maturing trial. K.SUPY (49.5 bus. per acre), Gala (49.3 bus.) and V<sup>2</sup>TCH5575 (48.9 bus.) produced best grain yields in the mid-season trial. Flour quality of K.SUPY was very poor, but that of the other two varieties was very satisfactory.

In the quick maturing trial, Gamenya (47.4 bus. per acre), Spica (46.9 bus.) and Kenora (45.6 bus.) significantly outyielded L.G. 5390 (42.1 bus.), Mengavi (42.0 bus.), VTS25380 (41.4 bus.) and Gabo (40.4 bus.).

Results of depth of sowing trials conducted at Bongeon in 1961 and 1962 showed that sowing depths ranging from 1-4 in. had no effect on yield of wheat. The result is of considerable importance from the viewpoint of wild oat control with Avadex, in cereal crops.

A series of trials at Biloela Research Station designed to investigate the effect of different methods of cultivation (tine and disc) on grain yield of wheat was completed in 1962. The series demonstrated clearly that, under the conditions experienced, both types of implement gave similar yields. Differences between the two treatments had previously been obtained at the Wagga Agricultural Research Institute.

Five field trials using zinc sprays (1 per cent. ZnSO<sub>4</sub> at 10 gal. per acre), each duplicated for wheat and linseed, were conducted on the five main soil types of the Darling Downs. Only in the Mywybilla series, where pH and phosphate content of the soil were lower than in the other soils, was no response obtained. More research is required on this problem but tentative recommendations for spraying with zinc sulphate have been made, based on development of symptoms in suggested test strips planted on farmers' properties. These recommendations apply to maize as well as to winter crops.

*Barley.*—Varietal trials at Hermitage and Jondaryan provided high yields of grain. Spartan (69.1 bus. per acre), a two row barley, and Regal (68.3 bus.), a six row barley, outyielded all other varieties in the Hermitage trial; Ablyn (62.3 bus.), Maltworthy (58.7 bus.), Abyssinian (58.6 bus.) and Research (58.4 bus.) yielded best in the Jondaryan trial.

In a Warwick district trial, nitrogenous fertilizer increased the yield of barley from 15.7 bus. per acre (control) to 45.9 bus. (1½ cwt. urea per acre) while still maintaining good malting quality. Urea at 2 cwt. per acre further increased yields slightly to 47.4 bus. but malting quality was impaired.

*Maize.*—The most serious problem facing the maize industry at the present time is the increasing incidence of tropical rust in Atherton Tableland crops. The disastrous effects which tropical rust and cob rots have on yields in this area is indicated in results obtained from Atherton district hybrid maize trials of 1961-62. Trial average was only 25.6 bus. per acre. Grafton hybrids GH170 (35.6 bus.), GH327 (30.3 bus.) and GM211 (30.0 bus.) yielded best while GH128 (19.9 bus.), the most popular hybrid in this area, turned in a disappointing performance.

During the 1962-63 season the Maize Plant Breeder stationed at Kairi Research Station produced promising rust resistant hybrids of African parentage. While this represents an encouraging start, it is pointed out that several years of careful breeding and increase will be required before suitable material is available commercially. Moreover, such a result will depend to a marked degree upon the capacity of this rust to develop new races capable of attacking hitherto resistant lines of maize.

Strain trials conducted at Kairi Research Station over the 4-year period to 1962 indicate that the best Grafton hybrids GH128 (average 68.3 bus. per acre) and GM211 (59.5 bus.) both produced better yields than the open pollinated Atherton Dent (54.3 bus.). Atherton Tableland maize farmers will have to rely for the present on hybrids such as these.

The effects of nitrogenous fertilizer, plant population and row spacing on irrigated maize in the Lockyer were again studied in trials at Gatton Research Station. In the plant population/nitrogen fertilizer trial, yields of maize increased progressively as population increased from 12,000 per acre (78.9 bus.) to 24,000 per acre (101.0 bus.). Responses to nitrogenous fertilizer were negligible at this site, which had grown lucerne 2 years earlier. In the row spacing/plant population trial (Table 2), yields were significantly higher where the lowest row spacing and higher plant populations were employed. In both trials, as the plant population was increased, the number of ears per plant and weight of grain per ear decreased, and the percentage of nubbins increased.

TABLE 2  
IRRIGATED MAIZE ROW SPACING AND PLANT POPULATION TRIAL  
GATTON RESEARCH STATION, 1962  
Yields in Bushels per Acre

Plant Population	Row Width			Average
	30 in.	36 in.	42 in.	
12,000 plants per acre .. .	67.63	66.26	67.44	67.11
16,000 plants per acre .. .	82.76	76.52	74.93	78.07
20,000 plants per acre .. .	86.00	78.33	79.48	81.27
24,000 plants per acre .. .	93.34	83.55	83.07	86.65
28,000 plants per acre .. .	89.51	91.43	87.28	89.40
Average .. .. .	83.85	79.22	78.44	80.50

*Sorghum.*—In 1962-63, for the first time, hybrid grain sorghum seed was made available commercially to farmers in Queensland. Approximately 16,500 bushels of certified seed of Texas 610, Brolga and Texas 630, were distributed for planting. On the basis of trial results to date, a general recommendation of Texas 610 for southern Queensland and of Brolga for central Queensland has been made.

A series of regional trials conducted in 1961-62 (Table 3) indicated the capacity of a number of hybrids to outyield the standard variety, Alpha.

TABLE 3  
REGIONAL HYBRID GRAIN SORGHUM TRIALS, 1961-62  
Yields in Bushels per Acre

Hybrid or Variety	District					Average	Per cent. Increase over Alpha
	Biloela	Gayndah	Kingaroy	Roma	Warwick		
Texas 610	59.1	37.4	59.6	21.4	142.1	63.9	23.0
Brolga ..	59.4	47.6	54.7	22.0	134.4	63.6	22.5
Martin x Alpha	53.3	41.6	55.8	20.7	113.5	57.0	9.7
Texas 608	59.1	28.7	54.2	12.9	125.7	55.5	6.9
Texas 630	58.8	36.9	53.6	14.7	112.2	55.2	6.2
Texas 609	55.3	32.3	43.5	16.2	123.2	54.1	4.1
Texas 650	51.9	37.2	55.7	24.2	115.8	53.0	2.0
Alpha ..	44.3	32.9	48.5	24.1	110.4	52.0	..

Further evidence of the yielding capacity of hybrids Texas 610 and Brolga is available from results of seven regional trials conducted by the New South Wales Department, using seed provided from the Queensland breeding programme. Texas 610 (53.0 bus. per acre) and Brolga (50.5 bus.) outyielded other hybrids tested. They also outyielded Alpha (39.4 bus.) by 34.5 and 28.1 per cent. respectively.

Intensive plant breeding programmes are being maintained at Hermitage and Biloela Research Stations in both grain and forage sorghums. Apart from promising grain-producing hybrids, a hybrid forage sorghum has been produced which in its initial testing proved to be at least the equal of commercial "Sudax".

*Cotton.*—At Biloela Research Station, encouraging advances have been made in the agronomy of irrigated cotton. Pre-emergence weedicide trials (reported elsewhere) have demonstrated that barnyard millet and black pigweed can be controlled economically with diuron. In defoliation trials

planted in mid-October, defoliant treatments prior to mid-March have usually depressed yields. In the 1962-63 defoliation timing trial, the March 10 treatment (1,959 lb. seed cotton per acre) was outyielded by the March 22 (2,282 lb.), April 11 (2,278 lb.), and nil defoliation (2,168 lb.) treatments. In current trials "Diquat" at  $\frac{1}{2}$  lb. per acre and "De-fol-ate" at 10 lb. also gave excellent leaf drop. Cool weather prevented efficient defoliation by "Def" and "X5" (monosodium cyanamide).

Periods of rain and overcast conditions late in the season caused serious boll rotting, which reduced potential yields from nitrogen fertilizer trials. Nevertheless, urea at 200 lb. per acre (1,884 lb.) increased yield over the control (1,355 lb.) by 39 per cent. In another trial, 200 lb. urea caused a 26.5 per cent. increase. Bottom defoliation of nitrogen-fertilized cotton failed to increase yields in the current season.

Interesting results were obtained from an irrigation timing trial. Highest yield was obtained where irrigation (total 10.87 in.) was applied when 80 per cent. of the available moisture was used from the top 2 ft. of soil (2,347 lb.). When irrigation (total 4.20 in.) was applied after plants were noted to be wilting at 9.00 a.m., a surprisingly good yield of 2,292 lb. was obtained. Even the control treatment yielded 1,764 lb., though it is pointed out that the whole area was pre-irrigated to wet the top 4 ft. of soil to field capacity.

**Tobacco.**—The Mareeba-Dimbulah Irrigation Area is the State's largest tobacco producing area with about 12,000 acres under crop. The research programme at Parada Research Station aimed at elucidating the soil moisture/soil nutrient interaction and results indicated that leaching of plant nutrients occurred under heavy irrigation (applications  $> 1$  in.). The use of fertilizers providing slowly-available nitrogen was studied as a possible solution of this problem. More careful irrigation was also recommended. In addition, methods of desuckering and Ca-Mg-P interactions were studied. A severe hail storm at Parada completely ruined all experiments depending upon plot yields of leaf.

Tobacco acreage is increasing in the Moreton area and is relatively stable in the Bundaberg area. Plant nutrition trials were conducted in both districts. Best results in the Bundaberg district were obtained with 1,000 lb. per acre of a 3-9-12 fertilizer mixture; however, in a drier season this level of nitrogen could prove too high. In the Beerwah area, the lower-nitrogen fertilizers (1-12.6-20 or 2-11.4-20) gave best results. Barn rot studies at Bundaberg showed that spores of the causal organism remained stable under normal curing temperatures. Desuckering oils studied at Bundaberg were found to possess no advantages over normal suckering methods.

Tobacco research on the Burdekin, where the acreage is declining, was concentrated on nutrition and land use studies. Fertilizers providing less than 40 lb. per acre of nitrogen gave better quality leaf and a smaller percentage of nondescript leaf. The addition of potash did not improve leaf quality in "high nitrogen" treatments. Tobacco following 3 years of Rhodes grass gave better quality leaf than after other rotations.

Water supply controls expansion in the Border Streams district, especially on the Dumaresq River where better tobacco soils exist than occur on Macintyre Brook. The chlorine problem is also more serious on farms supplied from the Brook. A rotation trial confirmed Rhodes grass (3 years) as the best pre-treatment for tobacco. In a fertilizer trial with nitrogen (10-30 lb. N per acre) and potash (0-200 lb. K<sub>2</sub>O per acre), no differences in yield were obtained, possibly due to the erratic season which provided inadequate rainfall. Methods of reclaiming hail-damaged crops and suitability of mould-resistant tobacco strains were also studied.

Co-operative trials, especially on control of blue mould and leaf miner, were carried out in association with Plant Pathology and Entomology staff respectively.

**Potatoes.**—Detailed experimental work in potatoes was confined to Gatton Research Station. Varietal testing in both autumn and spring again showed that farmer preference for Sebago was soundly based, because the variety produced good yields of high quality potatoes in both trials.

Sebago gave yields of 12.6 tons per acre of first grade potatoes for the autumn plant and 8.5 tons for the spring plant. Kennebec (12.1 and 8.7 tons), Sequoia (13.2 and 9.3 tons) and Bungama (14.0 and 11.3 tons) yielded well in both trials but the culinary qualities of Sequoia and Bungama were inferior. S2888, which was tested in the spring trial and which gave a moderate first grade yield of 6.0 tons per acre, produced potatoes with surprisingly good culinary qualities. It was the only New South Wales selection under test to show promise.

A further trial was designed to evaluate the most suitable set size, type and spacing for the variety Sebago. Whole seed of 2½-3½ oz. weight outyielded all other seed sizes at nearly all set spacings. This is in conformity with results from previous trials.

**Soybean.**—Encouraging trial results with soybean have recently been obtained from a number of centres in Queensland. In the north, three introductions from Central Africa,

Batavian Yellow, C.P.I. 15944 and Avoyelles, have performed well at Millaroo and Walkamin Research Stations. Yields from the 1961-62 trial at Millaroo and the 1962-63 trial at Walkamin were as follows:

Batavian Yellow (2,040 and 1,597 lb. per acre respectively).

C.P.I. 15944 (1,540 and 1,606 lb. per acre respectively).

Avoyelles (1,260 and 1,534 lb. per acre respectively).

In south Queensland, unnamed strains bred by the Department for use in this region have performed extremely well. They topped trials in the Kingaroy district and at Gatton Research Station while being well placed in Hermitage Research Station trials. The five best yielding varieties in each trial are listed in Table 4.

TABLE 4

YIELDS (LB. PER ACRE) OF THE BEST FIVE SOYBEAN VARIETIES IN EACH OF FOUR SOUTH QUEENSLAND TRIALS

Variety	Kingaroy I	Kingaroy II	Gatton	Hermitage
MBH 7-3-2-2-2 .. ..	1,491	977	1,455	1,289
DEH 1-2-4-3-2-1 .. ..	1,431	..	..	..
S 100 .. ..	1,410	1,001	..	..
DEH 1-2-4-2-3-4 .. ..	1,337	..	..	1,488
MBH 7-2-1-1-3 .. ..	1,319	1,035	1,704	..
Nanda .. ..	..	1,080	..	1,655
Clemson Non-shatter .. ..	..	974	..	..
Batavian Yellow .. ..	..	..	1,579	..
MBH 7-1-3-1-3 .. ..	..	..	1,287	1,333
S 999 .. ..	..	..	1,237	..
Mamotan .. ..	..	..	..	1,545

A new strain of inoculum supplied by the Commonwealth Scientific and Industrial Research Organization and tested at Hermitage Research Station gave promising results. Strains previously tested there have performed indifferently.

**Safflower.**—Several tons of Gila safflower seed made available by the Department in 1962 resulted in a commercial increase which will allow plantings of 15,000 acres to be made in 1963. Among currently available varieties, Gila has proved so outstanding in yield and oil content that varietal testing was minimised in 1962.

Safflower showed promise as a grazing crop in a 5-year trial series completed at Biloela Research Station in 1962. Under the conditions of the experiment, safflower normally gave a similar yield to oats at the time of the first grazing, but produced a higher yield at the time of the second grazing. Samples analysed chemically indicated that the feeding values of safflower and oats were similar. Oats was more palatable initially but once stock acquired the taste for safflower they ate it with relish. Further information on animal growth rate studies is being sought.

**Navy Beans.**—In a May planting at Millaroo Research Station, the variety Corvette (24.2 bus. per acre) was more upright than Californian White (24.6 bus.) and was therefore more suited to mechanical harvesting. Variety Michelite yielded 20.2 bus. A breeding programme is under way to produce varieties suitable for direct heading.

**Weed Control.**—The wild oat control programme in winter cereals on the Darling Downs continued. Avadex at  $\frac{1}{2}$  lb. active ingredient per acre increased crop yields at all times of application as a pre-emergence herbicide, and gave satisfactory control of wild oats. The post-emergence herbicide Carbyne at 6 oz. active ingredient per acre gave similar results.

Recent pre-emergence herbicide trials in irrigated cotton conducted at Biloela Research Station demonstrated that efficient control of barnyard millet (*Echinochloa crusgalli*) and black pigweed (*Trianthema portulacastrum*) can be obtained using monuron and diuron at 2 lb. per acre of area actually sprayed. In the case of diuron, highly economic returns were obtained from applications of 2 and 3 lb. At Hermitage Research Station, monuron at 6 lb. was outstanding in its control of Urochloa grass (*Urochloa panicoides*), the most serious weed pest of cotton on the southern Downs.

Control of European bindweed (*Convolvulus arvensis*) in grain sorghum was attempted with Banvel T and Banvel D (both substituted benzoic acids), applied with and without 2,4-D, to a crop of grain sorghum in the late head stage. Both weedicides gave some control but, at the maximum rate used of 1 lb. acid equivalent per acre, a complete kill was not obtained with one spraying. Significant differences between yields were not obtained but yields were generally reduced by nitrogen deficiency.

2,4-D, at  $\frac{1}{2}$  lb. a.e. per acre applied at tillering stage, is currently used as a check-smother method for controlling climbing buckwheat (*Polygonum convolvulus*) in winter cereals on the Darling Downs. A number of rates of Banvel T, Banvel D and Gesagard (a mercapto-triazine) were compared in a trial using 2,4-D amine as a control. Banvel D at  $\frac{1}{2}$  and  $\frac{1}{4}$  lb. and Banvel T at 1 lb. gave complete weed control, while Gesagard ( $\frac{1}{2}$  lb.) gave 98.7 per cent. and Banvel D ( $\frac{1}{2}$  lb.) gave 98.2 per cent. control. The standard treatment 2,4-D ( $\frac{1}{2}$  lb.) gave 81.4 per cent. control. No treatment significantly outyielded the standard 2,4-D ( $\frac{1}{2}$  lb.).

Numerous rates of Vegadex, Randox and Gesagard were used as pre-emergence treatments, and numerous rates of Banvel D and Banvel T, Gesagard and 2,4-D amine as post-emergence treatments were tested for the control of dead nettle (*Lamium amplexicaule*). Gesagard at 2 lb. a.i. per acre pre-emergence (average yield 29.3 bus. per acre) was the only treatment which significantly outyielded the control (26.2 bus.). Gesagard gave best post-emergence control of the weed but considerable crop injury resulted from  $\frac{1}{2}$  and 1 lb. applications under the conditions experienced.

**Irrigation Studies.**—In the Mareeba-Dimbulah Irrigation Area, studies on tobacco have been concerned with irrigation techniques, optimum irrigation frequencies and amounts, and with nutrient losses resulting from leaching where excessive amounts of irrigation water are applied. It has been found that at maturity 80-90 per cent. of the tobacco roots are in the top 12 in. of soil. Provided the soil is wet to 24 in. at transplanting, there is evidence that a satisfactory tobacco crop may be grown by controlling the soil moisture in the top 12 in. of soil. Surveys of commercial farms made in 1960-61 and in 1961-62, indicate that applications of irrigation water are 1½-2 times as heavy as those used in the experimental crops. These heavier waterings would accentuate leaching problems and increase production costs.

Studies to define the available soil moisture capacity of the various soils used for tobacco are being continued. This information will permit recommendations to be made for amounts and frequencies of irrigations in relation to stage of crop growth for each particular soil type. These data should reduce leaching problems and promote more efficient water use. Spray irrigation is being used more widely in this area, about 70 per cent. of the 1961-62 tobacco crop being spray-irrigated. Many of the tobacco soils have high infiltration rates and the use of spray irrigation is to be encouraged. An important aspect in planning irrigation systems is to have them designed to meet the needs of the whole farm; not merely the needs of a particular season. The irrigation studies in progress are providing data to permit the design of appropriate irrigation systems.

Time and rate of application studies were continued on irrigated potatoes. The results of the two trials undertaken this year confirmed those of previous trials in that the yields of tubers increased and the specific gravity of the tubers decreased with increasing total amount of water applied. In the autumn-1962 crop, seasonal conditions provided a long satisfactory growing period, and specific gravity of tubers in experimental and commercial areas was higher (1.098) than usual (1.065).

The efficient and effective use of irrigation water on the Darling Downs black soils is being studied from both the agronomic and the economic aspects. A survey of existing irrigation farms is being undertaken to ascertain the results obtained to date, the enterprises being followed, and the irrigation techniques being used. These heavy black soils appear to present infiltration problems of some magnitude due to their low permeability of the order of 0.10 in. per hour. The yield potential and the economic returns of irrigated grain and other crops are being investigated. These studies are particularly important in view of the irrigation water likely to be available from the Leslie Dam. To date, cotton is showing considerable promise as an irrigated crop in this area.

## AGROSTOLOGY

**Pasture Varieties.**—The range of pasture varieties available to graziers has widened in the past year. Ten varieties were formally released by the Commonwealth Scientific and Industrial Research Organization and the Queensland Department of Agriculture and Stock through the Queensland Pasture Liaison Committee. Local supplies of seed of Tinaroo glycine, Townsville lucerne, siratro and *Dolichos lablab* improved, and availability of lotononis and Cooper and Clarence glycine is expected to be better in the 1963-64 season.

Approximately 300 new introductions were distributed to Research Stations for preliminary evaluation, the emphasis being placed on legumes.

Sowings of tropical legumes continued to increase and to show promise in areas previously considered marginal. Siratro grew aggressively on a variety of soils in coastal districts, and also performed well in sub-coastal areas such as Crow's Nest, Esk, Gatton and Gayndah.

The acreage of Townsville lucerne increased substantially especially in the Rockhampton and Bundaberg districts. In a grazing trial recently commenced at Bloomsbury, yearling cattle run on Townsville lucerne/angleton grass pastures at 1.1 acres per beast grew at the rate of 1.5 lb. per day from February to May. Similar steers grazing black spear grass at 25 acres per beast showed live weight gain of 0.9 lb. per day over the same period.

Sowings of glycine also increased. At Kairi Research Station glycine showed better compatibility with green panic, Rhodes and pangola grasses than with a number of other species. Seedling vigour and autumn growth of *Dolichos*

*lablab* were impressive at many centres. Silverleaf desmodium grew well in south-eastern dairy pastures, but *Desmodium intortum* and lotononis were superior in poorly drained situations.

At Parada Research Station, emphasis is on species which may have value as standover feed in the long dry season. Pigeon pea shows promise as a browse shrub and hybridizes with the native *Alyosia grandiflora*. *Phaseolus bracteatus* and *P. leucanthus* exhibit good late season growth. Stylo and Townsville lucerne also perform well, and selections are being made from the latter.

The first cattle from a grazing trial on irrigated pastures at Parada were slaughtered in November. Carcass gradings were high, especially from the paspalum/ladino pastures. Live weight production is shown in Table 5.

TABLE 5  
LIVE WEIGHT GAINS OVER 184 DAYS, MAY-NOVEMBER, 1962,  
PARADA RESEARCH STATION

Pasture	Cool Season Stocking Rate, ac./beast	Live Weight Gain, lb./ac.
Paspalum/ladino .. ..	0.63	452
Paspalum/ladino .. ..	1.0	298
Paspalum/ladino .. ..	1.38	228
Para/centro .. ..	0.94	333
Para/centro .. ..	1.50	167
Para/centro .. ..	2.06	128
Pangola/centro .. ..	1.0	255
Pangola/centro, plus nitrogen ..	1.0	276

The use of vetches as a late winter-spring supplement for dairy stock is increasing. The 1962 yields from a trial at Pimpama, near Brisbane were:

TABLE 6  
DRY MATTER YIELD LB./AC. FROM VETCHES

Management Treatment	Purple Vetch	Lana Vetch
One cut .. ..	6,270	9,860
Two cuts .. ..	4,700	3,360

At South Johnstone, the creeping *Vigna marina* was noted for its early vigour, good vegetative characters, heavy nodulation and free-seeding habit. Of the grasses, *Brachiaria ruziziensis* appeared superior to other members of the genus, and also matured a heavy seed crop. Elephant grass selection studies continued and three varieties, of many established from seed, breed true to type.

Burnett Makarikari grass continued to outyield green panic at Brian Pastures and displayed good frost tolerance and winter greenness.

Pasture work is also proceeding in the more inland areas of the State. Exceptionally heavy rains in the Roma, Charleville and Blackall districts brought about a tremendous improvement in all established buffel grass stands, while germination and growth of new sowings were very good.

**Pasture Nutrition.**—In the Brisbane and Cooroy districts, studies on the effect of applied nitrogen and phosphate on yield and composition of dairy pastures continued. At Mt. Mee, Rhodes grass showed marked growth responses to applied phosphate with or without added nitrogen.

TABLE 7  
RHODES GRASSES YIELDS LB./AC., MT. MEE

—	No Phosphate	3 cwt./acre Superphosphate
No sulphate of ammonia .. ..	2,870	4,190
2 cwt./ac. sulphate of ammonia ..	3,770	6,070

At Pimpama, a factorial fertilizer trial on white clover showed marked yield responses to superphosphate at 4 cwt. and lime at 10 cwt. per acre. No significant responses to potash or molybdenum were recorded.

Two nitrogen recovery trials involving paspalum (Rocklea) and kikuyu (Tamborine) are now in their third year. Continued yield responses to sulphate of ammonia up to 6 cwt. per acre have been recorded, but the overall yields of kikuyu at all levels of applied nitrogen have declined considerably over the second and third years on the Tamborine kraznozem soil.

The effect of applied nitrogen and phosphate on the comparative yields of paspalum and mat grass in a sward previously dominated by mat grass is being studied at Beechmere. Applied nitrogen substantially increased the total yields of forage, increased the percentage of paspalum in the pasture and decreased the percentage of mat grass. Under heavy



cutting the response to 200 lb. nitrogen per acre was 3,450 lb. dry matter in paspalum and 50 lb. in mat grass. Under lenient cutting, the response was 2,900 lb. in paspalum and 940 lb. in mat grass. Applied nitrogen reduced the clover contribution. Applied phosphate increased the percentage of white clover in the pasture (from 15 per cent. without phosphate to 38 per cent. at 100 lb. P<sub>2</sub>O<sub>5</sub> per acre) in the absence of applied nitrogen and under the heavy cutting system. More forage was harvested by mowing regularly at 1 in. than by mowing at 6 in. above ground level. Similar observations have been made on paspalum at Rocklea.

Complementary work at Cooroy has indicated that, in spite of the nitrogen growth response pattern described, there has been no basic change in the basal ground cover of the grass species after 3 years.

The increasing importance of applied molybdenum to pasture legume growth is a feature of work on Cooroy soils, especially in relation to glycine and white clover.

Legume nutrition studies with Tableland soils at Kairi Research Station were concluded. An examination of results from a pot trial showed that stylo and *Desmodium canum* gave low yields and responded little to applications of phosphate and lime. On the other hand, glycine, siratro and *Desmodium intortum* gave linear responses to phosphate up to the equivalent of 8 cwt. superphosphate per acre. Glycine required lime whereas *Desmodium intortum* grew well on unamended soils. The high competitive capacity of grass for phosphate is considered an important factor in determining glycine/grass balance in pastures.

Data were collected on nitrogen yields and nitrogen transferred from legume to grass in green panic/glycine associations grown in drums on red volcanic clay loam soils at Kairi. The underground transfer of legume nitrogen to grass, under a system where shoots were cut and removed, amounted to about 4 per cent. of the nitrogen taken up by the legume in mixed pasture. The associated grass depressed the yield of legume nitrogen by 10 times the amount transferred to the grass. The presence of the legume increased the yield of nitrogen in the leafy shoots of the grass by 100 per cent. Total soil nitrogen increased under the mixture by about 0.01 per cent. over the 2½-year period of the experiment.

At Brian Pastures the effect of applied nitrogen on mixed green panic/legume swards was studied in the field. The presence of legume (lucerne or siratro) increased the total pasture yield of crude protein in the absence of applied nitrogen, but reduced the pasture response to applied nitrogen in terms of both dry matter and protein yield.

At Millaroo, on Burdekin flood plain soil, evidence of a phosphate/molybdenum interaction was recorded with siratro. (Table 8).

TABLE 8  
DRY MATTER YIELD OF SIRATRO, LB./AC., MILLAROO

	No molybdenum	Molybdenum added
No phosphate .. .. .	391	466
Phosphate added .. .. .	508	761

Further work confirmed the responses to phosphate obtained at Echo Plains, near Tully, and indicated that shortage of zinc may also be limiting centro growth.

Investigations into the use of nitrogenous fertilizer on grass stands at South Johnstone indicated that nitrogen is the primary factor limiting growth, and that restricted moisture limits growth for only short periods during the year. The yield response to nitrogen of a *Brachiaria decumbens* pasture was near maximal at 650 lb. nitrogen per acre per annum. At this rate of application, dry matter production was 24,500 lb. per annum under a 4-weekly cutting treatment. The protein yields of *B. decumbens* continued to increase up to the 1,300 lb. nitrogen per acre per annum rate. More efficient use of nitrogen was obtained from the 325 lb. nitrogen rate, where 55 per cent. of the applied nitrogen was recovered in the plant tops.

*Pasture Establishment.*—At Brian Pastures, the optimum sowing depths on both light and heavy soils were ½ in. for Townsville lucerne and fine-leaved stylo, and ¼-½ in. for stylo. The establishment of fine-leaved stylo was favoured by cultivation treatments involving minimum ground disturbance; this may be associated with a compact seedbed in a season of poor rainfall.

Techniques of establishing tropical legumes in perennial grass swards are being evaluated at Cooran. The seedling vigour of siratro makes it outstanding under all methods of establishment. Tinaroo glycine establishment was good under cultivated conditions, fair in pasture sprayed with chemical desiccant, but poor in "rotovated" strips with fertilizer broadcast rather than drilled beneath the seed.

At the Millaroo Research Station, legume establishment has been difficult to achieve on the heavy flood-plain soils. This problem has been overcome by sowing the seeds on large ridges about 6 in. high. Experiments laid down on Barratta, Oaky and Dowie soil types on slopes varying from ¼-5 in. per 100 ft. showed that for siratro, centro, glycine and stylo, sowings on large ridges were superior to those on small ridges (2-3 in. high) or conventional seeding.

*Pasture Management.*—The value of supplementary grazing lucerne was demonstrated in the first year's results from an experiment at Texas, where wool yields and stocking rate were increased without detriment to wether body weight (Table 9).

TABLE 9  
WOOL WEIGHTS FROM NATIVE PASTURE, WITH AND WITHOUT LUCERNE, TEXAS

Treatment Acres per Sheep		Fleece Weight lb.	Wool per Acre lb.
Native Pasture	Lucerne		
2.0	Nil	7.7	3.8
1.0	Nil	6.8	6.8
0.83	0.17	8.5	8.5
0.55	0.11	8.0	12.0

At Brian Pastures, a grazing trial examining various methods of native pasture management was concluded. Animals grazing land on which ¼ of the area was devoted to lucerne gained 158 lb. live weight per head per annum more than animals grazing native pasture alone. This increased gain is referable to 1 acre of lucerne. The advantage was greater in poor years, and the system provided cattle ready for slaughter in the spring and early summer. Some data are summarised in Table 10.

TABLE 10  
NATIVE PASTURE MANAGEMENT TRIAL, BRIAN PASTURES; 1958-1962 INCLUSIVE

Treatment	Live Weight Gain per Head per Annum Lb.
Continuous grazing .. .. .	187
Rotational grazing .. .. .	140
Slashing and deferred grazing .. .. .	109
Chisel renovation .. .. .	229
Supplementary winter lucerne .. .. .	345

Other experiments at Brian Pastures are concerned with increasing stocking rate on native pasture grazed in summer-autumn only, and carrying cattle for the remainder of the year on grass/lucerne pastures reserved for this purpose. In the 1962-63 summer, grazing at 3.3, 2.0 and 1.0 acre per yearling steer resulted in live weight gains of 138, 142 and 34 lb. per head respectively.

At Utchee Creek near South Johnstone, cattle grazing guinea/centro pastures continued to benefit from rotational grazing. For the period January 1962 to January 1963, pastures rotationally grazed at 0.53 acre per beast yielded 529 lb. live weight per acre compared with 444 lb. from continuously grazed pastures.

The susceptibility of Townsville lucerne to shading was well demonstrated in an experiment at Mackay (Table 11).

TABLE 11  
TOWNSVILLE LUCERNE YIELDS AT DIFFERENT LIGHT VALUES, MACKAY

Light Values Fraction of Full Daylight	Yield, gm./pot
1.0	16.4
0.74	8.8
0.54	6.1
0.38	3.3

Shading did not reduce nitrogen concentration in roots or tops, but total nitrogen uptake was substantially lowered.

In the gidyea scrub lands where buffel grass sowings have been so successful, the major problem is the regrowth of false sandalwood (*Eremophila mitchellii*). A systematic property survey indicated that the incidence of the problem is inversely related to the severity of the firing of the pulled scrub.

## HORTICULTURE BRANCH

Highlights of the work of the Horticulture Branch during the year were:—

The transfer of the former C.S.I.R.O. Field Station at Applethorpe (and staff) to the Department of Agriculture and Stock. This will permit the integration of research programmes formerly carried out in the district by State and Commonwealth bodies. It will also lead to better liaison with industry. The Station will, in future, be known as the Granite Belt Horticultural Research Station.

The release for commercial trial of three stringless bean selections bred at the Redlands Horticultural Research Station. These new varieties have resistance to rust and a cropping potential which is at least equal to that of string bean varieties grown at the present time. Acceptance by industry will depend on consumer reaction to stringless beans, a commodity which is virtually unknown on Queensland markets.

The accurate assessment of the water and nutrient requirements of the pineapple plant from the time of planting to harvesting of the plant crop. Data from the Pineapple Research Laboratory suggest the possibility of equating fertilizer applications with the actual needs of the growing plant.

New light has been thrown on the phosphorus requirements of the tomato plant. Adequate phosphorus nutrition in the seedling stage confers on the plant an advantage which persists through the cropping period. Fertilizer placement is also critical, particularly during the winter and spring months when climatic conditions are not conducive to rapid root elongation.

### DECIDUOUS FRUITS

Nutrition trials in deciduous fruits are long-term projects because nutrients are stored in the woody tissues and deficiency symptoms may not become apparent for many years after the annual uptake has fallen below maintenance levels. Conversely, once deficiency symptoms appear, the response of the tree to applied nutrients is slow and several years may elapse before normal growth is resumed. It is not surprising therefore that field trials are often unsatisfactory. However, it has been established that adequate supplies of nitrogen and potassium must be maintained for normal growth in the apple. No response to phosphorus has yet been recorded, even though the quantities available in Granite Belt soils are frequently low.

Stock-scion work in the apple is being intensified even though Merton 778 and Merton 793 are reasonably satisfactory for most purposes. The more promising of the Malling-Merton (MM) stocks have been established at the Granite Belt Horticultural Research Station. Current policy is to include the best of these in trials both at the Granite Belt Station and on growers' properties throughout the district.

Some varieties of apple, notably Granny Smith, are notoriously subject to the disorder known as "staginess" in which renewal growth is insufficient for optimum lateral and spur cropping. Recent investigations suggest that gibberellin sprays (400-500 ppm.) applied at bud burst may be the answer to this problem though responses differ from variety to variety. Gibberellin promotes new leader growth which appears normal.

The apple industry has treated the Departmental recommendation of 2,4,5-TP as a pre-harvest drop spray with some caution because of possible adverse effects on the storage life of the fruit, particularly in the variety Delicious. Investigations recently completed in conjunction with the Food Preservation Research Branch have shown no significant differences between NAA, the material currently used, and 2,4,5-TP on the storage life of the fruit. Growers can therefore use 2,4,5-TP as a pre-harvest drop spray with confidence; it is more effective than NAA and particularly suited for use in the varieties Gravenstein and Delicious which are very subject to pre-harvest drop.

NAA is commonly used as a chemical thinner for apples but results are variable and over-thinning is not uncommon. Sevin promises to be a safe alternative when used at concentrations of 800 ppm. either alone or in association with insecticidal sprays. It has the merit of being less drastic than NAA and treatment can, if necessary, be delayed until the risk of damage from late spring frosts has passed.

In a soil management trial at Stanthorpe, differences in tree growth are very marked. Trees grown under a clover sod are unthrifty while those under a straw mulch are vigorous, with ample leader development. Trees under a soil management system combining clean cultivation with annual green manure have made satisfactory growth after an indifferent start, and current leader increments are comparable with those from the straw mulched trees. The technical data from this trial indicate that leader growth in the respective treatments is directly correlated with the availability of soil moisture during the spring and early summer months.

### PLANTATION FRUITS

*Pineapples.*—The new fertilizer schedule based on the use of a 0-4-37 pre-planting fertilizer mixture followed by regular applications of sprays containing urea has proved useful on the heavier textured soils containing reserves of nitrogen. On some of the lighter soil types, however, growth has been less satisfactory and leaf analyses indicated deficiencies of nitrogen (and possibly potassium) shortly before the plant crop was harvested. The fertilizer schedule has therefore been amended to provide for either: (a) more frequent urea sprays; or (b) supplementary side dressings of sulphate of ammonia or a 10-6-10 mixture when visual symptoms of nitrogen deficiency become apparent.

Some of the clones from the Maroochy Horticultural Research Station combine the attributes of high yield and superior fruit quality, the most promising being clones 13, 22 and 23. The formal trials at the Research Station have been supplemented by regional tests in various parts of the State and on a range of soil types and under a range of climatic conditions. These will permit technical evaluation to proceed concurrently with industry appraisal of the material. The selection of types to be bulked for commercial production will be made in consultation with cannery authorities.

Growth studies at the Pineapple Research Laboratory on the Research Station indicated that the uptake of nitrogen and potassium is very rapid between October and early April and, that, after the expected time lag, plant growth shows a corresponding increase. On the other hand, phosphorus uptake is greatest between February and June. The pattern of water and nutrient utilization by the pineapple plant has been defined with some precision. As fertilizer programmes should, where practicable, be equated with nutrient uptake, modification in the current fertilizer programme suggested by the data is to be checked in the field.

Water utilization studies carried out concurrently with nutrient investigations indicated that a pineapple plant uses about 0.13 gm. of water per gm. dry weight per month. Calculations suggested that the total water requirement up to fruit formation in the plant crop amounts to some 13 acre inches. To this must be added evaporation losses from the soil and losses by infiltration through the profile. It has further been noted that root development can proceed in southern Queensland during the winter months, provided soil moisture is adequate. These findings indicate the advantage of supplementary irrigation on the lighter soil types during prolonged dry weather.

Diuron is now well established as a weedicide in pineapple plantations. Though no ill effects on the crop have been recorded to date, there is a contingent possibility that residues may build up to harmful levels in the soil. Accordingly, the significance of residues is being investigated with the assistance of two indicator plants, water cress and sunflower. The water cress is more sensitive, and phytotoxic symptoms have been noted some 5 months after application of diuron at the rate of 4 lb./acre in a heavy rainfall area.

BOH (beta hydroxyethyl hydrazine) showed considerable promise as a flower inductant in the 1962 trials, when used at concentrations ranging from 2,000-3,000 ppm. It is potentially useful for application during the late summer when NAA is notoriously unreliable. Clearance for commercial use has been deferred until phytotoxicity studies are completed.

*Bananas.*—Nutrition studies in the banana continued to emphasise the importance of potassium for normal growth in all of the major producing districts.

In north Queensland, it has been established that the disorder known as "yellows" is corrected by the application of high potassium fertilizers such as a 4.5-9-22.5 mixture. As potassium nutrition reaches normality, the ability of the plant to utilize nitrogen improves but deficiency symptoms of magnesium may develop. This must be corrected by the soil application of magnesium, preferably in the form of dolomite.

A somewhat similar disorder has been investigated at the Redlands Station in a joint project with the Entomology Branch. Leaf analyses indicated that potassium uptake is increased by pre-planting soil fumigation on some soil types. It is, therefore, assumed that nematode infestation reduces the uptake of potassium but this has yet to be confirmed. However, irrespective of soil type, the manganese content of the leaf tissue was also increased by soil fumigation, sometimes to levels which were near-toxic.

The Cavendish strain trial established in 1960 was abandoned shortly after the commencement of bunching when a correlation was established between erratic plant growth and burrowing nematode populations. A duplicate trial was therefore planted in 1963 after preplanting fumigation with EDB. The strike was somewhat irregular but generally better in selected strains than in the standard type of Cavendish.

Trials were initiated to determine the value of some new weedicides as possible replacements for the arsenicals used in banana plantations. The most recent of these is now approximately 12 months old. Initially, Fenac at 10 lb./acre appeared the most promising but, recently, abnormalities in plant growth were observed in the treated plots. At present, it appears that a mixture of aminotriazole and 2,2-DPA could be commercially useful. However, on the steep slopes of southern Queensland where soil erosion is a problem, complete control of weeds may be undesirable. A soil management programme which keeps the plant rows free from weeds, and gives control of weeds in the contour inter-row spaces may be preferable. Aminotriazole + 2,2-DPA or alternatively, a desiccant such as paraquat could be used in these inter-row strips.

**Papaws.**—The breeding programme at the Maroochy Station is currently limited to the maintenance of a range of parental material for crossing purposes. Potentially useful hermaphrodite types include Solo selections from Hawaii, a local selection with possible resistance to die-back, and Guinea Gold. The dioecious types grown commercially fall into three distinct groups—Yarwun, Sunnybank and Brookfield—the individual characteristics of which reflect marketing requirements in the district concerned. The narrowing of the phenotype in the Sunnybank strain is a major commitment at the Redlands Station. Current selections are now in the F3 generation and some are outstandingly uniform, highly productive and suitable for both the fresh fruit market and canneries. Seed from these lines is now being supplied to the near-Brisbane districts for industry appraisal.

In spacing trials at the Redlands Station, maximum production was recorded from crops grown in rows 8 ft. apart with the plants initially spaced at 2 ft. in the row and subsequently thinned to 4 ft. at flowering. Given supplementary irrigation during dry weather, this spacing produces mainly cannery quality fruit in the first crop and medium sized fruit which is better suited for the fresh fruit market in the second and subsequent crops.

Methods of propagating papaws were investigated at the Maroochy Station. Germination and seedling establishment varied with the type of container used and were less satisfactory in earthenware pots than in malthoid or fibre "jiffy" pots. The factors responsible for differential germination and growth in the several containers have yet to be determined but moisture relations are obviously important.

Weedicide trials in papaws at the Redlands Station indicated that diuron may have a place in the weed control programme. When used at rates of 2-4 lb. per acre as a pre-emergent weedicide in established plantations, the more troublesome broad-leaved weeds were suppressed for periods up to 12 weeks and annual grasses were reasonably well controlled. Though unsuitable for use as a pre-planting weedicide, diuron may be used in established plantations at least on an experimental scale.

### TROPICAL AND SUBTROPICAL TREE FRUITS

**Citrus.**—The citrus stock-scion trials established during the past 3 years have made satisfactory progress. In some areas, initial growth was erratic because of dry weather or excess amounts of salt in the irrigation water. Further stock material has been obtained which may be of commercial value for its resistance to *Phytophthora* root rot and burrowing nematodes. These new stocks will be used in a supplementary series of stock-scion trials now being planned.

In an Ellendale mandarin nutritional trial at Gayndah, nitrogen levels in the leaf tissue were proportional to the amounts of nitrogen applied but there was no firm correlation with yields. Yield data from this and other nutrition trials during the past 5 years have been complicated by excess salt in the irrigation water; levels ranged from 0.6 to 2.0 per cent. which is high by accepted standards. Heavy rains were recorded in most citrus districts during 1962-63 and the consequent leaching of salt from the soil together with the improvement in water quality should make future experimental data more amenable to interpretation.

**Avocado.**—The avocado orchard at the Redlands Station contains a representative series of stock-scion combinations of commercial interest in Queensland. However, some 15 per cent. of the trees have either died from, or are showing symptoms of, *Phytophthora* root rot. The setback followed excessively heavy rains during the summer months and indicates the precarious foot-hold of this industry in Queensland. It appears that future plantings should be restricted to deep sandy loams in relatively light rainfall areas where irrigation facilities are available.

Fruit development in the avocado was also investigated at the Redlands Station in conjunction with the Food Preservation Research Branch. The experimental data suggested that times of fruit maturity are influenced by the size of the crop on the tree and water regimes during the later stages of fruit development. Early cropping is characteristic of trees carrying a light crop, and vice versa. These findings suggest that thinning of the crop could be desirable if it enables the grower to market a sizable portion of the crop on early high-priced markets.

**Macadamia.**—The demand for scion wood of the several strains of *Macadamia* established at the Maroochy Station exceeds the available supply. This demand is associated with an imminent break-through in propagation techniques by two major nurseries. Successful propagation of grafted trees in Queensland apparently depends on these factors: (a) a suitable potting medium; (b) grafting during the winter months; (c) careful matching of the stock and the scion; and (d) meticulous after-care of the graft. The type of graft is of secondary importance but after-care of the graft will possibly involve propagation under glasshouse or near-glasshouse conditions where water stress and wind stress can be kept to a minimum. In general, *integrifolia* strains are more easily grafted than *tetraphylla*; some of the latter are, in fact, extremely difficult to handle.

To date, selection has been based primarily on nut characteristics; little or no data are available on yield, consistency of bearing and tree shape, all of which can be important in the orchard. It will, therefore, be necessary to establish formal trials to determine the overall performance of the better strains under reasonably good orchard management. One of these will be located at the Maroochy Station.

**Custard Apple.**—In the custard apple stock-scion trial at the Redlands Station, zinc deficiency symptoms have become pronounced, and routine corrective methods have been only partially effective. Repeated applications of foliage sprays have failed to restore growth to normal unless preceded by severe pruning.

Fruit set in the orchard is only fair in the custard apple even when soil moisture is maintained at acceptable standards. Gibberellin sprays applied prior to bud burst improved fruit set in one trial but most of the parthenocarpic fruit fell from the tree when approximately 2 in. in diameter. Further trials with growth promoting substances are planned.

**Mango.**—Several mango varieties were introduced to Queensland during the year. These included polyembryonic and momoembryonic types of potential commercial value. All were channelled through post-entry quarantine at the Redlands Station where seedlings are raised and/or grafting is carried out. The introduction programme is designed to supply a good quality, early maturing mango, particularly for the Burdekin district where climatic conditions are favourable for commercial production. Types of special interest are Manzano, Karutha Colomban and Neelam.

### MISCELLANEOUS CROPS

**Passion Fruit.**—The passion fruit breeding programme is designed to produce varieties with resistance to fusarium wilt and a fruit quality comparable with that of *Passiflora edulis*. Selections from *P. edulis* x *P. edulis* forma *flavicarpa* are now in the F4 generation but fixation of the desired characteristics is presenting difficulties. However, commercial utilization of hybrid material is proceeding concurrently with the formal project with promising results.

Some of these hybrids crop more consistently than either of the parents, and the flowering pattern is rather different. Such characteristics have a monetary value. For example, growers supplied with selections from the first back-cross generation find the plants a better commercial proposition than grafted *P. edulis* in spite of variability in the plant type. Cropping is consistent, yield per acre is good and the fruit is acceptable to processors. Moreover, a proportion of the crop is harvested when markets are under-supplied with fruit, and overall returns to the growers are correspondingly high. The hybrid lines have a further advantage over *P. edulis* in that the bulk of the fruit develops normally in vines showing quite severe symptoms of woodiness.

**Strawberry.**—In the strawberry breeding programme, parental material was evaluated, and types selected for hybridization. The more promising parents were Majestic, Marion Belle and Phenomenal. Large numbers of seedlings are raised annually at the Redlands Station; 26 were retained from the 1963 season for propagation and these included a range of diverse types showing material differences in fruit quality and disease resistance. The programme is based on purification of the parental lines by inbreeding, followed by hybridization between lines to obtain the normal accession of vigour in the progenies from which types will be selected for commercial propagation.

**Ginger.**—Ginger spacing trials at Nambour demonstrated that, providing soil moisture is adequate and weeds are effectively controlled, crop yields are directly proportional to plant spacings up to the equivalent of 2 ft. between rows and 9 in. between plants in the row. Even closer spacings could probably be used commercially if the necessary adjustments can be made to existing tillage, mulching and harvesting practices. The associated increase in the cost of planting material may compel growers to use "seed" pieces smaller than the conventional 2 oz.

## VEGETABLES

**Tomatoes.**—The plant improvement programme in tomatoes is concerned with: (a) the production of new varieties possessing climatic adaptability and disease resistance; and (b) the development of better F1 hybrids for use in the winter crop at Redlands. Parental material includes the varieties Q1, Q3 and Q5 which are grown commercially in Queensland and a series of introduced varieties such as STEP 305, Manalucie, Pearson VF 6, and Manipal with characteristics of potential value. Some of the advanced progenies are currently under regional trial in the major producing districts.

Research in tomato nutrition at the Redlands Station suggests that, in the red-brown loams, high levels of phosphorus are needed for normal seedling development particularly during the winter months. For optimum results, therefore, a basal fertilizer high in phosphorus must be banded close to, and just below, the seed at the time of planting even in soils which are, by conventional standards, adequately supplied with this element.

In some districts, notably at Redlands, symptoms of nutritional disbalance are becoming increasingly common in the tomato crop. Glasshouse studies and the associated field trials leave no doubt that, except perhaps in very wet seasons, satisfactory crops can be grown with less basal fertilizer and little, if any, side dressing of fertilizer; nitrogen and potassium supplied in the basal dressing are adequate for normal growth once the plants are established in the field. New fertilizer recommendations will shortly be issued in which the basal dressing will not exceed 6 cwt. of 5-16-5 mixture.

Using radio-active phosphorus, it was demonstrated that, in the red-brown loams, little of this element is available to the tomato plant. However, phosphorus applied to soils already well supplied with this nutrient is not only accepted by the plant but also makes available soil phosphorus which would not otherwise be utilized. The response to applied sulphur recorded in some experiments is apparently due, less to a deficiency of this element, than to the increased quantities of phosphorus made available to the plant through increased acidity of the soil.

Tissue analyses of plants grown in soils at various degrees of compaction indicated that uptake of calcium, potassium and sodium increases with soil density. Conversely, uptake of phosphorus is decreased. In high density soils, morphological changes in the root system were also recorded; root extension was retarded, the roots became flattened and the arrangement of the conducting tissue showed abnormalities.

**Beans.**—Selections 627-1, 626-E-1, and 744 from the stringless bean breeding programme were released to the industry for appraisal. The first two of these selections are highly rust resistant, while 744 has commercial resistance to the disease. On their past performance at Redlands Station, all three strains should perform well, given reasonably good growing conditions. However, like other stringless bean varieties, they have less tolerance to cold than most varieties of string bean.

Parental material with climatic adaptability is available but, without facilities for the quick testing of progenies, progress is necessarily slow. At present, appraisal of progenies for cold tolerance is based on their performance in regional trials and in trials in the one area at different periods of the year. The work will be accelerated when the growth chamber currently on order becomes available.

A wide range of navy bean selections derived from Actopan X Senelac is available for field appraisal at Kingaroy. These all have commercial rust resistance and agronomic characteristics at least equal to those of existing commercial varieties. However, all commercial varieties have some defects in both plant type and processing quality. Steps have therefore been taken to produce superior types from the wide range of parental material collected during recent years. Some 150 white-seeded lines from various crosses were selected in the F3 generation for planting in 1963.

**Other Vegetables.**—Although peas are a relatively minor crop in Queensland, attention has been focussed on the crop by the excellent laboratory appraisal of selections from the breeding programme at the Redlands Station for both canning and deep-freezing. In coastal southern Queensland, the length of the growing period and the production potential are influenced by times of planting. Current investigations are, therefore, mainly concerned with crop performance in plantings made at regular intervals from March onwards. The work is directed from the Redlands Station.

