QUEENSLAND

Annual Report

of the

DEPARTMENT of AGRICULTURE and STOCK

1961-62

PRESENTED TO PARLIAMENT BY COMMAND

A. 34—1962

ORGANISATION OF THE DEPARTMENT AS AT 30th JUNE, 1962

MINISTER FOR AGRICULTURE AND FORESTRY .. Hon. O. O. Madsen, M.L.A.

CENTRAL ADMINISTRATION AND CLERICAL AND GENERAL DIVISION—

Director-General and Under Secretary .. .. W. A. T. Summerville, D.Sc.
Deputy Director-General .. .. W. Webster, B.V.Sc.
Assistant Under Secretary .. .. H. Barnes.
Special Administration Officer .. .. C. L. Harris, A.A.S.A.
Officer in Charge, Information Services .. .. C. W. Winders, B.Sc.Agr.
Accountant .. .. E. C. R. Sadler, A.A.U.Q.

DIVISION OF PLANT INDUSTRY—

Director of the Division .. .. W. J. S. Sloan, M.Sc.Agr.

Agriculture Branch—

Director of Agriculture .. .. L. G. Miles, B.Sc.Agr., Ph.D.

Horticulture Branch—

Director of Horticulture .. .. J. H. Smith, N.D.A., M.Sc.

Soil Conservation Branch—

Director, Soil Conservation Branch .. .. .. J. E. Ladewig, B.Sc.Agr.

Science Branch—

Sections of Botany (S. L. Everist, B.Sc., Government Botanist); Entomology (W. A. McDougall, D.Sc., Government Entomologist); and Plant Pathology (B. L. Oxenham, B.Sc., Government Plant Pathologist).

Agricultural Chemical Laboratory Branch—

Director, Agricultural Chemical Laboratory Branch W. J. Cartmill, M.Sc., A.R.A.C.I.

Food Preservation Research Branch—

Director, Food Preservation Research Branch .. S. A. Trout, M.Sc., Ph.D., F.R.A.C.I

DIVISION OF ANIMAL INDUSTRY—

Director of the Division .. .. A. L. Clay, B.V.Sc.
Assistant Director .. .. C. R. Mulhearn, B.V.Sc.

Veterinary Services Branch—

Director of Veterinary Services .. .. .. C. R. Mulhearn, B.V.Sc.

Pathology Branch—

Director .. .. L. G. Newton, B.V.Sc.

Biochemical Branch—

Biochemist .. .. J. M. Harvey, D.Sc., A.R.A.C.I.

Husbandry Research Branch—

Director of Husbandry Research .. .. .. J. W. Ryley, B.V.Sc.

Sheep and Wool Branch—

Director of Sheep Husbandry .. .. A. T. Bell, B.V.Sc.

Cattle Husbandry Branch—

Director of Cattle Husbandry .. .. .. D. N. Sutherland, B.V.Sc.

Pig and Poultry Branch—

Sections of Pig Husbandry (F. Bostock, Senior Pig Husbandry Officer); and Poultry Husbandry (F. N. J. Milne, B.Sc., Senior Poultry Husbandry Officer).

DIVISION OF DAIRYING—

Director of Dairying .. .. E. B. Rice, Dip.Ind.Chem., M.Inst.Biol.

Research Branch—

Director of Research .. .. L. E. Nichols, B.Sc.Agr., A.R.A.C.I.

Field Services Branch—

Director of Field Services .. .. V. R. Smythe, M.Agr.Sc.

DIVISION OF MARKETING—

Director of Marketing .. .. A. A. Ross, M.Agr.Sc.

Marketing Branch—

Director of Marketing .. .. A. A. Ross, M.Agr.Sc.
Assistant Director of Marketing .. .. .. D. P. Lapidge, B.Comm.

Economics Research Branch—

Director of Economic Services .. .. E. O. Burns, B.Ec.

Standards Branch—

Standards Officer .. .. A. C. Peel, Dip.Ind.Chem., A.R.A.C.I.

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REPORT OF THE DEPARTMENT OF AGRICULTURE AND STOCK FOR THE YEAR 1961-62

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, 1962. 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 of Agriculture and Stock.

GENERAL REVIEW

The dry conditions which prevailed during the autumn and early winter of 1961 were only partly relieved in July, when useful rains were received in south-eastern Queensland late in the month. These allowed general planting of winter cereal crops and improved the outlook for southern dairy farmers. Follow-up rain in the southern agricultural areas in August allowed completion of planting of winter cereals. The grain crops then went through a dry period until early October and in mid-November heavy to flood rains with storms were received in south-eastern districts. These falls at harvest time caused abandonment of a large area for grain and depressed grain quality in many districts.

Up till this stage the pastoral districts had remained dry, with some stock losses recorded. Variable storm rains brought relief from near-drought conditions in the North in November, but it was not until December that widespread storm rains were received. These did not benefit the Far South West and isolated parts of the west.

January brought good storm rains to most of the State and prospects for the agricultural and pastoral conditions at that time were bright. However, the usual February monsoonal rains did not penetrate further south than Mackay, and pastures and water supplies deteriorated in central and southern areas. These areas were relieved by good rains in the first half of March, and northern areas were then in fair condition from the February rains. The western areas had received patchy rainfall but the outlook for winter was not bright.

Good rains in April improved the outlook in central and southern areas. Despite below-average rainfall over most of the State in May and June, pastures were in fair to good condition for that time of the year and stock were expected to winter reasonably well. Light rains in early June allowed most of the winter grain crops to be planted.

THE BEEF INDUSTRY

Although unfavourable seasonal conditions were experienced over a large portion of the State in the winter and spring of 1961, both cattle numbers and beef and veal production have shown a tendency to rise.

Beef cattle numbers increased by 99,000 to a total of 5,890,000 at March 31, 1962. There were gains of 89,000 and 82,000 in South Queensland and Central Queensland, respectively, but a decrease of 72,000 in North Queensland. The total was the highest recorded since 1958.

A marked rise in beef and veal production in 1961-1962 corrected the decline from the high level of 1958-59 that was evident in the two succeeding years. With cattle numbers now at a high level and a large number of properties developed for early turn-off of cattle through the use of improved pastures or crops, it is expected that production will be maintained at a high level over the next few years.

Trends in consumption of beef are causing concern to the beef industry. Consumption of beef and veal in Australia declined from 129