Some anomalies in plant response to applied molybdenum have been recorded in tomatoes and lettuce. Recent investigations suggest that these may be linked with manganese toxicity, at least on certain soil types. In pot cultures, symptoms similar to those normally associated with molybdenum deficiency were noted in plants grown in nutrient solutions containing high levels of manganese. Current investigations should establish the significance of this finding in commercial practice.

Rotation trials at the Redlands Station have demonstrated the importance of applied phosphorus and green manures for efficient land use in vegetable growing areas. Significant responses to both treatments were recorded. Though the data are not conclusive, they suggest that phosphorus utilization by crops such as lettuce and cucumbers is improved where a green manure is grown each year during the off season.

Weedicides are seldom used in commercial vegetable crops other than carrots because of the associated risk of damage to the plants. The position is unlikely to change until such time as more information is available on the reaction of individual crop and weed species to particular weedicides. Current work at the Redlands Station has shown that: (a) operational hazards with most weedicides increase with rising temperatures; (b) lettuce show a considerable tolerance to substituted ureas such as monuron; and (c) no one weedicide is capable of handling all weed problems in areas with different weed associations.

## SERVICE PROJECTS

**Bananas.**—The incidence of bunchy top infected plants was higher than usual, subsequent to the heavy rains in December and January. However, the proportion of diseased plants recorded for the year was only 4 per million of the total number of plants and had no appreciable effect on production. In two areas—Victoria Point and Rochedale—the outbreaks were slow to subside and this involved close supervision of eradication measures.

The position is complicated by the recent trend to close planting which makes detection of bunchy top plants more difficult. The Banana Industry Protection Board feels that the disease merits further investigation. Existing control measures are based on work carried out in the 1920's and research may suggest ways and means by which eradication can be achieved.

**Citrus.**—The demand for both budwood and seed under the Citrus Budwood Distribution Scheme was higher in 1962 than in the previous year. Some 126,125 buds were distributed to nurseries. A noteworthy point was the large orders placed for Washington navel orange budwood. This may reflect developments in irrigation along the coast; navel oranges are less tolerant to water stress than other citrus varieties.

The demand for Ellendale and Glen Retreat mandarin budwood also showed an increase. The renewed interest in Glen Retreat was surprising, as this variety, in spite of its excellent quality fruit, is difficult to handle in the orchard. Seed distribution amounted to 288 lb. including sweet orange, 152 lb.; citronelle, 104 lb; and Emperor mandarin, 32 lb.

**Bean Seed.**—Seed produced under the Bean Seed Approval Scheme amounted to 22,304 bus. from some 1,440 acres registered for inspection. This represents an average yield of about 15 bus. per acre. The bulk of the seed was grown in the lower Burdekin district where seasonal conditions were generally favourable. Merchants currently hold carry-over stocks for the 1963-64 season. It should be noted that production is now sufficient to meet about 70 per cent of Australian requirements.

**Tomato Seed.**—Three Stanthorpe growers collaborated with the Department in the production of certified tomato seed of the varieties Q1, Q3 and Q5. Production amounted to: Q1, 5,166 oz.; Q3, nil; Q5, 98 oz. The Q3 crop was rejected for certification following an outbreak of bacterial spot and the consequent shortage of seed of this variety could have repercussions on the tomato industry in north Queensland. Precautions have been taken to ensure that certified seed will be free from mosaic, a disease of considerable economic importance on the coast. Treatment involves dipping in a solution of sodium triphosphate.

**Strawberries.**—Strawberry runners were produced by three growers in 1962 under the Strawberry Runner Approval Scheme, and some 300,000 were sold for the 1963 planting. The demand exceeded the supply and the available runners had, therefore, to be allocated on a quota basis. The Scheme provides reasonable sureties that the runners are free from the more important virus diseases associated with the crop. Guarantees of absolute freedom from disease, however, presuppose the laboratory and glasshouse screening of mother plants, their subsequent increase under supervision in isolation and final bulking up for commercial plantings. Facilities for effectively screening mother plants are now available at the Redlands Station.

## EXTENSION

No major developments occurred in the extension programme during the year. Routine services were maintained in spite of complications caused by transfers of senior personnel. The work followed the usual pattern with farm visits, group discussions and field days, in that order of importance.

Institutional and grower demand for information on nursery, gardening and lawn management problems continued to present a problem and some time must necessarily lapse before the floricultural unit can adequately cope with its assignment. With the expanding inter-State market for nursery stock of ornamental plants, work in this field cannot fail to be productive.

The training of district extension staffs in packing methods has simplified the Branch commitment to school packing classes. The growing trend for schools to compete in special sections at the more important Agricultural Shows does much to foster an interest in efficient packing throughout the producing districts.

Of the several field days held during the year, possibly the more successful were those arranged by industry organizations. Particularly noteworthy in this connection were the bi-annual field days held at the Committee of Direction's Beerwah farm where improvements in pineapple production methods suggested by the research programme at the Maroochy Station are demonstrated. Talks and discussions are maintained at a high technical level.

District extension projects which required a considerable amount of attention during the year were: (a) fertilizer schedules for pineapples on various soil types (Nambour); (b) control measures for yellows in bananas (Innisfail); (c) harvesting and packing for export (Stanthorpe); (d) new fertilizer schedules for tomatoes (Redlands); (e) correction of salting in citrus (Maryborough); (f) crop control in pineapples (Rockhampton); (g) tomato varieties (Dry Tropics); (h) alternative tree fruits for north Queensland (Cairns).

The several advisory committees functioned satisfactorily and grower members effectively carried out their liaison obligation to the various C.O.D. Sectional Groups which they represent. Branch relations with industry organizations are excellent and this can perhaps be attributed to the fact that, through these committees, the industry is kept informed on Departmental programmes of work.

### HORTICULTURAL RESEARCH STATIONS

The Research Stations are committed to full research programmes in fruit and vegetable crops. These programmes are, however, changing because modern research work places considerable emphasis on environmental control. To achieve this, adequately equipped laboratories and glasshouse facilities are a necessary adjunct to field trials.

The Maroochy Station is interested principally in plantation crops such as pineapples, bananas and papaws. Current projects in these crops deal with soil management, crop management, tillage practices and plant improvement. The new Pineapple Research Laboratory on the Station makes technical service of nutritional and some other types of field trial much more effective than in the past. The limited water supply for irrigation is still a handicap to the development of some projects.

The Redlands Station is now fully staffed with a balanced team of horticulturists, plant breeders and plant physiologists working on vegetable crops. Water supplies for irrigation are below requirements, and allocations to projects had to be rationed during the dry spring and early summer months. With the recent extension of the machinery shed, equipment is now adequately housed. An insect-proof enclosure was installed to facilitate the screening of strawberry mother plants for virus diseases.

The Granite Belt Station at Applethorpe will be developed as a centre for deciduous fruit research. At present, plans are in train for the erection of central laboratories to house research personnel in the several Branches of the Division of Plant Industry associated with pome fruits, stone fruits and grapes in the Granite Belt. The apple root stock projects initiated by the Commonwealth Scientific and Industrial Research Organization will be expanded as facilities permit.

Kamerunga Station is the headquarters for horticulture and plant pathology staffs working on fruit and vegetable crops in north Queensland. A new office-laboratory building is to be erected during the coming year.

### PLANT QUARANTINE

Phytophthora root rot continued to be a problem in citrus nurseries, and restrictions had to be placed on the movement of trees from another nursery. A solution to this problem will probably involve routine fumigation of the soil with chloropicrin or alternatively, container propagation in sterilized soil. Either procedure should lessen the risk of introducing the disease to areas which are currently free from infection.

Restrictions on the importation of seed in bulk for sowing have again been tightened up. Introductions will be sanctioned only when the variety or strain is not represented in Australia and even then, only nucleus quantities will be permitted entry. This policy is dictated by the need for efficient servicing of the material in post-entry quarantine.

A quarantine house is to be erected at Indooroopilly to handle ornamental and other plants introduced under permit by importers who do not have the requisite post-entry quarantine facilities. Plans have been completed and construction is about to begin.

Pin-hole borers are commonly found in sawn timber from Asian countries when shipments arrive in Brisbane. Much of the timber is shipped "off saws" without prior seasoning. Fumigation with methyl bromide is prescribed for sawn timber with a moisture content in excess of 40 per cent.

The number of second hand cars entering Queensland ports from overseas continued to increase. They are frequently contaminated with soil and must be cleaned as a precaution against the entry of nematodes and other soil organisms. Current inspectional and treatment procedures are not entirely satisfactory. It is, therefore, proposed to erect hoist and steam cleaning facilities at a central wharf where all vehicles can be handled.

### EXPORT

Vegetables exported overseas showed an increase over exports in the previous year. Consignments were despatched mainly to New Guinea and Asian countries. The more important commodities were potatoes (8,800 bags), tomatoes (7,480 cases) and lettuce (2,750 cases).

Apple exports amounted to 175,800 bus., part of which was packed in the standard wooden case, and part in tray-pack cartons. Shipments fell below the Apple and Pear Board's allocation to the State, contributory causes being hail injury in certain areas, and defects (particularly bitter pit and dimpling) in some lines of fruit submitted for examination. Rejections were higher than usual, and this reflects the difficult season experienced both here and elsewhere in the Commonwealth.

Following increased plantings in the Granite Belt, apple exports are expected to increase sharply in the next few years. Packing sheds must, therefore, adjust their operational practice to export requirements. At the moment, far too many lines of fruit are packed to marginal standards which cannot be expected to establish an outstanding reputation for Queensland apples on world markets.

Citrus exports increased to 22,906 cases, most of which were despatched to Eastern ports.

### SOIL CONSERVATION BRANCH

Interest in soil conservation continued to increase, and landholders made more than 2,500 applications for technical assistance during the year. In order to meet these pressing needs, the soil conservation extension staff was increased by 22 per cent., and new centres were opened at Roma, Mareeba, Millmerran, Wondai and Yarraman.

Twenty-eight soil conservation extension officers are now providing direct services to the farming community in 17 districts ranging from Warwick to Mareeba. During the course of the year, they made 4,496 visits to farms for the purpose of providing advisory services, preparing farm plans and surveying sites for earthworks. In addition to these farm visits, the maximum use was made of mass media to convey information and stimulate interest. Thirty-two press articles were released, 28 radio talks were given and 33 field days, schools or inspection tours were conducted. Four show displays were prepared and addresses were given at 105 meetings of primary producers' organizations.

### CONTROL OF RUN-OFF AND EROSION

Technical services were provided by Departmental officers in connection with the installation of 121,549 chains of protective earthworks on 39,087 acres of eroded cultivation land. This area includes 20,461 acres protected on the Darling Downs, and represents a 26 per cent increase over the previous year. In the Burnett, a total of 13,463 acres was protected, an outstanding achievement for six officers in this district of intensive agriculture, as it represents an output of 2,240 acres per officer. Good progress is also reported from the Central Highlands where earthworks were installed on 1,929 acres of land by one officer who also surveyed lines for contour working on 12,853 acres. In the north, attention was devoted to initiating soil conservation in the Mareeba tobacco areas, and earthworks were installed on 1,200 acres of tobacco land on 40 farms.

The use of contour cultivation procedures without contour banks continued to expand on the gently sloping lands of

the Central Highlands, Maranoa and Western Darling Downs. Surveys were made on 16,830 acres, an increase of 13 per cent. on the figure for the previous year. More than 40,000 acres of land are now worked on the contour without structures.

There was a slight decline in the waterway construction programme. Approximately 9,000 chains of artificial waterways were designed and constructed during the year.

A plough planter developed by a Darling Downs officer offers the best promise so far for the efficient establishment of kikuyu grass waterways. In the Mareeba area, African Star grass has proved a success for stabilizing waterways.

### PLANNING

Greater emphasis was placed on planning during the year, resulting in an expansion in topographic mapping and in the preparation of soil conservation plans.

Ground control for the 200,000 acres Maclagan topographic mapping project was completed and a number of contour maps were issued. These maps enabled the expeditious development of soil conservation plans in the areas covered by them.

Ground control is well advanced on the 200,000 acres Greenview project, and a start was made on the 250,000 acres Warwick area. The Survey Office is directing this work and is carrying out all the horizontal control, compilation and plotting.

Soil conservation plans were prepared for 165,510 acres during the year and although this is a substantial improvement on the output of 74,000 acres for the previous year, it is below the total of 172,000 acres reached in 1959-60. However, this result is entirely satisfactory because the Darling Downs reached the record of 120,000 acres while the Burnett figure of 32,000 acres was achieved despite an inadequate staff establishment and very substantial staff commitments on topographic surveys.

Excellent progress was made in the preparation of soil conservation plans for irrigated tobacco farms in the Mareeba-Dimbulah area. Plans were finalised for a further 10,000 acres and preliminary plans prepared for another area. The Mareeba-Dimbulah area planning progressed to the stage where it is now possible to implement soil conservation work immediately in any part of the district.

During the year, steps were taken to develop the Toowoomba drafting office as the main drafting centre for the State, and good progress was made in the preparation of various key and reference maps.

### INVESTIGATIONS

Because of limited staff, research work was restricted. The Darling Downs investigations relating to the effect of run-off detention on crop growth were continued. Results so far indicate that while substantial yield increases may be expected from increases in soil moisture at planting time, nutritional levels will be an important over-riding factor.

## BOTANY SECTION

The work of the Section is conducted in two main directions:

1. Research; 2. Identification and Advisory Services.

### RESEARCH

Research work proceeded in three main fields: (a) Taxonomy, (b) Ecology and Vegetation Mapping, (c) Economic Botany.

*Taxonomy.*—The advisory services of the Section depend primarily on the accurate identification of plants. To maintain these services it is essential that knowledge of the native plants be kept up to date. To do this, critical studies are needed of their structure, relationships and nomenclature so that the species may be accurately delimited, classified and named. Work of this kind continued in many genera and families including *Acacia*, *Calotis*, *Carpobrotus*, *Dendrobium*, *Disphyma*, *Eremophila*, *Hakea*, *Micraira*, *Neurachne*, *Phaleria* and *Plectranthus*.

A revised account of *Micraira*, a most unusual grass found only in widely spaced localities in Queensland and Northern Territory, was accepted for publication. A preliminary revision of *Neurachne*, a genus of grasses which contains the economically important Mulga Mitchell grasses, was prepared. Articles also accepted for publication were a paper on the taxonomy and nomenclature of the Cooktown orchid, notes on a species of *Calotis*, the first of a series of papers on *Acacia* and a further paper on miscellaneous species of Queensland plants including an account of one section of the genus *Hakea*.

A trial in which wheat was flooded to a depth of 6 in. in mid-vegetative, late vegetative and milky stages, showed high levels of survival. After 6 days of inundation, survival was 95 per cent. in the mid-vegetative stage, 97 per cent. in the late vegetative and 100 per cent. in the milky stage. There was no loss of yield in the mid-vegetative stage. Substantial increases in yield resulted from flooding in the late vegetative and milky stages for periods of 1 day, 3 days and 6 days. Nine days of flooding resulted in a drop in survival rate, and yields declined.

The catchment instrumentation programme was commenced and plans were finalised for the instrumentation of the 600-acre Galligan's Gully black soil catchment near Pittsworth on the Darling Downs and a 250-acre red soil catchment near Kingaroy in the South Burnett district. Both stem from joint interest with other authorities, the Water Research Foundation, and Irrigation and Water Supply Commission, and will provide basic data on runoff. The Pittsworth weir is now being constructed, and the Kingaroy weir was completed.

Further field and laboratory trials were carried out to determine the value of bitumen emulsion in helping to establish, in black soil waterways, green panic and Rhodes grass grown from seed. Although definite beneficial effects on germination were demonstrated, field trials were disappointing. In laboratory trials using soil trays, increases in temperatures and reduction in the rate of desiccation of the surface inch of soil were demonstrated. These changes were accompanied by increases in germination. Germination rate for the control averaged 9 per cent. but increased to 31 per cent. for the bitumen application at a quarter of a gallon per square yard. Increases of this order are not considered high enough to make the use of the method economical. The cost of bitumen is so much higher than the cost of seed that this method would be acceptable only where it meant the difference between the success or complete failure of a seeding. This situation has not occurred in any of the trials except the initial exploratory trial reported last year.

During the year, a joint survey was carried out with Agriculture Branch and Agricultural Chemical Laboratories Branch to investigate salinity levels in the Linthorpe area. The results were not conclusive, but some points emerged which may have some significance in relation to productivity in certain areas during dry seasons.

### GENERAL

The year marked a step forward in staff liaison and training. A system of quarterly regional conferences was instituted, and resulted in a substantial improvement in liaison between staff members, in the resolution of problems and the development of uniform procedures and, more importantly, in improved staff morale.

A conference of all Branch senior officers was held resulting in the development of a sense of common purpose among participants and resolving a great number of technical and administrative problems.

A key to all genera of grasses known to be native, naturalized or cultivated in Australia was prepared and issued in cyclostyled form for testing by trained officers of other branches in the field. This is the first step towards the preparation of a comprehensive account of the grasses of Australia.

All Queensland material in the genus *Phaleria* was examined and the distribution of the species in Queensland mapped.

The task of identifying the plants collected in Cape York Peninsula by the Archbold Expedition of 1948 continued and a total of 260 specimens in 49 families has now been identified from this collection.

The ultimate objective of all these studies is the preparation of a new Flora of Queensland but progress on this work is considerably hampered by lack of space in the present building.

*Ecology and Vegetation Mapping.*—In continuation of studies being made of the botanical composition and distribution of rainforests in north Queensland, the Bailey's Creek area north of Daintree and the McIlwraith Range east of Coen were visited. Approximately 600 plants were collected, some of which appear to be previously undescribed species.

North western Queensland was visited to study the distribution of *Acacia georginae*, *Georgina gidyea*, and to examine differences between that species and the non-toxic *Acacia cambagei*, the common gidyea of western Queensland. A collection was made of 150 samples of *Acacia georginae* for examination by the toxicologist, and also a general collection amounting to about 80 different species.

Work on the ecology of brigalow (*Acacia harpophylla*) was continued. Two parts of an account of the ecology of this species were completed. These described briefly different types of communities in which brigalow occurs and dealt in detail with methods of control which have been used and their effects. Progress was made on the preparation of the third part, namely, the floristics and detailed descriptions of the plant communities.

An ecological study of limebush (*Eremocitrus glauca*) was begun. The aim of this study is to determine if possible the reasons for the encroachment of this species into pastures, particularly on country which has been cleared for some years. Two preliminary reconnaissance surveys were carried out during the year.

*Economic Botany.*—The survey, begun in 1958, of control methods for brigalow was completed and results were submitted for publication. The report which accompanied this paper also contained recommendations for further research. Some findings from this survey were incorporated in articles published in the December issue of the *Queensland Agricultural Journal* and were subsequently reprinted as a special bulletin on brigalow development.

Experimental work continued on the use of an air-blast misting machine to control brigalow suckers from 1 ft. to 4 ft. high.

Results of trials put down in December 1960 and March 1961 were analysed. They showed that 2,4,5-T ester in distillate, distillate plus water or water alone, 2,4,5-T amine in water, 2,4,5-T plus amitrole in water, 2,4,5-TP in water and 2,4,5-T invert emulsion can give significant control of these brigalow suckers at rates of 1 lb. of 2,4,5-T per acre. Monuron at 10 lb. per acre and amitrole at 2 and 4 lb. per acre were ineffective. On the whole, treatment was more effective and less variable in March than in December. This finding is consistent with results of trials on mature brigalow, both in aerial spraying and in mechanical clearing. It is now known that the technique employed in this particular trial was faulty and that better results can be obtained by more careful and thorough application to ensure that the spray mist is blasted into each clump of suckers.

A large scale trial (25 acres) with 2/3 lb. 2,4,5-T in 3 to 4 gal. of water and of distillate gave interesting results which appeared to have been influenced by the fact that the area was heavily stocked with sheep both before and after treatment. The initial treatment gave excellent top kill (95 per cent. or better) but there was considerable sucker regrowth from the roots and the bases of the sprayed plants. Evidence suggested that the heavy grazing prior to treatment had reduced the area of leaf so much that absorption by the plant was insufficient to ensure translocation to the roots but that grazing subsequent to the spraying controlled the plants by destroying the suckers. After treatment, this removal of suckers by grazing was so effective that it was impossible to assess differences between the water and distillate treatments.

Final figures were obtained from a trial laid down in 1961 to compare various rates of 2,4,5-T butyl ester in different volumes of water but statistical analysis of these data is not complete. Indications are that there are no differences between the different rates (1/4, 1/2 and 1 lb. of 2,4,5-T) or different volumes (4, 6 and 8 gal. per acre) in the water treatments but that all were inferior to the check treatment of 1 lb. 2,4,5-T in distillate.

From a series of trails begun in November, 1960, to determine the effect of different rates of 2,4,5-T in water and in distillate at different times of the year, using a fixed volume (4 gal. per acre), some important conclusions can now be drawn. Complete control was obtained by spraying with 1/4 lb. 2,4,5-T in distillate in November and January followed by another application of a 1/4 lb. 2,4,5-T in distillate in the following November. In plots treated in February there was great difficulty in applying a follow-up treatment 12 months later because of heavy growth of grass. Diesel distillate was a better carrier than water, for example 1/4 lb. 2,4,5-T in distillate was better than 1 lb. 2,4,5-T in water. Winter applications of 2,4,5-T were almost as effective as summer application but spring (September-October) applications were markedly worse, probably because of low soil moisture.

For the control of suckers from 1 ft. to about 4ft. high, an initial treatment with 1/4 lb. 2,4,5-T in distillate in the period between November and about July, followed by a second treatment at the same rate in the following November or December can now be recommended. The application, however, must be done with care and skill. Initial treatment in September-October is not recommended.

A small-scale trail on the control of two species of eucalypts in the Texas area, using an air-blast misting machine to treat suckers from ringbarked trees, was concluded during the year. Results were completely negative; 2,4,5-T offered very little promise for controlling these species (*E. microcarpa* and *E. dealbata*) with this particular technique.

Comments from landholders at a field day at Karara, revealed that regrowth of these species on the traprock country is a major problem and that further experimentation to find means of handling them is required. The matter was discussed with officers of the Biological Section, Department of Public Lands, who have undertaken to investigate mechanical and chemical techniques for handling these species.

#### IDENTIFICATION AND ADVISORY SERVICES

During the year about 8,000 specimens were identified and reports furnished on their characteristics. Included were grasses, weeds, trees, poisonous plants, herbage plants and garden plants from members of the general public as well as field officers of this and other departments. A total of 85 samples of stomach contents were examined for the presence of suspected poisonous plants.

Large collections of plants from Cape York Peninsula were identified for C.S.I.R.O., Chemical Research Laboratory, C.S.I.R.O. Rainforest Ecology Section and for the Queensland Forestry Department. Other large collections from the Fitzroy River Basin were identified for C.S.I.R.O. Division of Land Research and Regional Survey and from north Queensland for C.S.I.R.O. Division of Plant Industry, Canberra.

Much of the material in these collections was devoid of flowers or fruits and could only be identified by botanists with long experience and acquaintance with plants of these regions.

*Weeds.*—Close liaison was maintained with other branches and departments working in the field of weeds and weed control, chiefly Agriculture Branch, Horticulture Branch, Forestry Department, Department of Public Lands, and Bureau of Sugar Experiment Stations.

Specimens of two new weeds were recorded but so far determinations can only be regarded as tentative and specimens were sent to overseas specialists for checking. The first, a shrub tentatively identified as *Eupatorium serotinum*, was reported from the Albert Shire where it occupied a small area of land only. The species is a native of North America and is closely related to crofton weed and mist flower which are serious pests in similar country in Queensland. This area will be kept under close observation to determine the rate of spread of this plant. The second was a legume tentatively identified as *Moghania congesta*, a native of India. It appeared in a pasture sown with centro seed near Nambour. Nothing is known of its properties but this, too, will be kept under observation.

Wider distribution was reported for the following weeds which are already established in the State:

*Ambrosia artemisiifolia*, annual ragweed. This was noted in several new localities within the Brisbane area and other parts of the Moreton district. It is the most important cause of hay fever in North America and if it is allowed to grow in quantity close to tourist areas it could seriously affect the popularity of these places for tourists from the United States. Action has been taken by the Co-ordinating Board and by local authorities to keep the known infestations in check.

*Ambrosia psilostachya*, perennial ragweed. This is a relatively rare species in Queensland. Specimens were received from the Gayndah district where it was reported to have been spreading along watercourses during the past 2 years. The Co-ordinating Board has taken action to deal with this new infestation.

*Themeda quadrivalvis*, grader grass or Habana oats grass. This vigorous annual grass is causing serious concern in sugar cane land and some pastures in the Mackay-Proserpine area and is also very abundant on parts of the Bruce Highway and secondary roads in the area from about Marlborough northwards. This year it appeared in several new localities further south, namely between Bundaberg and Gin Gin, around Clermont and near Brisbane. All these patches were on roadsides or disturbed ground. Steps were taken to have them treated before they get out of hand.

*Mimosa invisa*, giant sensitive plant. The Government Botanist was a member of a committee appointed by the Co-ordinating Board to enquire into the progress of the programme for the control of giant sensitive plant in north Queensland. Progress has been made in the control of this plant but many years of work will be needed before intensive control efforts can be relaxed.

Late winter rain in 1962 and late autumn rains in 1963 were responsible for the appearance of a number of weeds not commonly seen in Queensland. These included lesser snapdragon, capeweed, sorrel, spurred vetch, *Arctotheca repens*, wild turnip (*Brassica tournefortii*) and slender thistle.

Further complaints were received from residents of the Condamine River district south of Chinchilla, about the encroachment of *Phyla nodiflora*, carpet weed or fog fruit. This plant has been well established along the channels of the Condamine River for a long time but in recent years it appears to have moved out from the channels and to be encroaching on pasture.

**Poisonous Plants.**—In most pastoral districts the season was reasonably good and this probably accounts for the fact that reports of suspected plant poisoning were rather fewer than in the previous year. About 35 new records were added to the poisonous plants files.

The Government Botanist attended the sixth Phytochemical Conference in Sydney in August at which current chemical work on Australian plants was discussed. It was obvious that a great deal of chemical work is in progress on the Australian flora but that relatively little of it is directed towards the understanding of the toxicity of these plants.

A number of enquiries was received for advice on plants poisonous to human beings, and addresses were given to several gardening clubs on this subject.

**Brigalow.**—Extension work on brigalow control problems increased during the year. Development of brigalow country was discussed at the Beef Cattle Production School at Eimeo near Mackay, at a special school convened by the Commonwealth Development Bank at Dalby and at two departmental conferences, one at Miles and one at Biloela. As a result of these conferences and schools departmental officers are in a better position to give advice on the problems of brigalow control and primary producers who attended the schools are better equipped to deal with their own problems.

The success of the Fitzroy Basin Development Scheme will depend in part on the application of sound scientific principles in the clearing of the brigalow scrub, control of suckers and the treatment of other invading species such as blackbutt or Dawson gum (*Eucalyptus cambageana*) and sandalwood (*Eremophila mitchellii*).

## ENTOMOLOGY SECTION

Pests of most crops were satisfactorily kept in check by well-timed spray applications. Plagues of army worms occurred in most coastal areas and main inland tablelands. Attacks by these pests on economic crops were scattered and easily controlled by standard methods. The prolonged mild autumn weather favoured additional generations of some major pests but natural controlling factors such as parasites and entomogenous diseases were conspicuous in places where insecticides had not been used.

In north Queensland, the wet season was the heaviest for many years. Insect activity was particularly high although good growing conditions masked the immediate importance of chronic pest problems. An increased awareness of the limitations of many of the new insecticides was evident in several districts, and interest was shown in the need for greater biological detail to enable better understanding of pest control recommendations.

Entomological field stations continued an active programme of investigational work in all major centres of agricultural and horticultural production. A new station has been established at Mareeba in north Queensland. When fully equipped, this will be the centre of expanded investigations on the biology and control of tobacco pests.

The new laboratory at Indooroopilly is now fully functional.

A conference of entomologists from central and southern districts was held in Toowoomba.

**Deciduous Fruits.**—The major pests in the Granite Belt, codling moth, *Cydia pomonella* (L.), light brown apple moth, *Epiphyas postvittana* (Walk.), and the common fruit fly, *Strumeta tryoni* (Frogg.), were all active at some stage but control generally was good. Woolly apple aphid, *Eriosoma lanigerum* (Hausm.), became prevalent and difficult to control in orchards where reinfestations occurred.

The apple dimple bug, *Campylomma* sp., showed a marked increase over the previous season. The attacks at pink tip involve an additional spray application in an already extensive insecticidal programme on apples. Biological studies on red spider species, *Tetranychus telarius* (L.) and *Panonychus ulmi* (Koch), were continued with particular attention to nutrition under varying temperature, and photoperiod conditions in relation to both survival and overwintering. The San Jose scale, *Quadrastpidiotus perniciosus* (Comst.) increased in orchards where winter oil sprays were not used.

**Pastures.**—A complete survey of the Atherton Tableland revealed that 11.0 per cent. of the pasture land is infested with the funnel ant, *Aphaenogaster pythia* Forel. The value of pasture renovation to overcome the ravaging effect of this pest has been proved. Chemical and biological studies are revealing the reason for hitherto unexplained plant responses on renovated funnel ant soils. The formidable range of pasture pests on the Tableland has been enlarged by the discovery of the pasture soldier fly, *Altermetoponia rubriceps*

Advice was furnished to the Land Development Committee on these matters and a preliminary survey was made of the site of the proposed Research Station north-west of Theodore.

**General.**—Two proposed standardized lists of names prepared by the Standards Association of Australia were examined in detail, namely a proposed Standardized List of Names for Timber Species and a proposed List of Standardized Common Names for Pest Destroyers.

Appraisal of the former involved several weeks of detailed bibliographical research by a senior member of the staff.

## HERBARIUM AND LIBRARY

Approximately 6,000 specimens were mounted during the year, including 754 sheets from the New Guinea Forest collection made in the 1940's, and 200 ferns presented to the Herbarium by Mr. J. Manski, of Maryborough. A total of 377 specimens was received on loan from other herbaria, 344 were sent on loan; 2,211 were received on exchange and 1,768 were distributed.

During the year, 34 new books and 124 reprints were added to the library as well as periodicals. A total of 152 books was issued on loan; loans from other libraries totalled 16; 156 volumes were bound.

## VISITING BOTANISTS

Nineteen visitors worked in the herbarium during the year, including botanists from England, United States of America, Indonesia, India, South Africa, New Guinea and Canberra.

(Macq.), as a major problem in areas from Malanda to Upper Barron, and the kikuyu grass bug, *Sthenaridea* sp., of more general distribution.

Grass caterpillars, particularly *Spodoptera mauritia* (Boisd.), were in plague proportions in many parts of eastern Queensland during January to March. Damage to economic crops was slight where timely controls were applied. The nematodes, *Meloidogyne javanica* (Treub) and *M. incognita* (Kofoid & White), were recorded from clover pastures in the Kenilworth district.

**Tobacco.**—Leaf miner, *Gnorimoschema operculella* (Zell.), in the Mareeba-Dimbulah districts showed moderate activity, with the usual seasonal increase in late December. Some early infestations in the Burdekin district were associated with areas carrying winter-grown tobacco. Normal control schedules were successful in all districts.

Trials showed that the new material, azinphos ethyl, as a 0.05 per cent. spray, does not taint cured leaf. This material has proved to be outstanding against leaf miner attacks but is not effective for budworms, *Heliothis* species, and still requires to be tested against other major pests of tobacco.

Wet weather precluded early disposal of plants after harvesting in the far north, and leaf miner, budworm and cluster caterpillar, *Prodenia litura* (Fabr.), were prevalent in crop residues. In the Burdekin area also, leaf miner increased in plants after harvesting.

**Citrus.**—Red scale, *Aonidiella aurantii* (Mask.), continues to be the major scale pest of citrus. Favoured by wet weather, the entomogenous fungus, *Microcera coccophila*, was commonly associated with this scale during the autumn. Hot summer weather in the Gayndah and near north coast districts caused a marked reduction in white wax scale, *Ceroplastes destructor* Newst., but with an egg capacity of 1,500-2,000 this pest continues to be troublesome in the coastal districts.

Investigators in the Byfield district in central Queensland showed that correctly-timed summer insecticidal applications lead to improved fruit appearance but a more satisfactory scale control in this area may require an additional spray application in March. Citrus decline is becoming common in far north orchards, particularly at Koah. The root borer, *Leptopius* sp., is implicated in this trouble and is now the subject of control studies.

**Tropical Fruits.**—The banana fruit fly, *Strumeta musae* (Tryon), is of concern to northern growers marketing fruit in Victoria. Biological studies and observations on natural hosts and distribution are planned. A control project on the banana weevil borer, *Cosmopolites sordidus* Germ., was established in the Nambour district.

Populations of the pineapple mealy bug, *Dysmicoccus brevipes* (Ckll.), occurred in districts adjacent to Nambour. Occasionally plants were wilted but further studies are



required to determine any direct association. The fruit spotting bug, *Amblypelta nitida* (Stal.), usually troublesome in coastal area, caused damage to papaws in Charters Towers districts. The coconut scale, *Aspidiotus destructor* Sign., usually an incidental pest of bananas, occurred as a heavy infestation of foliage and fruit at Bowen.

**Cotton.**—Pests of one kind or another were active throughout the cotton season in central districts. Studies on the survival of the pink-spotted bollworm, *Pectinophora scutigera* (Hold.), showed that a soil cover of 2 in. or more made as late as July was sufficient to kill overwintering larvae. A laboratory breeding technique has been developed and this will allow ample material for detailed studies under controlled conditions. Seasonal history studies are being followed in the field.

The rough bollworm, *Earias huegeli* Rogen, is a persistent pest in southern districts, and field studies are aimed at finding a suitable insecticide. The control schedule for cotton pests under irrigated conditions is receiving further study.

To assist growers, a special brochure was prepared showing the more common cotton insects in colour.

**Forestry.**—The leaf bagworm, *Hyalarcta hubneri* (West.), increased in pest status in *Pinus radiata* plantations at Passchendaele. The major field project on this insect is designed to determine the relationship between degrees of defoliation and tree growth. Studies of parasitism and population distribution are also being made. Damage by the kauri coccid, *Conifericoccus agathidis* Brimb., increased in southern kauri pine plantations where peak hatchings coinciding with the spring growth flush were responsible for extensive shedding of new leaves. Investigations are being made on seasonal occurrence and means of control.

In a survey of metropolitan areas and *Pinus* plantations in south-eastern Queensland, no evidence of *Sirex* was found. The reinspection of houses fumigated for European house borer, *Hylotrupes bajulus* L., continued without evidence of live borers.

**Grain crops.**—The sorghum midge, *Contarinia sorghicola* (Coq.), was abnormally active and a further study of control is being undertaken. Mice were widespread on the Darling Downs in sorghum crops. Attempts at control included some new methods such as boom spraying, but results were variable.

Technical assistance with the handling of wheat at export terminals enabled corrections in fumigation methods. The high number of waggons requiring treatment indicated the need for more satisfactory methods of pest control at inland storage centres. Malathion as a bulk wheat treatment allowed a build up in populations of the lesser grain borer, *Rhizopertha dominica* (Fabr.).

**Vegetables.**—The heavy attacks of leaf miner last year subsided, and populations in control trials were low. All major vegetable pests occurred in only moderate infestations in commercial crops in most districts and normal controls were satisfactory. Biological studies of the eggfruit caterpillar, *Sceliodes cordalis* (Dblid.), were undertaken prior to control trials. The inconspicuous damage by this pest is the cause of market rejections in southern States.

**Stored Products.**—Reports on a wide survey of all major grain pests with suggested control methods, and on infestations of deliveries to State Wheat Board storages were prepared and circulated to interested parties. As a result of trials at Kingaroy, the 1963 peanut crop stored in silos is being treated with malathion at intake. Other research projects are concerned with the compilation of annotated records of all stored products pests in Queensland; an examination of lindane and malathion as seed and grain protectants respectively; a study of the comparative toxicities of dieldrin, lindane and malathion as residual sprays to all major stored product pest species; and with the incidence of diseases of insect pests.

**Insecticide Resistance Studies.**—Most work was undertaken with leaf miner from tobacco, potato and tomato growing areas throughout the State, and covered a selection of insecticides. As yet no strain susceptible to DDT has been available for comparison. The "anti-resistant" compound, butyl chlorobenzene-sulphonamide, did not cause death when included with DDT at all concentration levels. Other projects are concerned with *Heliothis* species and stored products pests. With some pests exhibiting a high resistance factor to insecticides used commercially, the team handling these projects is now in a position to help industry with a wide range of insecticidal problems.

**Host Resistance Studies.**—A range of cultivated and weed Solanaceae has been examined for susceptibility to attack by leaf miner. A definite pattern of responses has been determined and the factors responsible are being investigated.

**Nematology.**—Nematode problems in tobacco, pineapples, bananas and strawberries were investigated, general surveys were continued, and attention given to the necessary systematics. Several new host records were listed and new species described.

Trials cover the role of nematodes in banana "yellows," the effect of DBCP on nematode populations in the banana root zone, the economic value of banana planting material treatments, the evaluation of cover crops as a help with nematode control in pineapple fields, and the pre-plant treatment of strawberry runners infested with *Meloidogyne hapla* Chitwood. In tobacco trials the most promising nematocide increased the chloride content of flue-cured leaf.

**Miscellaneous Field Crops.**—In the survey of white grubs, *Heteronyx* sp. in peanut soils in the Kingaroy district, adults commenced to emerge in late October and continued until mid-February. This work indicated that early November plantings are most likely to be affected by the peak of emerging adults. Peanut plants showed an attraction for ovipositing females. Bean fly, *Melanagromyza phaseoli* (Tryon), caused seasonal damage to cowpeas in the Burdekin district. Interest in insecticidal seed dressings for this problem is increasing.

**Miscellaneous.**—Localised outbreaks of the yellow winged locust, *Gastrimargus musicus* (Fabr.), in the Longreach and Clermont districts resulted in some damage to natural pastures and young sorghum crops. Work on fruit flies has been limited to maintenance of male trapping stations at various centres throughout the State, and the identification of the species caught. Fruit sucking moths, *Othreis fullonica* (L.), occurred in several districts and were successfully bred in the laboratory on the vine *Stephania japonica* var. *discolor*. A large number of spotted gum trees in forestry regeneration areas in the Dalby district were damaged by the bull's eye borer, *Tryphocaria acanthocera* (Macl.). The bronze orange bug, *Musgraveia sulciventris* (Stal.), usually found in orchards on the Blackall Range, was recorded from the Lockyer district.

## BEEKEEPING

A moderate crop of honey was harvested from ironbarks, boxes and mangroves in the principal districts of Darling Downs, Moreton, Wide Bay, Rockhampton and Atherton. Production was often affected adversely by the wet summer conditions. About 2,000 tons of honey from northern New South Wales as well as from Queensland were processed in two modern packing plants in Brisbane for local and export markets during the year.

Generally disease and pest troubles were negligible, although during the wet summer large numbers of giant toads, *Bufo marinus* L., congregating near apiaries caused reductions in field bee populations.

Extension work covered 3,158 colonies in 25 districts. In addition the following mass media were used: talks and film evenings 8; press, radio, television and journal articles 13; agricultural shows 3; and beekeeping schools and field days 3. The attendance of 803 at a Brisbane field day was a record.

At March 31, 1963, 1,495 beekeepers were registered, compared with 1,454 for the previous year.

## FLORA AND FAUNA CONSERVATION

By the end of the marsupial skin year (December 31) 1,615 permits and licences were issued under "The Fauna Conservation Act of 1952." A booklet entitled "Queensland Fauna Sanctuaries" was published to satisfy an increasing public demand for reliable information on the locations of the many fine mainland sanctuaries declared in this State, and as the first step in rationalising wildlife refuges. Following discussions in Canberra, Queensland is now a participant in the Australian Bird Banding Scheme.

An open season for ducks was declared in central and north Queensland commencing July 7 and terminating September 30, and for southern Queensland from June 2 to August 26. Following a reasonably productive breeding season, bags were much better than in the 1961 season. Black duck, *Anas superciliosa rogersi* (Mathews), easily maintained its place as the major game bird sought and taken. Red deer, *Cervus elephas* L., were criticised by graziers in the Crows Nest district as being a factor in spreading cattle tick, *Boophilus microplus* (Can.), into marginal clean areas. Accordingly, controlled culling of deer is now allowed in this area.

Extension activities included talks and film evenings 4; press, radio, television and journal articles 71; and agricultural shows 1.

Forty-nine honorary protectors (fauna) and honorary rangers (flora) were appointed. Nine prosecutions under "The Fauna Conservation Act of 1952" were conducted.

An area of 10,860 acres of typical wallum country north of Noosa was reserved for fauna and flora conservation purposes, under the control of this Department as trustee.

Wild duck and marsupial research projects, under both cage and field conditions, were continued and are making progress. These are mostly concerned with biological and other studies which will assist conservation and profitable harvesting.

## PLANT PATHOLOGY SECTION

The functions of the Plant Pathology Section continued to involve routine diagnostic and advisory services, research into the etiology and control of plant diseases, and legume bacteriology. Facilities for such work were significantly improved during the year by the occupation of the plant pathology laboratories in the new Queensland Wheat Research Institute at Toowoomba, and the opening of a further regional laboratory at Mareeba. Staff at the Toowoomba laboratories will be concerned primarily with research into root and crown diseases and stem rust of wheat. The main function of the Mareeba laboratory will be research into diseases of tobacco and associated crops. There are now seven plant pathology laboratories in country districts in addition to the central laboratories in Brisbane.

Heavy summer and autumn rains favoured many fungal and bacterial diseases in coastal districts. In particular, high soil moistures stimulated the development of root infecting pathogens, and considerable damage resulted in crops such as tomatoes, papaws and avocados.

## FIELD CROPS

**Wheat.**—Stem rust (*Puccinia graminis*) was widespread in early wheat crops but dry weather later in the season prevented an epiphytotic. Race 34—Anz-2,4 was predominant and some crops of the susceptible Mengavi variety suffered severe damage. This race has been found to over-summer effectively on *Agropyron scabrum* as well as volunteer wheat.

Several field experiments were conducted to test the efficacy of dithiocarbamate-nickel spray mixtures for stem rust control. Maneb-nickel sulphate significantly reduced both stem and leaf rust incidence but under the prevailing dry conditions and low rust incidence, yield differences did not result.

Laboratory investigations of wheat root and crown rots were intensified. A picture of the fungi associated with these diseases in Queensland soils is being developed. Techniques are being investigated to enable the ready checking of these organisms for pathogenicity, and the large scale testing of varieties for resistance. In addition to *Fusarium graminearum*, other species of *Fusarium* and *Helminthosporium* are receiving particular attention.

**Sorghum.**—Pre-emergence and seedling rots have previously been of negligible importance in sorghum plantings in this State. However, poor stands of some of the newly developed hybrid sorghums occurred in various districts in the past season. Fungicidal seed treatments were subsequently tested and the organic-mercurials proved to be markedly superior to captan, thiram, chloranil, copper oxychloride and hexachlorbenzene as sorghum seed protectants in the problem soils.

**Tobacco.**—Early summer storm rains favoured tobacco blue mould (*Peronospora tabacina*) development in some areas of north Queensland. Field experiments again illustrated the efficacy of .15 per cent. mane and .25 per cent. zineb sprays for leaf and stem mould control. At the effective concentrations, mane is the more economical treatment. Dithane M45 and Antracol have also given promising results.

Rhizoctonia stem rot was serious on some tobacco farms. One or more factors such as the late ploughing of organic matter before planting, use of poor seedlings, deep planting and high early hilling were found to contribute to the losses.

**Cowpeas.**—Cowpea stem rot (*Phytophthora vignae*) isolates from various districts were tested for pathogenicity and all were found to be Race 1. The only incidence of Race 2 (infecting Blackeye 5 variety) is still the one isolated recording at Nobby in 1961-62. Further cowpea lines were tested for resistance to stem rot, and Chinese Red variety was found to be resistant to both Races 1 and 2.

Certified seed of the variety Caloona, which has Blackeye 5 resistance to stem rot, has now been produced in sufficient quantity to enable release for next summer's plantings.

**Peanuts.**—Peanut disease work was concentrated on Verticillium wilt (*V. dahliae*), *Sclerotium rolfsii* and *Cercospora* leaf spot control. Eighty peanut varieties were screened in pots for resistance to Verticillium wilt and were also planted in small field plots. None of the lines showed complete resistance but there were some surviving plants in a few varieties. These will be further examined next season.

Various methods of crop residue disposal and tillage are being examined for their effects on *S. rolfsii* incidence. The economics of *Cercospora* leaf spot (*C. personata* and *C. arachidicola*) control with copper, sulphur and mane dusts are also under study.

**Maize.**—Seasonal conditions were again conducive to tropical rust (*Puccinia polysora*) in Atherton Tableland maize crops, and yields will be appreciably reduced as a result. This rust is still confined to far northern districts. Rust reaction on resistant African inbreds indicated that Race E.A.3 is not present here as yet.

Several inbred lines from the maize plant breeding programme were checked in the greenhouse for resistance to maize stripe virus. None was highly resistant but differences in tolerance to infection were apparent.

**Cotton.**—Severe leaf damage occurred in non-irrigated cotton crops when heavy late season rains fell after prolonged drought. The fungi responsible, predominantly *Alternaria* sp. but also *Aschochyta gossypii* and *Cercospora gossypina*, are weak pathogens of cotton but in this case were apparently able to infect foliage weakened by dry growing conditions.

A study of the bacterial blight (*Xanthomonas malvacearum*) racial position in Queensland is under way as an adjunct to the cotton plant breeding programme. Isolates so far examined have conformed in pathogenicity to U.S.A. Race 1.

**Miscellaneous.**—Ratings on a range of lucerne varieties inoculated with *Phytophthora cryptogea* indicated a wide variation in reaction. At this stage, however, none appears more resistant to root rot than the widely grown Hunter River variety.

Verticillium wilt (*V. dahliae*) of safflower was recorded on the Darling Downs for the first time in Queensland. A severe new bacterial leaf spot of Guar was found to be caused by *Pseudomonas syringae* infection.

## VEGETABLES

**Potatoes.**—Black dot disease (*Colletotrichum atramentarium*) was recently found associated with the roots and lower stem of wilted potato plants in the Lockyer Valley. The etiology and importance of this disease under local conditions are being assessed as it has not been recorded here previously.

The rate of spread of potato virus x in the field and its effect on yield under Queensland conditions are being investigated. Indexing has shown that although the incidence of this virus is generally low in seed potato lines imported into the State, some lines have appreciable infection.

**Onions.**—The pathogen responsible for onion pink root disease in the Lockyer Valley was shown to be *Pyrenochaeta terrestris*. The host range of this fungus in the area is now being checked. Laboratory inoculations produced lesions on the roots of wheat, sorghum, maize and several vegetables.

**Tomatoes.**—Bacterial canker (*Corynebacterium michiganense*) has become widespread in the Granite Belt and to a lesser extent in the Victoria Point districts. Although suitable seed extraction and treatment precautions are now taken with all important seed sources there is a season to season carryover on infected farms which is being further examined. Greenhouse inoculation tests indicated that the popular varieties fall into two reaction classes. The larger group including Grosse Lisse, Q2, Q3, Grosse Lisse x Salads F1 hybrid, Daydream, College Challenger, C2, Break O'Day, Indian River, Manalucie and Step 305 were highly susceptible to canker. The second group including Q5, Salads Special and Tecumseh were tolerant to infection.

Seed contamination with tobacco mosaic virus was found to be high in some tomato lines. Tri-sodium phosphate and hydrochloric acid seed treatments have proved effective in removing this contamination, and the safety of the treatments is at present under investigation.

**Beans.**—*Sclerotinia sclerotiorum* infection causes major damage in winter bean crops in wet years. Recent fungicidal control work showed that Allisan effectively controls the transit rot phase of the disease when applied as a post-harvest dip. Sodium salicylanilide, captan and Mycostatin were not effective. Allisan also controlled the field incidence of *Sclerotinia* rot when applied as a cover spray during the flowering period whereas captan and ferric omadine were ineffective. This new fungicide should prove of considerable value to the winter bean industry.

**Miscellaneous.**—Maneb sprays effectively controlled powdery mildew (*Sphaerotheca fuliginea*) on watermelons in a field experiment at Ormiston. This fungicide has been used on cucurbits for some time against other pathogens but its control of powdery mildew was unexpected.

The lettuce necrotic yellows virus which was described from Victoria has now been detected in Queensland lettuce crops. It is of low incidence, however, and lettuce mosaic virus is more common.

## FRUIT CROPS

The reasons underlying the development of latent infections by species of *Colletotrichum* causing ripe rots in tropical fruits were investigated with respect to the four aspects of nutrition, enzyme activity, toxins and respiration. The cause of latency can be largely ascribed to a nutritional basis although there may be some interaction of all four aspects.

The changes in metabolic resources occurring during the climacteric phase of fruit development may be the factor responsible for the breaking of latency. The presence of a highly toxic substance was demonstrated in hot extracts of green, but not ripe, banana peel. There is circumstantial evidence that this anti-fungal toxin may play some part but its true role awaits more detailed investigation.

Further studies on the control of banana ripe fruit rots were commenced, including heat treatment and fungicidal dipping of fruit prior to artificial ripening. The effects of field fungicidal programmes and fruit handling methods on the development of such diseases will also be surveyed.

A serious vascular wilt was observed in several strawberry crops in districts near Brisbane. *Fusarium oxysporum* was isolated from the infected plants and pathogenicity was proved in greenhouse tests. There appear to be no substantiated reports of a *Fusarium* wilt of strawberry from other countries and further work on the specificity of this pathogen will therefore be carried out.

*Verticillium dahliae* was isolated from a wilt of Aroma x Klondyke hybrid strawberries. Although isolates of the fungus wilted this hybrid in pathogenicity tests, the popular local variety, Phenomenal, was not infected.

A further mild-strain protection experiment with the passionfruit woodiness virus has shown that the strain in commercial use is still affording significant protection and has not increased in severity after several years' propagation.

Further fungicidal work has failed to locate a material superior to captan for the control of brown rot (*Sclerotinia fructicola*) in stone fruit. Heat treatment of harvested peaches is also being investigated in connection with the control of this disease.

Although *Phytophthora parasitica* is a common cause of citrus root and trunk rots in Queensland, brown rot of the fruit is an uncommon occurrence. However, a group of coastal orchards near Beerwah suffered very severe fruit losses from brown rot during torrential late summer and autumn rains this year. The identity of the causal *Phytophthora* is being studied.

The banana leaf spot (*Cercospora musae*) control experiment at Cairns continued. The standard copper oxychloride—white oil—malachite green treatment remains outstanding for disease control but has the defect of phytotoxicity. None of the straight copper or organic fungicide treatments has been as effective as the mixtures containing white oil.

#### FORESTRY

*Phytophthora* root rot (*P. cinnamomi*) was identified from slash pines in another two forest nurseries at Beerwah and Beerburum. It was also responsible for poor establishment in field plantings from these nurseries.

Further greenhouse inoculation tests verified the susceptibility of *Pinus radiata* to *Phytophthora* root rot. *P. taeda* was more resistant and again showed a recovery phase after initial infection. *P. patula* was intermediate in susceptibility.

*Phytophthora boehmeriae* was isolated for the first time in Queensland from *P. patula* roots at Yarraman. In greenhouse tests it proved pathogenic to *P. radiata*, *P. taeda* and *P. patula*, but *P. patula* was the only species to develop pronounced root rot.

*Monochaetia unicornis* was also recorded for the first time from pencil pine canker in the Yarraman and in the Brisbane areas. In pathogenicity tests *Cupressus torulosa*, *C. forbesii*, *C. sampervirens* and *C. arizonica* were all infected, with *C. torulosa* being most susceptible.

#### ORNAMENTALS

Ray blight (*Ascochyta chrysanthemi*) of chrysanthemums was recorded at Sunnybank, causing such severe damage that few blooms could be harvested. This was a new recording for Queensland.

A rose spray experiment revealed that on the score of efficacy and cost, a maneb plus sulphur schedule was the best treatment for black spot and powdery mildew control.

#### LEGUME BACTERIOLOGY

Although legume inoculants are no longer supplied for general use by farmers, some 1,200 cultures were distributed during the year for legume plantings in Departmental field experiments and demonstrations. Approved strains of *Rhizobium* for the important tropical legumes were again supplied for use in commercial inoculant manufacture.

A plant dilution tube test technique was developed for testing the viability of these commercial tropical legume inoculants. *Phaseolus lathyroides* is employed as the indicator plant in this technique. All inoculant samples tested so far have been found satisfactory.

The improved strain of soybean *Rhizobium* released by C.S.I.R.O. was checked against eight varieties in the greenhouse and the field. In both trials it effectively nodulated all varieties. Field performance of this strain was kept under observation in a number of localities. Its performance in most situations proved superior to that of strains used in the past. Some varieties, however, are still nodulating poorly on new soybean land.

Seed inoculation of desmodium, siratro, glycine and centro was tested in three soil types in the greenhouse. Positive growth response following inoculation was obtained in the majority of legume-soil combinations. This result tends to support the existing general practice of inoculating seed of these legumes before planting.

### AGRICULTURAL CHEMICAL LABORATORY BRANCH

Branch activities have expanded following the establishment of field laboratories at some research stations and strategic country centres. These laboratories provide the Branch with facilities to investigate chemical aspects of important production problems in areas where they occur. Furthermore, by being in constant touch with field aspects of problems, officers now have opportunities for making a close study of these problems, which is often an essential prerequisite to the solution of them. A further advantage of these facilities is that the Branch can now engage to a greater degree in co-operating with specialists of other branches in joint investigations.

#### PLANT NUTRITION SECTION

*Soil Survey.*—Following previous work in the Mareeba-Dimbulah irrigation district, further areas, aggregating more than 40,000 acres, were surveyed. Soils suitable for irrigation were mapped in sufficient detail to allow planning of intensive irrigation development, mainly for tobacco growing. In addition, a reconnaissance survey was made of soil on the Upper Herbert River (Mt. Garnet) to assess areas in that district that might be suitable for development for tobacco growing under irrigation. In the Lower Burdekin River irrigation district, soil surveys covered areas bordering on the present irrigation settlements, and an area west of Dalbeg in an endeavour to find alternative sites for some tobacco farmers who wish to transfer from the river-levee country. In the Mackay hinterland, a broad-scale survey was made of soils in the Bowen River-Broken River area to assess the overall potential for irrigation from these streams. On the

site of the new research station near Moura, in the brigalow belt, soil types of areas that are to be cleared for development are being mapped.

*Soil Physics.*—Soil physics laboratories are now operating at Brisbane and at the Research Station at Millaroo in the Lower Burdekin.

The tight packing noticed in the profiles of soils at the Tobacco Research Station at Parada is reflected by the bulk densities with average values of 1.7 gm. per cc. being recorded at the 6–18 in. depth. At Carbrook, on the South Coast, where drainage investigations are being made, it appears that bulk density of the soil on the experimental site impairs crop growth less than salt concentration. Bulk densities for a number of samples from a rotation trial on the Darling Downs indicate that differential cropping has had an effect on this important soil property, but the data have yet to be analysed statistically. Studies were commenced on methods of improving the physical properties of flood plain soils within the Lower Burdekin River irrigation area as a step towards solving problems associated with the irrigation of these heavy-textured soils.

*Pasture Investigations, Maleny.*—Kikuyu grass has been one of the principal pasture species on the Maleny tableland for several decades, but its productivity is declining. White clover in the original *Paspalum dilatatum*-white clover pastures has almost disappeared. The kikuyu at a certain stage of growth is chlorotic and has short internodes associated with the development of multiple shoots. Pests and diseases, although present, do not seem to be the primary cause of the disorder.

A chemical assessment of changes which have occurred in these red volcanic (krasnozem) soils under cultivation has shown that a drop in pH of 5.2 to 4.2 is accompanied by a loss of 75 per cent. of the exchangeable calcium and 50 per cent. of the exchangeable magnesium. In comparable soils under permanent pasture, the losses were 23 and 38 per cent. respectively.

Field trials to date have indicated that, in regard to plant nutrients, nitrogen is the most important single factor influencing pasture growth, and that phosphorus may be of further significance. Plots laid down in mid-December and cut on January 30, yielded 7,900 lb./acre of dry matter from nitrogen-phosphate treatments as against 3,700 lb. from the controls (no fertilizer).

*Wallum Investigations.*—The Research Station at Coolum is now operating under the administration of the Research Stations Board, but the Branch is still responsible for much of the planning and execution of the investigational work.

In trials with winter grazing crops, oats continued to improve with basal applications of sulphate of ammonia up to 4.5 cwt. per acre. Symptoms of magnesium deficiency appeared in plots with no dolomite, but not in plots treated with dolomite at the rate of 5 cwt. per acre.

In a winter grazing varietal trial, oats (Bovah, 25 cwt./acre oven-dry matter) and rye-corn (Black Winter, 24.2 cwt./acre) yielded better than wheat (Lawrence, 19.7 cwt./acre) and barley (Cape, 19.1 cwt./acre).

The legumes lotononis and siratro responded much better to lime and dolomite than to magnesium carbonate. This indicates the importance of calcium in the development of legume-based pastures on these infertile sands.

*General Analysis.*—A total of 4,609 samples of soils was analysed. Most of these were samples from farmers and trials carried out by officers of the Department of Agriculture and Stock. Approximately 200 samples were received from sporting clubs seeking an opinion on the suitability of soils for top-dressing or for laying down greens. Waters analysed for suitability for irrigation or stock-watering purposes totalled 1,200; while the data for 1,113 samples analysed by the Government Chemical Laboratory were assessed for the same purposes.

Many waters are rejected for irrigation purposes because of their high chloride content, and some because of a relatively high content of sodium. Waters regarded as unsuitable for stock often contain a high content of salt and in some cases a relatively high amount of the sulphates and chlorides of calcium and magnesium.

### GENERAL ANALYTICAL SECTION

A total of 4,511 samples was analysed, comprising grasses, grains, stockfoods, fertilizers, pest destroyers, and veterinary medicines. Of the 574 stockfoods samples, more than 23.0 per cent. contained less than the declared protein content. Approximately 54.0 per cent. of the fertilizer samples were below the declared level of one or more of the constituents, especially nitrogen. Liming materials were of a satisfactory standard, though in some dolomite samples there were suggestions that soil impurities were rather high. Of the 116 pesticides and 11 veterinary medicines examined, only 15 and 4 respectively contained less than the declared level of a constituent. Deficiencies found in pesticides are generally due to errors in preparation of formulations, but occasionally it is found that decomposition is the reason for the low results. It has been found too that some weedicides precipitate active material on storage.

Research on analytical methods continued, and for this purpose, a collection of samples of pure pesticides is steadily being acquired. Infra-red methods of analysis for single substances were established for a number of pesticides and veterinary medicines. Investigations to establish similar methods for mixtures are proposed.

Several samples were analysed for captan and BHC following complaints of insect infestation in stored grain treated with these materials. In all cases, the samples were up to the guarantee.

Comparisons of the properties of oil extracted from linseed and safflower seed by mechanical (hydraulic press) and chemical (solvent) means, showed the iodine value to be slightly higher, and the refractive index slightly lower, for oil extracted mechanically.

Soybean varieties from Research Stations at Gatton and Walkamin, near Mareeba, showed interesting comparisons in their protein and oil contents as indicated in the following table:—

Variety	Gatton		Walkamin	
	Protein	Oil	Protein	Oil
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Nanda ..	34.5	19.4	39.3	17.5
M.B.H. Series ..	38.1	17.0	43.2	16.5
D.E.H. Series ..	32.7	20.4	41.7	18.8

### CEREAL SECTION

*Wheat.*—Work in the cereal laboratory included quality appraisal of wheat from plant breeders' samples, from variety and rotation trials, and from quality surveys made in association with the State Wheat Board and some agricultural show societies. Generally, the plant breeders' samples were of good quality, but as a group the slow-maturing varieties (average protein 15.1 per cent.) were superior. Wheat from rotation trials on the Research Station, Hermitage, including one treatment from land which had been under lucerne for a number of years, was of generally high quality, with strong flours of good extensibility and baking quality. Samples from trials on the Biloela Research Station had protein ranges from 15.8 to 16.6 per cent. for a rotation trial and 13.1 to 15.1 per cent. for a variety trial. Varieties Spica and Mengavi gave the best flours with good extensibility. Wheat following pastures at Jondaryan was exceptionally high in protein content (average 16.0 per cent.) and gave flour of excellent baking quality.

The baking quality survey made in conjunction with the State Wheat Board again showed the overall superiority of Spica, particularly in baking tests, where higher loaf volumes were obtained consistently from the flour of that variety. Mengavi also ranked high in this survey.

A survey of protein content, made on samples taken from depots, indicated that the overall protein figures were lower for the 1962 season (average 12.0 per cent.) than for the 1961 season (13.6 per cent.). These differences are considered to be due to seasonal effects.

*Barley.*—With the co-operation of the Barley Board, samples were received from depots and growers. The object of this survey is to locate malting grade barley on a depot basis. The average protein content of 11.8 per cent. was higher than the level for optimum malting quality.

A fertilizer trial was run in the Warwick district to determine the minimum levels of nitrogen that could be applied to increase yields without impairing the malting quality of the grain. Yield increases and good malting grain were obtained up to levels of 1.5 cwt. of urea per acre.

*Laboratory Investigations.*—Tests of a rapid colorimetric method for protein estimation indicated that, while it is quicker and cheaper than Kjeldahl method, it is much less reliable.

Experiments on test baking have shown that moulding methods and procedures have a marked effect on the loaf volume obtained by the "pup" loaf test. Baking quality is now assessed by this small scale test and the handling of samples has been much accelerated thereby. All baking facilities are now located within the laboratory and a considerable increase in efficiency has resulted.

### FIELD LABORATORIES

*Tobacco Laboratory, Northgate.*—More than 1,000 samples of cured leaf, mostly from field trials carried out by officers of the Department, were examined in this laboratory for the purpose of assessing the quality of leaf based on its chemical constituents. This information can have important practical implications in determining the effects of cultural treatments on leaf quality and as a guide to modifications of those treatments that might be adopted to improve quality or offset undesirable properties of the leaf.

*Research Station, Millaroo.*—This laboratory is concerned with studies of problems associated with irrigated agriculture on the heavy flood plain soils of the Burdekin River Valley, and with investigations into tobacco-growing problems. It also provides an advisory service to tobacco farmers, and in this connection more than 2,000 soil-nitrogen tests were made during the season.

*Research Station, Parada.*—Work done in the past two seasons on nutritional problems of tobacco in relation to nitrogen has indicated that, to adjust the nitrogen to desirable levels on all soil types, more basic knowledge is required than is available at present. Glasshouse and other nutritional studies have been planned to provide some of the required information.

*Mareeba.*—This recently completed laboratory is intended to be a regional laboratory for the Atherton-Mareeba Tableland, and when fully staffed and equipped, will duplicate many of the facilities available in Brisbane.

*Wheat Research Institute, Toowoomba.*—At this newly established laboratory, studies commenced of chemical methods of plant nutrient extraction. The object is to determine those most suitable for correlation of laboratory data with observed plant behaviour in the base-saturated soils of high colloidal content that characterise most of the wheat-growing soils on the Darling Downs.

## FOOD PRESERVATION RESEARCH BRANCH

Very satisfactory progress was made during the year in both post-harvest physiology and food technology research.

In the physiology field the outstanding results were the control of bitter pit in apples and brown rot in peaches, the inducement of ripening in Santa Rosa plums, the development of a pressure tester for measuring the firmness of bananas, the effect of small concentrations of ethylene on banana ripening, the effect of restricted ventilation on the commercial ripening of Williams pears, and the retardation of yellow colour in leafy vegetables. The formation of the Banana Research Advisory Committee is the first step by the fruit industry to provide financial assistance for post-harvest physiology research on a Commonwealth basis.

In the field of food technology, valuable technical information was obtained on the concentration of pineapple juice, the identification of the volatile pineapple flavours, the assessment of pineapple clonal material for canning purposes, the processing suitability of peas grown in Queensland and the extraction of oil and oleo resins from ginger.

Equipment for experimental work on the accelerated freeze drying of foods and the puff drying of vegetables is being sought in 1963-64. Both processes are recent overseas developments in food technology and have the advantage over other methods of drying, in that the foods are of better quality and rehydrate quicker.

### PHYSIOLOGY

*Delicious Apples.*—Experiments were carried out with the 1962 apple crop to determine whether the Delicious variety is suitable for controlled atmosphere storage. Good results were obtained when fruit picked in early March was held at 32 deg. F. in an atmosphere containing 5 per cent. oxygen plus 2.5 per cent. carbon dioxide. Fruit stored under these conditions had few disorders and was firmer than that stored under other conditions.

Further investigations confirmed Departmental recommendations that 245 TP is preferred to NAA as a "stop-drop" spray. However, fruit for long storage should not be harvested from trees treated with these compounds as they increase storage disorders.

*Jonathan Apples.*—Investigations were commenced to determine the keeping quality of the Jonathan variety; the effects of time of picking and storage temperature are being studied.

*Granny Smith Apples.*—Studies begun in 1961 were continued on pre-harvest sprays of calcium chloride and calcium nitrate for controlling bitter pit in early picked, export Granny Smith apples. Good results were obtained in both the 1962 and 1963 seasons by using two sprays, 14 days apart, applied 7 days before harvest, and containing 10 lb./100 gal. of either of these two compounds. At this concentration, calcium chloride caused some severe marginal leaf scorching. While this appeared to have had no effect on the general health of the trees, the possibility of using less damaging concentrations is to be investigated.

Superficial scald has been controlled effectively in this variety by post-harvest dips containing either diphenylamine or ethoxyquin but neither of these compounds has yet received a health clearance for use in Queensland. Experiments were therefore continued to establish storage conditions under which this disorder can be kept at a minimum without the aid of chemical inhibitors. The results show that the most suitable picking period is mid to late April, with 32 deg. F. the most satisfactory storage temperature.

Further experiments with controlled atmospheres confirmed previous findings that a storage temperature between 36 and 38 deg. F. is the most satisfactory because the incidence of core flush is higher at lower temperatures. The results also indicated that lower oxygen concentrations than those previously recommended result in less core flush.

*Avocados.*—Oil content determinations are the prescribed criteria of maturity for avocados, but a more rapid method of determining maturity is needed; hence the use of specific gravity measurements was investigated. No constant relationship, however, was found to exist between specific gravity and oil content of the fruit.

In conjunction with officers of the Horticulture Branch, investigations are being carried out to measure certain physical and chemical changes in Fuerte avocados during development and maturation and to determine whether the rate of fruit growth is related to maturity.

*Bananas.*—Work is being concentrated on maturity studies with a view to obtaining information on mixed ripeness, which is a major problem in the marketing of the Cavendish and Mons Mari types. An instrument was developed at the Laboratory to measure small changes in firmness in bananas, without damaging the fruit, and to establish when the ripening

processes are initiated. Much variation in maturity was found between the top and bottom hands in cut bunches. Bunches are being tagged at flowering on a number of plantations to determine whether this effect is seasonal. Advanced maturity by some fruit in the bunch at the time of cutting may have an important bearing on the problem of mixed ripeness.

Further investigations into the efficacy of wax emulsion dips as a means of prolonging the post-harvest life of bananas showed that the concentration of the dip which will yield the best results depends largely on the time of the year when the fruit is treated and fruit size. Usually small fruit ripens more rapidly after treatment than large fruit and its shelf life is longer; its rate of weight loss, however, is greater than that of large fruit.

Queensland bananas, packed in cartons after pre-cooling, were reported to be arriving in southern markets in a mixed ripe condition. The type of injury suggested that low temperature combined with small concentrations of ethylene were responsible. Typical symptoms were produced in the laboratory using concentrations of ethylene as low as 1 ppm. Pre-cooling is now being carried out commercially in a room isolated from ripening rooms and free from ethylene contamination.

*Citrus.*—In conjunction with officers of the Plant Pathology Branch, experiments were carried out to determine whether small concentrations of gaseous ammonia would effectively control green mould in citrus fruits in the degreening chamber. Results indicated that a concentration of 500 ppm is the most suitable as it effectively suppressed mould growth and did not injure the fruit to any extent.

In view of new maturity standards for Navel oranges and mandarines now gazetted in Victoria where Brix and acid are specified, maturation studies were recommenced in Queensland. Previous results showed that palatability was related to both Brix and acid and further work is being done on these lines.

*Grapes.*—Small quantities of potassium metabisulphite were used to control mould in stored grapes. Muscatel grapes in sealed polyethylene bags kept satisfactorily for up to 6 weeks at 30 deg. F. provided that the seal was broken immediately the fruit was removed from the storage chamber. Severe bleaching of the berries occurred during subsequent storage at 70 deg. F. for 7 days when this was not done.

*Pears.*—A large grower-to-grower variation has been shown in the life of WBC pears. Chemical investigations were commenced to determine whether any correlation exists between storage life and the nitrogen/phosphorus ratio in the fruit.

Investigations were carried out with the 1963 crop to determine the effect of ethylene on the ripening behaviour of early harvested WBC pears. Using 1,000 ppm ethylene for 1 to 2 days was sufficient to initiate ripening but periods longer than this shortened the shelf life of the fruit. When ethylene was applied to late harvested pears it had no effect on ripening.

Heavy losses in Stanthorpe WBC pears ripened at the cannery were shown to be due to high carbon dioxide levels in the unventilated ripening chambers. It seems that WBC pears grown in Queensland have to be ripened somewhat differently from those grown in southern States.

*Pineapples.*—Further determinations were made on the chemical changes in pineapples from the 1 in. red heart stage to maturity. Fruit weight and total soluble solids increased until optimum maturity was attained. Acidity increased to a maximum at optimum maturity and then decreased rapidly. The 14 days prior to optimum maturity are very important as, during this period, several volatiles are produced which appear to be responsible for the improvement in pineapple flavour. Physiological studies of the maturing pineapple are being carried out in conjunction with these chemical studies. In another experiment, 5 weeks' storage life was obtained at a temperature of 44 deg. F.

*Stone Fruit.*—Further experiments confirmed findings in 1962 that Santa Rosa plums can be ripened uniformly at a constant temperature with 1,000 ppm ethylene. This variety can be ripened artificially to good eating quality by gassing the fruit for 1 to 3 days with 1,000 ppm ethylene at 70 deg. F.; otherwise the plums remain hard and never ripen satisfactorily.

Trials showed that a maximum storage life of 3 weeks for Burbank and 4 weeks for Mariposa could be obtained by storing the fruit at 30 deg. F. Storage life was approximately halved by storing at 34 deg. F.

Overseas workers report that hot water dips will control brown rot in peaches. Preliminary experiments here in 1963 with the Elberta and Golden Queen varieties indicated that a 3 min. dip at 130 deg. F. or a 7 min. dip at 120 deg. F. controlled this disease. Although some skin damage occurred with the Golden Queen variety, the results were very promising and further trials are planned.

**Tomatoes.**—Green mature tomatoes were stored at 45 and 55 deg. F. and respiratory patterns measured. At 55 deg. the fruit behaved normally but when stored at 45 deg. for more than 7 days, abnormal respiratory behaviour occurred. The results confirmed earlier recommendations that green mature tomatoes should not be stored at 45 deg. F. although this is the normal storage temperature for ripe tomatoes.

**Vegetables.**—Screening trials carried out to determine the effect of dips of N6 benzyladenine on the post-harvest life of vegetables indicated that treated brussels sprouts, cabbages and celery retained their original green colour after 9 days' storage at 70 deg. F. while the untreated vegetables were very yellow. The work is being extended to cover a wider range of vegetables, particularly leafy vegetables.

## FOOD TECHNOLOGY

**Pineapples.**—To reduce transport and packing costs, foods should be as concentrated as possible. As pineapple juice comprises over 90 per cent. of Australian juice exports, methods of concentrating this juice to about 20 per cent. of its original volume are being investigated. The installation of the Luwa turbulent thin film evaporator made it possible to produce on a pilot scale the first batches of fully flavoured frozen concentrated pineapple juice.

During the year, over 1,000 gal. of pineapple juice were processed. The juice is taken direct from commercial screw presses, transported to the laboratory and then pasteurized as quickly as possible. Concentrations as high as 70 deg. Brix (6:1 concentration) have been obtained but for the time being 55 deg. Brix (4:1 concentration) is being produced. Although ester losses were initially high, these problems have been overcome and essences of 250 fold are now being successfully prepared with a yield of about 80 per cent. in a 12 ft. high atmospheric fractionating column. The esters are returned to the concentrate under the level of the liquid. Experiments are now in progress to determine the optimum ester level and the effect of temperature on evaporation.

To determine the volatile flavouring constituents of pineapples which will assist in the standardization of the flavour of juice concentrates, their identification by gas chromatography and chemical methods continued. Two sulphur-containing esters have been found and the other compounds so far positively identified include three methyl esters, four ethyl esters and one amyl ester, diacetyl and four alcohols. At least 12 other compounds indicated by gas chromatography have yet to be identified.

*Acetobacter aceti* strain B999 has been found most suitable for processing pineapple vinegar. In submerged acetification experiments the best results were obtained by using a high rate of air flow, reducing the temperature of fermentation to 76 deg. F. and by starting the acetification in a single tube with cells in an active stage of growth drawn from another fermentation tube.

A trial was carried out to determine the canning suitability of 25 selected clones grown at the Maroochy Horticulture Research Station. Over a 3-week period, 50 fruit from each clone were examined for size, shape, external colour, internal colour, translucency, porosity, sugar, acid, esters and internal defects. Seven clones have been tentatively selected as being worthy of further examination.

**Citrus.**—As there is a good demand in Australia for frozen concentrated orange juice, the suitability of Queensland grown oranges for juice purposes is being investigated. Samples of late Valencias grown on three rootstocks, trifoliata, sweet orange, and rough lemon, were taken over a 10-week harvesting period, and sugar, acid and pH determinations were made. From the limited number of trees so far examined, trifoliata appears to give highest yield of total soluble solids per ton. The juice was canned and is to be examined for bitterness after storage. A similar trial with the Joppa variety is now in progress.

**Ginger.**—To determine the suitability of Buderim-grown ginger for the production of oleo resin and volatile oils, samples harvested over a 6-monthly period were analysed during 1962 and a second trial is in progress in 1963. Results indicated that provided the local ginger is harvested before June, the oleo resin and volatile oils are much higher than those of imported products so far examined. Quality has generally been equivalent to imported but the acetone-extracted oleo resin is superior to alcohol-extracted oleo resin. The packaging trial indicated that the volatile oils of ginger can be retained much more satisfactorily by storing the ginger in the whole dried form than in the ground form. Although the rate of dehydration can be increased by raising the temperature, 135 deg. F. appears to be the optimum dehydration temperature.

**Beetroot.**—Since the canning of beetroot is based on existing varieties developed for the fresh vegetable market, the canning suitability of six new varieties, Chieftain, Chieftain Selection, Detroit Dark Red (U.S. Selection Nos. 1 and 3), Detroit Dark Red (Dundas Selection 96) and the Detroit Dark Red (control) was examined. Each variety was graded into three sizes, namely, up to 2½ in. diameter, from 2½ in. to 4½ in. diameter, and above 4½ in. diameter, and then canned by normal techniques.

A comparison of varieties made on the basis of colour indicated that the varieties Chieftain and Chieftain Selection were outstanding, being much brighter than Detroit Dark Red.

**Mangoes.**—The quick freezing of Kensington mango slices has become a well established industry in central Queensland. Unfortunately when this variety is selected for optimum flavour, its texture is usually soft after processing. Further processing trials were conducted on Kensington, Goldsworthy, A. S. Roberts and R<sub>3</sub>, but final observations are not complete.

**Papaws.**—When cubed papaw is canned by normal commercial procedures, major flavour changes usually occur. As this could be due to heating effects, the spin cooker is being compared with the commercial rotary cooker for cooking times, texture and flavour. Heat penetrations curves for this product at varying rotational speeds and steam pressures were determined.

**Pears.**—The commercial canning of Stanthorpe W.B.C. pears during recent years has raised problems owing to variation in product quality. The optimum harvesting date for storage and ripening time of these pears was studied in 1962, but the results were not conclusive. Further work is to be done.

**Apples.**—Dehydro-freezing is a process in which the product is dehydrated to 50 per cent. of its original weight and then quick frozen, thereby saving freight and refrigeration. As dehydro-frozen apples are used extensively in the U.S.A. for pie fillings, small experiments were carried out on Queensland Granny Smith apples. The dehydro-frozen samples reconstituted to a product resembling freshly cooked apples in appearance and taste.

**Bananas.**—Although most of the world's production of bananas is eaten fresh there is a demand for a processed product, particularly in the pure form for use in the bakery trade, for flavouring purposes, and for baby foods. The cause of the gelling problem in processing canned banana puree is being investigated. It may be related to starch content, and the conversion of starch to sugar as the banana ripens is, therefore, being studied.

**Macadamia Nuts.**—Commercial plantings of grafted trees of the selected varieties of both the *integrifolia* and *tetraphylla* types are being made. *Integrifolia* requires more heating than *tetraphylla* for processing and has a better keeping quality. The association of processing methods and lipase activity with rancidity is being examined.

**Strawberries.**—There is a growing demand both overseas and in Australia for individually frozen products, particularly berry packs. It is customary to quick freeze strawberries in syrup or mixed with sugar, but latest developments overseas suggest that this coating is not necessary when the berries are frozen very rapidly in single layers on trays. A small trial was commenced on the freezing of whole strawberries, blast frozen without sugar or syrup at three different air velocities, but results are not complete.

A fungus with all the properties of *B. fulva* was isolated from commercial samples of canned berries which had completely disintegrated during storage. This may be the first isolation of this organism in canned fruit in Australia. The fungus has caused considerable trouble in strawberry canning in England. Recommendations were made to increase the cooking temperatures and times for canned strawberries to destroy these micro-organisms.

**Peas.**—A recent survey indicated that 50 per cent. of quick frozen food sales in Australia are vegetables and of these peas amount to 60 per cent. As the annual Australian production at present is 30 million pounds, all of which is produced in southern States, interest in growing peas in Queensland for processing has been intensified, particularly as this State has a longer harvesting period than other States.

To determine the suitability of varieties of peas for processing, knowledge of their maturity response to seasonal conditions is necessary. Times to optimum harvest and increases in Maturity Index (MI) per day vary according to variety and time of planting. Variety B27, planted in mid-June, showed rather rapid increases in MI values of up to 25 per day, while variety A3 showed a much steadier rise of 15 per day. The increase in MI values for April planted peas is approximately 10 per day. Yields of approximately 5,000 lb. per acre were obtained from both varieties planted in mid-June.

## DIVISION OF ANIMAL INDUSTRY

As foreshadowed in the last Report, the year proved notable for some easing of the Division's difficult staffing position, especially with the graduate staff. From the Government's University Scholarship scheme, seven veterinary graduates came onto the strength, along with two graduates in Rural Science and one in Science. In addition, the Division recruited two graduates in Agricultural Science and a further graduate in Science. On the other side of the picture, there were three resignations by veterinarians, two of them of considerable standing and experience.

There is an urgent need to strengthen Queensland's veterinary services. Under present day conditions of trade and commerce, not to mention the mass migration of peoples, the risk of exotic diseases penetrating Australia's quarantine barrier has increased greatly. There seems less reason for optimism about the future than ever and the consequences for the State's export trade in animal products, especially beef, could be extremely serious.

The country's quarantine precautions have been taken about as far as they can reasonably be expected to go. But extensive and far reaching as the precautions may be, they are not proof against accidents, human error or deliberate transgressions of quarantine law. Queensland must be ready to come to grips with and vanquish any disease that threatens the security of its livestock industries. To that end a marked increase in the number and experience of the State's veterinary staff is essential. The level of experience is important as there is a very real problem in keeping veterinary staff with more than 5 or 6 years' experience.

The problem is not restricted to veterinarians serving in Government departments. Opportunities for practice are wider in southern States and prospects for the practitioners a good deal better.

The Department has done much to encourage private veterinary practice in Queensland. Still more may yet have to be done if the rewards offering to practitioners in southern States are to be matched.

### DISEASE SITUATION

Of most interest unquestionably was the finding in the State's pig population of positive reactors to a blood test, known as the gel diffusion test, for swine fever. Such reactions, in the present state of scientific knowledge, have to be accepted as presumptive evidence of previous exposure of the pigs concerned to the virus of swine fever. Whether this will continue to be the accepted view remains to be seen. Meantime the fact remains that no clinical swine fever has been seen in Queensland and attempts to transmit the disease from pigs on "suspect" properties have been unavailing.

Infectious rhinitis of pigs, first reported in the State 2 years ago, is now recognized as a clinical entity with increasing frequency. However, the disease is still not common and under good management is not a source of great concern.

The national programme for the eradication of bovine contagious pleuropneumonia was carried a stage further, once again with very encouraging results. After a lapse of well over a year, two cases of equine infectious anaemia were reported, but the disease continues to give no indication of becoming a problem.

Ticks and tick fever were again a source of grave concern. There is ground for believing that the restrictions on the use of chlorinated hydrocarbon tickicides have contributed to an unhappy situation. Coupled with this is the fear that the tick may be slowly adapting itself to a wider range of

climatic conditions. Should this be so, the outlook for the future cannot be regarded as particularly rosy. Certainly the continuing occurrence of tick outbreaks on the Darling Downs and their accompaniment by tick fever are very serious indeed.

At the Animal Research Institute, Yeerongpilly, a start has been made in setting up virology and mycology sections. This will ultimately strengthen the diagnostic facilities at Yeerongpilly greatly.

### FIELD STATIONS AND LABORATORIES

Developmental work continued at Swan's Lagoon and Ayr Cattle Field Stations in the Burdekin River basin, the Toorak Sheep Field Station, and the Wacol property at which an expanded programme of tick fever research will be centred. Funds, however, remain a limiting factor, especially for Toorak where there is an urgent need for expenditure in the vicinity of £25,000 if the property is to fulfil its rightful purpose.

At "Swan's Lagoon" and Wacol the work of development was again assisted by grants from the Australian Cattle and Beef Research Fund.

At the Ayr Cattle Field Station, State funds only have been available. However, worthwhile progress has been made. The main remaining need is for a small laboratory block, but there is little ground for hoping that this will be built in the near future. This is a pity, as the tropical dairy breed project at the station is attracting attention in such places as the Northern Territory and the Territory of Papua and New Guinea.

At the Animal Health Station, Oonoonba, Townsville, construction of an isolation laboratory unit was commenced. This may well prove to be an important link in the chain of defence against the intrusion of exotic livestock diseases into Australia. Financial support for this project has been given by the Australian Cattle and Beef Research Committee.

At the Animal Research Institute, Yeerongpilly, the problem of space for the much enlarged staff continued unabated. A start has yet to be made on the proposed new Biochemistry/Husbandry Research Laboratory and Metabolism Block. This project is to receive some financial support from the Australian Cattle and Beef Research Fund, and it is hoped that construction will begin next year.

At Strathpine, a farm is to be developed as a study farm to investigate the spread of leptospirosis under field conditions. The Pathology Branch has felt the need of such a farm for some time. The acquisition is expected to increase the tempo of research into this disease.

### ARTIFICIAL INSEMINATION SERVICES

It is indeed pleasing to report the opening of the Department's A.I. Centre at Wacol. It has permanent accommodation for 48 bulls, and it can be extended to increase this number to 64. As a direct consequence of the Department's bull proving scheme, six of the bulls at Wacol are established herd improvers.

Both chilled and frozen semen are supplied at 5s. a dose or 7s. 6d. a dose if the semen is from a bull nominated by the purchaser. These prices, well below cost of production, were adopted to encourage the use of A.I. as a general practice by the Queensland dairying industry. Sales have exceeded expectations, and it is anticipated that 15,000 doses will be issued in the first 12 months of operation.

## VETERINARY SERVICES BRANCH

### STAFF

One Divisional Veterinary Officer (Poultry Diseases) resigned during the year. Six new Veterinary Officers were appointed. However, one transferred to research after a few weeks in the field and one was allotted to the Slaughtering Section. One District Inspector and one Inspector retired, and one field assistant resigned. Five Inspectors were appointed, one of whom was seconded to quarantine duties. One Veterinary Officer, one District Inspector and 10 experienced Stock Inspectors were seconded to pleuropneumonia work for the season. One additional Senior Inspector of Slaughter-houses was appointed.

### DISEASES OF CATTLE

*Bovine Contagious Pleuropneumonia.*—For the second year in succession, no clinical outbreaks of BCPP, either in travelling or paddock cattle, were detected. Three properties

were subject to quarantine restrictions at July 1, 1962, and a further property was quarantined during the year. The quarantines were imposed following the isolation of *Mycoplasma mycoides* from abattoir specimens in 1961 and 1962.

Two properties were released after the development of satisfactory vaccination schemes. One property in central Queensland remains in quarantine owing to inoculation difficulties. A property in north-west Queensland was quarantined owing to the introduction of a suspect mob from the Northern Territory, but subsequently released after adequate control measures had been adopted.

The control programme under the National Pleuro Fund got away to an early start in March. Numerically, the special staff was similar to that used in 1961 but greater responsibility for the implementation of the programme was

placed on the individual Divisional Veterinary Officers who will be in charge of operations within their own divisions.

A Veterinary Officer has been specially trained in serological techniques, including the Huddart test, and it is

proposed to introduce field testing as soon as the necessary equipment has been assembled.

Particulars of suspect lesions detected at northern meatworks during the 1962 season are listed in Table 1.

TABLE 1  
LESIONS DETECTED AT NORTHERN MEATWORKS

Meatworks	Oxen	Cows	Bulls	Suspected Active Cases	Suspected Sequestra	Adhesions	Reject Export
Queerah .. .. .	25,522	22,924	1,886	..	3	472	..
Ross River .. .. .	28,347	7,846	428	1	7	306	73
Lakes Creek .. .. .	43,382	20,830	1,058	..	2	313	233
Merinda .. .. .	19,801	8,318	985	..	3	204	12
Alligator .. .. .	19,551	7,998	97	1	2	454	384
Gladstone .. .. .	20,258	7,637	136	..	1	60	60
Mareeba .. .. .	1,314	1,116	151	..	..	25	..
Totals .. .. .	158,175	76,669	4,741	2	18	1,834	726

Laboratory tests failed to confirm the presence of active disease in either suspect case. Precipitin and culture tests were positive on sequestra from each of 3 properties and one positive precipitin from another property. The remainder were negative. *Pasturella multocida*, *Corynebacterium pyogenes* and *C. bovis* were also isolated from sequestra.

A total of 6,260 sera from more than 40 properties in the Alpha-Springsure area was tested on slaughter specimens, and 243 on field specimens. Two positives were obtained in recent inoculates. A further positive was obtained on testing 1,172 sera (586 head) from cattle in the Townsville-Peninsula area for New Guinea shipments.

More than 80 per cent. of travelling cattle within the endemic area were inoculated under Departmental supervision. In all, 148,341 inoculations were supervised by BCPP staff and 91,288 by Stock Inspectors. A further 60,387 were inoculated by owners or agents. It seems unlikely that the figure of 80 per cent. supervision can be exceeded without an unwarranted increase of staff. In addition, 63,393 inoculated cattle entered the State from the Northern Territory in 1962. Total numbers of travelling stock inoculated rose from 165,287 in 1961 to 302,907 in 1962.

Numbers of paddock cattle inoculated were approximately double those of the previous year. It is known that 286,730 were inoculated (40,449 under supervision) and the total would certainly exceed 300,000. In all, more than 600,000 cattle were inoculated against BCPP during the year.

A total of 980 properties were visited by specialist BCPP officers. Two-thirds of the properties either have or are likely to commence control inoculation schemes.

In the 1963 season to June, 13,085 sera have been submitted from meatworks and 40 were positives. Most, if not all, the positives resulted from recent preventive inoculation. *M. mycoides* was isolated from one sequestra only in 1963, but it has been impossible to trace the origin of the animal.

The time is ripe for consideration of further releases from the "endemic" area and subject to the success of the rapid field test, further measures to strengthen the status of the Protected Area.

**Tuberculosis.**—During the year a considerable number of changes occurred in tuberculin testing contracts. However, at the end of the year there were 39 approved veterinary surgeons, 33 3-year contracts and 3 temporary contracts.

TABLE 2  
SUMMARY OF TUBERCULIN TESTING BY APPROVED VETERINARY SURGEONS

Division	No. of Herds	No. of Tests	No. of Reactors	Percentage of Reactors
Brisbane .. .. .	1,823	115,604	233	0.2
Maryborough .. .. .	1,037	78,137	31	0.03
Toowoomba .. .. .	1,089	52,214	13	0.024
Rockhampton .. .. .	503	42,296	13	0.03
Cairns .. .. .	142	7,216	14	0.2
Townsville .. .. .	6	404	2	0.5
Totals .. .. .	4,600	295,871	306	0.1

TABLE 3  
SUMMARY OF TUBERCULIN TESTING BY GOVERNMENT VETERINARY OFFICERS

Division	No. of Herds	No. of Tests	No. of Reactors	Percentage of Reactors
Brisbane .. .. .	5	701	8	1.1
Maryborough .. .. .	26	1,725	22	..
Toowoomba .. .. .	14	1,025	..	..
Rockhampton .. .. .	36	2,089	*54	2.63
Cairns .. .. .	..	..	..	..
Townsville .. .. .	13	2,204	*17	0.8
Totals .. .. .	94	7,744	101	1.3

\* Beef cattle.

**Coast Disease (Botulism).**—Reliable figures on the incidence of this disease for this year are not yet available, but they are thought to be considerably lower than those reported for 1961-62. Owing to delays in the production of a mixed *Clostridium botulinus* strain C-D toxoid, sufficient lamsiekte vaccine for 1,000 head was imported from Onderstepoort, South Africa. Unfortunately, this is a 2-shot vaccine and difficulties were experienced in mustering for the second injection. However, in the Townsville-Charters Towers area, 713 head received the double dose and 57 one dose only. The remaining vaccine was used in the Bundaberg-Maryborough area on approximately 200 head. Recently, 760 doses of locally produced C-D vaccine became available and were issued for field experiments.

On a preliminary survey, no deaths have occurred in vaccinated animals but a full estimate of the effectiveness cannot yet be made.

As it is suspected that the botulism is closely associated with phosphorus deficiency, particularly in north Queensland, phosphorus supplementation trials were set up near Townsville using superphosphate in the drinking water. No conclusive results have yet been obtained.

**Infertility.**—Vibriosis continues to exact its toll in infertility in dairy districts and there is some evidence that the disease is prevalent in beef herds.

A considerable amount of testing and pregnancy diagnosis is being done by Veterinary Officers in the Townsville and Rockhampton divisions. A series of observations is being made on 7 large properties in the Cloncurry district. This shows that vaginitis is extremely prevalent. Average positive incidence of vibriosis in 10 groups of cattle tested was 27 per cent., and suspicious 22 per cent. Brucellosis incidence was very low in this survey although some herds in the district are known to be affected. Positive titres were found to *Leptospira pomona* in 7 per cent. and *L. hyos* in 69 per cent. of cattle tested. A survey of brucellosis incidence is also being carried out on the sera submitted from Lakes Creek meatworks for BCPP.

Branding percentages as low as 40 per cent. have been recorded and 50 per cent. empty cows is a common finding. It is clear that environmental and nutritional factors are extremely important. Further survey work is necessary however, to determine how much infertility in extensively managed beef cattle is caused by infectious disease, and whether any practical steps can be taken to increase fertility.

Dairy cattle infertility on the Atherton Tableland was carefully investigated. While the incidence of brucellosis and vibriosis is comparable to that in other districts, some areas have an anoestrus problem thought to be of nutritional origin.

A severe brucellosis storm occurred in a herd regularly inoculated with Strain 19 over the last 7 years.

**Trichomoniasis.**—The focus of trichomonad infection in the Brisbane area was shown to be rather more extensive than suspected. Two properties were released from quarantine during the year and 10 remain under eradication programmes. A positive isolation was made on one property near Toowoomba but surrounding properties appear to be clean.

Trichomoniasis was confirmed on a large beef property near Charters Towers. Artificial insemination is quite impracticable on this property and an attempt is being made by co-operation with this Department to set up a 2-herd eradication programme.

The disease was also diagnosed in a New South Wales border stud herd which supplies bulls to Queensland beef properties.

**Tick Fever.**—Minor outbreaks and individual cases were again prevalent in tick infested areas. Babesiosis was particularly severe in the central districts. Anaplasmosis was



again recorded from most ticky districts, but it is sporadic and not of major importance to the industry. One severe outbreak occurred near Brisbane, with deaths in 2 to 3 days. It was controlled reasonably well with Terramycin. *Theileria mutans* was found associated with a chronic wasting syndrome.

**Miscellaneous.**—Copper deficiencies in cattle are still frequently reported. Where the deficiency is acute with scouring and rapid loss of condition, copper treatment is extremely satisfactory but has little effect on more chronic cases. Sporadic cases of mycotic dermatitis occurred. St. George disease occurred in the spring.

### DISEASES OF PIGS

**Swine Fever.**—Close investigation of all pig losses and intensified supervision of the boiling of pig swill was maintained throughout the year. Histopathological examination of brain tissue was made routine in the investigation of suspicious field deaths of pigs. In appropriate cases sera were submitted to the New South Wales authorities for gel diffusion tests. Although provision had been made at the Animal Research Institute for suitable pig isolation facilities, it was not considered desirable to seek the introduction of Weybridge virus to enable antigen for this test to be prepared. Ninety-three sera were forwarded from 7 properties of which one sample was doubtful and the remainder negative.

A further 61 sera were submitted from 2 northern properties where an extremely serious disease, mainly of young pigs and characterised by nervous symptoms and some diarrhoea, was occurring. All were negative. A transmission test on 5 pigs with unfiltered blood also produced no febrile reaction and the recipient pigs were shown negative to the gel diffusion test. In subsequent transmissions, a febrile reaction has been produced in one case, with pleurisy and peritonitis as the sole abnormalities. This finding was not repeated in later tests and it is considered that the field cases were not due to swine fever.

A random survey of backfatters slaughtered in various parts of the State produced 14 positive and 3 suspicious gel diffusion reactions in a series of 219 sera involving 14 properties. No clinical evidence or history of unusual sickness could be detected on any of these properties and after a precautionary holding period, they were released from quarantine. Transmission tests from some of these properties were negative. Approximately 100 sera associated with these properties have returned only one positive gel diffusion reaction.

	Stud Rams	Flock Rams	Weaner Rams	Stud Ewes	Maiden Stud Ewes	Total
Sheep Tested .. .. .	302	246	598	3,528	454	5,128
Positive .. .. .	9	8	10	30	1	58
Suspicious .. .. .	6	2	5	17	..	30
Percentage Positive and Suspicious .. .. .	5	4	2.5	1.3	0.2	1.7

Infected rams were disposed of and repeated short interval testing of rams in infected flocks has indicated that eradication on the basis of ram testing only appears practicable. The survey is being repeated on stud and weaner rams only. It is hoped that it will be practicable to set up an accreditation scheme based on these findings. Preliminary tests indicate a major reduction in incidence. The survey has now been extended to Corriedale studs.

Enterotoxaemia is now regarded as endemic in the Dalby and Warwick areas. Tetanus occurred sporadically and an outbreak of blackleg occurred in stud sheep at Muckadilla. Foot abscesses were quite prevalent during wet weather and 2 outbreaks of foot rot were recorded.

### DISEASES OF HORSES

Two cases of equine infectious anaemia were confirmed for the year. One was at Quilpie and the other at Baralaba. The case at Baralaba was on a property from which a positive was obtained in 1958. It showed extreme anaemia and a high siderocyte count. The disease was confirmed by transmission.

Severe wet conditions were responsible for numerous cases of coronitis, particularly on heavy black soil and for a disease of unknown etiology in the Peninsula known as "foot-rot". Ringworm, strangles, tetanus and pathogenic worm burdens were reported.

### DISEASES OF POULTRY

Infectious laryngotracheitis has again caused severe losses on a large northern broiler establishment. Vaccination of day-old chicks has been shown to break down in 6 to 8 weeks and even a re-vaccination at 6 weeks of age has not been completely successful. An initial vaccination during the second week is now giving satisfactory results.

An outbreak in a very large Brisbane establishment has presented severe problems, mainly because of lack of accommodation for isolation and physical difficulties associated

The summary of gel diffusion tests is as follows:—

	Sera	Positive	Percentage Reactors
Properties suspected on clinical grounds ..	154	..	..
Random Survey .. .. .	219	14	6.4
Arising from Survey .. .. .	93	1	1

In the absence of any clinical evidence of swine fever in Queensland, the significance of the positive gel diffusion tests is difficult to determine. It could mean that Queensland pigs have been exposed to swine fever virus of low virulence. It is known that similar findings were recorded in all other Australian States. Accordingly, after consultation with other States, legislative prohibitions against the entry of pigs and pigmeats were removed, subject to certain health requirements, from all States other than that part of New South Wales outside the Casino-Port Macquarie Protected Area. This restricted part of New South Wales is the one where outbreaks of virulent swine fever occurred.

**Inclusion Body Rhinitis.**—Further investigations have shown this disease is widespread and that in general it is not associated with heavy economic losses. A total of 8 properties was quarantined during the year and 11 released.

**Oedema Disease.**—This disease has now been shown to be a serious source of economic loss in all pig raising districts. More than 45 outbreaks have been confirmed in the past year. Recovery of the haemolytic coliform organisms usually associated with the disease is not always possible. Symptoms recorded are oedema of the eyelids, stomach wall and mesentery. Recently mulberry heart lesions have been recorded.

**Miscellaneous.**—Salmonellosis and virus pneumonia continue to exact their toll. Vitamin deficiencies and parakeratosis occurred in most districts. Nutritional anaemia, Glasser's disease, and infectious scours in suckers were relatively common.

### DISEASES OF SHEEP

**Brucellosis.**—An extensive survey of the incidence of ovine brucellosis in British breed stud sheep was undertaken with the co-operation of the Australian Society of Breeders of British Sheep.

The following table summarises the results of the 1962 bleeding on 59 properties:—

	Stud Rams	Flock Rams	Weaner Rams	Stud Ewes	Maiden Stud Ewes	Total
Sheep Tested .. .. .	302	246	598	3,528	454	5,128
Positive .. .. .	9	8	10	30	1	58
Suspicious .. .. .	6	2	5	17	..	30
Percentage Positive and Suspicious .. .. .	5	4	2.5	1.3	0.2	1.7

with the vaccination of very large numbers. Seventy thousand birds have been inoculated in the Brisbane area. In spite of the severe losses on broiler properties, the problem in Queensland is localised.

The nephritis-respiratory complex is believed to be widespread, and use of a serum neutralisation test has shown it to be present on several properties where it might not otherwise have been suspected. Epidemic tremor occurs sporadically. Its main effect in this State is an interference with the export trade of infected hatcheries. C.R.D., leucosis and coccidiosis are prevalent.

### EXTERNAL PARASITES

**Cattle Tick.**—The season, particularly in the latter half of the year, has been favourable for the build-up of cattle ticks. Numerous, but scattered, outbreaks of tick fever have occurred in the Chinchilla, Dalby, Oakey, Crow's Nest, Millmerran, Clifton and Toowoomba areas. Extensions and regressions have also occurred in the Kingaroy area. An attempt to eradicate ticks from the Chahpingah-Ironpot area by strategic dipping failed. The failure was due to incomplete producer co-operation, mustering difficulties and the marked deterioration of the season which made continued treatment impracticable. Ticks were found on sale cattle at Kingaroy saleyards and adjacent to the town. Tick fever outbreaks have been associated with a number of these extensions, particularly on the Downs. Good progress has been made in eradication and a number of quarantines lifted.

A serious dissemination of ticks occurred through the movement of an infested mob from marginal country through the Chinchilla saleyards. Infested animals were found at Chinchilla and Condamine.

A close check has been kept on the change over from chlorinated hydrocarbons to approved medicaments. No vats charged with chlorinated hydrocarbons are now being used for the treatment of cattle. Most owners have changed to organic phosphorus compounds but a small percentage have reverted to arsenic. A new carbamate formulation is now available.

**Buffalo Fly.**—Extremely wet conditions in March were not conducive to the spread of buffalo fly and with the onset of colder weather it appears that further spread is unlikely. Departmental control methods are continuing.

Although heavy infestations were observed in the northern endemic areas, they were sporadic. Although it is clear that the organo-phosphorus compounds are inferior to DDT for the control of this parasite, there have been no widespread complaints of failure to control fly.

Use of minimal quantities of 0.5 per cent. DDT as a back spray after dipping is still permitted. Experiments to reduce still further the permissible quantities of DDT have been carried out it appears 0.3 per cent. is the irreducible minimum. Use of the organo-phosphorus compounds as a special spray at 2 and 3 times the normal dipping strength gave protection periods of up to 8 days. Carbamates gave protection up to 10 days with some alleviation up to 15 days. Methoxychlor, a chlorinated hydrocarbon, at 0.5 per cent. to 1.0 per cent. gave the best protection, up to 15 and 21 days respectively. In this respect, it is comparable with DDT. It is however more expensive and has other disadvantages.

**Stickfast Flea.**—This parasite is now widely distributed in the State, especially along the coast and in the south-west. It does not cause any serious economic problems and has been easily eradicated on the few occasions when it has occurred on flocks of economic importance.

### POISONING

Isolated poisonings with arsenic occurred as usual. Generally, losses were low. However, in an outbreak at Ipswich, arsenic was maliciously added to the water trough at the trucking yards, and caused 30 deaths. A loss of 27 head was recorded at Pimpama where the stock were sprayed with a mixture alleged to be a chlorinated hydrocarbon preparation, but which actually contained 39.4 lb. of arsenic per 400 gal. Heavy losses also occurred in young cattle at Jandowae. Losses in sheep were recorded near Warwick. Malicious poisoning killed 600 fowls at Kingaroy.

Urea poisoning was considerably lower than during the previous year. Although somewhat less urea was used, it is considered that the reduction of deaths was due to better stock management. Lead poisoning killed calves at Oakey, Cairns, Brisbane and Rockhampton and adult cattle at Jandowae. Phenothiazine in incorrect dosage killed 13 weaner sheep in the Roma division.

Creosote was incriminated in the death of one cow at Tolga. Sucker pigs at Helidon and sheep at Stanthorpe died from phosphorus poisoning.

Isolated deaths, especially of calves, followed the use of organo-phosphorus compounds in dipping vats. Use of atropine as an antidote is reasonably successful. Losses were also experienced with the chlorinated hydrocarbons. Pigs sprayed with over-strength BHC. died after showing typical symptoms. It is possible that these animals drank from pools on the floor after spraying. In an outbreak of salt poisoning at Logan Reserve, severe symptoms and deaths occurred in a group deprived of water, while those with access to water were unaffected. Dieldrin killed fowls at Rockhampton.

**Sawfly.**—Infestations of sawfly larvae were fairly heavy, but scattered, in the Injune, Charleville and Taroom areas. An unexpected infestation at Surat caused the death of 150 cattle and some sheep in August-September, 1962. While some cases occurred in the Springsure district, losses were much lower than in previous years. Efforts are being made to plot the annual distribution of sawfly larvae by questionnaires to graziers.

**Weir Vine.**—From field observations it appeared that the administration of cobalt had some effect on the recovery of cattle from weir vine (*Ipomea calobra*) poisoning. As this is a source of serious economic loss on the western Downs, a trial using handfed cattle was undertaken. Eight head, 4 treated with cobalt bullets, ate 13,000 lb. weir vine in 46 days, averaging 40 lb. a day. At the conclusion of the trial, no symptoms of weir vine poisoning had occurred in either group and no differences were noted between them. Ten control animals (5 dosed with cobalt) were kept on natural pasture without weir vine. This group as a whole gained weight, while the weir vine group lost weight. Weir vine was credited with causing heavy losses in the St. George area and also reported as causing the death of one horse with typical nervous symptoms.

Darling Pea (*Swainsona* spp.) caused nervous symptoms in practically all of a mob of sheep introduced into the Meandarra district.

Lantana (*Lantana camara*), *Cestrum parqui*, Noogoora burr (*Xanthium pungens*), braken (*Pteridium aquilinum*) and poison peach (*Trema aspera*) continued to cause losses in most districts. Heavy losses from gidyea (*Acacia georginae*) poisoning were reported from the Georgina area. Yellow oleander (*Thevetia peruviana*) growing in a zoo at

Townsville was blamed for the death of two camels and a honey bear. At Ayr, poultry died after eating Mexican poppy seed (*Argemone mexicana*).

Yellow wood (*Terminalia oblongata*) is still a major cause of deaths and wastage in the Emerald-Duarlinga area, especially on the heavy brigalow country of the Nogoia, and Mackenzie Rivers.

Scattered hydrocyanic acid poisonings followed feeding on grain sorghum and sorghum alnum.

### INTERNAL PARASITES

Seasonal conditions favoured the development of heavy infestations of internal parasites on the Darling Downs and in the Charleville area. Some severe losses occurred, mainly in young sheep. The newer anthelmintics, particularly thia-bendazole, although expensive, are justifying their use by increased weight gains in young sheep.

Internal parasites in beef calves and weaners are receiving more attention from graziers and there are indications that anthelmintic routines are justified by increased gains, particularly in the Central Highlands.

Haemonchus (stomach worm) was the main problem in dairy calves, particularly in coastal areas but severe outbreaks of Bunostomum (hook worm) and Dictyocaulus (lung worm) were observed. Repeated small doses of organo-phosphorus compounds were effective in increasing weight gains in calves infested with Cooperia even though the burden was often well below the accepted pathogenic level.

Liver fluke was recorded in sheep at Longreach and a cow at Springsure. Both these cases are well outside the recognised endemic area and the source of infection cannot be traced.

**Stomach Fluke.**—A fulminating attack of stomach fluke (*Calicophoron calicophorum*) was reported in cattle recently introduced to irrigated pasture at Parada in the Mareeba district. Stomach flukes are common in the area but are not considered to do much damage on natural pasture. Some 20 steers were affected, of which 4 died.

While the intermediate host snail *Pygmanisus pelorius* was found in small numbers outside the irrigation area, it was present in very large numbers in the irrigation drains. Up to 50 per cent. of snails were parasitised with immature stages of *C. calicophorum*. Faecal examinations showed the cattle to be heavily infected with mature fluke.

It appears that stomach fluke infestation may become a problem in the initiation of irrigated pastures in this area unless the snail can be controlled. Treatment of immature flukes with chemical specifics is being explored.

### BRANDS

Details of registrations and transfers of brands and earmarks for the year 1962-63 are as follows:—

TABLE 4

Item	Number	No. since Inception of Legislation
Ordinary three-piece horse and cattle brands registered .. .. .	..	92,242
Cancelled horse and cattle brands re-allotted .. .. .	742	23,232
Horse and cattle symbol brands registered .. .. .	167	4,175
Horse and cattle brands transferred .. .. .	1,500	97,006
Cattle earmarks registered .. .. .	561	42,043
Sheep brands and earmarks registered .. .. .	106	16,476
Sheep brands and earmarks transferred .. .. .	183	11,690
Distinctive brands registered .. .. .	10	1,405
Alterations of address .. .. .	151	..
Brands cancelled .. .. .	28	..
Earmarks cancelled .. .. .	174	..

The number of registrations of cancelled horse and cattle brands, cattle earmarks and symbol brands was approximately the same as that of the previous year. There was, however, a slight decrease in the number of transfers of horse and cattle brands, and in the number of registrations and transfers of sheep brands and earmarks. Very few reports of irregular branding or earmarking were received, and there were no prosecutions under the Brands Acts.

The Sheep Brands and Earmarks Directory, revised to December 31, 1961 has been published and copies distributed to centres throughout the State.

### STOCK MOVEMENTS

Interstate stock movements are set out in Table 5.

TABLE 5

—	Cattle	Sheep	Swine	Others
Entered from Northern Territory	72,515	..	..	197
Entered from New South Wales	77,005	780,039	41	1,882
Removed to Northern Territory	1,614	..	..	355
Removed to New South Wales	253,362	460,770	36,795	8,250

## EXTENSION AND TRAINING

A special in-service training school on BCPP was held for new members of the pleuropneumonia control team. An extensive cover of short radio talks was arranged in Cairns and individual field officers contributed periodical long talks. Press releases were made regularly and at some centres arrangements were made to cater regularly for local newspapers. Branch officers were regular participants in field days in their areas.

## SLAUGHTERING SECTION

The Slaughtering Section undertakes as one of its main duties the inspection of carcasses, after slaughter, for freedom from disease and for wholesomeness—a responsibility it carries as a safeguard to public health.

Regular inspection is carried out of the 1,500 butchers' shops and meat processing factories in the State. Standards of butchers' shops are being continually raised by the use of impervious materials and such aids as air-conditioning. One-tenth of the shops in Brisbane are now air-conditioned.

Details of stock slaughtered for local consumption are given in Table 6.

TABLE 6  
STOCK SLAUGHTERED FOR LOCAL CONSUMPTION 1962-63

	Bullocks	Cows	Calves	Sheep	Swine
Brisbane Abattoir ..	71,983	49,393	86,684	663,986	44,032
District Abattoirs ..	38,712	13,375	17,317	257,544	30,255
Bacon Factories ..	37,418	34,148	55,071	122,972	326,192
Other Centres ..	183,287	113,996	163,536	471,468	93,660
Total ..	331,400	210,912	322,608	1,515,970	494,139

Details of condemnations of total carcasses at all slaughtering establishments under State inspection are shown in Table 7. In addition, partial condemnations of carcasses and organs were ordered for localized conditions such as abscesses, cysts and other parasitic lesions, septic wounds, cancers and arthritis.

TABLE 7  
CONDEMNATIONS OF STOCK SLAUGHTERED FOR LOCAL CONSUMPTION, 1962-63\*

Disease	Cattle	Calves	Sheep	Swine
Abscess .. .. .	10	48	10	16
Actinomycosis .. .	10	1	..	..
Arthritis .. .. .	2	55	5	601
Bruising .. .. .	61	13	26	2
C.L.A. .. .. .	..	..	101	..
Emaciation .. .. .	176	35	3,868	21
Fever .. .. .	314	67	1,459	19
Immaturity .. .. .	..	2,509	..	..
Jaundice .. .. .	2	41	21	8
Septic Conditions ..	156	24	26	279
Sparganosis .. .. .	..	..	..	36
Tuberculosis .. .. .	525	..	..	35
Other Conditions .. .	53	15	33	26
Total .. .. .	1,309	2,808	5,549	1,043

\*Inspection of stock for export is carried out by the Commonwealth Department of Primary Industry.

Information on the incidence of diseases found at slaughter is being passed on to the animal disease control services to undertake control measures in the field. Officers of the Commonwealth Department of Primary Industry continue to assist materially, particularly with information on tuberculosis and bovine contagious pleuropneumonia in stock slaughtered at export meatworks not under State control. The appointment of a Veterinary Officer during the year will enable the Section to commence further investigations into diseases of high incidence found at slaughter, such as septic arthritis in pigs.

As the meat hall at Cannon Hill provides a reliable guide to local trade requirements, officers of the section are able to keep closely in touch with any variations. There is a continuing demand for young, light weight cattle with an even but not excessive external fat covering.

Consumption of lamb has risen greatly, drawing heavily on interstate carcasses. Introductions into the Brisbane area have risen to a monthly peak of 25,000 carcasses. This trade has developed mainly since 1960, but there has been no appreciable fall in the slaughter of lambs locally.

The system of voluntary beef grading has continued to expand in popularity with the trade and consumers. Over 98 per cent. of the beef slaughtered at Cannon Hill is being subjected to grading and blue ribbon branding. An average of 10 per cent. is graded "prime" and 56 per cent. "choice".

Choice grading now has more than 95 per cent. acceptance at the Townsville District Abattoir, where an average of 46.5 per cent. of the beef slaughtered receives the blue ribbon brand of choice quality. With the welcome co-operation of the District Abattoirs at Ipswich and Toowoomba, the voluntary grading service was extended to these areas. In its first month of operation, the system met with 70 per cent. acceptance at Ipswich and 90 per cent. at Toowoomba. The service has also been extended to a privately-owned meatworks in Brisbane.

Some important developments in District Abattoirs have taken place during the year. Tenders for the major part of the construction of the Mackay District Abattoir have been let, and it is expected this abattoir will be operating in the next financial year. The Gympie District Abattoir Board has been formed and the Board is now considering the establishment of a District Abattoir. In lieu of giving approval to the Rockhampton District Abattoir Board to construct a District Abattoir at Rockhampton for the slaughtering of stock for district consumption and for export, the Government reached agreement with 2 meatworks companies (one with an existing abattoir and one intending to construct an abattoir in the area) to slaughter all stock for consumption in the area. These works are to provide 20 per cent. of their capacity to other operators to kill for export.

The abattoir of the South Burnett Co-operative Meatworks Association at Murgon commenced operations in the early part of the year. The venture of the Callide-Dawson Co-operative Meat and Bacon Association met with financial difficulties and the premises were acquired by Amagraz Ltd. This Company has now commenced operations.

Poultry were treated at 175 licensed poultry slaughterhouses during the year.

Details of slaughtering at poultry slaughter-houses in the Brisbane-Gold Coast area from 1956-57 to 1962-63 appear in Table 8. Table 9 shows the total slaughtering in the State for 1962-63.

TABLE 8  
POULTRY SLAUGHTERINGS AT ABATTOIRS IN THE BRISBANE-GOLD COAST AREA, 1956-57 TO 1962-63

Year	Chickens (Broilers)	Hens	Total Slaughtered (Including Ducks, Turkeys, &c.)
1956-57 ..	348,922	400,105	751,196
1957-58 ..	362,713	377,105	779,090
1958-59 ..	552,794	345,992	928,654
1959-60 ..	829,946	384,443	1,248,964
1960-61 ..	1,843,769	434,078	2,311,840
1961-62 ..	2,360,377	500,951	2,903,549
1962-63 ..	3,273,892	446,601	3,768,969

TABLE 9  
POULTRY SLAUGHTERED IN QUEENSLAND, 1962-63

Year	Chickens (Broilers)	Hens	Total Slaughtered (Including Ducks, Turkeys, &c.)
1962-63 ..	4,767,924	637,449	5,405,373

## PATHOLOGY BRANCH

The appointment of a virologist has added much needed strength to the microbiological field, but additional staff and facilities are needed to cope with the increasing demand for work on viral diseases.

The tick fever research centre at Wacol has been fenced and some stock moved in. Acquisition of the "Rockangle" farm will enable long awaited epidemiological work on leptospirosis to begin.

Surveys of infertility diseases in selected groups of cattle and sheep were continued in conjunction with other Branches.

The success of the serological testing programme of British breed stud sheep has led to a request from Corriedale and Polwarth breeders for examination of their flocks. A group of dairy herds was tested for infertility diseases for the second year. Testing for bovine pleuropneumonia antibodies in serum samples from animals killed at central Queensland meat works has been extended.

Among the new causes of disease discovered were two conditions due to fungi—ringworm in pigs and a yeast-like infection, cryptococcosis, in the brain of a cat.

Specimen numbers have again increased (Table 1). At Yeerongpilly 17,000 tests were made with blood, more than 5,000 tissues were processed for microscopic examination, 2,638 faecal samples were examined for parasite eggs and 13,217 specimens were submitted to bacteriological examination. The number of serological tests undertaken for the major diseases is shown in Table 2.

TABLE 1  
GENERAL

Laboratory Activity	Yeerongpilly	Oonoomba	Total
Diagnostic specimens examined ..	6,376	896	7,272
Stud cattle immunised .. ..	159	96	255
Bleeders sold .. ..	137	15	152
Vaccines dispatched—			
Contagious bovine pleuro-pneumonia .. ..	304,580	463,760	768,340
Tick fever .. ..	93,005	24,352	117,357
Infectious laryngo-tracheitis ..	161,200	..	161,200
<i>Brucella abortus</i> Str. 19 .. ..	11,040	..	11,040

TABLE 2  
SEROLOGICAL TESTS

Test	Yeerongpilly		Oonoomba	Total
	Routine	Survey		
Complement fixation tests—				
Contagious pleuro-pneumonia—				
cattle .. ..	2,001	14,320	1,671	17,992
Actinobacillosis—sheep .. ..	555	1,099	..	1,654
Melioidosis—sheep .. ..	386	..	..	386
Brucellosis—sheep .. ..	618	1,286	..	1,904
Serum agglutination tests—				
Brucellosis—				
cattle .. ..	7,140	3,363	3,041	13,544
pigs .. ..	2,852	..	125	2,977
<i>Leptospira pomona</i> —				
cattle .. ..	4,698	..	2,806	7,504
pigs .. ..	1,179	..	68	1,247
<i>Leptospira hyos</i> —				
cattle .. ..	4,579	..	1,526	6,105
pigs .. ..	1,111	..	67	1,178
Mucus agglutination tests—				
Vibriosis—cattle .. ..	5,197	3,068	1,257	9,522

## DIAGNOSTIC WORK

### Cattle

*Tick fever*—*Babesia argentina* caused 194 outbreaks, of which 30 were in the northern part of the State. *Babesia bigemina* caused 22 outbreaks, and anaplasmosis 27. Tick fevers have increased in the last 2 years. This may be associated with continuing use of more effective acaricides and consequent lowering of carrier rates in cattle.

*Blackleg*.—The causal organism was isolated in 13 specimens. Three outbreaks were in vaccinated cattle.

*Mycotic dermatitis*.—Ten positive specimens were received from widely scattered areas.

*Virus diarrhoea—mucosal disease*.—Five suspected outbreaks were studied in the Townsville district. Some affected animals died within 3 or 4 days. No leucopenia was observed. Autopsy findings included sloughing and ulceration of the oesophageal mucosa, ulceration of the abomasum and sinusitis. No infective agent was isolated.

*Ruminal hyperkeratosis*.—Microscopic examination revealed hyperkeratosis of the ruminal epithelium of feedlot cattle receiving molasses and urea.

*Salmonellosis*.—Salmonellas were isolated on 22 occasions from sick cattle, 17 being *Salmonella typhimurium*.

*Coast disease*.—In north Queensland, 11 batches of specimens from animals suspected of dying from coast disease were examined. No *Cl. botulinum* toxin was detected.

*Mastitis*.—*Mycoplasma* sp. was recovered for the first time from one of several samples from a herd of 40 cows with a high incidence of mastitis which did not respond to penicillin therapy. In another herd in which 50 per cent. of the cows were affected, a slow growing organism similar to *Streptococcus thermophilus* was recovered.

### Pigs

*Swine fever*.—Where suggestive sickness has occurred and where suspicious brain lesions have been seen microscopically, serum samples have been sent to the Veterinary Research Station, Glenfield, New South Wales, for testing.

More than 300 tests were done on serum from suspect pigs. As there is some cross immunity between the virus of virus diarrhoea of cattle and of swine fever, cattle sera from some properties were also tested. None of these gave positive reactions. In a further 219 sera from adult pigs sent for slaughter to abattoirs in various part of Queensland, 14 positive and 3 suspicious reactors were obtained with the gel diffusion

test. Eight properties were involved. Blood or other tissue from pigs on some of these properties and from sick pigs on other farms was injected into 27 pigs at the laboratory, but no evidence of swine fever was obtained.

*Undiagnosed mortality in pigs*.—In North Queensland 400 pigs up to weaner age died on 2 properties in 6 months. Clinical signs were fever, inappetence, staggering, vomiting, diarrhoea and dysentery. Convulsions and muscle tremors were noted. At autopsy necrotic areas in the large intestine, pneumonia and haemorrhages of serosal surfaces were seen. Microscopic brain lesions were seen in 50 per cent. of cases autopsied. Transmission tests produced fever in the inoculates. Tests for swine fever were negative.

*Salmonellosis*.—Salmonellas were isolated from sick pigs on 58 occasions. Of 49 which have been classified, 37 were *Salmonella cholerae suis* or its Kunzendorf variety.

*Melioidosis*.—*Pseudomonas pseudomallei* was isolated on 3 occasions in March–April from abscesses in pig organs at a Townsville abattoir.

*Inclusion body rhinitis*.—This disease was confirmed on 9 properties on the Darling Downs, South Burnett and Brisbane from July to December.

*Oedema disease*.—Since 1959, this disease has been observed with increasing frequency. Most cases have had the characteristic oedema of the eyelids, wall of the stomach and mesentery of the large intestine. Some have had the haemorrhagic syndrome with haemorrhage of the lymph nodes, massive congestion and oedema of the lungs and acute reddening of the intestinal mucosa. The haemorrhagic heart lesion referred to as "mulberry heart" has been seen several times. Haemolytic coliform organisms have been isolated from most of the typical cases received at the laboratory.

*Ringworm*.—At Beaudesert, *Microsporium nanum*, was found to be the cause of ringworm in pigs. The worst lesions covered the entire depth of the side of the pig. Similar lesions were produced by inoculating the isolated strains on to the ears and flanks of 2 pigs. Two outbreaks have been confirmed subsequently at Calliope and Mundubbera. These isolations are the first definite evidence that ringworm of pigs occurs in Australia. *M. nanum* is transmissible to man.

### Sheep

*Suspected Selenosis*.—Approximately 1 per cent. of sheep on a north Queensland property collapsed into sternal recumbency when mustered for routine jetting. At autopsy the sheep showed small pneumonic areas in the lungs; sub-epicardial haemorrhages; and renal haemosiderosis. The livers and kidneys contained low levels of selenium. *Neptunia amplexicaulis* containing 35 p.p.m. selenium had been grazed by the sheep. Further investigations are being made into the problem.

### Horses

*Equine infectious anaemia*.—The disease was confirmed on one property at Windorah and another at Baralaba. The case at Baralaba was of interest as this property was one of the first on which the disease was originally found in 1958. In other parts of the world equine infectious anaemia remains quiescent for long periods, after which severe outbreaks may occur.

### Poultry

*Infectious laryngotracheitis*.—Six outbreaks were confirmed, 4 in south and 2 in north Queensland. It had never been detected previously in any of the southern flocks. In one of the northern flocks, active infection had not been seen since 1961 and vaccination had been discontinued.

*Nephritis and respiratory disease*.—Kidney disease has been seen in chickens from a few days old to adulthood from all poultry raising districts. It has frequently been associated with respiratory disease.

### Miscellaneous

*Cryptococcosis in a cat*.—Yeast-like bodies morphologically similar to *Cryptococcus neoformans* were seen in the inflamed meninges of a cat which had shown clinical signs of central nervous derangement for about 12 months. A number of cases of cryptococcosis have been reported in human beings in Queensland, but this is the first recorded case in a domestic animal.

*Rare parasites*.—*Cheyletiella parasitivorax* was found in mange-like lesions in rabbits at Oonoomba. *Knemidocoptes* spp. were present in scaly leg lesions, commonly called tassel toe, of canaries from Toowoomba and of finches from Warwick.

*Gaucher's Disease in a Sheep*.—A sheep killed at the Brisbane Abattoirs was mottled with multiple grey areas, roughly oval and approximately 0.3 cm. long. Microscopic examination showed changes in the reticulo-endothelial cells suggestive of a rare condition known as Gaucher's Disease. This is the first report of this disease in a domestic animal.

**Taint in Meat.**—In the winter of 1962, the cause of meat taint was investigated on three occasions. In one case bitter cress, *Coronopus didymus*, was considered to be responsible.

**Salmonellas in meatmeals.**—Previous work had shown that meatmeals may be contaminated with salmonellas when collected from the point of sale. During 1962-63 studies were commenced to determine the point of entry of the salmonella into the meatmeal products. Fourteen daily samples collected from a Brisbane meatworks were examined, and 11 were positive. A more detailed examination of the meatmeals at various stages of manufacture at this abattoir is now being done. A point of interest in this work is the lack of correlation between the salmonella serotypes isolated from meatmeals and those isolated from pathological specimens submitted

to Yeerongpilly. For instance *S. typhimurium* was not isolated from more than 50 samples of stock feeds and fertilizers of animal origin although it is the most frequently isolated salmonella in specimens from diseased animals.

#### DISEASE SURVEYS

Increased activities in this field are reported in this section.

#### Infertility Diseases of Cattle

The following table sets out the number of animals tested in the 1962 survey of dairy herds and the incidence of the several diseases.

Disease	Number Tested	Positive	Suspicious	Negative	Percentage of Reactors	Percentage of Herds Containing Reactors
Brucellosis .. .. .	3,987	480	142	3,361	12.4	87.2
Vibriosis .. .. .	3,405	219	80	3,069	6.2	69
Trichomoniasis .. .. .	3,426	7	..	3,419	0.02	10.3
Leptospirosis .. .. .	3,987	..	..	..	..	..
<i>L. pomona</i> .. .. .	..	393	133	3,406	9.8	74.4
<i>L. hyos</i> .. .. .	..	190	35	3,707	4.8	35.9

The data have been analysed and clearly demonstrate the seriousness of brucellosis and its adverse effect on reproduction. Brucellosis-infected animals had an average first conception rate of 50 per cent. compared with 66 per cent. in herds where heifers were vaccinated regularly with Strain 19 vaccine. Herds which had experienced an abortion problem in 1961 and were vaccinated at that time had a conception rate of 62 per cent. in 1962. Herds with a current abortion problem had a conception rate of 17 per cent. Trichomoniasis was more prevalent than was expected. Sampling for 1963 has been completed, 3,236 cattle being done in 35 herds. Laboratory testing will not be completed for some time.

Infertility in a beef herd in north Queensland was investigated. The genitalia from 74 cows culled for infertility were examined after slaughter. The following conditions were found: pustular vaginitis 15; cysts of the fallopian tube 3; blocked fallopian tubes 2; metritis 2; vaginal cysts 2; cervical cysts 1; and bifid cervix 1. *Trichomonas foetus* was isolated from 9 and *Vibrio fetus* from 5 sets of genitalia. This was the first time that trichomoniasis has been diagnosed in north Queensland.

Thirteen strains of *T. foetus* were tested against sera using *T. foetus* var. Belfast and *T. foetus* var. Manley by the agglutination reaction. Ten strains, including a New Zealand strain and a fowl strain, agglutinate with the Belfast serum and not with the Manley serum. The other 3 strains did not agglutinate with either. Sera prepared against these 3 strains and the Manley strain agglutinated with each serum. Subsequent cross absorption agglutination tests using the 3 strains and the Manley serotype and the sera prepared against them indicate that the 3 strains are similar to each other and possess both a common and a different antigen from the Manley strain; and that sera prepared against Manley was weak in the antibody corresponding to the common antigen.

#### Infertility Diseases of Sheep

Five thousand British breed sheep were tested for ovine brucellosis in 59 studs in the 1962 survey. The incidence of reactors was 5 per cent. in stud rams, 4 per cent. in flock rams, 2.5 per cent. in weaner rams, 1.3 per cent. in stud ewes and 0.22 per cent. in maiden stud ewes. Sheep giving positive reactions were destroyed. In follow up work in those flocks with positive reactors, all rams were repeatedly bled at not less than monthly intervals, and positive reactors culled until all remaining rams were serologically negative. In those flocks in which the initial incidence was low, rams gave a negative test at the second sampling, while in flocks in which the incidence was high, repeat sampling up to 5 times was necessary before all rams gave a negative test.

In the second year of the survey, rams only have been bled. To date 711 rams have been sampled including 440 stud rams, 99 flock rams and 172 weaners. The incidence of reactors in stud rams was 1.1 per cent. None of the flock or weaner rams tested have had positive reactions. These results suggest that the prospects for eradicating this disease from British breed studs are quite good.

In the 1962 survey there were no reactors to the test for *Actinobacillus seminis* infection. Among the 711 sera tested this year, 4 reactors were detected. The epidemiology of this disease is not known and to date it has not been possible to infect rams experimentally other than by intra-epididymal inoculation of cultures of the organism. The appearance of titres in serum in sheep tested during the survey suggests an environmental source of infection.

#### Contagious Bovine Pleuropneumonia

To assist in the eradication programme for this disease, 11,867 serological tests were done at Yeerongpilly on sera from slaughter cattle at the Rockhampton and Gladstone abattoirs. Thirty-nine positive reactions were found from 10 properties. Lungs with pneumonic lesions from slaughter cattle have also been examined. Of 18 examined at Oonoonba only one had lesions of contagious pleuropneumonia. The Huddart test, to be applied in the field, has also been studied by Yeerongpilly staff during the year.

#### Leptospirosis Survey

At the Oonoonba laboratory the incidence of leptospira serotypes other than the recognized animal types *Leptospira pomona* and *Leptospira hyos*, is being studied. Tests on 755 cattle sera from northern areas of the State gave negative results for *L. grippityphosa* but 10 positive reactions to *L. kremastos* were found.

#### Poultry Diseases

A virus has been recovered from a number of outbreaks of respiratory and nephritic disease of poultry. As it is believed that the disease is widespread, breeding flocks from various parts of the State are being examined to determine the incidence.

#### RESEARCH

##### Tick Fevers of Cattle

**Vaccine Experiments.**—Vaccine sometimes may have failed to produce immunity because insufficient organisms have survived to produce infection. Investigations have been aimed at determining the number of organisms in the blood of bleeder animals and the means of keeping the maximum number alive until injected.

Measurement of serum antibody in infected animals has been considered as a possible means of studying the carrier state. This work is very costly if cattle are used so experiments have been done with rats infected with *Babesia rodhaini*. A fluorescent technique has been worked out for detection of antibody in serum. Antibody can be detected shortly after the rapid decline in parasitaemia and remains for many months even when parasites can no longer be detected in the blood by subinoculation into mice.

Various ways have been tried for diluting and storing blood containing *B. argentina*. Blood diluted in buffered saline and kept for two days at 5 deg. C and a further day at 27 deg. C before injecting produced infection in cattle. Experiments with *B. rodhaini* showed that better results were obtained if blood was stored undiluted and the diluent added immediately before injection.

Two methods of deep freezing *B. bigemina* were investigated. Infected blood containing 12 per cent. glycerol was both rapidly and slowly frozen to -79 deg. in a dry ice and alcohol bath and maintained at this temperature. The organisms remained alive and produced infection after 30 days storage following the rapid freezing technique. *B. argentina* has been repeatedly passed through calves and mice in an endeavour to adapt the parasite to mice. The organism has persisted in mice for 9 days after infection.

**Persistence of infection of *B. argentina*.**—An experiment was carried out at Oonoonba to ascertain how long cattle infected with *B. argentina* continued to carry the organisms and the accuracy of the brain smear technique in detecting carriers. This experiment also yielded information on the number of times that brain smears could be taken from each animal. None of the animals submitted to brain biopsy 4

times at 3-monthly intervals suffered any ill effects. Of 20 cattle known to be carrying *B. argentina*, 57 per cent. had positive brain smears at the end of 12 months. Ten of these animals which were inoculated only once and never allowed to become tick infested were still carrying organisms in their blood 15 months later. Five of them, challenged with blood containing the same strain of *B. argentina*, were solidly immune. Five were challenged with a different strain. These developed mild fevers and organisms were seen in blood smears, but the animals were not severely ill. This work suggests that it may be desirable that more than one strain of organisms be included in tick fever vaccine.

**Anaplasmosis.**—As anaplasmosis is becoming more prevalent there has been an increasing demand for bleeders carrying *A. centrale*. This organism can produce severe infection in some animals. Studies were carried out during the year on both *A. centrale* and *A. marginale* infection.

In one experiment eight steers were infected with *A. centrale*. At the peak of infection haemoglobin levels fell to an average of 5.2 ug/per cent. *A. centrale* can be freed from contaminating blood parasites by passage through sheep. The same result can be achieved by rapidly freezing infected blood without the addition of glycerol and storing for 24 hours at -79 deg. C or by heating the blood to between 48 deg. C and 52 deg. C for 10 minutes and then cooling to 30 deg. C.

Experimentally some strains of *A. marginale* produced mild disease only.

#### Studies on Sheep Blowflies

Two techniques were used during the year to study the efficiency of insecticides against sheep blowflies. As well as the implant technique used previously, a tube method was used. In this, small wool samples are brought into the laboratory and placed in tubes of nutrient media containing first stage larvae. The tube test appears to be more sensitive than the implant test in detecting low levels of insecticides. It is particularly useful in that fewer larvae are required and wool samples can be stored during periods of larval shortage or when weather is unfavourable for implants.

Three new organic phosphorus insecticides, Nivon (DDVP), Union Carbide UC16888 and I.C.I. 800 and two carbamates, Sevin, wettable powder, and Union Carbide UC10854 were tested during the year. None of these gave very long protection in comparison with diazinon. The two carbamate insecticides, Sevin and UC10854, show promise. It is desirable to explore this field in an attempt to find insecticides that could be used effectively in the event of resistance developing to the organic phosphorus preparations.

#### Tick Control

Prohibition of the use of chlorinated hydrocarbon acaricides in 1962 has focussed attention on the organic phosphorus compounds. In one dip under observation, a wettable powder formulation, Asuntol was found to be still giving satisfactory results during the second year of operation. More than 3,400 cattle have been dipped and there has been no observable falling off in efficacy, and the kill of all stages has been satisfactory. On occasions, however, some engorging nymphs have survived dipping but not in sufficient numbers to affect tick control. Approximately monthly dipping of a dairy herd has been sufficient to keep the tick population at very low levels. At no stage even during the wet late summer was the population greater than 5 adult females per animal.

The Ooonooba dip was charged with Bercotox 10 months ago and 30 cattle have been dipped at intervals of approximately 4 weeks consistent with maintaining a tick burden which would ensure a high level of tick fever resistance. Observations made in detail have shown that the overall efficacy of this preparation is good. A few live adult ticks could be collected from some animals 24 hours later and odd ones with sluggish leg movement 2 and 3 days after dipping. The remainder including all younger stages were dead and shrivelled. The residual effect was very good. During the drier periods of the year seed ticks were noted to be attaching from 9-12 days but in the wet months they were returning by the fourth and fifth days. Regular sampling showed that the fluid remained stable during the period of usage.

#### Buffalo Fly Control

In further control work Asuntol and Sevin were compared with D.D.T. All were used at recommended dipping concentrations. Three trials were undertaken, each of 2 weeks' duration. In general, the organic phosphate and carbamate were found to give control for up to 7 days, while D.D.T. was effectively killing at 9 days and even at 14 days. Nine other formulations were examined but none gave superior results.

#### Bovine Botulism

Botulism has been recognized as a part of the coast disease syndrome for many years. The toxin of Type D *Cl. botulinum* has been recovered from the intestines of affected animals. From one specimen from a property near Bundaberg, an organism with the characteristics of *Cl. botulinum* Type D has been isolated at Yeerongpilly and tests with the toxin from cultures of it have been done at Ooonooba. Four heifers were inoculated subcutaneously with 0.01, 0.001, 0.0005 and 0.0001 ml/kg. of toxin. The beast receiving 0.01 ml/kg. was dead in 39 hours without showing symptoms. The 0.001 ml/kg. level caused death in 64 hours with nothing more than inappetence on the day before death. A dose of 0.0005 ml/kg. produced stiffness, weakness, inability to eat, and by the second day gradually developing paralysis of the digestive, respiratory and urinary tracts. Death occurred in 60 hours. The fourth animal survived after being slightly off its appetite and showing slight ataxia from the ninth to the 25th day after inoculation. That this toxin is tremendously potent is demonstrated by the fact that about one drop (0.075 ml) was sufficient to cause death of an animal weighing 300 lb.

Toxin was demonstrated in the blood serum of the animal receiving 0.01 ml/kg. but not in the others.

The isolation of a Queensland strain of *Cl. botulinum* Type D will enable more detailed studies to be made with particular reference to the syndromes produced by different dose levels. Information obtained from this work may enable better differentiation of the components of coast disease.

#### Sheep Diseases

**Ovine Toxoplasmosis.**—To determine the incidence of toxoplasmosis in sheep flocks in Queensland, a search for a suitable serological test is being made. The haemagglutination test, which at first gave promising results, is now considered not sufficiently reliable to warrant its adoption. An indirect fluorescent antibody test is at present under consideration, and the necessary equipment has been obtained.

Seven pregnant ewes and two rams have been experimentally infected using an ovine strain of *Toxoplasma gondii* isolated locally to provide positive sera and clinical information concerning toxoplasma infection in sheep.

**Bent-leg in sheep—*Trachemene glaucifolia*,** wild parsnip, has long been associated with a bent-leg syndrome and sudden death in sheep. The acute poisoning syndrome of pallor, ataxia, poor exercise tolerance and death on exercise was experimentally produced in 2 sheep. A third recovered when the plant was withdrawn from the feed even though an ataxia had developed. The bent-leg condition in lambs was also experimentally reproduced.

**Toxic Principle of *Myoporum deserti*.**—In conjunction with the Chemistry Department of the University of Queensland, trials are being done in sheep to determine the toxic principle of *Myoporum deserti*. Plants from three areas of Queensland have been tested. Plants from two of these areas are toxic, 1 lb. killing an adult sheep in 3-4 days with jaundice, hepatitis, anasarca, hydrothorax and gastro-enteritis. The plants from the third area are non-toxic. The toxic principle is in the essential oil fraction. One essential oil has been recovered from batches of toxic plant. On administration to sheep by mouth, this produced lesions similar to those produced by the whole plant.

#### Poultry Diseases

**Avian Leucosis.**—The importance of the leucosis complex in poultry has long warranted investigation. Because of its complexity and because extensive work was being done on it in other countries, no studies had previously been made here. During the year, 280 day-old cockerels from random sample entries were divided into 2 equal groups. One was exposed by the respiratory route and the other by the intraperitoneal route, to a suspension of leucosis lesions from a natural outbreak. The birds were penned side by side. Seventy-eight of the birds injected intraperitoneally and 54 of those exposed to aerosol showed lesions at autopsy. The figures are still being analysed, but it appears that at least one form of leucosis can be transmitted relatively easily. This finding is of great importance and the work will be continued.

**Nephritis and Respiratory Disease.**—Considerable progress has been made during the year in that the infective agent recovered from the kidneys and respiratory tract of chickens has been proved to be a virus. It produces respiratory disease when injected into the trachea of chickens. Nephritis cannot be so reliably produced.

The disease has features in common with bronchitis, particularly that form accompanied by nephritis, and the virus affects embryos as does the virus of infectious bronchitis. For these reasons, antisera prepared against several strains of bronchitis virus were introduced from the

United States and the United Kingdom for neutralization tests to identify the Queensland virus. This work is still proceeding, but tests with certain of the sera suggest that the virus is that of infectious bronchitis. Preliminary attempts at protection have shown that the virus administered in the drinking water for 1 day may produce mild respiratory symptoms in a proportion of the birds but results in good immunity.

#### Publications and Staff

One of the problems of a busy laboratory is finding time to compile papers for publication. Nevertheless staff members submitted 19 papers for publication in several scientific journals. Dr. L. L. Callow was awarded a Ph.D in 1963. Five other graduate officers are studying for higher degrees.

Mr. C. G. Ludford, Senior Serologist attended a course at the Animal Health Research Laboratory, Melbourne to study the technique of the Huddart test for bovine contagious pleuropneumonia. Mr. W. T. K. Hall, Chief Pathologist, spent several days at Glenfield Veterinary Research Station studying the gel diffusion technique for swine fever. Mr. M. D. Connole, bacteriologist specializing in mycology, visited several Sydney laboratories for a week to obtain information on fungi. Miss P. Stephens, virologist, visited the National Biological Standards laboratory, Melbourne, to observe tissue culture methods. Scientific papers were presented at the Australian Veterinary Association Conference in Sydney in 1963 by Mr. M. D. Connole and the Branch Director. The Branch Director also presented a paper at the World Poultry Science Congress in Sydney in 1962.

### HUSBANDRY RESEARCH BRANCH

The most significant development in the Branch during the year was the opening of the Artificial Insemination Centre at Wacol on December 17, 1962. The centre consists of a laboratory and administrative block, a combined feed and machinery shed, and 50 pens for bulls. The activities of the centre are threefold. Firstly, it supplies semen to commercial distribution centres. This service commenced with the opening of the centre, and now 7 units are being supplied regularly. Secondly, the centre is continuing to collaborate with the Cattle Husbandry Branch and Herd Recording Section in proving A.I.S. and Jersey bulls. Bull proving began in 1955, with the bulls being housed at, and semen distributed from, the Animal Husbandry Research Farm, Rocklea. This work ensured that adequately-proven Jersey and A.I.S. bulls were available for the opening of the centre. Thirdly, the centre is undertaking research on some aspects of bull fertility in a sub-tropical environment. It will investigate, in the laboratory and in the field, any developments in A.I. before introducing them for commercial usage.

Experimental work completed or in progress at the Animal Husbandry Research Farm, Rocklea, includes: feed lot studies with cattle; the utilization and toxicity of urea; sorghum utilization in pigs; the effect of excitement on blood constituents in cattle; breeding programmes for broilers; genetic analysis of the Large White pig breed; and the effect on animal production of nitrogenous fertilizer applied to paspalum pastures. The effects of fineness of grinding on digestibility and of intermittent feeding of sorghum grain at survival levels are under study. A number of experiments incorporating accurate determination of either carcass or body composition are in progress. These include comparisons of different techniques for measurement of chemical composition of dead animals; change in carcass composition, the yield of

edible meat and trade cuts of beef with feed-lotting; the effect of survival planes of nutrition on body composition in sheep; and the effect of hormone implants on carcass and body composition of poultry.

A summary of the findings of completed experiments, progress reports of some of the studies in progress and data relating to artificial insemination are outlined in the remainder of the report.

#### INVESTIGATIONS

##### Feedlot Studies

In the 1961-62 Report, the results of an experiment designed to study the effect of 3 grain-roughage ratios (40-60, 60-40, 80-20) with and without urea were recorded. In this experiment, the efficiency of feed conversion and rate of body-weight gain increased as the grain ratios became higher. As it was considered that graziers planning the feed-lotting of cattle in grain growing areas may desire to feed as little roughage as possible, higher grain-roughage ratios were examined this year. Because of the marked response to urea in 1961-62, the effect of its inclusion at the higher grain ratios was studied.

Seven groups, each of 10 Hereford steers approximately 18 months old, were used in the experiment. One group was slaughtered before feeding to obtain initial carcass data. The treatments, body-weight changes and feed intakes of the groups are presented in Table 1.

The main findings can be summarized as follows:—

- (1) Rate of body-weight gain on these high grain-urea supplemented rations was very good.

TABLE 1  
RESULTS OF FEEDLOT EXPERIMENTS 1962-63  
Body-Weight Changes and Feed Intake

Group	Final Ration (dry matter basis)			Group Mean Body-weight (lb. shrunk basis)			Days in Feed Lot	Mean D.M. Consumption (lb./head/day)		Total Feed Intake/Head During Feed Lot (lb. D.M.)	Feed Required per lb. gain (lb.)
	Sorghum Grain (%)	Sorghum Silage (%)	Urea/Head/ Day (%)	Initial	At Slaughter	Gain/Day		Grain	Silage		
1	80	20	..	542	843	1.85	171*	12.71	2.83	2,663	8.55
2	80	20	60	545	885	3.16	110	13.77	3.87	1,937	5.70
3	90	10	..	542	899	2.40	150	14.63	1.98	2,490	6.98
4	90	10	60	546	882	3.40	100	14.65	2.87	1,755	5.23
5	100	..	..	545	898	2.50	144	14.50	0.95	2,229	6.33
6	100	..	60	544	885	3.47	101	13.99	2.21	1,642	4.82

\* Terminated at 171 days when only 5 animals in this group had reached the final slaughter weight of 900 lb.

- (2) There was a marked response in rate of body-weight gain, markedly reduced feed conversion ratio, and a decrease of approximately 50 per cent. in time required to reach prime condition as a result of urea supplementation.
- (3) Rate of gain was higher on the 90 per cent. and 100 per cent. final grain rations than on the 80 per cent. grain rations.
- (4) All groups were changed gradually from roughage to their final rations, Groups 5 and 6 taking 56 and 70 days respectively. There were only minor digestive disturbances, although intermittent bloating occurred while animals were on all-grain rations.
- (5) The overall group average carcass gain represented 60.1 per cent. of the live weight gain, calculated on a shrunk basis.
- (6) Carcass measurements indicate that there is a linear relationship between per cent. fat in the 9th, 10th and 11th rib cut section and the specific gravity of the carcass.
- (7) There was a disproportionate increase in yields of commercial cuts of meat during feed lotting. The percentage of increase was—Forequarter: ribs 168, bladebone 85, chuck 69, brisket 77, shin beef 53; total meat 85; total fat trimmings 227; total bone 18. Hindquarter: sirloin 93, skirt 78, rump 69, silver side 70, thick flank 52, topside 51, leg beef 50, fillet 44; total meat 69; total fat trimmings 253; total bone 26.
- (8) Determination of iodine numbers on the body fat indicated that it became softer with feed-lotting. There were no significant differences between groups.

### Studies with Urea

**Utilization.**—Despite the high grain and moderate crude protein levels (8.8–10.9 per cent.) of the rations used in feed-lot studies, striking responses have been obtained by the inclusion of urea. The mechanism of this response is being examined in studies on the effect of urea on digestibility, on the rate of cellulose digestion in the rumen,

and on the rate of passage of digesta through the gastrointestinal tract.

Data for digestibility are available for rations with the 3 sorghum grain—sorghum silage ratios, 40-60, 60-40, and 80-20. In all 3 rations, urea resulted in significant increases in digestibility of dry matter, fat, nitrogen-free extract and organic matter. The mean comparison with and without urea for the 3 rations is given in Table 2.

TABLE 2  
EFFECT OF UREA ON APPARENT DIGESTIBILITY COEFFICIENTS  
OF GRAIN-SILAGE RATIIONS

Treatment	Dry Matter	Crude Protein	Crude Fat	Crude Fibre	N.F.E.	Organic Matter
No urea .. .. .	58.5	44.4	39.4	33.4	68.1	60.3
Urea (60 g/head/day) .. .. .	63.8***	45.6	45.6*	36.1	74.8***	65.8***

\*, \*\*\*, —Digestibility of urea treatment significantly higher at 5% and at 0.1% levels of significance respectively.

**Toxicity—Cattle.**—There have been suggestions from the field that urea may result in abortions or still births in cattle. If this suggestion is correct, then a near-fatal dose would probably be responsible. In a study with 6 pregnant heifers fed a maintenance ration, the animals are receiving single doses of 0.35 g./kg. at different stages of pregnancy. Dose rates of 0.4 g. and 0.45 g./kg. administered under the same experimental conditions have proved fatal. Ammonia levels in blood samples obtained at frequent intervals during a period of 7 hours after dosing, are being studied to assess the degree of physiological stress. Dosing at the 4 to 5 months' stage of pregnancy has caused no ill-effects on the foetus. The experiment is continuing.

**Pigs.**—With the possible extensive use of urea in ruminant rations, the risk of its being accidentally eaten by monogastric animals is always present. Urea has been suspected of causing deaths in pigs. Preliminary studies indicated that urea administered by stomach tube to pigs at dose rates as high as 5 g./kg. body-weight only resulted in slight inco-ordination of gait, trembling and very fluid scouring. Recovery occurred within 8 hours. When administered in the same manner, less than one-tenth of this dose is fatal to cattle. These studies are continuing.

### Feeding Cattle for Survival

**Effect of fineness of grinding on digestibility of grain fed at survival levels.**—Studies at Rocklea on the survival requirements of different classes of cattle included experiments on feeding restricted amounts of all-sorghum grain rations. Results were given in Annual Reports of the Branch for 1957-58, 1958-59 and 1960-61. In all studies the grain was kibbled. As kibbling increases the cost a comparison has been made of the digestibility of whole grain with that of 2 types of processed grain, fed at the survival level of 3.3 lb. per head per day. From the results set out in Table 3, it will be noted that, in the indices of digestible energy, the main consideration in survival feeding, whole grain is less digestible than either cracked or kibbled. However, it may be more economical to feed additional whole grain and accept the reduction in utilization (approximately 20 per cent.) than to grind the grain. There appears to be no advantage in kibbling compared with cracking. A group feeding experiment is being planned to extend these findings.

TABLE 3  
EFFECT OF GRINDING ON DIGESTIBILITY OF SORGHUM GRAIN

Determination	Apparent Digestibility Coefficients (Means)			Significance
	Cracked (C)	Kibbled (K)	Whole (W)	
Dry Matter .. .. .	89.7	88.6	75.6	C, K > W ***
Crude Protein .. .. .	65.0	60.8	53.5	C > W; K > W; C > K **
Ether Extract .. .. .	71.5	57.5	61.7	C > K; C > W *
Crude Fibre .. .. .	75.3	63.5	65.5	C > K, W ***
Nitrogen Free Extract .. .. .	95.3	95.2	80.2	C, K > W ***
Organic Matter .. .. .	91.0	90.2	76.9	C, K > W ***

\*, \*\*, \*\*\*, —Significant at 5%, 1%, 0.1% levels of probability respectively.

**Effect of Fertilized Pasture on Animal Production.**—In this experiment the effect on animal production of the application of nitrogenous fertilizers to paspalum pastures is being studied at 2 stocking rates. Body-weight gains of Hereford heifers, yield and chemical composition of pasture, and changes in botanical composition are being used for the assessment of results.

The treatments and body weight changes since the reintroduction of experimental animals on November 28, 1962, are given in Table 4

TABLE 4  
BODY WEIGHTS IN NITROGENOUS FERTILIZER EXPERIMENT

Group	Stocking Rate per Acre	Mean Initial Body-Weight (lb.) 28-11-62	Body-Weight Change (lb./head)	
			28-11-62 to 1-5-63	1-5-63 to 29-5-63
No Nitrogen .. .. .	1	320	+159	+17
No nitrogen .. .. .	2	313	+135	-6
Nitrogen* .. .. .	1	311	+163	+27
Nitrogen* .. .. .	2	309	+144	-6

\* Applications of nitrogenous fertilizer, each 75 lb. N per acre, in mid-October, 1962 and mid-April, 1963.

The main findings of the 1962-63 phase of the experiment are summarized as follows:—

- (1) The bulk of available pasture is consistently higher in treated paddocks, but treated pasture is, in general, lower in percentage of crude protein. There are only slight body-weight advantages in favour of cattle grazing this pasture.

- (2) All groups gained in the late November to early May period. The paddocks stocked at the lower rate showed better weight gains per head, but less gain per acre, than those stocked at the higher rate. In the same period of 1961-62, the more heavily stocked paddocks had higher weight gains per head.

- (3) As in 1961-62, cattle stocked at the higher rate commenced to lose weight in early May. The application of nitrogenous fertilizer has not delayed the commencement of weight losses. In animals stocked at one to the acre, the rate of gain is declining.

- (4) Findings in this experiment suggest that, at set stocking rates, there has been little advantage from nitrogen fertilizer. In this environment, either conservation or a very high stocking rate for a short time during the period of rapid growth response of the pasture to nitrogen in early summer, appears to offer the best chance of economic utilization of nitrogen fertilized paspalum pastures.

**Growth Response in Pure and Cross-bred Chickens.**—An experiment to examine the genetic differences of pure and cross-bred chickens of the Australorp and White Leghorn breeds in their growth behaviour on different levels of protein intake was completed. Six dietary protein levels ranging, in 3 per cent. increments, from 10.5 to 25.5 per cent. were studied in chickens during growth from 1 to 8 weeks of age.



Significant findings were—

- (1) As expected, growth was extremely poor on the 10.5 per cent. ration. The growth rate rose to a maximum on the 19.5 per cent. ration.
- (2) Feed conversion efficiency increased with protein level, decreased with age of bird, but did not differ between breed types.
- (3) Heterosis achieved by mating Australorp sires with White Leghorn dams was twice as great as that of the reciprocal cross.
- (4) Disproportionate differences for growth between the sexes suggest that birds with White Leghorn sex chromosomes may have a higher requirement for some essential food factor than those with the Australorp sex chromosome. Further studies to identify this factor are planned.

*Meat Chicken Breeding Techniques.*—The aim of this long-term work is to compare different techniques to determine an economical and efficient programme for breeding a meat chicken suitable for marketing at 8 weeks. The techniques under study vary in the age at which, and the accuracy with which, parents are selected and mated. Two selection lines of similar genetic composition have been established and mated by artificial insemination. Selection from the 1,200 progeny will be on the basis of growth rate, body conformation and feather colour.

Carcass studies are being made to obtain a rapid method for determining the amount of edible flesh in the meat chicken. This will be used as another guide in assessing the relative merit of the alternative breeding programmes. Meat-type chickens are being dissected into an edible portion

(wing, breast, leg muscle and edible viscera) and an inedible portion. Correlations found so far between edible flesh and dissected breast meat, leg meat and wing meat are +0.94, +0.98 and +0.25, respectively. Dissected breast would appear to be the most suitable measurement, because it represents a major proportion of the more desirable white flesh and is easily dissected.

#### ARTIFICIAL INSEMINATION

Since the opening of the Artificial Insemination Centre at Wacol, all semen supplied by the Branch has come from this centre. The numbers of bulls stationed there are: A.I.S. 24, Jersey 28, Friesian 5, Guernsey 2, Ayrshire 2, Hereford 2, and Aberdeen Angus 1. The Ayrshire and Aberdeen Angus bulls are too young for service. The numbers of A.I.S. and Jersey bulls are high because they comprise proven bulls, bulls undergoing proving, and young bulls that are being reared for future proving.

The bull proving projects were continued, the main modification being that in the Jersey project, some deep frozen semen was used to obtain more comparable numbers of inseminations per bull on each farm than in previous years. The bull proving projects have produced 4 proven Jersey bulls and 1 proven A.I.S. bull. These are available to supply semen to commercial herds.

For the year ending June 30, 1963, 23,860 doses of semen were distributed by the Branch, at first from Rocklea and later from Wacol. Data on number of inseminations, conception rates, and breed distribution for the 12 months ended February 28, 1963, are given in Table 5. It should be noted that the commercial supply of semen did not begin until December 17, 1962.

TABLE 5

SEMEN USAGE FROM WACOL, CONCEPTION RATES AND BREED DISTRIBUTION FOR 12 MONTHS ENDED FEBRUARY 28, 1963

Distribution Centre	Chilled			Deep-frozen			Breed				
	Inseminations		First Insemination 60-90 day NR (%)	Inseminations		First Insemination 60-90 day NR (%)	A.I.S.	Jersey	Guernsey	Friesian	Hereford
	First	Total		First	Total						
<b>DEPARTMENTAL</b>											
Bull Proving, Nambour ..	1,088	1,528	60.4	234	377	52.1		1,905	..	..	..
Bull Proving, Kingaroy ..	1,063	1,709	49.1	..	..	..	1,709	..	..	..	..
Training Unit, Samford ..	949	1,555	70.5	532	778	63.5	..	12	1	2	..
Total .. .. .	3,100	4,792	59.6*	766	1,155	60.1*	4,027	1,917	1	2	..
<b>COMMERCIAL</b>											
Beaudesert .. .. .	202	329	69.3	106	166	64.1	417	44	..	34	..
Dayboro .. .. .	..	..	..	31	61	61.3	38	..	..	..	23
Gympie .. .. .	72	111	68.1	..	..	..	..	111	..	..	..
Kilcoy .. .. .	403	505	68.2	16	22	50.0	177	333	..	..	17
Killarney .. .. .	..	..	..	230	388	72.2	204	184	..	..	..
Total .. .. .	677	945	68.5*	383	637	68.1*	836	672	..	34	40
Grand Total .. ..	3,777	5,737	61.2*	1,149	1,792	62.8*	4,863	2,589	1	36	40

\* Average conception rate.

*Experimental.*—The young bulls that are obtained for bull proving have been used in an experiment to study the comparative sexual maturity of bulls of the A.I.S. and Jersey breeds. Results from 16 A.I.S. and 17 Jersey bulls show that the average age at which the bulls were capable of service was:—A.I.S. 47.2 weeks (range 39-52 weeks), and Jersey 41.8 weeks (range 28-56 weeks). The average body-weight at this time was: A.I.S. 647 lb. (range 431-814 lb.), and Jersey 462 lb. (range 341-612 lb.).

Other studies in progress include the effect of tick fever and environmental temperature on semen quality, the relationship of age and breed to semen volume and density, and the effect of food dyes on fertility of deep frozen semen. The last experiment is being done before considering the introduction of coloured dyes for breed identification of deep

frozen semen. Dyes are already being used in chilled semen supplied from Wacol.

#### RESEARCH COMMITTEE

The Beef Cattle Husbandry Research Committee was formed as a committee of the Division of Animal Industry, to define the nature of problems of the beef cattle industry requiring research. Its other functions are: To allocate priorities for work, to consider the general design of major projects, and to follow the progress of these experiments. The committee consists of 3 members—the Director of the Cattle Husbandry Branch, the Biochemist, and the Director of Husbandry Research. Sixteen projects were approved at 6 meetings held during the year.

#### BIOCHEMICAL BRANCH

The continued expansion of the Department as a whole, and especially that of the Division of Animal Industry, has increased the demands on this Branch. These have been met in 3 ways: the appointment of additional staff; the introduction of modern physico-chemical equipment; and the provision of some additional temporary laboratory accommodation.

The present technical staff of 20 includes 10 graduates. In addition there are 4 Departmental scholarship-holders undertaking full-time training in biochemistry at the University of Queensland. This compares with a technical staff of 7 at the inception of the Branch in 1956.

Both thought and money have been and are being given to the provision of equipment which is adequate for the expanding Branch requirements. Highlights have been: the introduction of gas chromatography embracing thermal conductivity and flame ionisation detectors; a recording spectrophotometer covering both the ultra-violet and visible spectral regions; a further spectrophotometer with increased range and

sensitivity and improved fluorimetry attachments; an atomic absorption spectrophotometer; and freeze drying equipment. Branch needs in infra-red spectroscopy and in the use of radioactive isotopes have been met by the co-operation of the Veterinary Parasitology Laboratory of C.S.I.R.O. However, the increasing use of isotopes now necessitates the provision of at least a minimum of basic equipment within the Branch. Another urgent requirement is an electron capture unit for use in association with gas chromatography. Provision for such equipment has been requested in Branch estimates for the ensuing year.

The problem of accommodation is most serious. Laboratory space is grossly inadequate for even the present staff. Moreover, expensive and sensitive equipment is inadequately housed in offices and temporary buildings. The provision of a new building at Yeerongpilly to accommodate the Husbandry Research and Biochemical Branches has been approved in principle and the Department of Public Works has collaborated in the preparation of suitable plans.

The Branch at present comprises the 3 sections—Toxicology, Nutritional Biochemistry, and Clinical Biochemistry. Each provides a diagnostic service and engages in research in its own field of biochemistry.

### TOXICOLOGY SECTION

#### Diagnostic Service

A total of 698 specimens were analysed in 360 cases where poisoning of livestock was suspected. The presence of arsenic in concentrations consistent with those reported in known cases of arsenical poisoning confirmed the cause of death in 48 individual cases. On most occasions, the source of arsenic involved careless disposal after the use of this element either as an acaricide or weedicide. One serious loss involving a complete dairy herd was associated with the preparation for cattle tick control of a spray mixture from a number of concentrate residues available on the property. An arsenic preparation was included at the 1/80 dilution used for chlorinated hydrocarbons instead of the correct 1/320. Another serious loss involving 50 head of cattle was due to arsenical contamination of the drinking water. An unusual source of arsenic resulting in deaths in fowls was shown to be the excessive use of organic arsenicals as a growth stimulant in a home mixed ration.

Lead poisoning was established in 18 cases. Where follow-up information was collected, the source usually proved to be lead paint.

A number of fodder crops and herbage plants was examined in connection with stock losses. Lethal levels of prussic acid were found in 4 samples of *Sorghum almum*.

There has been a further increase in the number of samples from dipping vats submitted for testing. The objective of this service to producers is to use chemical analyses as a control procedure in maintaining vats at an economic effective strength. Of 1,638 samples analysed, 75 were arsenical preparations and the remainder proprietary preparations based on a variety of organic phosphates.

For chemical control, the analytical method must be rapid, simple and inexpensive. Accuracy must be adequate, but not necessarily optimal. It has been necessary to devote a considerable amount of research to the development of suitable procedures, each organic phosphate requiring a specific analytical method. Solvent partitioning and absorption spectroscopy, usually in the ultra-violet, have generally been successful.

#### Investigations

**Pesticide Residues.**—Following the prohibition of the use of acaricides based on chlorinated hydrocarbons, field observations have shown that normal dipping practices using proprietary preparations based on the organic phosphates are not effective in the control of buffalo fly. Promising results have been obtained by using small amounts of DDT, applied as a spray to the back of the neck and the withers. The use of 1 pint of 1 per cent. DDT, resulted in unacceptable residues. The repeated use of 0.25 pint of 0.3 per cent. DDT, at about monthly intervals resulted in residues within the tolerance of 7 p.p.m. set down by the U.S.A. The possibility of using 0.5 pint of 0.5 per cent. DDT, was examined by controlled studies involving treatment at 3-weekly intervals and fat sampling by omental biopsy after 3, 6 and 9 treatments. There was a gradual increase to a mean value of 13 p.p.m. DDT, in rendered fat.

Studies were made on the magnitude of residues in butterfat following the treatment of dairy cattle with acaricides based on organic phosphates. Essential findings were:

- (1) The concentration in butterfat is a function of the type of preparation, the concentration of active ingredient in the dipping fluid, the milk output, and the time interval following exposure.
- (2) Residues after exposure to the preparation, based on the organic phosphate Delnav, were greater than those resulting from exposure to acaricides based on the organic phosphate Bayer 21/199.
- (3) Maximum residues occurred at the first milking, approximately 5 hours after exposure to Bayer 21/199. With Delnav maximum residues were found at the third milking approximately 29 hours after exposure.
- (4) With both compounds, residues in butterfat were virtually not detectable at the fifth milking, approximately 53 hours after dipping.

**Selenosis.**—A paper entitled "Selenosis in North Western Queensland associated with a Marine Cretaceous Formation" has been submitted for publication in the *Queensland Journal of Agricultural Science*. Analytical and field data presented in this paper support the following conclusions:

- (1) Selenosis in north-western Queensland is associated with the Tambo formation of cretaceous marine clay limestone shales.

- (2) Outcrops of this formation are found at intervals throughout a 200-mile traverse, but are extensive only in the Hughenden-Richmond area.
- (3) A highly selenised 70 acre "poison strip" is associated with recent intensification of land use, the major cause being cultivation for pasture improvement. This has encouraged the spread of both introduced and native selenium-accumulating plants.
- (4) Acute poisoning has occurred in unacclimatised stock restricted to the poison strip.
- (5) Elsewhere disorders in livestock attributable to selenium are rare and of a most moderate nature, in spite of measurable selenium levels in soils, plants and animals.

**Poison Plants.**—The isolation and identification of fluoroacetic acid as the toxic principle in *Acacia georginae* has been published in the *Queensland Journal of Agricultural Science*. Present studies are concerned with a survey of allegedly toxic and non-toxic areas of the Georgina River watershed in north-western Queensland. Data are being collected on the influence of soil factors, season and stage of growth on the concentration of fluoroacetate in seed, pod and leaf of *Acacia georginae*.

The chemical nature of the toxic principle in *Gastrolobium grandiflorum* is now clear. Further purification by chromatography is in progress and should permit complete identification of the toxin. Work has continued on the toxic factor in *Cestrum parqui*. All findings support the presence of a saponin.

### NUTRITIONAL BIOCHEMISTRY SECTION

#### Diagnostic Service

Partial or complete stock food analyses were made on 1,500 samples. These included pasture and crop silages, individual pasture and crop species, experimental rations and ingredients of rations, and a wide variety of samples related to field trials by the husbandry branches. For diagnostic purposes, a general appreciation of stock food value can usually be obtained from the protein and moisture content. Complete stock food analyses have been restricted to fodders for which there is little or no information in the literature, and to representative samples from experiments where such analyses are necessary for the translation of findings to other feeds of similar composition.

A number of additional measurements have been made on certain fodders. These include: analyses for trace elements and some major minerals; bomb calorimetry as an index of energy value; the degree of fineness in mineral licks as a measure of availability to livestock; and quality tests to determine the effectiveness of silage conservation. A total of 140 samples of silage was examined. These included 30 samples of pasture and crop silage in 2 silage competitions, one in southern and the other in Central Queensland. Similar competitions have been organised and extended for this year.

Another service which has continued is the use of chemical analysis as a quantitative measure of carcass composition. Replicate analyses have been made on 270 samples. These represent either whole or half carcasses or selected rib cuts for which regressions have been developed to relate findings back to the whole carcass. A major problem in this work is the magnitude of sampling errors. These have been minimised by the introduction of freeze drying. This has two advantages. Firstly, it permits a ten-fold increase in sample size for moisture determination. Secondly, the texture of the freeze dried sample facilitates further mechanical processing and permits more accurate sub-sampling for the determination of protein, fat and ash.

#### Investigations

**Silage Studies.**—Studies on the conservation of pasture consisting mainly of *Paspalum dilatatum* as silage have shown the advantages resulting from the use of both additives and a type of harvester that gives the maximum fineness of chopping. These findings have been extended to studies on the conservation of lucerne as silage. The crop was an almost pure stand of lucerne at the early flowering stage. The protein content was 24 per cent. on dry matter. A comparison was made between the cutter-bar type and flail type of commercial harvesters. Additives tested were molasses at 40 and 80 lb. per ton and metabisulphite at 12 lb. per ton. Measurements included chemical composition, quality tests, fermentation losses, digestibility and palatability. Data are by no means complete, but essential findings are:

- (1) Maximum quality with minimum fermentation loss resulted from the use of a cutter-bar harvester and the addition of molasses at 80 lb. per ton.
- (2) A good product was obtained also from flail harvested material following the use of molasses at 80 lb. per ton.

- (3) With the flail method of harvesting, the improvement in quality from the lower level of molasses was intermediate.
- (4) The flail-harvested product containing metabisulphite showed a fermentation loss comparable with that of the flail harvested product containing the lower level of molasses.
- (5) All products were palatable, but the silage containing metabisulphite showed some deterioration and loss in palatability on exposure.
- (6) Digestibility data are not yet complete.

**Nitrogenous Fertilizers and Animal Production.**—Studies have been in progress since March, 1961 to examine the effect of top dressing with ammonium sulphate on the productivity of cattle grazing on pastures in which *Paspalum dilatatum* is the dominant species. Applications at the rate of 75 lb. of nitrogen per acre have been made in early and late summer. Replicate treatments using Hereford weaners involved stocking rates of 1 and 2 animals per acre. Measurements included bodyweight, faecal analyses as an index of the chemical composition of the diet selected, and quadrat yield and chemical composition of total available pasture. Essential findings are:

- (1) Top dressing in early summer resulted in a marked increase in yield and protein content of pasture. The response from fertilizer application in late summer was much less evident.
- (2) In all treatments the protein content of the selected diet was greater than that of the total available pasture.
- (3) Following periods of maximum pasture growth, there is evidence of an adverse response in animals from nitrogen treatments. This has been attributed to a greater overburden of mature pasture in paddocks top dressed with nitrogen.
- (4) At periods of minimum pasture growth, there is evidence of a favourable response in animals from nitrogen treatments. This has been attributed to a greater amount of available pasture in nitrogen treated paddocks at a time when the quantity of feed is limiting.
- (5) Similar effects are evident due to stocking rates.

**Nutritional Status of Grazing Sheep.**—A 12 months' study has been completed in the Julia Creek area of north-western Queensland. Measurements include: bodyweight; yield and fibre diameter of wool; faecal analyses as an index of the chemical composition of selected diet; changes in the botanical composition of both total-available and selected pasture; and digestibility measurements on total-available and some selected pastures. Essential findings are:

- (1) Bodyweights remained relatively constant, but there was a seasonal decline in wool yield and fibre diameter.
- (2) In summer and autumn, the selected diet is high in protein and consists predominantly of summer growing annuals.
- (3) In winter, there is a fall in protein content of the diet which then consists of mature annuals, seed heads of Mitchell grass, and a limited amount of "green pick" from leaves of mimosa and couch from along bore drains.
- (4) In spring before the onset of effective summer rains, sheep are on a diet moderately low in protein from mature Mitchell grass.
- (5) In this experiment the findings suggest that, in this particular year, a limitation of dietary energy rather than of protein may have been primarily responsible for the seasonal decline in wool production.
- (6) Further studies, including digestibility measurements, are necessary and are continuing.

## CLINICAL BIOCHEMISTRY SECTION

### Diagnostic Service

Blood inorganic phosphate analyses were made on 685 samples representing 99 individual properties. On 7 of these properties the diagnosis of phosphate deficiency was confirmed, while on a further 6 the phosphate status was marginal.

Blood copper levels were determined on 344 samples representing 73 individual properties. A diagnosis of copper deficiency was confirmed on 10 of these properties. Liver copper analyses were done on 119 samples representing 71 different properties. A diagnosis of copper deficiency was confirmed on 11 properties and a further 7 showed a marginal status.

Liver vitamin A analyses confirmed the field and pathological diagnosis of vitamin A deficiency in fowls from 3 properties and in pigs from 2 properties. A marginal vitamin A status was indicated on a further 2 poultry and 3 pig farms.

Suspected metabolic disorders involved the analyses of 319 sera for calcium and 172 for magnesium. Hypocalcaemia was confirmed on 17 occasions. There were 7 cases of hypomagnesaemia and 6 of hypermagnesaemia, all occurring in association with hypocalcaemia.

Of the 6,000 miscellaneous samples analysed, some 300 were concerned directly with the diagnostic service and the remainder with investigations by the Husbandry Research, Pathology and Field Branches. Such investigations originated largely as a direct result of the diagnostic service. The variety of analyses included: blood haemoglobin, haematocrit, glucose, copper, molybdenum and inorganic phosphate; plasma chloride, sodium, potassium, phosphate, alkaline phosphatase, vitamin A, carotene, ammonia, urea, and carbon dioxide; serum calcium, magnesium, total protein, albumin, globulin, uric acid, glutamate oxalacetate transaminase and bilirubin; liver copper, manganese and vitamin A; blood volume, plasma volume and extra-cellular fluid; rumen fluid and duodenal chyme for total volatile fatty acids, molar percentage of individual fatty acids, lactic acid, ammonia, pH, volume, nitrogen, ash and dry-matter; body fats for iodine number and fatty acid composition; semen fructose; urine for a variety of tests; bones for ash, mineral content and fluorine; and eggs for tests associated with conditions of storage.

### Investigations

**Trace Elements.**—Two field trials with beef cattle on marine plains in the Rockhampton district are approaching completion. The first is a study of the effect of copper and cobalt therapy on the growth rate of weaner steers. The second is designed to evaluate the effect of trace element supplementation of pregnant and lactating cows on the growth performance of their progeny.

The data from the first experiment show a significant growth response in steers to copper, but not to cobalt therapy. This is due primarily to the influence of copper in minimising weight losses during the period from July to October. The data from the second experiment are not yet complete but again there is a significant response to copper but not cobalt therapy.

**Protein Quality.**—Studies in this field were extended to the influence of processing temperature on the biological value of meat and bone meal. Three products, prepared in a single digester, were classed by the manufacturer as under-cooked, average, and over-cooked. The opportunity was taken to evaluate simultaneously the use of tallow in chick starter rations. Two types of rations were used, each having a protein content of 21 per cent. One was a standard type of broiler ration containing 7 per cent. meat and bone meal, the other contained only meat and bone meal, 26.5 per cent., as the source of protein additional to grain. Tallow was used at the 3 per cent. level as a replacement for starch. Essential findings from this multifactorial experiment were:—

- (1) Both weight gain and feed conversion were significantly better in chicks on the broiler type ration.
- (2) The degree of cooking did not significantly affect weight gain.
- (3) On rations containing 26.5 per cent. meat and bone meal, feed conversion was significantly better in the group fed the average cooked product.
- (4) On the broiler ration containing 7 per cent., meat and bone meal, the degree of cooking did not significantly affect feed conversion.
- (5) The use of tallow improved feed conversion in chicks on the broiler ration, but had an adverse effect when included in the high meat meal ration, differences being significant at 4 weeks of age.

**Urea Toxicity.**—An experiment, designed to see whether a high urea intake by pregnant heifers can cause abortion, has provided the opportunity to examine the use of blood ammonia levels as an index of urea toxicity. Under controlled feeding conditions the level of blood ammonia is related to the amount of urea administered. Maximum blood ammonia levels occur 1½ to 2½ hours after dosing with urea. At safe dose rates, there is a rapid fall in blood ammonia levels after the initial peak. When approaching the toxic dose, blood ammonia levels tend to remain at peak level. At the toxic dose, the build up in blood ammonia is rapid and continues until death.

**Normal Biological Values for Beef Cattle.**—Analytical data are now complete on a 3-year study to establish normal values for a number of blood constituents. It was considered necessary to determine the effect on these values of varying degrees of excitation. Essential findings are:

- (1) Excitation markedly increases haemoglobin, packed cell volume and red cell count. Inorganic phosphate, potassium and serum protein are affected to a lesser degree.
- (2) Even mild excitation such as sighting the operator causes an appreciable and immediate rise in these blood constituents compared with the values obtained at rest.
- (3) Animals tranquilized with chlorpromazine show lower resting values and a reduced excitation effect.
- (4) In splenectomized animals, blood constituents are only mildly affected by the degree of excitation.

## SHEEP AND WOOL BRANCH

## EXTENSION

*Staff.*—The graduate strength of the Branch was increased from 2 to 4 during the year. New graduates were appointed to Cunnamulla and the Toorak Field Station. The field centre of Barcardine again has an advisory officer, but the Hughenden and Longreach centres remain vacant. The Branch, both Head Office and Field, is still inadequately staffed. The death of Mr. M. N. S. Jackson, M.C., Senior Adviser, occurred in October. Mr. Jackson entered the Department in April 1947, and gave loyal and conscientious service.

Planning of accommodation for increased staff and improvements for better handling of sheep at the Toorak Field Station are being implemented.

A wool Research Committee Refresher Extension School at Prospect, Trangie and Canberra in February and March, was attended by Sheep and Wool Advisers from Dalby, Goondiwindi and Blackall.

*Extension Work.*—Branch officers attended conferences on brigalow at Dalby and Biloela, an agrostological conference at Charleville, and a conference on fleece measurement at Sydney. Seven Branch officers participated in a 4-day school on sheep husbandry at Terrick-Terrick Stud in September.

With widening drought conditions in the quarter ended December, supplementary feeding with grains, lucerne hay and meatmeal was considerable. With urea block supplementation of sheep, sheep intake has been found to be variable and

toxicity danger unpredictable and considerable. Blowfly, although fairly active in the wetter part of the year, by no means reached the wave proportions that are often associated with such a wet period.

Twenty field days were held during the year in conjunction with producers' organizations, woolbroking and commercial firms. The total number of recommendations and demonstrations given by field officers was 4,467.

## INVESTIGATIONS

*Anthelmintic Trial.*—The Warwick district trial which involved carrying out observations with body weights approximately monthly, various drenchings and faecal egg-count checks, was continued. Five groups of sheep, each of approximately 67 4-month-old Polwarth-Merino cross lambs, were used. The main observations ended with the first shearing in March, 1963, when final weighings were made of the wool, and the fleece weights were recorded to compare group variations. For the coming year, it is intended to subject the same sheep to another set of observations. Comparison of fleece weights at the end of the second year will permit the assessment of the possible advantage of early worm treatment on subsequent fleece weight and quality.

For the first year of the trial, body weight variations at approximately monthly weighings in all groups are indicated in the table below. Increases shown are variations from initial weighings.

Treatment	Period Elapsed and Weight Increases in lb.							
	11 Weeks	15 Weeks	20 Weeks	26 Weeks	31½ Weeks	35½ Weeks	41½ Weeks	49 Weeks
Various drenches, Eludon, phenothiazine, neguvon not regular .. .. .	3.2	2.27	6.72	8.40	17.2	20.32	24.68	27.89
Phenothiazine not regular .. .. .	3.7	3.28	6.91	8.96	15.8	18.54	24.0	24.28
Thiabendazole monthly .. .. .	6.23	5.40	11.28	14.63	23.93	29.17	35.75	38.31
Thiabendazole not regular .. .. .	6.48	5.43	11.32	14.38	23.68	27.76	32.92	34.58
Phenothiazine monthly .. .. .	2.62	1.89	5.10	8.41	15.52	19.69	25.27	27.62

The thiabendazole-treated groups showed consistently higher body weights throughout. (It is to be noted that the phenothiazine used was not the newer anthelmintic, which is a mixture of 2 phenylbenzimidazole and phenothiazine).

Faecal samples taken monthly from 5 sample sheep per group indicated greater and more consistent reduction in eggs per gramme in thiabendazole treated groups than in other treatments.

*Anthelmintic thiabendazole.*—From the first year's trial, fleece weights and clean scoured weights from sheep identifiable in the various groups are indicated in the table below. Losses of ear tags reduced the numbers of identifiable sheep in some groups.

Groups	Number of Sheep in Group Identifiable	Average Greasy Fleece Wt. lb.	Average Clean Scoured Fleece Wt. lb.
Various Drenches .. .. .	43	6.0	3.5
Phenothiazine—not regular .. .. .	61	5.7	3.2
Thiabendazole—monthly .. .. .	62	7.2	4.2
Thiabendazole—not regular .. .. .	65	7.1	4.1
Phenothiazine—monthly .. .. .	50	6.1	3.4

*Copper and Cobalt Deficiency Trials.*—Field trials are in progress on 3 Tambo district properties and one Blackall property to determine whether copper or cobalt deficiencies exist in this heavily grassed country following heavy summer rains, like those that occurred this year.

*Ovine Brucellosis Observations.*—Co-operative work between 3 Branches of the Division of Animal Industry has enabled a survey to be made of British Breeds Stud sheep for brucellosis. The percentage incidence in stud flocks has been found to be low, but the disease is fairly widespread. This work is to be continued to assess the practicability of eradicating the disease from infected flocks.

*Humpy-back Observations.*—Further observations were reported by field officers regarding humpy-back outbreaks in sheep. Conclusive evidence has not yet been obtained that *Solanum esuriale* is the cause, although this plant was common on properties observed.

## TOORAK FIELD STATION

In accordance with planning in co-operation with the Toorak Advisory Committee, good progress is being made with the erection of subdivisional fences for facilitating trial work.

*Seasonal.*—It became necessary to give lambing ewes a supplement in September. The first rain to relieve a position of drought came in December, 1962. Nine inches of rain fell in January and February, 1963 and almost 2 inches more in March. Good pasture resulted and sheep recovered condition quickly, but the drought caused some losses. Dingoes invaded the run during the year.

*Performance of Nucleus Flock.*—Observations and recording of performance continued in this long term trial. Fertility records are being assembled for analysis on the electric computer. Between March 26 and May 6, 1962, low (plain) and high (wrinkly) skin fold groups of ewes were joined by hand service to low and high skin fold groups of rams respectively and a random skin fold group of ewes to both groups of rams. The ewes were lambed under surveillance in August-September, 1962. The performance of the ewes at this joining and the subsequent lambing was as follows:

	Plain	Random	Wrinkled	Total
Ewes present at joining ..	177	216	150	543
Ewes showing oestrus at joining	148 84%	170 79%	122 81%	440 81%
Ewes lambed—number ..	111	113	83	312
Ewes lambed as a percentage of ewes present at joining ..	63	52	55	57
Lamb marking percentage based on ewes joined .. .. .	47	31	35	39

Of the 312 lambs born to all groups of ewes, 214 lived to marking on November 23. The percentage of lambs born and surviving to marking was 69 per cent. in the plain group, 55 per cent. in the random group, and 58 per cent. in the wrinkly group. The average birth weight of all single lambs was 8.1 lb. and twins 6.8 lb. The gestation

length of all males averaged 151.4 days and all females 151.2 days. Daily gains in body weight between birth and marking averaged 0.19 lb. for male and female single lambs and 0.18 lb. for male and female twins.

The performance of the groups of rams, that is the number of ewes lambing to the number of ewes served, is shown in the following table. Cross-over figures result from the mating of ewes in the random group to both wrinkly and plain rams. It will be appreciated that the random group contains both wrinkly and plain ewes. These are mated to plain and wrinkly rams in sequence as oestrus is exhibited during the joining period.

	Plain Ewes	Wrinkly Ewes	Total
Plain Rams (6)	140 out of 230 (61%)	20 out of 35 (57%)	160 out of 265 (60%)
Wrinkly Rams (6)	34 out of 60 (57%)	98 out of 166 (59%)	132 out of 226 (58%)

These results can only be considered along with those previously obtained and those yet to be recorded.

*Spring and Autumn Joining Trials.*—These trials are to compare the results of joining in the spring with those of joining in the autumn. The main flock ewes were divided at random into 2 equal groups. The autumn joined group was mated in mid April for 6 weeks. From this mating 444 lambs were marked to 925 ewes mustered—48 per cent. The spring joined group was mated in mid October for 6 weeks. In this, 459 lambs were marked to 990 ewes mustered—46 per cent. A serious flywave caused mis-mothering at lambing and treatment for control reduced the lambmarking percentage in the spring joined group.

*Winter Joining trial.*—A group of ewes was joined in July-August for the third successive year to ascertain oestral activity and lambing percentages from ewes joined in the coldest month.

Results were:

	July-August 1960 Joined	July-August 1961 Joined	July-August 1962 Joined
Ewes present	98	97	79
Showing oestrus during 6 weeks joining	84=85.7%	93=95.9%	77=97.5%
Showing oestrus in first fortnight	58=59.2%	84=86.6%	58=73.4%
Ewes lambing to service—			
In first fortnight	42	53	31
In second fortnight	22	6	24
In third fortnight	2	2	2
Total ewes lambing	66	61	57
Lambs survived	46*	17**	41**

\* To first fortnight after completion of lambing.

\*\* To first week after completion of lambing. The big loss in the 1961 group was attributed mainly to predators.

*Oestrus Trial.*—The trial to observe the occurrence of oestrus in 200 ewes running continuously with vasectomised rams (teasers), and in 3 groups each of approximately 100 ewes spending 2 months with teasers and 4 months away, was commenced on July 18, 1961.

Figure 1 gives the percentage of ewes in Group I (running continuously with teasers) which showed oestrus at least once during the 6 weeks prior to the dates shown. The minimum percentage showing oestrus during any of these 6-weekly periods was 59 per cent. during the 6 weeks between November 15 and December 27, 1962. The maximum percentage was 90.2 per cent. during the 6 weeks between July 18 and August 29, 1961.

In Figure 2, the percentage of ewes in the intermittently mated groups which showed oestrus one or more times, recorded at fortnightly intervals after being introduced to the teasers, is shown progressively for the teasing period of 8 weeks. For example, the first column for each group shows the number of ewes marked by the teasers in the first 2 weeks. The second column shows the percentage of ewes marked at least once in the first 4 weeks; and the third those in the first 6 weeks. The final column shows the percentage marked during the 8 weeks of teasing. (In the Group II ewes joined on December 4, 1962, the progressive percentage of ewes showing oestrus at least once has been recorded at the end of the first, third, fourth, sixth and eighth weeks. This was because of mustering difficulties.)

The highest percentage of ewes showing oestrus during the first 14 days of joining occurred during July, 1961 and April, June and August, 1962. The lowest percentage of ewes showing oestrus during the first 14 days occurred during January and February, 1962 and January and February, 1963.

Figure 3 gives a comparison of the occurrence of oestrus, during 14 and 42 days following the dates shown, in a group of ewes running continuously with teasers, and in a group of ewes introduced at that date after 4 months absence from teasers.

In figure 3 the observations can be read by use of the key below the figure. For example, 77.5 per cent. of the ewes in Group I (continuous group) showed oestrus in the 14 days immediately after July 18, 1961 and 90.2 per cent. in the 42 days after that date. Similarly, with the intermittent groups, taking Group II as the first example, 72 per cent. of the ewes in this group showed oestrus in the 14 days immediately following July 18, 1961, and 83.5 per cent. in the 42 days after that date. At the next date, reading from the left, September 12, 1961, in Group I 29.9 per cent. showed oestrus in the 14 days after that date, and 79.5 per cent. in 42 days. Of Group III, introduced to teasers on September 12, 1961, 32.9 per cent. showed oestrus in 14 days and 84.1 per cent. in 42 days.

This trial was begun on July 18, 1961, and following the initial period of approximately 6 months, the intermittent groups have always shown a higher percentage of ewes showing oestrus during 42 days' joining than has the group run continuously with teasers.

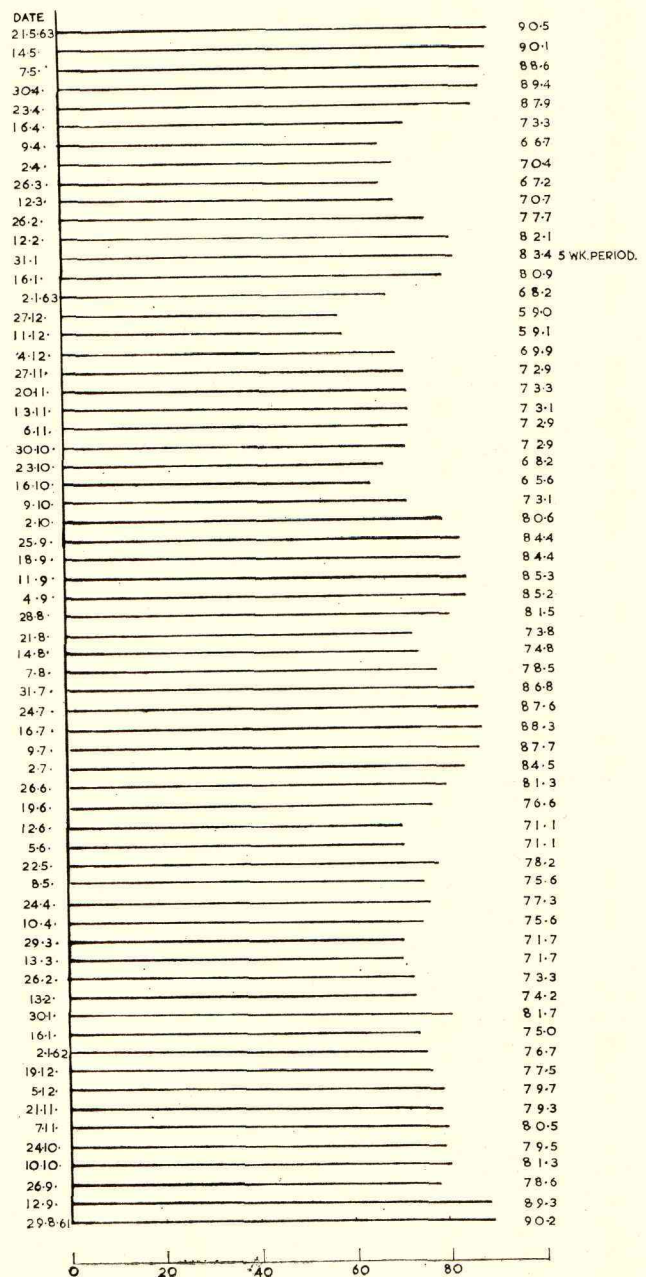


Fig. 1.—Toorak oestrus trial. Percentage of ewes showing oestrus during the 6 weeks ending at dates shown.

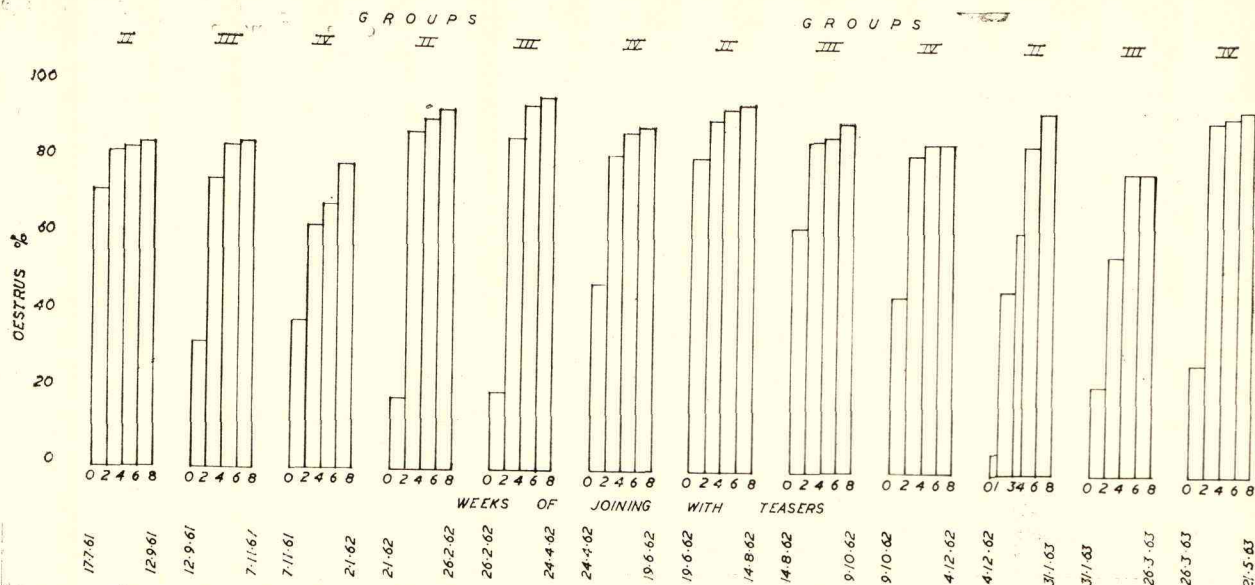


Fig. 2.—Toorak oestrus trial. Progress percentages of ewes showing oestrus up to 8 week periods.

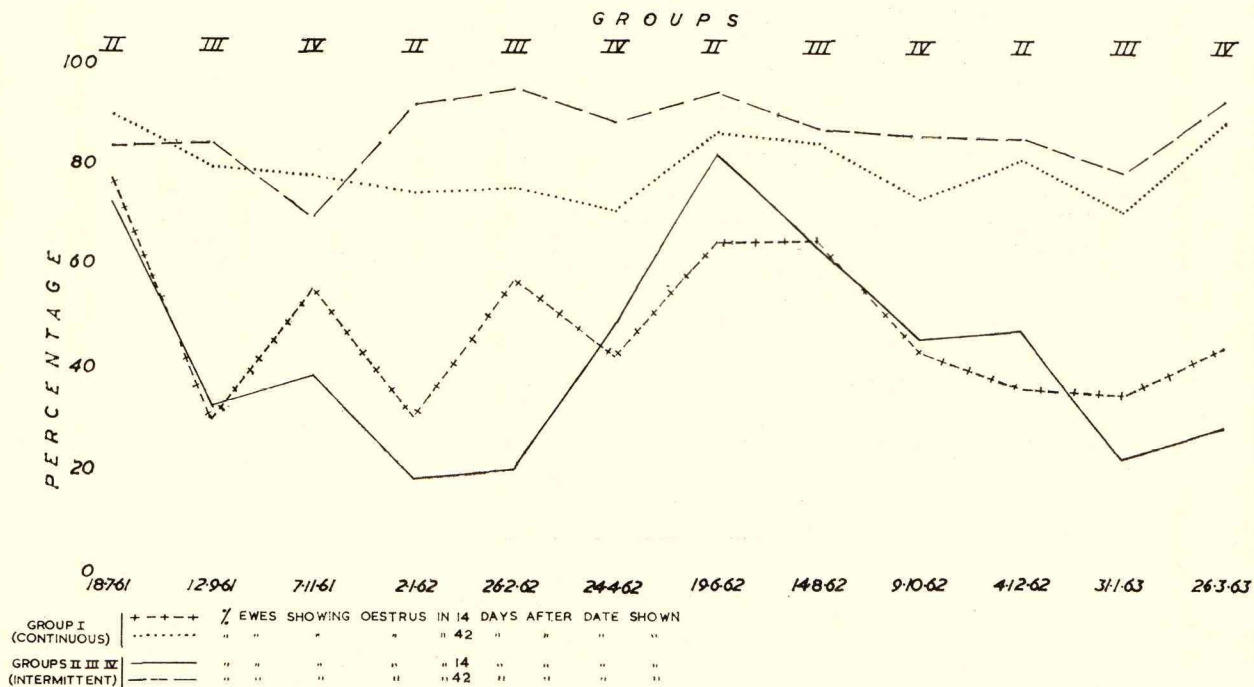


Fig. 3.—Toorak oestrus trial.

**Ram Semen Observation for Seasonal Fertility.**—This survey was commenced in October, 1961. Semen was obtained by electrical stimulation, fortnightly from July 18, 1962, to June 30, 1963. Before July 18, 1962, collection was obtained every month. The semen was measured for density, volume and pH, sperm motility under the low-power microscope, motility under high-power, morphology and the ratio of live to dead spermatozoa.

Seminal degeneration, as judged by motility, morphology and live-dead ratio, has again occurred during the late summer. However, during the period July, 1962–June, 1963, the depression occurred later in the season than in the previous twelve months.

**Effects of Arsenic on Ram Semen.**—As drenches containing arsenic are frequently used for internal parasite control, a trial to determine the effects of drenching with a commercial preparation of bluestone-arsenic on the semen of rams was begun in May. There are 4 groups of rams in this trial, a control group and three other groups drenched at varying intervals. Normal doses of commercially available bluestone-arsenic drenches are being used.

**Effect of Testosterone implants.**—Studies were made into the effects of testosterone implants on body weight and wool production. Four tooth wethers were divided into an untreated group and 2 treatment groups. One treated group received ear implants of 4 x 17.5 mg. of testosterone on March 10, 1963, and the other 6 x 17.5 mg. on March 19, 1962.

The table below shows the variation in fleece growth in treated and untreated sheep at shearing on June 24, 1962.

	Fleece Wt. lb.	Body Wt. lb.
Control group	10.42 ± 0.18 (57)*	81.9 ± 1.1 (60)
4 x 17.5 mg. ..	10.50 ± 0.18 (57)*	85.5 ± 1.1 (60)
6 x 17.5 mg. ..	10.83 ± 0.17 (62)*	88.0 ± 1.1 (63)

\* Means, standard errors and numbers of wethers per group.

There are no significant differences among the 3 group greasy fleece weights. However, in body weight, sheep in the 6 x 17.5 mg. group are greater than the controls at the 0.1 per cent. level; and those in the 4 x 17.5 mg. group are greater than the controls at the 5 per cent. level.

The conclusions from this trial are that there was a significant difference in body weight in the group treated with 4 x 17.5 mg. and a highly significant difference with 6 x 17.5 mg. when compared with the untreated controls.

**Pasture Intake Studies.**—The pasture intake studies, commenced in January 1962, have been continued in conjunction with the Biochemical and Agriculture Branches. At the stocking rate used, it appears that the sheep, by selective grazing of the natural pastures obtained a diet adequate in protein content throughout the year. But the total feed intake may have been below requirements in the dry spring and early summer.

**Seasonal Wool Growth Studies.**—A long-term project studying the variation in wool growth throughout the year in north-western Queensland was commenced in July, 1961. Results for greasy and clean wool production per 10 sq. cm. skin surface per 28 days are shown in the Figure 4. For example, in the first sampling period between July 12, 1961, and October 30, 1961, the average greasy wool production was 487 mg. per 10 sq. cm. and clean wool 301 mg. The incidence of greatest and least wool growth is as follows:

Greatest wool growth, March 27, 1963, to April 23, 1963. (Greasy, 643 mg., and clean 410 mg. per 10 sq. cm.). Least wool growth, October 30, 1961, to January 2, 1962. (Greasy 325 mg., and clean 219 mg. per 10 sq. cm.).

The mean fibre diameters have varied between 19 microns and 25 microns, that is between a count of 66's and 58's respectively, as based on fibre diameters according to the Duerden scale. The average body weights rose to 99 lb. during the autumn of 1962 but rose only to 91 lb. in 1963.

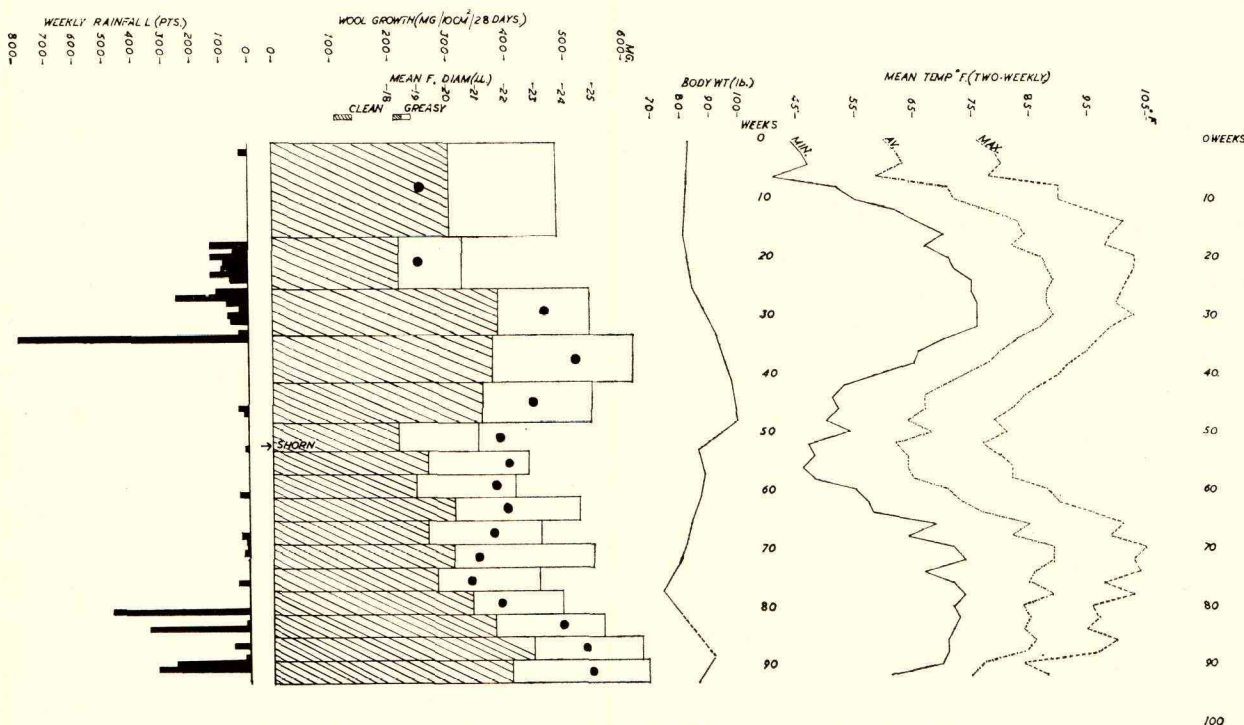


Fig. 4.—Seasonal wool growth at Toorak. The average is based on 14 sheep.

#### WOOL BIOLOGY LABORATORY

In this year, 3,070 wool samples were received for fleece measurement components, an increase of 13.8 per cent. over last year's figure.

Numerous technical inquiries were received concerning wool samples showing various defects. The measurement of skin thickness of sheep subjected to periods of varying duration of drought rations has been completed, but the results have not yet been statistically analysed.

#### CATTLE HUSBANDRY BRANCH

The Branch, responsible for research and extension in beef and dairy regions, has now a graduate staff with diverse training backgrounds, including Veterinary Science, Agricultural Science, Rural Science and Economics. New graduate officers were assigned to research and experimental programmes at the research stations at Kairi and Biloela. Another has been assigned to further work on the field investigation of infertility in dairy herds.

New extension centres in the beef districts of Mount Isa and Roma have been staffed, and extension activity in the South Burnett is being reorganised. The recently formed group in Regional Planning within the Department resulted in the secondment of 2 officers of the Branch—one of whom was the Branch Director. Mr. L. E. Donaldson, awarded the degree of Master of Veterinary Science in 1962 by the University of Queensland, is at present undertaking further studies at Cornell University in the United States.

#### EXTENSION

In the dairying industry there has been a notable addition to field activities of the Branch. A movement gaining considerable momentum is the growth and development of A.I. Co-operative Associations. These producer-owned and controlled organisations are the principal means of supplying A.I. field services to dairymen. Assistance to these groups in organising local support, in planning field operations, and in training technicians is a Branch responsibility that has grown greatly in volume since the opening of the A.I. Centre at Wacol late in 1962.

The existing and older established A.I. distribution centres have provided valuable help to the Department by making available details of their operations and of their financial affairs. These have proved of considerable value to the newer distribution centres and to those being formed. Operating A.I. distribution centres are at Malanda, Bundaberg Gympie, Dayboro, Beaudesert, Killarney, Kilcoy, and Beenleigh. Additional centres are expected to be operating soon at Monto, Mundubbera, Toowoomba, Wondai, Southport, and Murgon.

In the beef industry also, the currents of change are marked and significant. In this industry the extension activity of the Branch has changed. The staff is now spending more time on programmes involving new techniques for improving growth and reproduction and for drought alleviation. Dry feedlot and greenlot feeding and crop fattening are the practices that are becoming increasingly important to producer and Branch extension officer alike. With these significant changes in production methods, the rapid development of additional land resources for beef is continuing, especially in the brigalow areas. Selected officers of the Branch took part in the brigalow schools at Miles, Dalby and Biloela. In addition, short regional and district conferences and seminars for staff are becoming regular features of the in-service training programme.

#### DAIRY INDUSTRY

##### Artificial Insemination and Proving Dairy Bulls

The Department has maintained the A.I. unit at Samford for technician training and for research. Its utility in these two roles is increasing as A.I. services spread throughout the dairying regions. To date 33 inseminators have been licensed by the Department. The majority have acquired initial proficiency in the Samford unit. In addition, overseas students and visitors, including some Colombo Plan students, have received A.I. training here. The standard of proficiency attained by trainees is considered to be high.

Officers of the Branch have been engaged in extensive promotion campaigns in the areas of existing and developing distribution centres. Operating cost is still the main problem in a developing centre. The position of the distribution centres has been much strengthened by the availability of semen from the Wacol Centre at a rate cheaper than that from southern centres. Several districts are planning operations on a seasonal basis. This arrangement is expected to bring A.I. more rapidly into remote areas and to areas devoted to butter production where dairying tends to be seasonally organised.

The scale of charges made by distribution centres to dairymen ranges upwards from £1 15s. for the first service. A total of 20,235 cows were inseminated in commercial and Departmental training and research centres for the 9 months ended March 31. This represents an increase of more than 9,000 cows since 1961-62 with all of the expansion in the co-operative commercial centres. An interim dissection of 16,983 inseminations indicates the following breed preferences—Dairy breeds: A.I.S. 7,534, Friesian 4,010, Jersey 3,385, Guernsey 852, Ayrshire 94. Beef breeds: Herefords 796, Angus 312. The available figures are mainly from areas having a substantial milk output. This explains the relatively low demand for Jerseys and the greater demand for Friesians. Expansion into cream supply areas is expected to increase the demand for Jersey semen.

The Departmental programmes for the identification of bulls of greater merit was continued at Kingaroy and Nambour. These projects are supported by funds from the Commonwealth Dairy Industry Extension Grant. So far 5 Jersey bulls and 1 A.I.S. bull have been designated A.I. Proven. These bulls, and particularly the A.I.S. bull, "Veugon Justice", have been in keen demand by clients of the distribution centres.

### Infertility Investigations

The infertility survey in 39 herds adjacent to Brisbane is continuing. Breeding performance records have been collected for these herds for correlation with the 1962 survey. The incidence of reactors in the survey herds is set out in the following table.

TABLE 1  
INFERTILITY DISEASES IN SURVEY HERDS (39 HERDS)

Disease	Number of Cows Tested	Overall Percentage of Cows Showing Titres	Percentage Herds Containing Such Cows
Vibriosis .. .. .	3,405	88.0	69.0
Trichomoniasis .. .. .	3,426	0.2	10.3
Brucellosis .. .. .	3,987	15.6	87.2
Leptospirosis (pomona) .. .. .	3,987	13.0	74.4
Leptospirosis (hyos) .. .. .	3,987	5.6	35.9

Points arising from the survey records and the herds' breeding performance are—*Vibriosis*: 75 per cent. of herds included in the survey because owners recognised an infertility problem contained vibrio reactors. 50 per cent. of herds included as control herds because the owner considered the breeding performance to be at a satisfactory level contained vibrio reactors. In some of these herds, a high percentage of vibrio reactors occurred with no apparent effect on fertility. Vibrio reactors had a conception rate (C.R.) to first service of 59 per cent. compared to 61 per cent. in disease-free cattle. The reproductive record of vibrio reactors is further summarised—

TABLE 2

Vibrio Reactors	Percentage Pregnant*	Percentage Empty
In natural service herds .. .. .	61	39
In A. I. herds .. .. .	74	26

\* Includes cows calved within 14 days.

The state of herds bred naturally and artificially in terms of the reaction to vibrio is also summarised.

TABLE 3

	Percentage of Herds Containing Reactors	Range of the Percentage's of Reactors within Herds
A. I. Herds (3 years' usage) .. .. .	73	0-6.5
A. I. Herds (1 year's usage or less) .. .. .	91	1-14
Natural Service Herds .. .. .	38	4-26

Herds negative to vibrio reaction had an average conception rate at first service of 62 per cent.; herds positive and artificially bred averaged 54 per cent.; and herds positive and naturally bred averaged 61 per cent.

*Brucellosis*.—Brucella reactors had an average first service C.R. of 50 per cent. The herds can be classed in accordance with recent practice, and average conception rates compared:

- herds in which heifers are vaccinated regularly, C.R., 66 per cent.;
- herds in which the adults were vaccinated in 1961 and which had no abortion problem in 1962, 62 per cent.;
- herds in which the adults were vaccinated in 1962 and an abortion problem is still being experienced, 17 per cent.;
- natural infection herds (current problem), 30 per cent.

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*Leptospirosis*.—*Leptospira pomona* reactors had a first service C.R. of 46 per cent. while *L. hyos* reactors returned C.R. of 25 per cent. There is a need for closer and more detailed scrutiny of the role of leptospirosis in causing infertility.

*Clinical Abnormalities*.—Cattle rated in this manner had an average C.R. of 43 per cent. The removal of disease reactors from the group resulted in an improvement to 56 per cent. on first service figures.

*Treatment*.—The treatment of repeat breeders by intra-uterine injection of penicillin and streptomycin is an effective way of raising the C.R. at the next and succeeding services to approximately 50 per cent. in cows mated at the first oestrus after treatment. In 2 low fertility herds, the treatment of each cow by this method before the first service resulted in conception rates at normal levels.

Some aspects of management have been studied to define their role in modifying the overall reproductive performance of the herds. The time of first service after calving is one such practice. Cattle mated less than 40 days after calving had an average C.R. of 47.2 per cent., and cattle mated later than 100 days after calving had C.R. of 58 per cent. The effect of the cow's age on C.R. is: Cows under 4 years 52 per cent., 4-9 years 57 per cent., over 9 years 61 per cent.

The importance of nutrition and its effects on fertility are recognised as a complex problem, especially in coastal regions. Cows were appraised in several herds at calving time for (a) general condition at calving time, (b) post calving body weight changes, and (c) blood phosphate levels and the general relationship with the length of interval to first oestrus. The interval range was from 35-142 days. Preliminary conclusions indicate a strong relationship between physical condition at calving time and the length of the interval to first oestrus.

The presence of disease reactors makes the assessment of the role of nutrition in fertility difficult. The few disease-free herds with satisfactory nutritional levels were high fertility herds, while, in the few disease-free herds with unsatisfactory nutritional levels, fertility was low, with pre- and post-service anoestrus principally involved. A recent herd production programme aimed at raising average nutritional standards has been accompanied by improved fertility, the disappearance of anoestrus, and a lower incidence of retained placenta.

### Dairy Farm Surveys

This project, which is supported by funds from the Australian Dairy Produce Board Research Committee, was outlined in the 1960-61 Annual Report. It aims at defining the resources and production methods available and now practised on dairy farms to allow the most appropriate application of research and extension effort. Four technical papers arising from the study of the initial group of East Moreton dairy farms have now been published.

Processing of data on Darling Downs and coastal forest groups has continued, and further information has been collected from an additional sample of scrub farms in the South Burnett. However, it is considered that more rapid progress towards solving some of the production problems of dairy farmers will result if the limited staff and time available for this work are devoted to the investigation of production methods. For this reason, priority has been given to the dairy nutrition studies which are supported by the same fund.

### Dairy Nutrition Studies

Collection of information on feeding practices in the main dairying districts of southern Queensland continued during the year. This involves continuous monthly records of feed utilisation, herd composition, and production from representative farms in various districts. These data allow the evaluation of present feeding methods. Subsequently, practices likely to result in improved herd nutrition and production are evaluated by the same method. This stage has been reached on the Darling Downs. There, trials involving the use of cowpeas for late summer and autumn grazing have resulted in substantial improvements in production. Other important aspects of herd nutrition will now receive attention in this district, for example, methods of using grain for supplementary feeding. In other districts, sufficient data have now been accumulated for current feeding regimes to be evaluated.

### Cattle Field Station, Ayr

The Department acquired in 1958 several Sahiwal bulls from C.S.I.R.O. They are now in use as one of the foundations in a breed establishment programme. Other breeds used in this long-term genetic programme are Friesian, Jersey and A.I.S. Some resources and facilities at the Kairi and Biloela Research Stations have been used to aid the programme.



The breed development process involves the infusion of high-producing cattle of the 3 European breeds into the foundation stock to provide a representative selection of genetic material for milk production performance. The programme has been commenced with crosses between Sahiwal and females of the other 3 breeds. By crossing and reciprocal crossing it is planned to have accomplished a thorough blending of the elements of all 4 breeds by the second generation. The programme ultimately involves the performance testing of females and the progeny testing of selected bulls each year with a lapse of 5 to 6 years between the birth of a bull and his final evaluation.

#### Research Station, Biloela

A graduate officer has been appointed to the station and the dairy section has been reorganised and equipped for controlled nutritional studies. This has made it possible to supplement the dairy programmes on the station with trials having greater precision and ultimately greater utility. It is now possible to undertake programmes involving direct input and output measurements on individual animals. The first of these programmes involves the determination of the effects on lactation persistency of the climatic environment. Several groups of dairy cows have been allocated to this stall feeding project.

### BEEF INDUSTRY

#### Beef Cattle Reproductive Performance

Field surveys and detailed investigations have been conducted in recent years into the reproductive performance of cattle under the northern seasonal environment. These field observations have involved the examination of herd statistics, pathological examination for infectious reproductive diseases, and clinical examination and fertility checks on working bulls. These have defined one of the most important management problems facing northern cattle producers, and also have provided useful background information in the planning of the research programme at the Swan's Lagoon Cattle Field Station.

The main results may be summarised as follows: the reproductive rate of beef cattle in North Queensland is low, and decreases immensely as property size increases and also as management methods become more extensive. Infectious diseases that affect fertility play an important part in reducing herd reproduction. The diseases found in the survey herds included brucellosis, vibriosis, leptospirosis and trichomoniasis. Of these, only vibriosis appears to be sufficiently widespread to affect the branding percentages of a large number of herds. The relative importance of these diseases in reducing branding percentages is difficult to assess. Zebu-type, cross-bred cattle appear to produce appreciably more calves than cattle of the straight British type. While the fertility of particular Zebu-type bulls varies considerably, some being extremely low with others very high, fertility in such herds seems to be maintained at a higher level than in British breeds, provided an adequate number of bulls are used. It seems that a major share of the infertility in British breed herds is associated with the cow. The Zebu-cross cow, however, is much more fertile and is capable of producing a living calf and rearing it to branding.

While it was not possible to measure the effects of nutrition on fertility directly, the condition of breeding cows was observed at various times of the year in conjunction with state of pregnancy and lactation observations. Well conditioned cows usually had higher conception rates than poorly conditioned animals. Most properties display a seasonal pattern of conceptions—high in summer and low in winter, with a smaller peak in spring.

#### Copper—Cobalt Field Trials

A project to provide additional information on the value of copper and/or cobalt therapy in beef cattle has been in progress in the central coastal area since May, 1961. For some years, the area has been known to be copper deficient. The present programme has as objectives the testing of cobalt as an additional treatment, the possibility of vitamin B12 deficiency, and the general effects on performance of cows and calves and steers of periodic treatment.

Two trials were carried out on the property, one with steers and the other with cows. The trial with steers was commenced in January, 1962 and ended in April, 1963. The weight gains of the steers receiving the different treatments are given in Table 4. Cobalt treatment had no effect on performance but there was a definite effect from copper treatment. The second trial, using cows, compared the same treatments with the exception of the cobalt group. The results, listed in Table 5, indicate that copper treatment was responsible. The treated cows were better able to stand up to the poorer pastoral conditions. Observations on their calves are continuing.

TABLE 4

Treatment Group	Steers	
	Mean Weight Change for Period 9-1-62 to 17-4-63	
Copper .. .. .	..	Lb. 306
Cobalt .. .. .	..	269
Copper plus Cobalt .. .. .	..	308
Control .. .. .	..	255

TABLE 5

Treatment Group	Cows	
	Mean Weight Changes for Period 10-5-61 12-12-62	
Copper .. .. .	..	Lb. -25
Copper plus Cobalt .. .. .	..	-42
Control .. .. .	..	-96

#### Cattle Field Station, "Swan's Lagoon"

The 31 square miles of open forest country on the Burdekin River at Millaroo that comprises this research station was acquired in 1959. The purpose of the station is to undertake research into beef cattle management with initial emphasis on reproductive behaviour and performance. The period up to February last was one of development for research purposes. In addition, a foundation herd of 300 Shorthorn heifers and bulls, all from northern sources was assembled.

The first major project, a time of mating trial, was begun in February, 1963. This trial has as its objectives:

- (i) The description of the seasonal incidence of mating under uncontrolled conditions, common procedure in northern areas.
- (ii) The determination of the relative levels of fertility of cows mated at different times of the year.
- (iii) The survival rates of cows and calves when calving occurs at different times of the year.
- (iv) The record of performance of calves born at these various times.

The 300 Shorthorn heifers have been assigned to groups for this trial. Mating will be continued for 6 years, ending early in 1970, but the progeny performance observations will be carried on until November, 1972.

In the programme, a group of 75 heifers will be run with bulls all year round for the purpose of comparisons. The experimental herd of 225 heifers has been split into five 45-head groups for regular mating in rotation at 5 two-monthly periods throughout the year.

#### Research Station, Coolool

The Branch participates in the planning and development of this Station in the coastal wallum area. The principal project now in progress is an evaluation of the carrying capacity and the growth performance of steers on improved pasture in the heath-type wallum. It is planned to begin the trial next spring.

#### Cattle Field Station, Ayr

The ready availability of molasses in north Queensland and the extensive cultivation of cowpeas have prompted detailed investigations into their place in cattle fattening. Molasses and cowpea form the basic ration in a greenlot trial that has commenced at the field station. Groups of cattle are being fed rations with three levels of molasses and corresponding levels of grain. The feeding programmes will be continued until average liveweight gains of 200 lb. a head have been achieved. A detailed description of the carcass and its component parts and analysis of selected tissues is planned for each of the 7 trial cattle groups, including a pre-feeding control group. The control group of 5 head (Group A) has already been slaughtered and the feeding programme is scheduled for completion in August. The feed schedules are summarised in Table 6.

TABLE 6

Group	Number of Animals	Percentage Cowpea	Percentage Molasses	Percentage Grain
A	5	100	..	..
B	8	90	10	..
C	8	90	..	10
D	8	75	25	..
E	8	75	..	25
F	8	75	25 (+urea)	..
G	8	75	..	..

This greenlot project using summer growing legume foliage will be followed immediately on completion by further trials using maize forage as basal ration, with and without urea, and with varying levels of grain.

## PIG SECTION

Work for which the Pig Section is responsible covers three major projects. These are pig testing at Rocklea, managing piggeries and conducting trials at the Hermitage, Biloela, and Kairi Research Stations, and extension work by staff located in most of the major production centres.

*Pig Testing Station, Rocklea.*—During the year, the progeny of seven boars completed all tests. On May 3, 1962 there were 38 pigs on hand. In the following 12 months 132 pigs were received, and 51 pigs remained on May 3, 1963. Four pigs died, 1 in transit and another 4 days after arrival; these deaths did not disqualify the 4 groups from which they came. Apart from these deaths, the health of the pigs was generally good.

Because of the high protein content, considerable difficulty was experienced in obtaining suitable sorghum and wheat to maintain the protein level of the 50 per cent. wheat-50 per cent. sorghum mixture at 11 per cent. crude protein. As the amount of animal protein (skim milk powder) is kept at the lowest possible safe minimum, any rise in vegetable protein content would require a lowering of the animal protein level to maintain the predetermined overall crude protein content. This would lead to amino-acid imbalance.

A number of overseas and interstate visitors inspected the station. Queensland stud breeders also visited the Station to discuss progeny testing or to see the performance of their stock under test station conditions.

There was a wide range in the amount of food required by the pigs tested to produce 1 lb. liveweight gain. Conversion figures between 2.70 and 3.09 lb. were recorded by 85 per cent. of the pigs, with the greater number of the pigs in the 2.90 to 2.99 lb. range. In no case was the standard maximum of 3.5 lb. exceeded.

There was an overall improvement in body length, and this can be attributed in some measure to the inclusion of the first groups of Landrace pigs. But the Large Whites also showed an increase over previous averages.

There was an improvement in the overall backfat measurement, from 33.32 m.m. to 32.49 m.m. this year.

Thickness of eye muscle was again disappointing. Measurements from test station pigs and those entered in show carcass competitions during the year indicated that the majority of pigs were deficient in this measure of meat in the carcasses. It is the factor to which most stud breeders must pay attention.

To date only Large White and Landrace boars have been progeny tested. Nominations for testing in the ensuing year are at the average level, but unfortunately do not include any boars from other breeds as yet not tested.

### RESEARCH

All three piggeries were maintained in working order as well as the staffing facilities permitted. Experimental work was continued to the capacity that stock numbers, facilities, and staff allowed.

*Kairi.*—Owing to the lack of trained staff, experimental work has been confined to the sow performance trial. This was concluded in October. Results will be compared with those from the other Stations. The figures from this station show a very satisfactory level of sow performance over the 3-year period, 8.9 pigs being weaned per litter at an average weight of 47.4 lb.

From December 31, 1962, records have been kept of food and stock costs. For the first 3 months, these indicate a gross margin from 8 cows of £282 (excluding skim milk) or £170 including skim milk at 3.5d. per gallon. These figures exclude bonus payments which have been as high as 20 per cent. of sales in recent years. Suitably trained staff and a reasonable expenditure on equipment would enable this piggery to be used to greater capacity for demonstration work.

*Biloela.*—A high level of trial work has been maintained throughout the year at this station. A total of 11 trials or observations were completed, with five others in progress. These trials were mainly associated with investigations into protein supplementation of rations, grazing, and "hogging-down" of sorghum. Conclusions in the protein trials emphasise the importance of the biological value of supplementary proteins for economic growth and indicate that fish meal has a valuable part to play in spite of its cost per ton.

In a clover trial, the third of a series, it was found that the replacement of up to 2lb. of the ration by grazing irrigated clover maintained growth rate at a level equivalent to that of controls, but that the cost of providing the clover slightly exceeded the value of the meal saved.

The sow performance trial was completed at this station in May. Results from two levels of sow feeding over the 3-year period were both satisfactory, averaging 11.5 pigs born alive and 9.2 weaned at an average weight of 39 lb. However, performance was slightly better on the lower level of sow feeding with costs appreciably lower.

A number of outbreaks of disease has occurred among weaner and store pigs. These have been controlled by prompt treatment, but no diagnosis has been made. These outbreaks

have been more frequent among pigs on dirt yards and the provision of more intensive accommodation is considered necessary. Post farrowing fever in sows and scouring in suckers shortly after birth has been controlled with antibiotic treatment, but the incidence of scouring in suckers appears to be on the increase, and facilities for further investigation appear necessary.

*Hermitage.*—Performance, in terms of numbers born, has not compared very favourably with that at the other stations. This appears to be due partly to a higher percentage of stillbirths, and partly to a breed difference. Over the period of the sow performance trial, live births have averaged 6.9, with 5.7 pigs being weaned. Post farrowing troubles have been frequent, although no definite diagnosis has been made, in spite of the submission of specimens to the Animal Research Institute.

Experimental work has been concentrated in a series of restricted feeding trials in an effort to improve factory grading and to decrease backfat. By the end of the year, it was apparent that restriction in daily intake to a scale varying from 2 lb. of meal per day at 40 lb. live weight and increasing to 4.4 lb. at 180 lb. live weight, gave excellent food conversion and eye muscle figures. Average daily gain was reduced, but not to an uneconomic extent. The scores for eye muscle, an indication of the meat content of the carcass, were extremely good. This suggests that the Berkshire breed has a valuable part to play in improving the meat content of our pig population.

A trial involving the feeding of high levels of copper in rations indicated little apparent response, but will be repeated. Another trial involved the replacement of 15 per cent. of the grain portion of the ration by lucerne meal. The aim was to investigate the possibility of improving carcass quality by restricting energy intake. Results indicated that this was not an economic approach, but the work is being repeated.

The construction of bulk grain storage facilities are still under discussion and urgently required. Approval has been given for the construction of additional pens with individual feeding facilities for 24 pigs. These pens will have dunging passages with slatted floors to enable observations to be made on this system of housing and manure disposal.

### GENERAL

Favourable weather conditions, ample feed, and satisfactory prices for most of the year, followed by feed shortages during the last few months, all brought about an increased demand for the services of officers of the Branch.

The prices quoted for pigs, together with cheap grain, focussed the attention of investors and farmers on the potential of pig raising as a profitable venture. Further, good financial returns to pig raisers already established encouraged increased pig raising activity, and developed a recognition by farmers that good stock, proper feeding, and well constructed buildings are essential for pig raising to yield a profitable return. Consequently many producers used a substantial proportion of their profits in modifying existing piggeries, or building completely new piggeries.

The increase in the number of persons seeking information on starting as pig raisers made considerable demands on the time of officers, decreasing the time available for field work. Further time required in assisting newcomers to become established, though profitably spent, reduced the amount of attention which could be given to others.

Requests for advice from established pig raisers have been numerous, most noticeably in the fields of feeding and building. These are two subjects where officers could only assist to a limited extent by group extension methods, and ultimately had to solve each individual problem according to its peculiarities.

The expansion of pig raising in the grain growing areas, and the greater use of grain to maintain pig production on dairy farms required different advice on feeding. All officers reported problems associated with the poor quality of most of the meat-and-bone meals fed as protein supplements. Low biological values and high ash contents (particularly calcium) were often responsible for poor growth or parakeratosis. In many piggeries the addition of zinc carbonate or sulphate was recommended as a preventative measure. In others, a protein meal of better quality, such as fish meal, was recommended. Supplies of imported fish meals were irregular, and the manufacture of small quantities of fish meal in Brisbane, a venture commenced during the year, will help meet the increased demand for high quality protein meals.

The shortage of feed during the dry summer months brought numerous inquiries for advice on alternative feeds and economic feeding. Many examples of troubles due to insufficient vitamin A in rations were discovered by the field staff. Pig raisers were advised of the need to use green feed or a vitamin A supplement.

An increasing proportion of pig raisers appeared to be willing to accept new ideas, or to try new practices for themselves, particularly with buildings and equipment.

Staff in all districts were occupied for much of their time in assisting farmers to design new piggeries or modify old ones. As a result the Branch has developed three shed designs suitable for tropical, cold, and moderate climates. These are the basis of planning on many new piggeries. Developments in the manufacture of concrete masonry blocks and steel in various forms have enabled officers to incorporate these materials in designs, with improvements in durability at no increased cost.

The use of more grain in pig feeding was accompanied by an increase in the number of intensive type piggeries, with attendant problems of manure disposal. Various methods of cleaning pens have been suggested by Branch officers, or tried under their supervision. Defects have been noted. In the previous year, the method of draining to a sump, then pumping away with a special manure pump, was developed at Biloela piggery. To meet the needs of the man who cannot provide land for convenient disposal of manure and to cut costs, a manure pond was built at the Biloela station, and on three farms in the district. Manure and wash water were pumped or drained into these ponds. There, bacterial action breaks down the solids and renders the liquid far less attractive to flies. Further work on two manure disposal plants is under observation. In these, the material, after treatment, will be used for irrigation.

A further development in manure disposal is to be tried at Hermitage. There, a slatted floor is being built in the dunging race of three pens, different material is being used in each lot of slats, and all manure and wash water will accumulate in a concrete trough underneath; at intervals this will be drained away to a manure pond.

Litter recording has been continued during the year, and approximately 80 record books were issued.

A modification of the Hammond system of carcass appraisal was made in 1962. After experience with this, further modifications were made, and all officers used the new Queensland scales of measurement when judging carcass competitions during the year. The new system differentiates carcasses more in line with local requirements, and there has been little adverse criticism from exhibitors. In a number of instances, exhibitors have asked that this system be used.

Officers have used press and radio, whenever available, to further extension work. Throughout the year, articles were supplied regularly to the *Queensland Agricultural Journal*. On the Darling Downs, three officers have combined their contributions to maintain a regular weekly broadcast. Numerous meetings, lectures, film evenings, group discussions, and field days were attended by staff throughout the year. Assistance given to various organisations included conducting practical examinations at the Queensland Agricultural College, supervising young judges' competitions, and co-operating with the Department of Education in preparing visual aid material for lectures.

The Smith ultra-sonic meter for measuring fat depth was tested on live pigs, on freshly killed and chilled carcasses, and on cured bacon. No readings of any significance were obtained on chilled and cured carcasses. There was a reasonable correlation in fat measurements on live pigs and hot dressed carcasses.

Staff changes made during the year include the promotion to Senior Adviser and transfer to Toowoomba of one officer, the transfer to Warwick of an Adviser, the appointment to Field Assistants of four cadets, interchange of two field assistants between Hermitage and Rocklea. Development of pig raising in the Emerald-Springsure districts is such that it warrants the location of an officer in that area to assist new producers.

## POULTRY SECTION

### EGG PRODUCTION

Total egg production in south-eastern Queensland as recorded by the Egg Marketing Board was almost 10 per cent. higher than for 1961-62 despite a larger-than-normal decline in production in autumn and winter. This production decline increased returns to farmers during the second half of the year under review. This helped to cushion the rise in feed prices following shortages, particularly of grain sorghum.

In the near north coast district—traditionally an area of semi-intensive poultry farms—a significant change to intensive deep litter housing and laying cages is evident. This change has been dictated by the need to produce fewer soiled eggs and to help limit the recurrent outbreaks of ground-borne diseases. Any further expansion in the egg industry in South-eastern Queensland is likely to be on the Darling Downs. This district has a decided advantage in grain purchasing, especially in lowered freight costs.

In central Queensland, the downward trend in production during 1961-62 has been arrested. The intake by the Central Queensland Egg Marketing Board from January to May of the year under review was almost 50 per cent. above the intake for a similar period in the previous year. Some increase in flock size occurred. However, the key to the situation lies in the emphasis on increasing production during this period by using an "all pullet" flock, and the installation of electric lights in laying sheds for early morning lighting.

In north Queensland estimated production for 1962-63 was similar to that for the previous year. Concern was voiced by the producers in Townsville and Cairns regarding the influx of eggs from Egg Marketing Boards in south and central Queensland respectively. Producers in north Queensland have to pay more for their feed than those in south and central Queensland.

### TABLE POULTRY PRODUCTION

The production of broilers or table chickens increased in nearly all poultry districts during the year. The greatest expansion was in the Brisbane metropolitan area where an increase of approximately 23 per cent. was noted. The second biggest broiler growing district, Maryborough, remained relatively static, producing about 20 per cent. of the total production in this State. In the Townsville area, a modern broiler plant was established towards the end of 1962 and a large farm situated some 50 miles north of Townsville has now added additional facilities to produce broilers. Broiler growing in the Cairns area continued to be an important part of the industry. However, poultry from Sydney and Brisbane is now competing with the locally produced product and has caused a fall in local prices.

There is a considerable demand for broilers, but with the number of large farms now engaged in broiler processing, the business is becoming highly competitive. The price paid to the producer fell by approximately 2d. per lb. during the year. To offset lower returns, broiler growers have tended to

increase their output. In addition, more efficient broiler rations and improved breeds of meat chicken have offset to some extent the lower returns per bird.

It is of interest to note that there has been an expansion in both turkey and duck raising, particularly for the hotel trade.

Details of poultry slaughtered in the Brisbane-Gold Coast area appear in the report of the Veterinary Services Branch.

### DAY-OLD CHICK PRODUCTION

The total number of chickens hatched in Queensland in 1962 was 8,298,583. The total number sexed was estimated at 4,265,386 and is only slightly lower than the total number sexed in 1961. Over 5,000,000 chickens were supplied to broiler growers by registered hatcheries and nearly 70 per cent. of this number were synthetic meat breeds available from some of the large Queensland hatcheries franchised to parent breeding organisations in New South Wales. Nearly 250,000 day-old chickens were sold interstate, mainly to New South Wales, and a further 70,000 were exported, mainly to New Guinea and Asian countries.

### POULTRY ADVISORY BOARD

This Board met on 2 occasions. Items considered included the amount of precept to be levied on Marketing Boards, proposed changes in random sample testing procedures for laying tests, and the preparation of rules for the conduct of a broiler random sample test.

### STOCK SUPPLIERS

During the year, 18 stock suppliers registered under the Poultry Industry Acts did not renew their registrations. These included 9 engaged in hatching chickens for sale, 4 supplying fowl eggs for hatching, and 5 poultry dealers. There were 4 new registrations for hatching chickens for sale, 5 for supply of fowl eggs for hatching, and 5 for poultry dealers. The number of registered stock suppliers now stands at 162.

### EGG QUALITY INVESTIGATIONS

The egg quality investigations commenced in the previous year at the request of the Egg Marketing Board, have been continued. These investigations have centered round the washing of eggs with detergent sanitiser solutions.

*Effect of Washing Water Temperature.*—In the previous year, it was shown that eggs washed in a detergent sanitiser solution at 120 deg. F. for 5 minutes actually showed better interior quality after 1 and 2 weeks' storage at room temperature in summer time than clean unwashed eggs. Experiments undertaken to find the cause of this better quality revealed that the temperature of the washwater was responsible. The detergent sanitiser did not appear to have any beneficial or adverse effects.

**Cleaning Power of Detergents.**—As a number of manufacturing firms are interested in producing detergent-sanitisers, experiments were conducted to see whether differences existed in the cleaning power of the various available detergent-sanitisers. The experimental results indicated that very large differences do exist and that the formulation of detergents for egg washing is quite complex.

A problem which has arisen concerning the washing of eggs in detergent sanitiser solutions is the staining of eggs by the detergents. Recently, the South Queensland Egg Marketing Board had cause to down-grade to second quality a number of eggs that were stained from this cause.

Assistance with the problem was sought from the Agricultural Chemist. It has now been fairly well established that the stain is a pigment from the shell of the eggs which has first been dissolved from and later re-deposited on the shell. The problem is still under investigation.

**Keeping Quality of "Washed" Eggs**—Further work is under way to investigate the effect of washing with detergent sanitisers on the keeping quality of eggs. In these experiments, the eggs are being stored at low temperatures (32 deg. F.) for a period of months. The experiment is at present incomplete, but of the eggs so far removed from storage, the "washed" eggs on break-out evaluation appear to be as good as, if not better than those in the "unwashed" group. It has been shown, however, that the "washed" eggs lose slightly more weight in storage than the "unwashed" eggs. This difference is eliminated if all the eggs are oiled as is done commercially with cold stored eggs. Some eggs will remain in storage for six months before an evaluation of their quality is carried out. No rots have been detected in the "washed" eggs subjected to storage.

**Influence of "Washing" on Hatchability**—Some large scale experiments have also been conducted to investigate the effect of washing with detergent sanitisers on the hatchability of fowl eggs.

Two large scale experiments involving the use of a total of 27,000 fertile eggs were conducted in conjunction with a large commercial hatchery. A further smaller experiment involving the use of 2,880 eggs has been conducted at the Poultry Section, Rocklea Animal Husbandry Research Farm. These experiments were all designed to find the optimum temperature to use when hatching eggs are to be washed. Though general conclusions cannot yet be drawn, it can be said that eggs washed in detergent sanitiser solutions for 5 minutes at temperatures from 100 deg. F to 120 deg. F. will hatch at least as well as "unwashed" eggs. This work is at present continuing.

Experiments are also proceeding to determine whether "washed" eggs lose more weight than "unwashed" eggs when stored at room temperature for up to three weeks.

### RANDOM SAMPLE TESTING

**Egg Production**—The layer random sample test No. 5 was completed in November, 1962. Purebred stock from 11 breeders was tested. Random sample test No. 6 was commenced during the year, and some notable changes are evident. The testing of purebreds has now been abandoned in favour of testing the commercial end product of breeding—the crossbred. Purebreds can still be entered if the breeder desires, but the great majority of entries are crossbreds.

Only 5 of the entrants in test No. 6 are conducting their own breeding schemes, against 11 in test No. 5. This reflects a trend in the poultry industry as a whole towards specialisation. Breeding has now become a very specialised section of the industry and must be done on a large scale which is very expensive. Consequently a number of Queensland breeders have abandoned their breeding operations and in place of this they have associated themselves with large breeding organisations, mainly in New South Wales. The Queensland farms now sell the New South Wales-bred stock under franchise. The franchised hatcheries are now permitted to enter the random sample test, but first preference is given to Queensland-bred stock.

In the period under review, also the rules governing the random sample test have been revised to bring the test into line with modern developments. The laying sample size has been increased from 72 to 90 layers in three replications of 30 birds. This will come into operation for random sample test No. 7 commencing in mid-July and should increase the accuracy of the test. Changes have also been made in the method of testing for internal egg and shell quality to give a better estimate of these characters.

**Broilers**—The first broiler random sample test was commenced in April, 1963, with a total of 8 entrants and a control flock. Four of the entrants were hatcheries franchised to sell New South Wales-bred stock. The other 4 entrants were Queensland breeders. The test will be complete in a period of 10 weeks from hatching. In future years, 2 broiler tests will be conducted in each year. As far as possible the broiler chickens are being brooded and reared under conditions similar to those found commercially. The type of ration used is in line with better class locally manufactured broiler feeds.

### XIIIth WORLD'S POULTRY CONGRESS

An outstanding event was the XIIIth World's Poultry Congress in Sydney. The Poultry Section was represented by 8 members of the staff. A number of important overseas officials visited Queensland as guests of the Department after the Congress, and members of the Poultry Section again had the opportunity to meet and discuss mutual problems with these people.

### RESEARCH

**Forced Moulting**—This trial which was commenced in January, 1962, finished early in October. From the trial it is evident that forced moulting will result in increased production in second-year birds with a profit margin of up to 4s. 10d. per bird over the return obtained from the control birds.

The quality of the eggs was examined by measuring albumen height. It was shown that the shell quality of eggs produced by force moulted birds was not so good as that obtained from those second-year birds which had been allowed to go into a normal seasonal moult. It was also noted that the internal quality of eggs produced by second-year birds, whether they were force moulted or not, was well below that of eggs obtained from pullets in the random sample test.

Forced moulting may have an application on a limited scale, but with the need to supply the local market with the best possible eggs, the accent should still be on the major portion of production coming from layers in their first year of production.

**Meat and Bone Meal Studies**—A very comprehensive trial was carried out in conjunction with the Biochemistry Branch to ascertain the effect of cooking temperature on meat and bone meal quality. The opportunity was also taken in the factorial design of the experiment to note whether the addition of tallow improved feed conversion. Further reference to this work appears in the report of the Biochemistry Branch.

**Broiler Breeding**—Facilities have been made available to the Animal Husbandry Research Branch to investigate various methods of broiler breeding with basic stock obtained from the Department of Animal Husbandry, University of Queensland.

### PULLORUM TESTING AND ACCREDITATION

The pullorum testing figures for the year are set out in Table 1. It will be noted that the number of birds tested is somewhat higher than in the previous year, due to further expansion in the size of flocks of the larger hatcheries producing day-old pullets and meat type chickens. It is also significant that the number of birds bloodtested for farmers wishing to produce their own replacement pullets has fallen from approximately 17,000 in 1960-61 and 10,000 in 1961-62 to 2,600 in 1962-63. From this it may be inferred that it pays to buy replacements rather than to maintain a separate breeding flock for this purpose. A rewarding feature of the annual programme was the very low overall percentage reaction for the State and a rise in the number of flocks wherein no reactors were found.

TABLE 1

	1960-61	1961-62	1962-63
Total number of fowls tested	291,118	300,343	309,700
Number tested for registered stock suppliers	284,067	290,297	307,100
Number of registered Stock Suppliers' flocks tested	118	108	109
Number of flocks with no reaction at test	78	75	86
Percentage reaction for State	0.11	0.11	0.05

The number of stock suppliers accorded "Pullorum Free" accredited status for their flocks or associated hatcheries for 1962 was 30, while a further 42 were granted a "Pullorum Clean" classification. Pullorum accreditation in 1963 is now well under way and already 41 suppliers have been granted "Pullorum Free" accreditation and a further 19 "Pullorum Clean" status.

### DISEASE CONTROL

Leucosis in its various forms was still the disease most frequently reported by officers of the Poultry Section, but it would appear that this disease did not make such heavy inroads into broiler flocks as in the previous year. Intestinal coccidiosis was also prevalent, particularly during the late spring and summer period, and did not always respond to treatment with the coccidiostats available.

Nephritis appears to be an ever present hazard, particularly in broiler flocks. While it does not cause heavy mortality or high morbidity, it does result in the production of a number of stunted birds. Attention should also be drawn to the possibility of fungal infections which may occur in broiler flocks where the litter is not completely changed after each batch of birds. The obvious remedy of changing the litter after each batch is no longer tenable because of the difficulty in obtaining a constant supply of suitable litter, and the difficulty of disposal of used litter.

## DIVISION OF DAIRYING

In addition to normal extension, regulatory and laboratory control services, there was some reshaping of research and advisory activities to intensify projects aimed at the diversification of dairy products, the provision of new foods, and the improvement of quality. This work was given a high priority in view of: (1) the problems related to the disposal of the exportable surplus; (2) the challenge offered by a world production that is increasing more rapidly than consumer demand; and (3) the need to consolidate the foothold recently established by the Australian industry in new Asian markets.

### SEASONAL CONDITIONS

Seasonal conditions in the main dairying districts in the early part of the year were better than for several years past, which brought production in the first quarter to a high level. A rather sharp decline occurred in the spring owing to below-average rainfalls, but pastures and fodder crops responded rapidly to good rainfalls in December and January in most districts. Production then increased and continued at a satisfactory level for the rest of the year, although some dairying districts had well above average rainfall and others had several dry months.

Butter production for the year was 36,456 tons compared with 35,643 tons last year, while for the corresponding periods cheese production was 10,201 tons and 8,973 tons.

### SALES SITUATION

Following the action taken to limit butter exports to the United Kingdom during the year to 62,000 tons, which was subsequently lifted to 65,000 tons, the market there became more stable and prices improved. They remained about 314s. sterling per cwt. due to similar controlled exports schemes of other major supplying countries and the action of the British Government to prevent the dumping of surpluses by non-traditional supply countries.

A matter of considerable concern to the industry was the suspension of the 15s. a cwt. preference duty in Britain on Australian butter. This had operated for over 30 years. However, this suspension was accepted subject to certain assurances given by the U.K. Government to safeguard the Australian industry's position on the British market. They were that its allocations would not be less than its present share of the British market; Australia would be consulted each year on butter imports into that market, and Britain would not encourage local milk production for manufactured products.

The decision of the Australian Government to pay a bounty on processed milk products resulted in milk which would have produced the equivalent of about 3,000 tons of butter being diverted away from the over-supplied world markets.

The Australian Dairy Industry Council, after reviewing trends in farm and manufacturing costs, decided that the wholesale prices of butter and cheese would remain unchanged.

### DAIRY FARMING

Statistics indicate that during the past 5 years, the dairy cattle population fell by 170,000 and there are 4,000 fewer suppliers to factories than 10 years ago. However, total milk production has not changed significantly, due to more effective use of manpower, aggregation of farms, and the wider adoption of pasture improvement, fodder conservation and other practices. This is exemplified by the acreages of sown pastures in the predominantly dairying districts having increased during 10 years from 1,700,000 to 2,100,000 acres, tonnages of hay from 101,000 to 161,000 tons yearly, silage from 10,000 to 45,000 tons yearly, and green fodder crops, which are used to supplement pasture feeding, from 600,000 to 800,000 acres. The average yield of production-recorded cows has risen from 150 lb. butterfat to 177 lb. butterfat, although the average for all dairy cows has remained about 110 lb.

From the flavour aspect, the crux of the problem of the unduly low percentage of choice butter produced in Queensland is that of borderline quality cream. Organised co-operative effort between factory managements, suppliers and Departmental field officers at the Esk, Laidley and Boonah factories has shown how a substantial increase in the percentage of choice cream and butter is attainable.

The more widespread cooling of cream on farms and efficient cleaning of milking machines would be two most potent factors in cream quality improvement. It is of interest then to record that there are now more than 3,800 farm refrigerators compared with 1,500 in 1955.

More active participation by industry representatives in joint planning of extension activities in recent years has also played a role in the various improved facets of dairying. There is, too, within the dairy farming communities a realistic coming to grips with the problem of the effective utilization of resources.

The quality of milk supplied to market milk and cheese factories continued to improve.

The Commonwealth Dairy Industry Extension Grant was renewed for a further 5 years from July 1, 1963, the total amount being increased from £250,000 to £350,000 yearly. The new allocation to each State has yet to be determined.

### BUTTER INDUSTRY

Although the seasonal conditions were somewhat better, only 813 tons more butter were produced than in the previous year. However, there was an increased production of some other products, including appreciable quantities of butterfat, ghee and junex, which consists of sugar and butterfat and is exported to the U.S.A. These products used the equivalent of over 4,000 tons of butter.

The percentage of choice grade butter again showed a slight improvement for the fourth successive year. It was 51.25 per cent. compared with 47.62 per cent. last year. First grade was 42.66 per cent. and 6.09 per cent. were of lower grades. The necessity for appreciably raising the proportion of choice grade butter is possibly as acute as at any stage of the industry's history in view of trends in international marketing, the current world over-supply and the sales promotion scheme within Australia. Improvement of cream quality is basic to flavour improvement of Queensland butter; its other physical properties of body and texture are unsurpassed by butters of any country.

The compositional standard and the hygiene of butter manufacture have been raised significantly during the 23 years in which the laboratory-control butter scheme has been in existence. The replacement of wooden churns, tinned steel vats and piping by stainless steel equipment, coupled with superior detergents and chemical sterilants has also aided in reducing the bacterial counts of butters. The industry has thus been in a position to export to some new markets which require butter to satisfy prescribed bacteriological standards. The results for the year were the best recorded.

### CHEESE INDUSTRY

Cheese production of 10,201 tons was at its highest level for 10 years. Although slightly below that of the previous year, quality was satisfactory, 91.5 per cent. being of choice and first grade.

Despite the provision of adequate facilities at factories for the propagation of starters, bacteriophage was found to be a factor at most factories which had occasional quality problems. The need for stricter control of pasteurising temperatures at some factories was also observed, as undesirable quality-affecting bacteria found in samples examined in the laboratory almost invariably reflect that the cheese was made from inadequately pasteurised milk.

Follow-up advisory visits were made on all reports from London regarding condition or other defects.

Reports on chemical analyses of cheese samples which indicate whether the various constituents and pH fall within a desired range or otherwise, proved helpful to factories in the compositional control of their product.

In the developmental work on the manufacture of several types of cheese of European origin, it seems clear that there are no insurmountable difficulties in producing them in this State. The problem is more that of the economics of their production and distribution on the small scale which is presently dictated by the local demand.

### OTHER PRODUCTS

The pasteurised milk trade used about 36,000,000 gal. of milk, and the sales of raw milk are estimated to be less than 10 per cent. of this volume. The school milk scheme absorbs about 9,000 gal. of pasteurised milk daily on school days, its distribution covering more than 330,000 or nearly 90 per cent. of eligible school children.

A gratifying feature of the Division's work is its success in ensuring that consumers receive a cleanly produced supply of milk of good keeping quality. Results are produced by testing samples of raw milk supplied to every factory not only at least weekly by the methylene blue test, but also at intervals by the thermoduric bacterial test. The value of the systematic use of this test is shown in the results of the Pittsworth factory. Since 1958, samples of its tanker milk sent to Brisbane with counts exceeding 100,000 per ml. have declined from 23 to nil per cent., while counts below 30,000 have increased from 8 to 60 per cent. Booval factory's milk samples exceeding 100,000 per ml. were reduced from 71 per cent. to nil and the counts below 30,000 from nil to over 80 per cent.

Bulk cooling of milk in farm tanks and its collection by road tankers was extended to five centres. While some expansion is envisaged, this system of milk handling is likely to be restricted for some time as large quantities of milk for picking up within short distances on good public and farm roads are characteristics of only a few dairying areas of this State.

More than 300 tons of full-cream milk powder were exported, the consignments being the first from a Queensland factory.

The Gympie factory commenced to manufacture casein.

### RESEARCH AND QUALITY CONTROL

There was no slackening in requests by the industry for technical guidance in improving the quality and the processing of the widening range of products. Financial assistance from the Australian Dairy Produce Board greatly helped in the extended research programme. Details of the wide range of investigations carried out are given in the reports of the Branch Directors.

Work commenced on the new research laboratory and pilot plant at Hamilton which is urgently needed to avoid the serious over-congestion of space and inadequate facilities for fully effective implementation of research and quality control schemes.

## FIELD SERVICES BRANCH

The Branch has a three-fold function: to implement the requirements of the Dairy Produce Acts; to assist the industry, through extension methods, to adopt better practices; and to carry out surveys, trials and investigations aimed at solving industry problems. All three facets were integrated successfully to provide an interesting example of how straight inspectorial work can be combined with extension work by each district officer in the district supervised. The prestige of the officer working under this system increased steadily and without prejudice to his regulatory activities.

### FIELD SURVEYS AND INVESTIGATIONS

*Bulk Handling of Farm Milk.*—The handling of farm refrigerated milk in bulk has expanded in south-east Queensland and is now in operation in five separate districts. In four of these the milk is delivered to cheese factories. While further steady expansion is expected, it is unlikely that the rate will be rapid.

Officers of this Branch carried out performance testing on refrigerated farm milk tanks, but it is likely that this work will be discontinued in view of the Victorian Electricity Commission's having agreed to the request of the Australian Agricultural Council to carry out this testing on behalf of the industry. The investigations carried out on some aspects of the design, cost of refrigeration and the quality of the resultant milk reached a stage permitting conclusions. The cost of power to refrigerate 1 gallon of milk under this system varies from slightly less than ¼d. to almost ¾d. depending on types of units and varying farm conditions. It is clear, however, that some producers regard bulk farm handling of milk under refrigeration as a cloak for faulty hygiene, for, while methylene blue tests are unaffected, due to low temperatures of storage, the bacterial counts of some milks were very high.

*Farm Separation.*—Investigations continued into the effects of varying conditions on the efficiency of farm separation of milk. Factors examined were temperature, speed and degree of float clearance, using both the Babcock and Rose-Gottlieb tests for determining the residual fat in skim milk. The results obtained showed that, whilst the temperature of the milk separated and the speed of operation of the separator have important effects on skimming efficiency, the degree of float clearance, varying between one-eighth and three-eighths inches was without effect under the conditions of the trial. This work is being repeated and, should the initial findings be confirmed, departmental recommendations to dairy farmers will be effected accordingly.

*Examination of New Materials.*—The examination of new materials for their suitability for use in the dairy industry continued. Various items of equipment manufactured from metals, alloys and plastics were examined and tested under commercial conditions. New materials for use as cleansers and sterilants are also under trial, some of which, for example, combined detergent-sanitisers, show promise of becoming useful.

*Cream Payment on Butter-fat.*—Further work was undertaken in relation to gravimetric and volumetric methods of testing for fat in cream in order to clarify the efficacy of conversion tables now being used to convert volumetric test

### HERD PRODUCTION RECORDING

There was an increase of 20 herds recorded under the purebred recording scheme, and the group recording scheme was maintained at 65 groups in which there were 1,120 herds having a total of 43,307 cows recorded. The pilot scheme for including total solids estimations as well as butterfat continued, with one herd of each of five breeds of dairy cattle and a goat herd.

Surveys of data obtainable from the herd recording schemes continued. They are giving reliable information which may be applied on all dairy farms.

Trials made with a milk meter imported from U.S.A. indicate that it offers promise as a basic piece of equipment which may permit the implementation of a simple, cheap production-recording scheme. While not giving information so fully as the conventional system, it may meet the needs of many farmers.

The current interest in sire surveying, bull proving and artificial breeding is highlighting the essential role of herd recording.

The position regarding recruitment of graduates eased, but the lack of diplomates for field duties continues to be acute.

results to a gravimetric basis. The work showed that, provided sampling and testing are carefully and accurately done, the use of conversion tables provides a fairly satisfactory means of converting to a pure butterfat weight basis. Where, however, the sampling and testing are not carefully carried out, wide differences result, preventing a satisfactory butterfat balance being obtained. Queensland factories have not yet converted from the volumetric to the gravimetric system of Babcock testing and conversion tables are in common use.

The practicability of composite sampling of raw cream supplies in preference to sampling daily for determination of both fat and commercial butter was examined at one factory during the summer of 1963. Supplies of choice and first grade creams of both low and high initial acidity were tested by volumetric and gravimetric methods. The range of differences in fat and commercial butter content under the two sampling systems varied quite widely when tested volumetrically and somewhat less widely when tested gravimetrically. The distribution of the differences indicated that the composite method was not of sufficient accuracy to be recommended as a suitable alternative practice. Two methods of drawing samples were also compared, one of which may have practical use in normal sampling procedures.

*Milking Techniques.*—A survey was initiated in one district in an endeavour to gain first hand information of the methods of milking used on dairy farms to lead to the pin-pointing of incorrect milking techniques. It is intended to use the results obtained from this preliminary survey to plan a further survey on a wider scale to cover most dairying areas in the State. It is felt that much more work remains to be done to improve this aspect of dairy farming. To this end investigations are continuing to study effects of various factors involved in techniques of machine milking. Some of the findings will have an important bearing on departmental recommendation in the future. For example, it has been shown that the taking of several streams of foremilk from each quarter over a duration of approximately 20 sec. in addition to about 30 sec. required for udder washing is a very effective stimulus for milk let-down, apart from the raising of milk output and assisting in the detection of mastitis. The work also shows that on many farms, teat cups are placed on cows too early before milk let-down has occurred, and are also frequently left on cows long after milking has ceased. In addition, it was shown that machine stripping is frequently carried out ineffectively because it is being done in the wrong manner. This probably provides the reason why many farmers have lost confidence in machine stripping and many have returned to the more time-consuming stripping by hand. Using experimental apparatus developed in Queensland, investigations of the various factors affecting the efficiency of machine milking are being made, using various breeds of cows.

*Survey of Abnormal Milk.*—The advent of the rapid mastitis test which depends on an abnormal factor in cows' milk has provided a means of measuring abnormality quickly and easily. Much of the abnormality registered by this test is the result of mastitis infection. A preliminary survey on a pilot scale was initiated in an endeavour to study the incidence of abnormal milk on Queensland farms, the effect of such abnormality on some aspects of milk quality, and the relationship between abnormality, including mastitis

infections on milk production in terms of weight of milk and butterfat. The effect of milking machine adjustment and methods of machine milking on the incidence of milk abnormality is also being examined closely. This work can be done quite conveniently with the herd recording groups already in operation. In fact, one such group was chosen in the Brisbane area for pilot purposes. In the ensuing year, it is intended to extend the survey to some 15 to 20 herd recording groups covering most of the dairying areas of the State.

*Disposal of Whey by Irrigation.*—At one dairy factory manufacturing hydrochloric acid casein, the disposal of whey and waste water has presented a difficult problem. As a consequence, attempts were made to dispose of the whey and waste water by irrigation on to pastures on an adjoining farm. The whey, diluted at the rate of approximately 4:1 was sprayed on to the pastures at fortnightly intervals and resulted in a spectacular step up in the growth of pastures and oats. Because this factory waste contains appreciable quantities of chlorides derived from the hydrochloric acid used in the manufacture of casein, a build-up of chlorides in the soil is being carefully watched so that soil fertility will not be impaired and plant growth retarded. Depending on seasonal conditions, the rate of application and the degree of dilution of the whey will be varied, and quantitative estimations of plant growth obtained in comparison with that in adjacent control areas. These investigations are important because the disposal of whey in this manner, once proven in the case of casein whey, high in chlorides, will be surely adaptable to the disposal of cheese whey which is free of this hazard. Officers of the Division of Plant Industry are co-operating in this work.

*Sire Surveying.*—One of the many uses of herd production recording is to provide a means of evaluating the worth of bulls used in the herds being recorded. This work is increasing each year as farmers show a greater appreciation of the value of such surveys. The surveying is divided into two categories: (a) bulls used in stud herds, and (b) bulls used in grade herds. The results of surveys on bulls used in stud herds are published each year and are widely used by both stud breeders and other dairymen in the selection of suitable animals. Surveys were made of 85 bulls which had sufficient recorded daughters. Of these 36 were raising, 12 maintaining and 37 lowering production. Surveys were also carried out on a large number of bulls (514) used in grade herds. This is a significant increase on the number (428) surveyed during the previous year. Of these bulls 175 (34 per cent.) raised, 189 (31 per cent.) maintained, and 150 (29 per cent.) lowered production. These percentages were similar to those of the previous year.

*A.I. Bull Proving Programme.*—Bulls used in the bull proving groups are proven by the Herd Recording Section. Four bulls of each of the A.I.S. and Jersey breeds are proved each year. Records are first examined when 180 days of the lactation period have been reached by the heifers and again at the completion of 300 days. There is a strong correlation between the results obtained for the two periods, and the early proving at the end of the first period enables arrangements to be made to keep or dispose of the animals concerned.

A problem which has occurred in sire surveying is the change in rating of some bulls from year to year. An investigation is being made to ascertain the reasons for these changes.

*Relationship of Fat Test to Production.*—The survey carried out to determine the nature of the correlation between fat test and overall production was completed during the year. It was shown that there was strong correlation between fat content and yield of milk and, as the fat percentage of cow's milk is a heritable factor, the survey provides useful information in the planning of breeding programmes.

*Lactation Curves.*—Surveys of herd production data are being continued to provide typical production curves according to the month of calving. These curves have now been prepared for a number of districts and are being revised as more data comes to hand. They are used by extension officers in the areas concerned.

*Milk Meters.*—A suitable meter for attachment to the milking machine to record the amount of milk given by each cow has been long sought because it would obviate the necessity for weighing the milk production from each cow. Several meters have been patented but trials carried out in the past always proved them unsuitable. A new meter referred to in American literature was obtained, and subjected to a series of tests. It shows considerable promise as the weight of milk is quickly shown; it is easy to use; its cleaning is simple; and the readings are quite accurate enough for the purposes of herd production recording. It is felt that this meter will satisfy requirements and is applicable to use by farmers as a quick and simple way of measuring milk production without recourse to the weighing of the milk and the carrying out of the Babcock test for fat by herd recording officers. Trials have shown that production recording based on measurement of milk and ignoring fat content is generally a useful guide for the farmer in planning his farm programmes.

*Seasonal calving and Continuity of Production.*—In some dairying areas there is a need to maintain production at a fairly steady rate throughout the year. This is necessary at factories which are required to maintain a milk intake adequate to meet liquid milk demands. At the same time it is desirable to reduce the peak of production which may occur during a few months of the year in this State. Accordingly, surveys of herd production data over a 5-year period have been made wherein production has been related to factory output and market commitments. In a group of three cheese factories which also supply milk for the metropolitan trade, a suggested calving pattern for the areas was compiled which should ensure that sufficient milk is available at all times and that the peak summer production is reduced.

The adoption of this calving pattern by the suppliers could result in a reduction in factory costs by curtailing overtime and reducing the need for additional staff during the peak milk intake.

*Cost of Cow Replacement.*—The difference in cost between rearing and purchasing cattle for replacement in dairy herds is being studied. To date the calves involved in the study have reached weaning age. The information on cost of feeding is providing a useful lead on the economics of calf rearing and has actually led to some of the participating farmers' altering their methods. This project will be continued until calves enter the herd as cow replacements.

*Production Recording of Total Solids in Milk.*—Trends in the dairying industry are towards the greater use of non-fat solids in milk and it has been considered important, therefore, to investigate a means whereby herds may be production recorded for total solids and not merely for fat production. Work on this matter commenced during the previous year and continued using A.I.S., Ayrshire, Friesian, Jersey, Guernsey and goat herds. The work has yielded valuable information on the seasonal incidence of total solids and solids-not-fat production and is providing the basic data which will be required for any expansion of this work dictated by industry trends.

*Insulation Covers for Road Trucks.*—During the year, attention was drawn to some instances of marked deterioration of butter transported to Brisbane by road from outlying factories. It became apparent that tarpaulin and other similar covers were not adequate to protect butter from the high temperatures and hot sun and thus prevent deterioration. Consequently, some investigations were carried out by the Queensland Co-operative Cold Storage Federation in an endeavour to find a suitably light insulated covering which might be used for transporting dairy produce in this way. Initially some covers tried, whilst giving excellent protection to the butter, were far too heavy for constant use. More recently, layers of felt have been successfully used for this purpose.

*Quality of Dairy Produce.*—The production of butter for the year was 36,456 tons which represents an increase of approximately 2.3 per cent. over that of the previous year. Of this production, approximately 75.5 per cent. was submitted for grading, and yielded slightly more than 51 per cent. choice and 42 per cent. first grade. Choice butter rose by approximately 3.6 per cent. over that obtained in the previous year, which is gratifying in view of the work which has been expended in quality improvement. Much more remains to be done. The quantity of cheese produced (10,201 tons) represents an increase of approximately 13.7 per cent. over the production for the previous year. The record Australian production has resulted in a recommendation from the Australian Dairy Produce Board that production of cheese should be curtailed by 10 per cent. next year. The quality of cheese was maintained at a fairly satisfactory level, 91.5 per cent. grading choice and first grade, which was slightly below that of the previous year. The quality of liquid milk was maintained at a satisfactorily high level as determined by regular tests conducted at the receiving factories and in the Divisional laboratories.

#### DAIRY FARM FACILITIES

There has been a further reduction in the number of dairy farms in the state from 16,150 to 15,580—a reduction of 570. This reduction is less than half that shown during the previous year and indicates slowing up in the rate of decline. New dairy farm premises erected during the year totalled 255 which was slightly less than the 263 for the previous year. At the same time there were 546 renovations compared with 503 last year. This situation may be taken as an indication of the economic circumstances prevailing in the industry which have induced fewer farmers to completely rebuild but more to outlay less capital on renovating existing premises. The combined dairy premises, which have been specifically designed for and have proved satisfactory under Queensland conditions, continue to be most favoured by farmers. Herringbone sheds were built only on a few farms where larger herds are milked. The use of clay or concrete building bricks for the construction of milking sheds continues to gain ground. More attention is also being given to construction of milking bails completely in metal, using predominantly tubular steel.

**Dairy Farm Machinery.**—The services given by Departmental officers to dairy farmers in the testing of, and advising on, dairy machinery were continued and have become an important part of each dairy officer's work. Using air flow meters and vacuum recorders, milking machines are tested for farmers on request. During the year a total of 1,308 machines, or approximately 8 per cent. of all machines in the State, was examined. Since the inception of this service it is estimated that almost half of the milking machines in the State have been tested at least once. Only 9 per cent. of those machines tested were without serious fault; 26 per cent. of faulty machines were able to be repaired and/or adjusted satisfactorily by the dairy officer, and the remainder required workshop repair. In addition to milking machines, cream separators, refrigerators, sterilizers and water heaters and pumps were covered by the testing and advisory service.

In an endeavour to increase the rate of adoption of stainless steel equipment on dairy farms, conferences were held with the Machinery Merchant's Association with a view to obtaining their co-operation in the replacement of tinned copper and brass milk equipment on farms. Minute quantities of copper cause serious quality deterioration of dairy products and consideration is being given to the implementation of regulations to reduce this problem.

#### DAIRY FACTORY ESTABLISHMENT

Three new factories were registered and commenced operation during the year and one cheese factory (Goomeri) ceased operation on June 30. Dairy Associations spent £335,580 in renovating their factories, installing new equipment, and replacing old and obsolete equipment. In addition a further factory commenced the manufacture of casein during the year. There was a marked increase in the installation of stainless steel butter churns and the complete equipment for cream handling facilities in stainless steel.

#### HERD PRODUCTION RECORDING

Under the conditions existing in the dairy industry in this State it is considered important that every effort be made to raise the income received by dairy farmers. Only a slight increase can be obtained by raising the percentage of high grade produce supplied but a far greater return could be obtained by increasing production at low cost. It is considered that in this matter, herd recording provides a key and serves as a sound basis for planning production improvement programmes. Because of this, the conception of the use of herd recording has changed considerably over the years from its original purpose as a means of identifying low yielding animals for culling. Herd production recording is now not only useful to the individual farmer in the general management of his herd but a valuable source of data for the assessment of various farm and herd management practices and means of defining problems of research.

Herd production recording caters separately for pure bred herds and grade or non-registered herds on commercial dairy farms.

**Pure Bred Production Recording.**—The results of pure bred production recording, besides being used by the stud breeder for checking his breeding programme, are published for the information of all dairymen. Many use these production records when selecting bulls and replacement females for their herds. During the year under review, a total of 160 herds was recorded, an increase of 20 herds on those recorded in the previous year.

The total of 3,865 cows completed recorded lactations of 270 days or less. The average yield was 6,327 lb. milk and 273 lb. fat. This compares with an average of 268 lb. fat from 3,162 cows last year.

For the third year in succession outstanding yields were recorded by two A.I.S. cows, Sunny View Little Princess 30th and Sunny View Bonnie 2nd. This year in 270 days Little Princess produced 24,120 lb. milk and 958 lb. fat. As she calved at the age of 4 years and 11 months, this constitutes a State record for all breeds. Sunny View Bonnie 2nd gave 22,860 lb. milk and 896 lb. fat in her 270-day lactation. In four lactations these two cows in the one herd gave 76,605 lb. milk and 3,160 lb. fat, and 77,785 lb. milk and 3,090 lb. fat respectively—a testimony to the husbandry and skill of their owners.

**Merit Stud Register.**—Merit studs are those with a concentration of merit register cows. Therefore, such studs should have bulls from merit cows available for sale. A total of 16 herds was admitted to the register compared with 12 in the previous year.

**Register of Merit for Dairy Cows.**—It is pleasing to note that an increasing number of farmers are seeking bulls from merit register cows. Previously farmers were content to select a bull on one production record of its dam.

Today most realise the importance of consistent high yields, regularity of calving, and longevity. The number of cows entered in the various sections of the register is shown in Table 1:

TABLE 1  
NUMBER OF COWS ADMITTED TO MERIT REGISTER IN 1962-63

Breed	Section of Register		
	Elite	Lifetime	Intermediate
A.I.S. .. .. .	10	46	69
Ayrshire .. .. .	..	2	4
Friesian .. .. .	..	4	9
Guernsey .. .. .	4	38	59
Jersey .. .. .	..	..	..
Total for year .. .. .	14	90	145
Total entries in Register to date ..	49	371	865

**Goat Recording.**—Goats from 6 herds were recorded. A total of 32 completed recorded lactations for an average yield for 270 days or less of 1,595 lb. milk and 60 lb. fat. The average fat content of the milk was 3.8 per cent.

**Group Herd Recording.**—The better seasonal conditions resulted in an increased demand by farmers for herd recording. Herd recording groups totalled 65, and the efforts of the field staff resulted in membership of groups being very close to full strength. Applications have been received for the formation of three additional groups. A total of 43,307 cows from 1,120 herds completed record lactations for the recording year which ended on September 30. The average yield of 423 gal. of milk and 177 lb. fat is the highest ever recorded, being 20 gal. of milk and 7 lb. of fat greater than the previous highest yield in 1958-59. The average length of lactation was 251 days, the longest yet recorded.

**Calf Identification.**—The identification of heifer calves is valuable in the planning of breeding programmes. Not only does it enable the proving of sires to be carried out accurately, but it also allows the selection of high producing cow families from which to select herd replacements. During the year 10,170 calves from 731 herds were ear tattooed by herd recorders.

#### EXTENSION WORK

Whilst the implementation of the requirements of the Dairy Produce Acts might imply inspectorial duties, it is found in practice that the greater part of these requirements can be achieved by an advisory approach in the course of extension work. Nevertheless, in each officer's district there seems to exist a hard core of recalcitrant dairy farmers for whom direct action taken under the provisions of the Act serves as the only successful inducement towards better methods.

**Dairy Production.**—The downward trend in the number of dairy farms in the State in recent years has not been accompanied by any significant loss in production; in fact, production this year increased slightly. The relatively low average income per farm from dairy production is a major problem and consequently a great deal of attention is being given to the matter. In this regard a useful extension approach is on the basis of farm planning as a whole to permit the widest and most economical use of farm resources. In any such planning an analysis of herd production provided by herd recording is considered to be an essential part.

The work of advising farmers in the use of herd production records continued, making use of annual herd summaries. This included the ranking of cows according to yield, the calving pattern of the herd and the most favourable months for calving. The length of lactation, period between calvings, and length of dry period are all related to management practices. Breeding programmes are concentrated on selection of suitable females from which to rear herd replacements. The accent nowadays is less on individual cow's records than on those cow families which have demonstrated their ability to transmit their production capacity to their progeny. Farmers are advised that low yielding cows should either be culled as opportunity arises or their progeny used for the vealer trade.

More attention is being paid to applying the lessons learnt from herd recording in the widest possible way. In this, the data obtained from surveys on some 7 to 8 per cent. of Queensland farms where production is recorded are used to guide recommendations framed for the remaining 92 per cent. Obviously this must be done with care, district by district, and whilst progress has been made, much more remains to be done. Since the inception of the group herd recording scheme in this State some 15 years ago, recording farms have shown a 23 per cent. increase in the average production per cow. Non-recorded herds have not shown any such increase.



The results of herd production recording have been published in the *Queensland Agricultural Journal*, press, *Recording Notes* and special reports and brochures. *Recording Notes*, a monthly publication which is distributed to all recording farmers and to the press, has proved a useful extension medium. Special reports covering pure bred production recording and sire surveys have an important use in assisting dairymen in selection of stock before purchase.

Under the conditions applying in this State, the greatest initial gain in production accrues from better feeding of dairy cattle. To this end, much extension work has been directed to wider use of improved pastures and conserved fodder. There was an increase of approximately 12 per cent. in the area sown down to improved, irrigated, and rain-grown pastures in which improved species of grasses and pasture legumes have featured prominently. The amount of hay and silage conserved has remained more or less stationary as compared with that of the previous year, but the amount of stored grain rose by more than 60 per cent.

**Quality Improvement.**—There is evidence that the hygiene employed on dairy farms is steadily improving. Much of this improvement has been due to the unceasing efforts of Departmental officers who have been assisted by the fact that more dairymen are supplying wholemilk instead of cream and are forced to better standards of hygiene in order that their products may qualify under market standards. The work of hygiene improvement in regard to cream production is made difficult by the very small price differentials which exist between various grades of cream. A widening of these margins would assist in raising quality, and the action taken voluntarily by three associations in this regard is progressive and must succeed.

In recent years there has been an improvement in the facilities for hygiene on farms. For example, the number of satisfactory installations for the provision of scalding water has increased. The amount of stainless steel equipment installed has resulted in a corresponding drop in the amount of tinned copper and brass equipment used, and there has been a steady improvement in the facilities available for cooling milk and cream, including the wider adoption of farm refrigeration. Farmers are taking advantage of the cheaper forms of farm refrigeration available, provided by small drop-in refrigeration units and adapted household refrigerators which are particularly suitable to small production farmers.

Officers of the Branch at Toowoomba organised a further Farmer's Festival on a local property. This successful function was attended by nearly 10,000 farmers over a 2-day period. Officers arranged a further 460 extension functions, with a total of more than 12,000 farmer contacts. The number of farm visits made by officers exceeded 26,000 while a further 11,000 farmer contacts were made. As much use as possible has been made of mass media distributed through the *Queensland Agricultural Journal*, special pamphlets, the press and radio. Officers in many

districts have been active in assisting farmer groups in early organisation associated with the establishment of A.I. groups.

**Dairy Extension Advisory Committees.**—These committees of Departmental officers and members of the Queensland Dairymen's Organisation have continued to meet and are carrying out a useful extension function. In many instances the good attendances obtained at extension meetings and field days are due largely to the support and work of farmer members on their committees. In addition, the committees plan their own extension programmes which often are sounder because of farmer participation.

The work of the West Moreton Committee in sponsoring the formation of Dairying Development Committees composed of farmers, the factory manager, a representative of local banks, with a Departmental officer as secretary, is worthy of special mention. These development committees have already had spectacular success in raising butter quality in the Laidley and Boonah areas.

### COMMONWEALTH DAIRY INDUSTRY EXTENSION GRANT

Funds made available by the Commonwealth under the Dairy Industry Extension Grant were applied to herd recording and to a number of projects aimed at demonstrating improved dairying methods. At the beginning of the year there were 110 farm demonstrations. Following 34 terminations of projects and the commencement of 26 new projects, the current number is 102.

The number of pasture demonstrations declined during the year, as greater emphasis was placed on demonstrations of some fodder crops, for example, cowpeas, designed to arrest the steep autumn decline in dairy production. Silage projects, mainly of the above-ground bunker type demonstrated the provision of valuable roughage in the winter and spring. Some pasture demonstrations showed the usefulness of summer legumes such as centro, glycine, siratro, and stylo in some coastal areas, particularly where phosphate fertilizers were used with increased quantities of molybdenum.

Water harvesting demonstrations were successful in the higher rainfall areas along the coast but storages in the drier inland were not filled during the year. Demonstrations of the plaster concrete water storage tank were set down in selected areas and stimulated a great deal of farmer interest.

A cheaper method of milk and cream refrigeration developed and demonstrated by the Department was adopted for manufacture by several commercial firms. The wider application of refrigeration on farms which has followed is considered to be an important factor in raising quality.

Grant funds were also used for several projects of a minor nature. Once again an exhibit was prepared for display at the Royal National Exhibition featuring a twin exhibit on "Farm Water Supplies" and "Care of the Cream Separator". This was displayed at numerous country shows.

### DAIRY RESEARCH BRANCH

As the traditional markets for butter and cheese are becoming limited, alternative outlets are being explored. Evidence suggests that the fat content of milk, if it is to be sold in additional quantities, will have to be marketed in the form of oil for cooking or recombined milk products. Consequently, the industry's research programme was planned to give emphasis to manufacturing research in preference to an expansion in dairy production.

Good progress was made with projects being undertaken through the Australian Dairy Produce Board's research and promotion scheme for dairying, and the stimulus given to research by industry funds led to increasing co-operation between the research and industry organisations concerned. The successful results obtained in the production of new dairy foods gave a lead to several dairying organisations in the development of new types of recombined flavoured milk concentrates, hot and cold beverages, recombined condensed milk, soft serve ice cream and toppings, frostings and fillings. The development of methods of butteroil purification, particularly the removal of weed taint, indicated how high quality butteroil could be prepared from weed-tainted butter or cream.

Bacteriological studies revealed how cheese and butter quality could be further improved and flavour enhanced.

Good progress was made with the development of hard and semi-hard (non-cheddar) varieties of cheese suitable to Queensland and efforts are now being made to reduce, by mechanisation, their cost of manufacture. Some interesting leads were investigated on the alleviation of weed taint in milk and cream on the farm.

Trends away from cream production towards whole-milk delivery with farm refrigeration and in some districts tanker collection necessitated an investigation of suitable methods for testing and grading such milk.

As some overseas purchasers are demanding higher chemical and bacteriological standards for dairy produce such as freedom from *E. coli*, Staphylococci, antibiotics, pesticides, detergents and chemical sterilants, the laboratory quality control services in this regard were intensified.

Laboratory quality control services were maintained for the Southern Queensland Egg Marketing Board and these resulted in a marked improvement in the bacteriological quality of pasteurised egg pulp. Baking quality of the product was well maintained and the simpler and less costly  $\alpha$ -amylase test for the efficiency of pasteurisation of egg pulp was also adopted.

## RESEARCH

The principal research projects undertaken were:

*New Dairy Foods.*—Further work on recombined flavoured milk concentrates led to improved manufacture, packaging and keeping quality. Seven companies are now manufacturing recombined flavoured milk concentrates for local sale and consumption is expanding. Thick shake drinks and soft serve ice cream are also being developed.

The dispenser developed for cold milk drinks was modified for hot beverages. Work also continued on recombined condensed milk, savoury spreads, and cake toppings, frostings and fillings. These products may have a demand in South East Asia where flavoured milk protein rich drinks are popular.

The process and equipment should also help in the development of other recombined milk products.

A topping containing 25 per cent. butterfat, although well received in consumer trials, developed a hard surface crust and sticky centre. By changing from an oil in water emulsion to a water in oil preparation and the use of a suitable emulsifier, the defect was reduced. The flavourings used were chocolate, strawberry and vanilla. Savoury spreads were also produced.

Details of the development of these products are being prepared for publication.

The installation of a specially designed high speed mixing vessel will facilitate the manufacture of products with a high solids content such as sweetened condensed milk, cake toppings and savoury spreads, under conditions simulating commercial manufacture.

*Removal of Weed Taints from Dairy Products.*—The severity of weed taints remains serious and investigation of taint removal methods continued. The urgency of this work was highlighted by the demand for weed-free butteroil for use in recombined dairy products in South East Asia. Supercentrifugation, and ultra-high temperature treatment of butter and both sweet and acid creams were further investigated.

Studies were also continued to assess the influence of various electrolytes during the removal of weed taints from melted butter prepared by the Queensland Butter Marketing Board. An automatic, in-line dosing device was incorporated into the process for commercial scale operation.

A new nozzle type separator became available and its use permitted a thorough examination of the effects of efficient water washing of weedy butteroil and cream by climbing thin film, counter current treatment. Water soluble defects of some *Lepidium* spp. were removed but not taints due to *Coronopus*. Microbiologically induced defects were also effectively removed.

Direct conversion of weedy cream to weed-free butteroil was also achieved. Objections to the lack of flavour in chemically refined oils suggested further modifications in processing were necessary. Equipment was therefore designed to permit ultra-high temperature processing of the weed tainted products during the coming weed season.

*Manufacture of Hard and Semi-hard Cheese.*—The need for increased local consumption of cheese, coupled with an oversupply of cheddar cheese has emphasised the desirability of increasing production of non-cheddar varieties of cheese. To assist in this, development studies and experimental work were directed towards the modification of manufacturing procedures applicable to local conditions.

Advice and control work were continued in relation to the following varieties of cheese the manufacture of which has been developed to the stage of commercial production—blue vein, gouda, edam and broodkaas, spiced and flavoured cheeses.

Investigations were also carried out on the manufacture of Cheshire and Danish danbo type cheeses which were not previously made in Queensland.

Research was conducted into ways and means of increasing the degree of mechanisation in the manufacture of all varieties and of improving the quality of stirred curd type cheese which has been produced commercially for some time.

Blue vein cheese of very satisfactory quality continued to be produced from heat-treated milk. The manufacturing company won first prize against other much longer established manufacturers in the mould cheese class at the 1962 Melbourne Royal Show and Sydney Royal Show, 1963. A manually operated cheese piercing machine was designed in association with a dairy engineering firm and successfully brought into use. This achieves a considerable saving in man-hours required to pierce the cheese and also ensures completely uniform treatment of the cheeses with mould spores. Further investigations were carried out in relation to the heterogeneity of composition of blue vein cheese.

The main work in the development of a mechanised process for the manufacture of stirred curd cheese centred around the designing of a mechanical cheese vat and an experimental vacuum pressing box both of which are now being made.

A paper on the manufacture of blue vein, gouda and edam cheese was submitted for publication.

*Cream Ripening.*—The flavour of butter depends primarily on the quality of the cream from which it is made. A detailed study of factors affecting cream quality is being made. It has been noticed that as temperatures of cream holding are reduced to 40 deg. F., as with the widespread adoption of farm refrigeration, defects other than bacteriological ones have been responsible for off-flavours. Consequently, studies on cream deterioration at the various temperature ranges and acidities are receiving attention. Effects of lipolysis, proteolysis, coliforms and psychrophilic bacteria are being examined in addition to traces of copper and iron and inhibitory factors. Simplified methods of detection of the various bacterial flora concerned in cream deterioration are also under examination.

The results indicate that 50 deg. F. may be the best holding temperature for optimum flavour development. The technique will require trial on a wide range of creams of different bacteriological quality.

Papers were published on inhibitory organisms in low acid cream and psychrophiles in cream and butter.

*Delayed Acid Production in Cheese Manufacture.*—Bacteriological studies on cheese were continued with a view to determining the factors contributing to a high grade product. Surveys were conducted at six factories and, in addition, a considerable amount of detailed work was carried out at three factories which produced large quantities of poor quality cheese.

A 7-day rotation of single strain starters was effective in controlling bacteriophage incidence within cheese factories. Over 90 per cent. of the surveys carried out at two cheese factories which were continually using such rotations showed that the cheese was completely free of bacteriophage for all starters used in the rotation.

It was found that the early die-out of starter and subsequent development of off-flavours often followed the growth of large numbers of other microflora during manufacture and the early stages of cheese ripening (1-3 days).

Currently, a detailed study of the bacteriology of cheese ripening is being carried out so that the typical flora of good and of poor quality cheese may be established. More detailed studies are also being attempted on cheese starter growth, metabolism and survival in milk, cheese, and other media. As starter survival has been shown to be related to the quality of the cheese produced, studies are continuing with a view to improving cheese quality through selection of more suitable starter cultures and rotations.

As some cheese starter cultures when grown together showed evidence of inhibition with consequent flavour defects in cheese, the inhibitory substances are being isolated and identified. The moisture, fat, salt, ash, calcium and phosphorus and lactose contents of these cheese are also being determined. Several techniques are being examined to establish the most suitable method for estimating sugars, particularly lactose, because of the possible association with starter die-out.

*Surface Defects in Cheese.*—Quantities of Australian cheese affected with surface defects are causing concern. Two aspects which have been investigated are the quality of the wax coating; and the use of fungicides to control mould growth.

The blend of wax developed last year was further tested on a large scale at one factory where considerable trouble had been experienced with crazed wax. Since changing to the new blend the incidence of crazing has decreased and further improvements can be expected where the waxing temperatures are increased to 295-300 deg. F.

The use of sorbic acid and potassium sorbate was investigated and various methods of application are being examined.

*Lipases in Cheddar Cheese.*—As lipase enzymes probably play an important part in flavour development of cheddar cheese, a method of measuring lipase activity may indicate desirable flavour development. Work was confined to the development of a better method of measuring lipase activity. The use of an isotope, carbon-14, in the butyric acid chain in the substrate is being tried. At present, a synthesis is being worked out by which the substrate molecule can be labelled.

**Rindless Cheese.**—The main problems with rindless cheese are the occurrence of mould growth and openness of the surface.

The influence hot pressing has on the survival of mould spores on the surface is therefore being examined. A thermistor thermometer is being used to record temperatures at the surface of blocks of cheese during hot-pressing and mould growth is being observed following treatment.

**Variation in the Freezing Point of Genuine Farm Milk.**—The minimum freezing point depression was determined on herd and individual cow's milk on the Atherton Tableland. A total of 1,775 milk samples was examined. Variations were found to occur with seasons of the year, morning and evening milks, stage of lactation and breed of cow.

**Clarification of Milk.**—The clarification of milk possesses advantages for cheese manufacture and for the market milk trade. It was observed that a considerable reduction in the leucocyte count of the clarified milks and a slight improvement in keeping quality occurred. The relative distribution of the fat globules is also being examined.

**Pre-incubation Testing of Chilled Milk.**—In the drive for further improvement of milk quality and because of rapid developments in farm refrigeration, tests to assess more accurately the quality of milk cooled at low temperature are being examined. These include comparisons of pre-incubation of cooled milk prior to testing and total plate count and tests for thermophilic bacteria.

**Keeping Quality of Pasteurised Cream.**—Market cream consumption could be considerably expanded in Queensland in order to aid the increased consumption of butterfat. However, it is important that the product have good keeping quality. As no suitable test exists for assessing the keeping quality of cream, investigations are being made of several types of tests for this purpose.

**Development of Rapid Field Tests for the Detection of Antibiotics in Dairy Products.**—Health and dairying organisations have expressed concern at the incidence of antibiotics in market milk and cheese milk supplies, and simplified rapid field tests have been sought for their detection as compared with more complex laboratory tests. The use of a *S. thermophilus* culture with the modified methylene blue test was applied in monthly surveys on farm milks taken by the Brisbane Milk Board, as well as at cheese factories. The total number of samples tested with this method exceeded 15,000. Good correlation was obtained when compared with the disc assay test for antibiotics. However, further investigational work showed that the night's refrigerated milk can be used without prepasteurisation but the night's unrefrigerated milk must be pasteurised.

Chemical sterilants such as hypochlorites, quaternary ammonium compounds and iodophors, when used as recommended, did not affect the test.

The investigations revealed that inhibitory factors other than penicillin influence the quality of cheesemilk, and simplified tests are being examined in this regard.

**Survey of Pesticides in Dairy Products.**—Concern expressed by overseas authorities at the possible incidence of residual quantities of chlorinated hydrocarbons in Australian butter and butteroil led to the laboratory being requested to examine the situation.

The accuracy of existing methods of analysis and possible levels of tolerance are being examined in the survey. Because of the recently introduced organophosphates as tickicides to replace chlorinated hydrocarbons, the rundown of the hydrocarbons and the secretion rates in milk of the organophosphates are also being investigated.

Methods of analysis, however, have been unsatisfactory for DDT levels below 2 ppm. With further work it is hoped to improve the methods of analysis to enable detection of 1 ppm with certainty.

In butter samples containing less than 2 ppm the concentrations have been estimated from paper chromatograms.

In association with the Biochemical Branch of the Animal Research Institute, it has been shown that there is a measurable excretion of organic phosphate acaricides in the fat content of milk of dairy cows treated at recommended strengths.

**Prevention of Weed Taints in Milk and Cream on the Farm.**—About 15 per cent. of choice butter is degraded in Queensland each year from weed taint.

Farm research, in association with officers of Agriculture Branch, working with well-fed cows in good condition revealed that taints in milk and cream due to *Coronopus* weed are more difficult to produce than was first believed. Grazing a pasture infested with at least 30 per cent.

*Coronopus didymus* for 30 min. daily, followed by weed-free grazing, failed to produce weed taints in milk and cream after 4 consecutive days. Weed taints in the butter churned from the cream were considered insufficient to cause degrading for export purposes. The carryover of *Coronopus* taints to the morning milking following grazing on weedy pastures the previous day was small. There was very little, if any, difference in the tainting potential between young and mature *Coronopus*.

In association with the Queensland University, a study is being made of the tainting principles in the plant. The conditions causing the production of the tainting constituents may offer a further solution to the problem of weed taint control.

For alleviation of the problem it appears imperative to devise a system of farming which will curtail both the numbers of weeds and the effects of weeds ingested by dairy cows. Work so far conducted shows that the amount and ratio of weed-free feed to weed-infested feed has a very significant bearing on the intensity of weed taints in the milk supply.

A publication on the results of the work to date is now in the course of preparation.

A simple method for the detection of weed taints in cream was devised and tried at a butter factory. Cream graded as choice quality by the factory grader was check graded for weed taint by smelling the odours given off when a sample of the cream was dropped into water at 180–190 deg. F. A considerable number of cans of cream graded organoleptically as being free of weed taint was found to contain detectable weed taint when submitted to the hot water test. However, the sensitivity of the method has yet to be tested.

**Detergent-Sanitiser Trials.**—Bacterial contamination from dairy farm equipment is responsible for more than 90 per cent. of milk and cream quality problems. Investigations were, therefore, carried out on several farms to determine the efficiency of a number of detergents and chemical sanitisers. They were brands which are commonly used in Queensland including sodium metasilicate, and wetting agents as detergents followed by boiling water as a final rinse. Hypochlorites, iodophors, and quaternary ammonium compounds as chemical sterilants were used as pre-rinses.

Combined detergent-sanitiser and new foaming detergent-sanitiser were also included in the trials. With these preparations, boiling water was not required and dairy equipment was sanitised by a bactericidal agent present in the detergent-sanitiser using the "drip-dry" technique.

The results of the trials showed that the detergents and sanitisers now commonly used in Queensland, in conjunction with the approved method of cleaning and sanitising milking machines, are very effective. It was found that milk of excellent bacteriological quality could be produced regardless of climate or weather conditions. It was also found that the detergent-sanitiser method of cleaning and sanitising milking machines was as effective as the approved method. Results also indicated that it is possible for dairymen to maintain their milking machines in a clean condition with monthly dismantlings instead of weekly pull-downs. Data were also obtained concerning the corrosive effects on metal, glass and rubber milk lines, the tainting effects in milk, and the general economics of use.

**Cheaper Farm Refrigeration.**—Efforts were continued towards the development of cheaper types of farm refrigeration for the small milk and cream supplier. Seven condensing units, made up from the units fitted to superseded domestic refrigerators, have been in use on dairy farms. Including farm built tanks, the total cost of the units was just under £100 for a unit capable of storing up to 8 cans of cream and £75 for a 3-can unit.

The introduction of these novel and cheap farm refrigerators created much interest and a number was bought by farmers from refrigeration suppliers able and willing to handle the job of conversion. The use of these units also allowed trials to be carried out on the necessity or otherwise for the shock-cooling of cream prior to immersion cooling, a practice which, if dispensed with, could effect a further saving. Information was also provided for several refrigeration suppliers who placed new sealed units on the market for immersion cooling in prefabricated tanks. As these units operate thermostatically with the aid of electric power, it is now proposed to develop a unit for operation from a milking machine engine.

**Steam-Metering.**—Further measurements of the steam demands of cream pasteurisation were made having regard to the manufacture of butter true to cream grading and maximum steam economy.

Using tandem vacuumation, nine recordings were made of the steam consumption per gallon of choice cream treated ranging from 1.73 lb. to 2.56 lb. with an average of 2.22 lb. In the case of first quality cream, the consumption varied from 2.09 lb. to 2.56 lb. per gallon of cream, the average being 2.23 lb.

The results indicate that at one factory, where a high incidence of weed taint occurred during the trials, the intensity of cream treatment was similar for both grades of cream.

#### LABORATORY QUALITY CONTROL SERVICES

In addition to carrying out routine laboratory examinations of materials and products, specific farm and factory problems were investigated, on request.

**Butter.**—A total of 25,971 tests was performed on 2,912 samples.

Moisture and salt determinations were carried out on 2,110 samples of butter of which 46 or 2.2 per cent. were found to be overmoist. This is rather high and more attention is being given to this aspect of buttermaking. The average chemical composition was—moisture 15.69 per cent., salt 1.41 per cent., curd 0.90 per cent., fat 82.00 per cent.

pH determinations were performed on 1,147 samples, the average serum pH reading being 7.67 which is almost 0.2 units higher than those of the previous two years. There have been fewer butters with pH values less than 6.8. As such "acid" butters have poorer keeping quality, it is encouraging to see this trend. During the past 15 years there has been a steady upward trend in pH values.

Routine bacteriological tests were carried out, the possible Bacteriological Quality Index being 300. The average B.Q.I. this year was 250 which is similar to that of the previous year (246).

There was a slight increase in the number of butters showing extraneous matter, 6.9 per cent. of the butters falling in this category from 2,271 samples examined.

The Hygienic Quality Index was again used as a means of determining general factory hygiene as it combines both bacteriological and extraneous matter results. The average H.Q.I. for this year was 343 which is only slightly higher than the index of 340 for last year and indicates a good standard generally.

The standard of working as judged by the size and distribution of the water droplets was checked by microscopic examination of 2,262 samples of butter. Results showed a very good standard, 90 per cent. being classified as "well worked" or "fairly well worked", an increase of 5 per cent. over that of the previous year.

Efforts by factories to produce an attractively flavoured 94 point butter, free of *E. coli*, for export to Japan met with success. Several consignments were forwarded and more have been requested.

Seven factory surveys were conducted for the purpose of pinpointing contamination or to determine the efficiency of processing in order to assist improvement of butter quality.

**Cheese.**—Cheese factories were supplied with starter cultures and bacteriophage surveys, and milk and cheese quality surveys were carried out. A considerable amount of detailed bacteriological control work involving more than 32,000 tests was carried out.

Although the widespread use of commercial mixed cultures has meant a lessened demand for single strain starter cultures, there are signs of the inevitable incidence of bacteriophage where the same mixed cultures are being used continually.

A total of 30 cultures was maintained with regular checks for vitality, morphology and repurification. New phages were also isolated, purified and cross relations performed. A total of 764 cheese starters was forwarded to factories.

Trials were carried out to determine whether a mixed culture commonly used by many cheese factories necessarily produces better quality cheese at 3 weeks and 2 months of age than the single strains. The grading results of 16 paired batches of cheese showed that the single strain starters produced better cheese than did the mixed strain culture. These findings were also confirmed under factory conditions.

Three factories experiencing major manufacturing problems were shown to be affected by unsatisfactory starter rotations, poor water supply, quality and phage proliferation owing to leftover curd being returned to the cheese vat the following day. Efficient treatment of the water supplies at one factory immediately resulted in improved cheese quality.

The presence of some coliforms and staphylococci in cheese was associated with improper pasteurisation of the milk and faults in temperature control and rate of milk flow were adjusted accordingly.

Altogether, 589 cheese samples were analysed and the results showed that factories generally were exercising good control over the composition of cheese. There was, however, a proportion of cheese produced with a slightly high pH. The application of a system of classifying the results of cheese analysis for the information of factory personnel has contributed towards a good standard of control of cheese composition since its introduction 3 years ago.

Research and development work has continued to expand the range of cheese varieties produced in this State. Quality standards have been high and the products have compared more than favourably with the imported equivalent.

In the course of the work and in the conduct of various investigations, a total of 232 visits was made to cheese factories.

**Market Milk.**—A summary of examinations made is set out in Table I.

The bacteriological quality of raw milk supplies was well maintained. Over 300,000 methylene blue reduction tests were carried out at milk receiving depots and only 2 per cent. of samples failed to reach the advisory standard of 4 hours. Smears of milks failing the methylene blue test were forwarded regularly to laboratories and the results of microscopic examinations to show the probable cause of low quality were sent to suppliers.

There was a marked increase in the number of thermiduric tests carried out at milk receiving depots. All milk supplied for the market milk trade is now being tested at regular intervals for thermiduric organisms, either by the receiving depots or by officers at branch laboratories.

The tests of bulk tanker milk supplies to the Brisbane depots were doubled. Tests for methylene blue reduction time, thermiduric count, fat, milk solids and freezing point were made on 1,141 samples. Fortnightly testing of samples from raw milk vendors was also carried out. Freezing point determinations were made on 2,735 milks, and only 15 samples showed indications of added water.

The chemical composition of raw milk supplies for fat and solids-not-fat was satisfactory. Only 1.7 per cent. of samples did not comply with the 3.3 per cent. standard for fat.

Since the regular testing of milk for antibiotics was introduced, a marked reduction in the incidence of antibiotics has occurred. Of more than 7,000 tests conducted, only 4.5 per cent. were positive for inhibitory substances.

Almost 2,000 samples of farm bulk milk tanks were tested and the milk quality was well maintained provided every attention was given to dairy hygiene. The quality of milk collected every other day also compared favourably with daily collection.

A total of 1,900 samples of pasteurised milk was tested for bacteriological quality and chemical composition. Fewer than 1 per cent. of samples failed the phosphatase test, showing that pasteurisation of milk was generally satisfactory.

In spite of the increased amount of thermiduric testing of raw milk supplies, 65 per cent. of samples of pasteurised milk had bacterial counts greater than 50,000 per ml. Many factories had consistently good results, but counts of milk from several large associations were frequently high. This indicates the need for the penalizing of suppliers who are consistently supplying milk with a high thermiduric count.

The results of coliform tests were not as good as in the previous year, with 27 per cent. of samples containing coliform organisms in 1 ml. There was a slight increase in the percentage of samples failing the keeping quality test. This was due to samples from north Queensland factories, and good results were obtained in tests of samples from other factories.

To aid in reducing contamination of pasteurised milk from incompletely sterilized milk bottles from soaker type bottle washing machines, an inexpensive sterilizer feeding device was designed enabling efficient treatment of the final rinse waters.

All samples of pasteurised milk were analysed for chemical composition. The average fat percentage was 4.1 and the average solids-not-fat percentage was 8.7, these figures being the same as in the previous year.

Cultures were supplied to persons desirous of making yoghurt in the home. Other cultures were tried for the production of flavoured fermented milk drinks.

Milk samples were taken regularly for a survey conducted by the Atomic Weapons Safety Committee to assess the possible effects of radio-active fallout.

The regular testing of samples of whipping and dessert cream from Brisbane depots and of 35 per cent. cream from country factories was continued. There was some improvement in bacteriological quality as compared with the results in the previous year, but many samples were not satisfactory. The butterfat content of market cream was satisfactory in all samples.

TABLE 1  
SUMMARY OF MILK AND TABLE CREAM EXAMINATIONS

	1961-62	1962-63
<b>Bottled Pasteurised Milk—</b>		
Plate Counts—		
Number .. .. .	1,994	1,880
Per cent. over 50,000/ml. .. .. .	56	65
Coliform Tests (10 ml. and 1 ml.)—		
Number .. .. .	3,125	3,632
Per cent. positive in 1 ml. .. .. .	23.6	27.2
Phosphatase Tests—		
Number .. .. .	2,010	1,940
Per cent. positive .. .. .	0.2	0.5
Keeping Quality Tests—		
Number .. .. .	1,356	981
Per cent. failure .. .. .	0.9	3.0
Butterfat Tests—		
Number .. .. .	1,757	1,720
Average fat per cent. .. .. .	4.1	4.1
Solids-not-fat Tests—		
Number .. .. .	1,779	1,783
Average S.N.F. per cent. .. .. .	8.7	8.7
Freezing Point Tests—		
Number .. .. .	1,524	1,107
Empty Capped Bottles examined—		
Number .. .. .	42	340
Factory Surveys .. .. .		32
Shop Samples—		
Number .. .. .	24	71
Per cent. failure on Keeping Quality .. .. .	37	13
<b>Bottled Pasteurised Cream (42% fat)—</b>		
Plate Counts—		
Number .. .. .	282	262
Per cent. over 50,000/ml. .. .. .	26	10
Coliform Tests—		
Number .. .. .	566	532
Per cent. positive in 1 ml. .. .. .	49	60
Phosphatase Tests—		
Number .. .. .	288	275
Per cent. positive .. .. .	9.7	2.2
Butterfat Tests—		
Number .. .. .	299	273
Average fat per cent. .. .. .	43.8	43.8
<b>Bottled Pasteurised Cream (18% fat)—</b>		
Plate Counts—		
Number .. .. .	288	266
Per cent. over 50,000/ml. .. .. .	70	51
Coliform Tests—		
Number .. .. .	574	558
Per cent. positive in 1 ml. .. .. .	78	82
Phosphatase Tests—		
Number .. .. .	294	285
Per cent. positive .. .. .	2.7	..
Fat Tests—		
Number .. .. .	305	281
Average fat per cent. .. .. .	20.8	21.0
<b>Bottled Pasteurised Cream (35% fat)—</b>		
Plate Counts—		
Number .. .. .	313	323
Per cent. over 50,000/ml. .. .. .	20	40
Coliform Tests—		
Number .. .. .	310	608
Per cent. positive in 1 ml. .. .. .	39	47
Phosphatase Tests—		
Number .. .. .	293	306
Per cent. positive .. .. .	4.4	1.3
Fat Tests—		
Number .. .. .	318	320
Average fat per cent. .. .. .	40.5	40.5
<b>Raw Milk—</b>		
Methylene Blue Tests at Depots—		
Number .. .. .	373,945	329,017
Per cent. below 4 hours .. .. .	2.0	2.0
Butterfat Tests at Depots—		
Number .. .. .	130,410	129,833
Per cent. below 3.3% .. .. .	1.5	1.7
Bulk Tanker Samples—Official Tests—		
Thermiduric Tests—Number .. .. .	959	1,273
Methylene Blue—Number .. .. .	959	1,273
Butterfat—Number .. .. .	1,141	1,325
Raw Milk Vendors—		
Methylene Blue Tests—Number .. .. .	330	331
Butterfat Tests—Number .. .. .	331	334
Thermiduric Tests at Depots .. .. .	32,692	42,326
Microscopic Examinations .. .. .	2,637	3,237
Examinations for Mastitis .. .. .	3,921	3,101
Miscellaneous Samples .. .. .	399	254
<b>Summary of Tests—</b>		
Quality Control of Market Milk—		
Laboratory Tests .. .. .	35,091	34,923
Depot Tests .. .. .	530,000	501,176
Total .. .. .	565,091	536,099

## CHEMICAL AND BIOCHEMICAL

The number of samples received in the chemical laboratory for examination totalled 8,148. They comprised milk powders, milk, cream, ice cream, cheese, butter, casein, margarine, egg pulp, farm and factory waters, brines, and detergents. The number of individual tests exceeded 13,000. The suitability of a number of proprietary products for dairy farm use was examined. They included oils for use in milking machine vacuum pumps, metals for milk can manufacture, and plastic polymer tubing for milking machine use.

With increasing trends towards wholemilk and farm bulk milk collection, rapid and more convenient tests for fat, solids-not-fat and total solids and milk protein were sought.

As the public demands more and more milk protein instead of fat, there is a world-wide trend towards testing and paying for milk on its total solids content, and tests with such an objective continued. In this regard, dye absorption tests for milk protein, detergent tests for fat specific gravity and electronic devices for assessing the important constituents of milk were examined.

A rapid detergent test for fat was investigated and found to be more convenient, less hazardous and as accurate as the Babcock test, and wider field trials with individual cow herds are now under way. More than 2,000 test comparisons were made in this regard.

With the acceptance of butterfat testing in cream gravimetrically by the Australian Standards Association, dairying organisations have requested investigations of this method and its suitability as compared with existing estimations volumetrically. Aspects of labour, time, equipment, accuracy and cost are being examined in association with the officers of the Field Services Branch. More suitable balances were considered, and convenient and accurate sampling methods tried. Seasonal effects using the two methods are also being studied. To date, comparisons have been based on more than 500 cream samples.

## PUBLICATIONS

Eleven research and six advisory papers were prepared and 16 radio talks and 18 addresses given to various conferences and schools. Press releases totalled 19.

## STATISTICS

Table 2 summarises the services performed:—

TABLE 2  
SUMMARY OF TESTS PERFORMED

	No. of Samples	No. of Tests
Cheese Improvement Service .. .. .	15,000	32,000
Butter Improvement Service .. .. .	3,000	26,000
Laboratory Quality Control of Market Milk .. .. .	18,000	35,000
Chemical and Biochemical .. .. .	13,500	21,000
Analyses associated with various research projects	24,000	50,000

In order to meet the greatly expanded research and quality control services of the Branch, the Government approved the establishment of research laboratories and pilot plant at Hamilton at a cost of £219,000. All necessary plans were completed and work on the foundations commenced. The provision of experimental factory facilities will enable the Branch to give the industry effective service and advice and to assist in the diversification of dairy product manufacturers. Site and plans for a new dairy research laboratory at Malanda were also finalised. An extension to the laboratory at Murgon was completed by the South Burnett Co-operative Dairy Association and the Government provided fittings, staff and equipment.

In all projects, a high level of collaboration was maintained between the research groups in the various States, the Australian Dairy Produce Board, the Department of Primary Industry, dairy machinery manufacturers, and dairy companies. This co-operation was greatly appreciated and has assisted the Branch in furthering its research programmes.

*Staff.*—Two officers of the Branch obtained their Master's degree in pure science and another is continuing advanced studies for the same purposes. Another officer is continuing his studies for a higher degree.

At the invitation of C.S.I.R.O., two officers went to Melbourne for training with specialised equipment associated with flavour problems of dairy products.

At the request of the Education Department, a chemist was also stationed at Gatton College to carry out research work under the Research and Promotion Grant for Dairying.

## DIVISION OF MARKETING

### MARKETING

During the year, marketing of the main primary products was overshadowed by the uncertainty surrounding the Common Market negotiations in Europe, and the possible effects on our export trade. There is a growing need for market advisory and market research work in Queensland and in future more emphasis will have to be placed on this aspect of marketing.

One of the outstanding features of the export market during the 12 months was the high level of prices reached in the free sugar market. The London price rose from c.i.f. stg. £25 10s. per ton at the beginning of the year to over c.i.f. stg. £100 per ton in May, 1963.

A new development was the export of 4,700 tons of maize from southern Queensland to Japan, and an agreement with Japanese buyers to purchase up to 20,000 tons of maize each year, subject to availability.

Exports of malting barley to Korea, a new outlet, were well received and there are good prospects of a small but increasing trade to this country.

Thirty thousand tons of grain sorghum were exported from Queensland, chiefly to the United Kingdom market, being approximately the same tonnage as in the previous year.

The export wheat market was dominated by the large sales of Australian wheat to the Peoples' Republic of China, on extended credit terms. Exports from Queensland to China totalled 152,683 tons, of which more than 110,000 tons were premium wheat.

Australian exports of apples are estimated to reach 7,000,000 cases, a near record, and an increase of approximately 200,000 cases on the previous year. Queensland exports, mainly Granny Smiths, approximated 177,000 cases, about 22,000 fewer than in the previous year.

Both domestic and export markets for canned pineapple were affected by the greater availability of canned deciduous fruits.

Egg exports from Queensland to Europe were confined to frozen liquid egg, which totalled 934 tons, compared with 770 tons last year. Sales to other markets, both in shell and as frozen liquid, were made at prices similar to those of last year.

As a result of the introduction of a quota system in September, 1961, for imports of butter into the United Kingdom, prices for Australian butter rose from 247s. to 334s. stg. per cwt. It has been estimated that this has resulted in an increased return to Australian dairy farmers of approximately £5.5 million.

During the course of the year, spot prices for Australian cheese in the United Kingdom increased from 210s. to 226s. stg. per cwt. Exports of cheese from Queensland increased from 3,361 tons in 1961-62 to 5,318 tons in 1962-63.

Satisfactory progress was made in the development of the public fruit and vegetable market at Rocklea. Tenders amounting to approximately £700,000 were let on behalf of the Brisbane Market Trust.

The three grain marketing boards, representing wheat, barley and grain sorghum, have set up a committee to investigate the economics of establishing bulk handling facilities at a port in central Queensland to deal with the increasing grain production in that area.

Upon the retirement of Mr. H. S. Hunter, the position of Director of Marketing became vacant and Mr. A. A. Ross was appointed. Mr. D. P. Lapidge was appointed Assistant Director of Marketing.

There has been little change in the staff position of Marketing Branch during the year, the graduate staff being increased by one Marketing Officer attached to the Market Intelligence Services. Difficulty is being experienced in obtaining suitably qualified persons for appointment as Marketing Officers.

### AGRICULTURAL STANDARDS

Seed testing continued to be an important function of Standards Branch, the number of germination tests undertaken representing an increase from the previous year of 3,983 tests to a total of 15,393.

The Standards Officer (Mr. A. C. Peel) attended, as the Australian representative, the 13th International Seed Testing Association Conference in Lisbon, Portugal. A new technical sub-committee has been formed under the Association rules to investigate techniques for testing seeds of tropical and subtropical importance.

Seed Certification and registration of Agricultural Requirements continued as very important functions of the Branch and no doubt the efforts in these fields of endeavour have been to the advantage of primary producers.

For the first time, large-scale bulk shipments of wheat were made from Queensland to the extent of 152,683 tons, and the export markets for other grains and seeds for sowing, particularly pasture seeds, was expanded. New markets, notably in Asia, were developed. All exports of fruit and vegetables, grain (including wheat) and seeds for sowing are subject to inspection or examination by members of the Standards Branch.

The Senior Inspector (Markets) is this year serving a period of approximately 6 months on behalf of the Commonwealth Government in the United Kingdom and on the Continent to undertake duties associated with inspection on out-turn of Australian apples and pears.

The Standards Branch continued to provide instruction to personnel from Asian Countries visiting Australia under the Colombo Plan. This instruction included seed testing, seed certification, seed cleaning and processing, marketing of fruit and vegetables with reference to standards of quality and the inspection techniques associated therewith.

The services of Mr. A. Hegarty, Assistant Standards Officer, were lost to the Standards Branch by his transfer to another Branch of the Department and Mr. S. W. Ivers, Senior Adviser (Herd Recording) was seconded to the Standards Branch to provide assistance in administrative matters.

### ECONOMICS RESEARCH

Considerable progress was made in the Economics Research Branch during the year through the recruitment of further graduate staff. This expansion has made it possible to plan in a concrete manner for the development of the Branch.

The work of the Branch has been classified into two main sections. Economic Research section is responsible for the design, performance, analysis and interpretation of economic research. Economic Services section handles collection, collation and dissemination of basic standard data relating to farm management and the operation of farm management accounting groups.

In pursuance of this policy an Agricultural Economist was transferred during the year to Toowoomba to initiate field services. This was the first country appointment made in this Branch.

Seven graduates are engaged in part-time studies for higher degrees.

The position of Director of Economic Services became vacant as a result of the resignation of Mr. C. H. P. Defries. The vacancy was filled by the appointment of Mr. E. O. Burns.

Three Agricultural Economists were appointed during the year, and there are now 9 graduate staff members. The clerical staff was also increased and the total staff now numbers 14.

## MARKETING BRANCH

### MARKETING ORGANISATION

During the year the terms of operation of two commodity marketing boards operating under "The Primary Producers' Organisation and Marketing Acts, 1926 to 1962," were extended. The Barley Marketing Board was extended from April 24, 1966 to April 23, 1978 to enable the Board to enter into commitments with regard to the purchase of storage facilities. The informal ballot of suppliers to The Central Queensland Egg Marketing Board resulted in an expression of opinion unfavourable to the proposed amalgamation with The Egg Marketing Board. Consequently, it was necessary to extend the term of The Central Queensland Egg Marketing Board for a further 2 years from January 1, 1963 to December 31, 1965.

Triennial elections were conducted of growers' representatives on The Atherton Tableland Maize, Barley, Butter, Central Queensland Egg, Cheese, Cotton, and Egg Marketing Boards and the State Wheat Board. In addition a by-election in connection with The Atherton Tableland Maize Marketing Board was necessitated by the resignation of three members. Action was also begun in respect of the extension of the term of The Ginger Marketing Board and forthcoming election of members. The term of The Queensland Dairymen's State Council was extended for a further period of 6 years to June 30, 1970.

The Primary Producers' Organisation and Marketing Acts were amended to remove the restrictions on travelling expenses payable to members of the Executive Committee of the Council

of Agriculture, to preserve the rights of Board employees upon the amalgamation of marketing boards, to permit the transfer of unclaimed moneys in the hands of marketing boards and finally to change the minimum number of growers required to present a valid petition for a poll in regard to particular levies made by the Queensland Canegrowers' Council or its constituent bodies.

Orders-in-Council were issued with respect to the functions of several commodity marketing boards. The Atherton Tableland Maize Marketing Board was empowered to process or treat maize by grinding, crushing, cracking or kibbling and to sell the resultant products from such processes. The Barley Marketing Board had its borrowing powers extended to facilitate the purchase of a storage shed. The Butter Marketing Board's powers of manufacture were extended to permit the Board to treat butter or derivatives of butter in various ways. The Egg Marketing Board's authority to request returns from growers was extended to cover other persons. The Tobacco Leaf Marketing Board, under certain conditions, was given power to destroy unsaleable leaf.

Orders-in-Council were issued with respect to the raising of finance by the Brisbane Market Trust, and the Trust was empowered to provide accommodation for the conduct of a service and repair station.

Branch officers in their capacity as members of the various marketing boards, attended 153 board meetings. In addition they attended the following conferences and meetings—a conference at Sydney to discuss specifications of various wooden and fibreboard containers of one bushel capacity for bananas; a conference at Murwillumbah on uniform grade standards for bananas; a conference on barley with the Reserve Bank at Sydney with respect to crop finance; a Commonwealth conference held at Canberra on the future of the cotton industry and the continuation of Commonwealth support; a conference at Sydney with the Australian Cannery Association on the market potential and quality standards for navy beans; meetings of the Council of Egg Marketing Authorities at Sydney and Melbourne; Central Tobacco Advisory meetings at Sydney and Canberra; quarterly meetings of the Egg Marketing Suppliers' Organisation; a conference at Kingaroy concerned with plant improvement in the peanut industry; and the annual conference of fruit and vegetable growers in north Queensland.

#### MARKET RESEARCH

Market information was provided in connection with the Dumaresq-Pike's Creek Border River Scheme, and the irrigation schemes at Inglewood on the Macintyre Brook and at Kaban and Tumoulin on the Evelyn Tableland in north Queensland.

A preliminary survey at the retail level was made of various aspects of banana marketing with particular reference to consumer preferences as to variety and size. An analysis was made of peanut sales by The Peanut Marketing Board over the period 1958-59 to 1961-62 inclusive, particular attention being given to distribution as between grades and

destination, and the effects of advertising and sales promotion. A statistical analysis was made of price trends and the correlation between prices to producers and retail prices of bacon and ham. The economics of a proposal to erect a cold store for the storage of potatoes at Laidley were investigated. Considerable progress was made in the calculation and graphical presentation of production trends in many of the major primary industries in Queensland.

#### MARKETING INTELLIGENCE SERVICES

Reports and forecasts published by the Branch during the year totalled 45, with a total circulation exceeding 29,000. This showed a slight increase on the figures for the previous year. Forecasts covered both winter and summer grain and seed crops, peanuts, potatoes and onions, and quarterly reports were made on the poultry industry in south-eastern Queensland. Publication was continued of the monthly "Report on Production Trends" and also "Grain Abstracts".

The system of forecasting, which depends on the co-operation of farmers in the growing areas, is continuously under review. During the year officers of the Branch visited the Lockyer and Fassifern Districts to enlarge and improve the sample of honorary potato crop correspondents. Similar visits were made to the South Burnett in relation to peanuts and to the Redlands and outer Metropolitan areas in connection with the sample of poultry correspondents. Officers of the Branch made check surveys of winter grains and seeds in the Central Queensland Highlands and on the Darling Downs.

#### MARKET REPORTING SERVICES

The daily and weekly market price reports for fruit, vegetables and farm produce were continued, and a report on fish prices supplied by the Fish Board was also issued daily. These reports are the official basis of the daily reports issued by newspapers and radio stations. Approximately 500 copies of the daily market price report were issued, 190 copies of the weekly report and 100 copies of the daily report on fish prices.

#### PRIMARY PRODUCERS' CO-OPERATIVE ASSOCIATIONS

The Primary Producers' Co-operative Associations Acts were amended during the 1962 session of Parliament to enable primary producers' co-operative associations to protect themselves against "snap" takeovers by outside interests.

New co-operatives registered during the year included The Maize Growers' Co-operative Association Limited, which was formed by maize growers in southern Queensland. Seven more co-operative artificial breeding associations were formed by dairy farmers in the districts of Glengallan, Bundaberg, Beenleigh, Monto, Mundubbera, Toowoomba and Wondai. With those already in existence at Atherton, Dayboro and Beaudesert, this makes a total of 10 artificial breeding associations formed in the last 2 years.

### ECONOMICS RESEARCH BRANCH

The scope of branch activities has been considerably widened during the year, two items of particular interest being the entry of the branch into the field of farm management training and the first appointment of an agricultural economist to a country centre. Work has continued on the dairy surveys in the Wide Bay and Eastern Downs districts, and on the poultry farm study in the Brisbane area. New projects commenced during the year include the Farm Management Accounting Groups scheme in the South Burnett district, and a survey of the economics of fertilizer use on Atherton Tableland dairy farms.

The accelerated rate of branch development, though essential in present circumstances, poses immediate problems in recruitment and in-service training. This latter appears likely to continue to be an important branch activity for at least the next 2 or 3 years.

#### RESEARCH

##### Investigation of Dairying Practices

Work continued during the year on two studies being made into the economics of dairying practices in the Wide Bay and Eastern Darling Downs districts. The investigations are being carried out at the request of the Dairy Extension Advisory Committees in these areas.

These are separate studies, although the main purpose of each is to produce economic data which will be of assistance to farmers and field officers when considering possible changes in farm practices.

In each case, budgetary analysis is being used to examine the effects on capital investment, revenue, costs and labour usage, which might be expected to follow changes in farm practices on a number of typical farms. Data for the budgets

were obtained after discussion with each farmer when technically practicable plans were drawn up for the farm. The Divisions of Plant Industry, Animal Industry and Dairying, as well as Economics Research Branch, were all represented at these conferences.

In the Wide Bay district, detailed budgets were completed for each farm in the sample. This resulted in a voluminous mass of data, and it has been decided that the most useful way of presenting this information is through a series of interim reports, each dealing with a similar set of practices.

The first of this series of interim reports was published towards the close of the year under review. It dealt with a number of case studies, relating to supplementary cropping practices which were either commonly recommended or were being considered by Wide Bay farmers.

Two further interim reports, dealing with irrigated pasture, and improved rain-grown pasture, are in course of preparation.

The shortage of trained staff, and the pressure of other work, have prevented any major progress in the Eastern Darling Downs study, but analysis of basic data is proceeding, and field work has now been completed.

This study has a different orientation from the Wide Bay work. Experience has shown that it would be impracticable to duplicate for this district the detailed amount of budgetary analysis which has been carried out in the Wide Bay.

It is proposed to issue a complete report on this survey during the coming year. This report will contain an analysis of the economic structure of a representative selection of 50 dairy farms, and an economic appraisal of certain farming practices. It will also draw attention to several aspects which warrant more detailed study.

The recent appointment of an Agricultural Economist to Toowoomba has made it possible to adopt this procedure. This officer will be available to conduct on-the-spot investigations into the specific problems which are revealed by the survey.

#### **Poultry Management Investigation**

A management study of a small group of poultry farms in the Brisbane area has been carried out on a continuous basis since July 1, 1960.

A report on the findings of the study for 1961-62 was published during the year.

The main purpose of the study has been to analyse and compare detailed information obtained from each member of the group. This is of particular interest to the co-operating farmers, and is also of value in drawing attention generally to those factors associated with successful management.

Following a request from the Egg Marketing Board Suppliers' Committee to expand the scope of this work, it has been decided to discontinue this study in its present form, and to constitute a Farm Management Accounting Group for poultry farmers. This will provide information similar to that gained from the present study, but a replacement of personal visits by a system of mailed monthly information will allow data to be collected from a larger number of poultry farmers.

A report on the findings for 1962-63 collected under the original system will be published during the coming year.

#### **Atherton Tableland Fertilizer Study**

An investigation commenced during the year aimed at clarifying the economic effects of fertilizing pastures on Atherton Tableland dairy farms. This work was requested by the Atherton Tableland Dairy Extension Advisory Committee.

Since October 1, 1962, a number of voluntary co-operators who use fertilizer have been providing weekly information on such things as fertilizer treatments and feeding practices.

It is proposed to follow up a year's recording in this way by a survey with a prepared questionnaire among co-operating farmers and a control sample of non-users of fertilizer.

#### **Special Projects**

The growing importance of the Economics Research Branch in the functional structure of the Department has resulted in a number of special projects designed to elucidate economic data for Departmental administration and other Divisions of the Department.

Two examples may be cited to illustrate this development:—

*Border Rivers Irrigation Scheme.*—To assist a Departmental committee considering agricultural aspects of a proposal to build a dam on Pike Creek, an economic survey was carried out on riparian holdings on the Dumaresq River. The survey was designed to obtain data relating to land usage, capital investment, income and costs of landholders affected by the proposal, and to their attitudes to the proposal and the probable uses to which the water would be put.

*Cherbourg Settlement Development.*—Assistance was given to the Cherbourg Settlement Development Committee in the preparation of a plan for the development of the Cherbourg Aboriginal Settlement. The plan aimed at integrated development of the dairy herd, beef herd and fodder crops, and the inclusion of a soil conservation scheme for the settlement.

### **FARM MANAGEMENT ACCOUNTING**

Active steps were taken during the year to encourage the use of modern accounting techniques as tools of farm management. Farming is a complex business, but there has been little general recognition of the value of records and accounts as guides to decision-making and checks on efficiency.

Farmers are acting under a severe handicap in the absence of these aids, which are taken for granted in other forms of business. In an endeavour to overcome this deficiency, action was taken to stimulate the interest of both farmers and public accountants in management accounting. Taxation and commercial accounting are of very little value for farm management and are quite inadequate in modern business conditions.

#### **Farm Management Accounting Groups**

With the co-operation, and under the sponsorship, of the South Burnett Dairy Extension Advisory Committee, a service known as Farm Management Accounting Groups, was inaugurated on July 1, 1962.

This is a system by which participating farmers are assisted in keeping records, and are provided at the end of the financial year with a detailed analysis of their own business operations, and a comparison with the averages of their groups. This assists farm management by directing attention to strong and weak features, which might otherwise be unrecognised, in the farm structure. Comparative accounting analysis is a well-known technique in farm management, and the successful establishment of this scheme is a significant step in this Branch's development.

Six groups, comprising more than 100 farmers, commenced functioning at the beginning of the year. Co-operation and interest have been well maintained and the big majority of these farmers completed their first year's recording.

This particular branch activity aroused considerable interest, and inquiries were received from other producer groups, requesting participation in the scheme. Three additional groups, including a poultry farmers' group, were formed and will start recording in the 1963-64 year.

As well as providing a service of direct value to participating farmers, this scheme also provides a continuous source of farm management data for economic research.

#### **Accounting Standards**

The inauguration of the Farm Management Accounting Groups has already met with a gratifying response from both farmers and public accountants. It is believed that this interest will grow rapidly after it has been demonstrated that management accounting can lead to increased productivity and profitability.

The Queensland Graingrowers' Association, for example, has appointed a Committee, on which the Economics Research Branch is represented, to formulate a similar system to be operated in conjunction with public accountants in the grain growing areas.

It is desirable, therefore, that close co-operation be established with practising accountants to ensure that standards are established on as wide and uniform a basis as possible. Negotiations have been opened with two of the major professional bodies of accountants, with a view to working out standard methods of accounts analysis and presentation for general recommendation.

The accountancy profession recognises fully the necessity of developing management accounting for farmers, and the Branch Director was invited to deliver a paper on this subject at the 1963 Practising Accountants' Conference towards the end of the year.

### **OTHER ACTIVITIES**

#### **Farm Management Training**

An important development occurred in April of this year when the Branch co-operated with Information Branch in presenting a course in farm management at an Extension Supervision and Farm Management School for senior advisers of the Department. The course was designed to teach principles of farm management, and to give practical instruction in the simpler tools of economic analysis.

This was the first course of this kind to be given in the Department, and it had a very good reception from the officers attending. A similar school will be conducted in the first half of the coming year.

#### **Field Services**

It has been clear for some time that a balanced programme of economic research and provision of the services for which the Branch was established, cannot be fully achieved until there is an agricultural economist stationed in the main country offices.

The first appointment to a country centre was made in the latter part of the year, Toowoomba being the selected area. This officer will be working, in close collaboration with other Departmental officers in the area, on economic research into local problems, and the adoption of improved management practices.

Extension services are expected to benefit considerably from this association, in conjunction with the new policy of farm management training for advisory personnel.

#### **Basic Data**

Estimating returns and costs of separate practices, by means of budgeting, is an important phase of farm management work. Budgets, however, can be no more accurate than the information on which they are based, and there is very little input-output data readily available in this State.

This problem is now being tackled, and considerable progress has been made over the last few months. During the coming year, it is proposed to publish a handbook containing such data for use in farm management. This handbook will be subject to continuous amendment, as further information comes to hand.



## Extension

Extension activities, aimed at developing an appreciation of economic principles within the rural community, have been expanded.

During the year, two A.B.C. Country Hour talks were delivered by staff members, six 1-min. radio talks were tape recorded for country broadcasts, and there were two interviews on country radio stations.

Lectures were given to a Farmers' School conducted by the East Moreton Dairy Extension Advisory Committee at Woodford, and to the Junior Farmers' School at Gatton. Three guest speakers were provided for meetings of primary producer organisations, and three addresses were given to professional bodies.

In co-operation with other branches, agricultural economists addressed farmers on two conducted tours, one in the Glastonbury district, and one in the Goomboorian-Kia Ora-Neerdie district, and at a field day at Brookstead.

Contributions to the feature page, "Profit and Loss"; in the *Queensland Agricultural Journal* this year totalled 30 short articles. Many of these short notes have been reproduced in the country press, and several have appeared in "Rural News Digest", published by the Reserve Bank of Australia.

The Branch combined with the Division of Animal Industry in the preparation of a joint exhibit for the 1962 Royal National Show. The focal point of the exhibit, demonstrating the continuous nature of the process of planning, recording and analysing, attracted more than passing interest, as evidenced by the heavy demand for publications displayed. In all, about 1,200 copies of various articles and booklets were posted in the following weeks as a result of inquiries received from the Show.

A small exhibit defining the scope of agricultural economics was also displayed at the Ian Clunies Ross Memorial Exhibit at the University of Queensland on September 21, 1962.

In addition, advice on economic principles and assistance in their application have been freely given on request to farmers and officers of other Divisions of this Department.

## STANDARDS BRANCH

With the continued expansion of the agricultural, horticultural and pastoral industries throughout the State, and the expansion and development of new export markets in the Far East and Europe, greater demands were made during the year on inspection and regulatory services provided by Standards Branch. Increased activity was undertaken to ensure that standards of quality for agricultural and horticultural produce and seeds and agricultural chemicals offered for sale within the State are maintained at a satisfactory level.

### SEED TESTING

The activities of the Seed Laboratory showed a considerable increase in every phase of work connected with the examination of samples for seed quality. A total of 15,393 germination tests for commercial and experimental purposes was carried out, representing an increase of 3,983 tests over those carried out in the previous year.

The Laboratory participated in testing samples related to the extension of pastures in Queensland and in this regard 1,901 grass seed samples were tested for purity and germination. In addition, all pasture seeds on offer to the Land Administration Board were tested prior to purchase on behalf of settlers in the Brigalow Development Scheme.

Experimentation with dry conditioned vegetable seed continued, with samples being received from a third company which commenced processing dry conditioned seed during the year. A total of 1,900 germination tests was carried out on this class of seed, showing an increase of 1,037 tests over those in the previous year. The interest shown in this dry conditioned seed has arisen from its apparent ability to withstand long-term storage without loss of viability in equatorial and tropical environments.

Following Australian representation by the Standards Officer at the 1962 International Seed Testing Association Congress in Lisbon, Portugal, experimental work, on an international level, was intensified with regard to grass and legume seeds. This work involves the exchange of seed samples between members of the Association in order to improve testing techniques and includes seed moisture and storage trials. From this work, rules for seed testing which will be considered at the next meeting of the Congress in Munich in 1965 will be developed.

All seeds imported into Queensland were sampled and examined on behalf of the Commonwealth Plant Quarantine Service.

In addition, a total of 1,258 samples representing seed for sowing and bird seed were tested prior to export overseas. Such exports include 141 tons of pasture seeds for sowing, and 267,563 bags of bird seed for use in the United Kingdom, the Continent and the Far East.

Details of Seed Testing activities are set out in Table 1.

TABLE 1

SUMMARY OF SEED SAMPLES EXAMINED

Source of Samples	1961-62	1962-63
Inspectors of the Branch .. .. .	1,964	3,229
Seed certification .. .. .	652	684
Experimental projects .. .. .	657	2,055
Submitted samples—		
(i) Merchants .. .. .	4,723	4,993
(ii) Farmers .. .. .	253	349
(iii) Government Departments ..	895	1,357
Total .. .. .	9,144	12,667
Germination Tests Carried Out .. ..	11,410	15,393

### SEED CERTIFICATION

The production of certified seed for farmers and graziers who require high-yielding selected strains which are free from disease, and which have a high germination capacity, continues to be an important activity. Administration of the Seed Certification Scheme, together with the testing, cleaning, storage and acquisition of foundation seed stocks, is the responsibility of Standards Branch.

The range of certified seeds available to the landholder has been enlarged this year by the inclusion of hybrid grain sorghum and Caloona cowpeas in the Seed Certification Scheme.

During 1962, 16,541 bus. of hybrid grain sorghum seed were produced for certification. Such seed includes the varieties Texas 610, Texas 630 and Broлга, the latter being a Queensland-bred hybrid. Some seed producers experienced problems connected with the viability of seed produced for certification. Experience has shown that the germination of certified hybrid sorghum seed can be adversely affected by continuous moist conditions during the final stages of seed ripening.

Prolonged dry weather can also seriously affect pollination in hybrid sorghum crossing plots causing yields lower than those recorded with standard grain sorghum varieties. These are problems being investigated by the Branch in association with other branches of the Department.

Approximately 12,100 bus. of grain sorghum comprising the varieties Alpha and Early Kalo were certified.

The quantity of grain sorghum seed rejected for certification purposes during the year amounted to 5,914 bus. Of this quantity, 5,460 bus. were rejected owing to the presence of prohibited weed seeds (*Ipomoea* sp.), and 454 bus. for low germination.

This is the first year that certified Caloona cowpea seed will be available commercially. Sufficient seed was produced from seed increase areas in the 1962 season to plant several areas in various parts of the State. These areas are now being harvested, and yields are expected to be reasonable.

Certified hybrid maize produced in 1962 amounted to 13,923 bus., this quantity being lower than that of the previous year due mainly to less favourable climatic conditions. Overall, 89.7 per cent. of the total hybrid maize seed certified germinated 90 to 99 per cent. a decrease on last year's figure. Prolonged wet weather promoting diplodia and gibberella cob rot during seed development was responsible for the lower germination.

Certified hybrid maize seed producers during the year considered modifications of their seed grade sizes. The principal modification was a step towards the elimination of seed of grade 1A, the smallest flat grade at present being marketed. All samples of hybrid maize seed submitted for certification were checked in the laboratory for effective size grading.

French bean seed certified in 1962, totalling 546 bus., was sufficient to meet requirements for the current season and provide a carry-over. Four seed merchants participated in the production of disease-free bean seed in Queensland, using Queensland certified bean seed as mother seed.

The production of certified Sugardrip and Italian sweet sorghum seed remained at a level which maintained a source of high quality seed barely sufficient for use by commercial seed producers. It is doubtful whether the production of this seed will rise substantially in future years.

A number of factors contributed to the reduction in the amount of certified sweet Sudan grass seed produced. Among these was the rejection, owing to weed seeds, of 5,100 lb. of seed, the abandonment of 27 acres owing to climatic conditions and the reduced acreage planted for certification.

Certified tomato seed production showed an increase this year to 687 lb. A problem which has developed with tomato seed is the incidence of tobacco mosaic virus and seed the subject of experimental treatment by officers of the Horticulture and Plant Pathology Branches was subjected to periodic germination tests in the Seed Testing Station.

A summary of the production of certified seed is set out in Table 2.

TABLE 2  
PRODUCTION OF CERTIFIED SEED

Crop	1960		1961		1962	
	Certi- fied	Re- fused	Certi- fied	Re- fused	Certi- fied	Re- fused
Hybrid maize (bus.) ..	6,540	17½	16,333	114	13,923	..
Grain sorghum (bus.) ..	16,766	..	19,767	184	28,635	5,914
Sweet sorghum (bus.) ..	3	..	421	..	901	..
Sudan grass (lb.) ..	120,066	..	94,585	..	57,418	5,100
French beans (bus.) ..	504	6½	637½	36	546	..
Tomatoes (lb.) ..	109½	9½	218	3	687	..
Buffel grass (lb.) ..	25	..	789	..	..	..
Cowpea (bus.) ..	..	..	..	..	20	..

### REGISTRATION

It is interesting to note that in the year 1952-53, when "The Agricultural Standards Act of 1952" was promulgated, the number of agricultural requirements registered was 1,728. The number of applications for the registration, re-registration or extension of registration of agricultural requirements rose from 3,762 last year to 4,152 this year. Surely this phenomenal increase in 10 years is a clear indication of the tremendous development of scientific agriculture and the importance placed on these aids to agriculture.

The rise in the number of preparations since the previous 12 months occurred despite the withdrawal from sale of 92 preparations advocated for use on cattle and sheep. These withdrawals were a result of an amendment to Regulation 27 of "The Stock Acts, 1915 to 1960," which prohibited the use of preparations containing chlorinated hydrocarbons such as aldrin, BHC, DDT, dieldrin, or toxaphene for use on cattle, and aldrin, dieldrin or endrin for use on sheep.

The Agricultural Requirements Board, at 20 meetings, reported on the efficacy of 638 preparations of which 367 were pest destroyers and 271 were veterinary medicines. On the recommendation of the Board, 10 pest destroyers and 3 veterinary medicines were refused registration.

One of the preparations refused registration was a penicillin udder infusion advocated for the control of mastitis, containing a blue marker dye. The board decided not to recommend the use of these preparations containing blue dye until such time as a decision has been made by the National Health and Medical Research Council on its use in milk products.

"The Agricultural Standards (Veterinary Medicines) Regulations of 1952" were amended to declare Shope Fibroma Virus a prohibited material in respect to veterinary medicines. The use of this material is a potential threat to the continued value of myxomatosis in rabbit control.

As a result of another amendment to the Veterinary Medicine Regulations prescribing oestrogens to be prohibited materials, there are no preparations containing these substances (stilboestrol and hexoestrol) now registered for sale in Queensland. These preparations were used for the chemical caponisation of poultry and to induce weight gains in cattle.

### INSPECTION—AGRICULTURAL STANDARDS

Agricultural Standards Inspectors carried out 1,608 inspections of wholesale and retail establishments in 139 towns during the year.

Inspection of crop and pasture seeds offered for sale in the main agricultural districts continued to be a vital activity. Details of action taken with respect to unsatisfactory seed are set out in Table 3.

TABLE 3  
ACTION TAKEN ON UNSATISFACTORY SEEDS

	1961-62	1962-63
Cleaned under supervision or by instruction—		
(i) Agricultural crop seeds	2,131 bags	2,964 bags
(ii) Vegetable seeds	..	994 lb.
Destroyed or otherwise rendered unsuitable as seed—		
(i) Agricultural crop seeds ..	164 bags	633 bags
(ii) Vegetable seeds .. ..	625 lb.	3,410 lb.
(iii) Packeted seeds .. ..	526 pkt.	57 pkt.
Processed for stock foods—		
(i) Agricultural crop seeds ..	521 bags	1,419 bags
(ii) Vegetable seeds .. ..	..	60 lb.

Inspections of farm produce were maintained at Roma Street railhead, the interstate railway yards at South Brisbane and Clapham Junction, while inspections were initiated at the Brunswick Street and Woolloongabba railway yards.

Inspections were made on 6,439 consignments comprising 178,610 bags of chaff, 339,475 trusses of hay, 109,388 bags of grain, and 28,152 packages of sundry materials.

A total of 36 consignments were detained, comprising 3,753 packages of various produce. Of these, 2,854 packages were reconditioned and released, 49 packages were destroyed and 850 packages were diverted to the holding yards at the Brisbane Abattoirs and fed to stock awaiting slaughter.

A summary of action taken by inspectors with respect to agricultural requirements other than seeds is set out in Table 4.

TABLE 4  
SUMMARY OF ACTION ON AGRICULTURAL REQUIREMENTS EXCLUDING SEEDS

	1962-63					
	Fertilizers	Lime	Pest Destroyers	Veterinary Medicines	Stock Foods	Total
Samples received from—						
Inspectors .. ..	20	10	117	13	596	756
Buyers .. ..	..	..	3	..	13	16
Seized .. ..	567 (b)	..	1,126 (b)	3,296 (b)	75 (a) 969 (c) 2,536 (d)	..
Reconditioned, relabelled or deficiency rectified ..	567 (b)	..	658 (b)	3,296 (b)	173 (e) 75 (a) 193 (c) 2,536 (d)	..
Destroyed .. ..	..	..	321 (b)	..	50 (e) 49 (c)	..
Diverted to Abattoir .. ..	..	..	..	..	727 (c) 123 (e)	..
Withdrawn from sale .. ..	..	..	147 (b)	..	..	..

(a) Bags of prepared stock foods; (b) Packages, tins or bottles; (c) Trusses of hay; (d) Bags of grain; (e) Bags of chaff.

A new activity included on behalf of the Commonwealth Department of Primary Industry was the inspection of 152,683 tons of bulk wheat at the Pinkenba and Gladstone shipping terminals for export to Mainland China.

Under the terms of the Export (Grain) Regulations, these inspections were carried out to determine freedom from insect pests, specific weed seeds and certain plant diseases.

Railway truck inspections disclosed an alarmingly high degree of infestation by all major and minor insect pests of stored grain, particularly in south Queensland wheat received at Pinkenba.

Ship inspections entailed an examination of 13 ships' holds to ascertain cleanliness and suitability to carry wheat, while continuous sampling and inspections on wheat being loaded aboard were also carried out. Certificates were issued covering the condition of the wheat.

The average bushel weight for the 152,683 tons of wheat exported to Mainland China was 65 lb., with an average moisture content of 11.41 per cent. Protein values averaged 12.24 per cent. while the average admixture content was 0.205 per cent.

### INSPECTION—FRUIT AND VEGETABLES

The policy of maintaining and improving the quality of fruit and vegetables marketed in Queensland has been continued to ensure that sub-standard produce is removed from the markets and retail shops.

During the year a prosecution against a farmer for removing produce from seizure under "The Fruit and Vegetables Acts, 1947 to 1959," was successful.

Retail shop inspection in the Brisbane, Ipswich and Redcliffe areas was maintained, with emphasis being placed on roadside stall and larger distributing retail shops. A total of 2,402 inspections was made. As a result of this service, the general quality of fruit and vegetables offered for sale in retail establishments has been maintained.

The larger chain store operators have maintained their standards and improved their handling techniques. Prepacking of fruit and vegetables increased during the year and the washing and prepacking of potatoes is now a well-established

practice. Bulk bins of oranges and apples appeared in quantity during the year and were generally suitable for the prepacking and self-service establishments. However, bruising of large Granny Smith apples, probably accentuated by this mode of packaging, caused concern.

Inspections on deliveries by road and rail to produce merchants totalled 456,419 bags of potatoes, 95,577 bags of pumpkins and 242,735 bags of onions. Of these totals, approximately 5 per cent. of the potatoes, 2 per cent. of the pumpkins and 12 per cent. of the onions were found to be faulty, and wherever possible reconditioning was carried out, thereby preventing unnecessary waste.

The total amount of fruit and vegetables condemned during the year was 71,742 packages. Much of this produce was marketed in times of oversupply and became unsound while it remained on agents' sections awaiting sale.

The regrading of fruit and vegetables during the year amounted to 76,671 packages. Apples, pears, tomatoes, citrus fruit, stone fruit, rockmelons, cucumbers, potatoes, onions and pumpkins were the main varieties of fruit and vegetables with faults.

Details of fruit and vegetables condemnations, regrading and reconditioning are set out in Tables 5 and 6.

TABLE 5  
FRUIT AND VEGETABLES DIRECTED FOR REGRADING AND RECONDITIONING

	Pkgs.	Lb.	Doz.	Bun.		Pkgs.	Lb.	Doz.	Bun.
<i>Fruit—</i>					<i>Vegetables—</i>				
Tropical fruits .. ..	1,466	..	42	..	Cucumbers and salad				
Citrus fruits .. ..	4,032	..	..	..	vegetables .. ..	1,358	..	..	..
Apples and Pears .. ..	12,358	..	..	..	Potatoes .. ..	24,712	..	..	..
Stone fruits .. ..	1,280	..	..	..	Onions .. ..	21,257	..	..	..
Tomatoes .. ..	5,934	..	..	..	Pumpkins .. ..	2,255	..	..	..
Rockmelons .. ..	828	..	..	..	Root vegetables .. ..	554	..	..	..
Other fruits .. ..	192	1,344	..	..	Other vegetables .. ..	445	..	..	..
Totals .. ..	26,090	1,344	42	..	Totals .. ..	50,581	..	..	..

TABLE 6  
MARKET CONDEMNATIONS—FRUIT AND VEGETABLES

	Pkgs.	Lb.	Doz.	Bun.		Pkgs.	Lb.	Doz.	Bun.
<i>Fruit—</i>					<i>Vegetables—</i>				
Tropical fruits .. ..	2,527	..	298	847	Cucumbers and salad				
Citrus fruits .. ..	3,092	..	..	..	vegetables .. ..	9,744	..	..	1,446
Apples and Pears .. ..	11,103	..	..	..	Cabbages, cauliflowers .. ..	1,426	..	4,304	..
Stone fruits .. ..	4,422	..	..	..	Beans .. ..	7,500	..	..	..
Tomatoes .. ..	9,744	..	..	..	Potatoes .. ..	6,242	..	..	..
Rockmelons .. ..	1,906	..	..	..	Onions .. ..	5,231	..	..	..
Other fruits .. ..	1,677	4,144	497	..	Pumpkins .. ..	1,099	..	..	..
Totals .. ..	34,471	4,144	777	847	Root vegetables .. ..	4,330	..	239	484
					Other vegetables .. ..	1,699	..	..	1,378
					Totals .. ..	37,271	..	4,543	3,308

### IMPORTS AND EXPORTS

Imported seed totalling 1,370 packages was detained and cleaned under supervision for the removal of prohibited material, while 285 packages of seed were inspected at the Customs Section of the Parcel Post Office and at the Eagle Farm Airport.

Velvet beans from South Africa totalling 2,636 bags (Table 7), continued to contain seeds of maize (*Zea mays*), a prohibited import, necessitating cleaning and dusting with a fungicide before release for sale.

TABLE 7  
IMPORTS—SEED FOR SOWING

<i>Agricultural Seeds—</i>		Bags
Centrosema .. ..	..	70
<i>Pueraria javanica</i> .. ..	..	6
<i>Stylosanthes gracilis</i> .. ..	..	9
Mangel .. ..	..	8
Clover .. ..	..	172
Rape .. ..	..	130
		395
<i>Grass Seeds—</i>		Bags
Molasses grass .. ..	..	23
Coloniao grass .. ..	..	131
Rye grass .. ..	..	45
Bahia grass .. ..	..	10
		209

TABLE 7—continued

<i>Velvet Beans</i> .. ..	..	2,636 bags
<i>Vegetable Seeds—</i>		Lb.
Beet .. ..	..	454
Cabbage .. ..	..	57
Carrot .. ..	..	134
Cauliflower .. ..	..	13
Celery .. ..	..	2
Cucumber .. ..	..	178
Lettuce .. ..	..	61
Marrow .. ..	..	5
Melon .. ..	..	171
Onion .. ..	..	11
Pumpkin .. ..	..	5
Radish .. ..	..	8
Turnip—kohl rabi .. ..	..	10
Miscellaneous vegetables .. ..	..	64
		1,173
Peas .. ..	..	797 bags
Herbs for culinary purposes .. ..	..	26 lb.
Miscellaneous parcels .. ..	..	130 bags

Grain and crop seed exports (Table 8) continued to find a buoyant overseas market. Major export items included 267,563 bags of bird seed grain, 409 tons Poona cowpea grain and 141 tons of pasture seeds. Principal grass seed exports included 102 tons paspalum seed, and 36 tons of carpet grass from northern New South Wales.

TABLE 8  
EXPORTS—GRAINS, SEEDS, &C.

Wheat .. .. .	152,683 tons
Beans .. .. .	233 lb.
Buffel grass .. .. .	1,900 lb.
Canary .. .. .	98,364 bags
Cowpea .. .. .	409½ tons
Carpet grass .. .. .	80,364 lb.
Centrosema .. .. .	131 lb.
Clover .. .. .	41 lb.
Green panic .. .. .	499 lb.
Blue panic .. .. .	2 lb.
Guinea .. .. .	1,141 lb.
Japanese millet .. .. .	2,538 bags
Lucerne .. .. .	522 lb.
Maize .. .. .	12,131 bags
Mixed bird seed .. .. .	47 bags
Molasses .. .. .	110 lb.
Mung bean .. .. .	25,200 lb.
Oats .. .. .	290 lb.
Paspalum .. .. .	227,878 lb.
Phasey bean .. .. .	248 lb.
Pueraria .. .. .	267 lb.
Rhodes .. .. .	2,325 lb.
Setaria .. .. .	42,458 bags
Siratro .. .. .	20 lb.
Sorghum .. .. .	15 bags
Sunflower .. .. .	1,691 bags
Soybean .. .. .	33 lb.
Stylosanthes .. .. .	12 lb.
White French millet .. .. .	124,156 bags
Miscellaneous grasses .. .. .	24 lb.

Queensland fruit and vegetables totalling 249,511 packages were exported during the year (Table 9). Under the provisions of the Exports (Fresh Fruit) Regulations, 175,800 bushel cases of apples and 13,129 cases of pears were inspected at approved packing houses in the Granite Belt district. Final inspections were conducted at the wharf area in Brisbane.

The quality of apples submitted for export inspection was not as high as in previous years and rejections were relatively heavy. Inspections for Phytosanitary Certificates showed a marked increase on previous years.

A further increase in the quantity of fruit and vegetables exported to New Guinea and the adjacent islands was recorded.

TABLE 9  
QUEENSLAND EXPORTS—FRUIT AND VEGETABLES

Apples .. .. .	175,800 cases 38 bins (approx. 25 x 1 bus. cases each)
Apricots .. .. .	55 cases
Avocadoes .. .. .	68 cases
Bananas .. .. .	28 cases
Cherries .. .. .	67 cases
Grapes .. .. .	459 cases
Grapefruit .. .. .	460 cases
Lemons .. .. .	372 cases
Mandarins .. .. .	752 cases
Mangoes .. .. .	9 cases
Nectarines .. .. .	42 cases
Oranges .. .. .	22,906 cases

TABLE 9—continued

Papaws .. .. .	80 cases
Passion-fruit .. .. .	20 cases
Peaches .. .. .	186 cases
Pears .. .. .	13,129 cases
Pineapples .. .. .	24 cases
Plums .. .. .	235 cases
Rockmelons .. .. .	2 cases
Strawberries .. .. .	30 cartons
Tomatoes .. .. .	7,480 cases
Beans .. .. .	133 cases
Beetroot .. .. .	9 cases
Cabbages .. .. .	86 bags
Cauliflowers .. .. .	1,538 cases
Capsicums .. .. .	386 bags
Carrots .. .. .	114 cases
Celery .. .. .	35 bags
Choko .. .. .	689 cases
Cucumbers .. .. .	1,003 cases
Eschallots .. .. .	798 bags
Lettuce .. .. .	577 cases
Marrows .. .. .	14 cases
Mushrooms .. .. .	863 cases
Onions .. .. .	12 cases
Parsnips .. .. .	2,750 cases
Parsley .. .. .	11 cases
Peas .. .. .	10 cases
Potatoes .. .. .	908 cases
Pumpkins .. .. .	7,873 bags
Radish .. .. .	360 bags
Rhubarb .. .. .	41 cases
Swede Turnip .. .. .	41 cases
Sweet Potatoes .. .. .	14 cases
Turnips .. .. .	4,481 cases
Total number of packages .. .. .	3,319 bags
Total number of bins .. .. .	798 bags
The total includes 24,093 cases of Queens- land apples exported ex Sydney	3 cases
	91 cases
	387 bags
	1 bag
	3 bags
	249,511
	38

#### THE FARM PRODUCE AGENTS ACTS

One hundred and eleven farm produce agents were licensed during the year. Of these 73 are in the Brisbane area while country agents are situated in 21 centres throughout the State.

Inspections of the books of account of several Brisbane agents and some country agents were made during the year. These revealed that the consignments were accurately accounted for and payments made correctly to producers.

#### INTERSTATE CONFERENCES

Staff members again took advantage of interstate conferences for discussion and contact with their opposite numbers in other States.

#### STAFF RECRUITMENT

An innovation in so far as the Branch was concerned was the development of a scheme for the appointment of cadets. Cadets are now employed in the Seed Laboratory and Registration Section and pursue studies for either the Diploma in Industrial Chemistry or the Certificate of Laboratory Technology. A continuation of this scheme should provide a constant flow of specialist officers for the Branch.

## CLERICAL AND GENERAL DIVISION

The total staff of the Department at June 30, 1963, was 1,652 officers. Of this number, 313 were Clerks, Clerk-Typists, Male Assistants and Female Assistants as shown in the following table:—

	Brisbane	Country	Total
Clerks .. .. .	101	9	110
Clerk-Typists .. .. .	92	91	183
Male Assistants .. .. .	13	1	14
Female Assistants .. .. .	5	1	6
	211	102	313

The appointment of male clerks and clerk typists to country branches of the Department is proceeding. Such appointments relieve technical officers of many routine clerical duties and enable them to devote more time to their primary duties in the field. These appointments also ensure that offices are always open during business hours for the convenience of the public. During the year 5 more male clerks and 16 female officers were appointed to country centres. Clerks are now located at Toowoomba, Warwick, Kingaroy, Ayr, Biloela and Oonoonba. Two more are undergoing training at Head Office before being transferred to country offices.

### TRANSPORT

Seventy-three motor vehicles were purchased during the year. Forty-six of these were replacements for vehicles which had served their economical lives and 27 were additions to the fleet. Twenty-one of the new vehicles were purchased from funds provided by the Commonwealth and from Trust and Special Funds.

In the interests of economy, it would be desirable to have a quicker turn over of official vehicles, but unfortunately insufficient money is available to replace all vehicles that have travelled more than 40,000 miles. As a consequence, there is still a number of vehicles in use which it would be better to replace. Forty-eight old vehicles were sold during the year and 14 are awaiting disposal. The Department now has 368 cars and trucks in its fleet, and these are located at 96 centres throughout Queensland.

### HOUSING

The Government's housing programme for country public servants is doing a great deal to relieve the difficulty in finding suitable accommodation for these officers. During the last few years, 27 houses were either erected or purchased for this Department. Twenty houses have been erected during the last 2 years and 14 more have been requested for 1963-64. The Queensland Housing Commission has been most co-operative and has made homes available when other accommodation could not be obtained.

### OFFICE ACCOMMODATION

Some relief from the overcrowding of offices in Brisbane followed the transfer of certain sections of the Department of Health and Home Affairs to new quarters. However, the problem has not yet been wholly overcome and a considerable amount of space is still required before it can be said that officers are comfortably accommodated.

There has been a very rapid improvement in country office accommodation in the past few years. New offices have been completed or are under construction at a number of centres, and others are planned. During the year additional space was provided at Roma, Bowen, Rockhampton and Winton, while extensions to the Court House at Longreach and a new Court House at Blackall have provided officers with excellent accommodation. At Laidley and Gatton new Government buildings are being erected, and it is known that new offices are planned for Cairns, Oakey and other centres.

### RECORDS

There was another big increase in the volume of correspondence handled by the Records Branch during the year. A comparison of the last 3 years is given in the following table:—

#### Mail Registered

Year	Inward	Intramural	Outward	Total
1960-61	98,126	14,863	59,631	172,620
1961-62	104,537	12,268	61,496	178,301
1962-63	119,339	12,781	66,614	198,734

These figures do not include the many thousands of forms and returns which are handled, sorted and distributed to the appropriate Branches each year. A 20 per cent. increase in the use of the file bring-up service during the year has assisted in making the Records Branch more efficient and ensured that files required urgently can be produced without delay.

Branches are making extensive use of the photo-copying machine for securing quick copies of articles and drawings. Work of this kind has also been done for other Departments, including those of the Public Service Commissioner, Irrigation, and the State Stores Board.

### ACCOUNTS

The total expenditure and receipts of the Department for the year 1962-63, compared with 1961-62, are as follows:—

	Expenditure		Receipts	
	1961-62	1962-63	1961-62	1962-63
	£	£	£	£
Consolidated Revenue .. .. .	1,737,361	1,918,903	274,275	299,652
Trust and Special Funds .. .. .	1,792,392	2,023,423	1,753,878	1,968,837
Loan Fund .. .. .	..	7,665	..	..
Schedule B—				
Salary of Minister .. .. .	3,852	3,852	..	..
Schedule C—				
Stock Fund .. .. .	316,273	315,135	..	..
Banana Industry Fund .. .. .	6,847	6,694	..	..
<b>Total .. .. .</b>	<b>£ 3,856,725</b>	<b>4,275,672</b>	<b>2,028,153</b>	<b>2,268,489</b>
Included in the figures shown for Trust and Special Funds are the following on account of the Sugar Bulk Handling facility .. .. .	1,075,446	415,880	355,157	329,909

Further statistical figures are detailed below:—

	1961-62	1962-63
Vouchers paid .. .. .	41,442	46,262
Receipts issued .. .. .	27,841	29,638
Cheques drawn .. .. .	60,730	67,496
Income-earning Certificates issued	2,221	2,399
Orders issued for vaccines and services .. .. .	3,717	4,363
Number of T.B. accounts .. .. .	32	14

### EXTENSION SERVICES

Two more extension schools were conducted during the year, the total enrolment being 65 Departmental officers. One of the schools followed the pattern of the extension methods

schools which have been conducted regularly for several years. The other was a combined farm management and extension supervision school which was attended mainly by district supervising officers. The farm management section of the school dealt with farm budgeting methods, farm accounts and other aspects of farm management. The supervision section covered such subjects as duties of supervisors, staff training and assessment, programme planning, interviewing and general aspects of field supervision.

A large volume of extension material, ranging from circular letters and field day notices to a large staff training manual, was printed on the Departmental offset duplicating machine. In addition some 900 broadcasting tapes covering 200 different items of interest to primary producers were

prepared and distributed to radio stations throughout the State. These tapes are used mainly in special sessions for farmers and reach a large audience.

With the opening of television stations in provincial cities, attention is being given to the use of motion picture film on primary industry matters through this medium. Some short experimental films are being made.

An experiment in the group approach to agricultural extension was continued into its second year by an extension research officer stationed at Toowoomba. A group of farmers on the Darling Downs agreed to co-operate in this work, and the Ashall Creek Soil Conservation Group was formed. The project aims at discovering whether the rationale for community development has application to rural Queensland and whether this approach could be employed by extension authorities. It is anticipated that a first evaluation will be possible in 1963-64 and that the final evaluation will be carried out 2 or 3 years after the withdrawal of the research officer. The policy has been that farmers identify their problems and determine which will be tackled within each 6-monthly period.

#### LIBRARY AND ABSTRACTING SERVICE

The library staff continued the circulation of periodicals and books on technical subjects to Departmental officers and to other libraries to enable them to keep abreast of new developments and improved farm practices in other countries. A monthly average of 1,200 periodicals is handled in the library, while the number of loans made is about 450 a month.

Obviously there are far too many periodicals and books for officers to read, so they are assisted by the Science Abstractor who makes short abstracts of material of interest to the Department from technical papers, periodicals, and

reports. Officers receive these through their Branches and the original papers dealing with the subjects in which an officer is particularly interested can then be obtained from the Central Library.

#### PHOTOGRAPHY SECTION

The Section is turning out excellent work following the purchase of some modern equipment. Apart from developing and printing exposures of special subjects made by the photographers themselves, the Section also processes film for field and technical officers for use in illustrated articles for the farming community.

More new films were added to the Central Film Library during the year. Officers are making good use of films at night meetings of farmers in country centres. They are an excellent extension medium.

#### PUBLICATIONS

The monthly *Queensland Agricultural Journal* maintained a steady circulation. Many tributes have been paid to the new form of presentation of this publication and to the value of the carefully-prepared advisory articles which appear as contributions from Departmental officers. Many of the articles that appeared in the *Journal* were reprinted for issue as advisory leaflets.

A weekly Press Release was again circulated to more than 100 newspapers and radio stations. In addition a 150-word precis of each item was forwarded to selected A.B.C. stations. Articles relating to current activities of the Department and others containing items of topical interest to the rural community were prepared regularly and released to newspapers, news agencies and radio stations.

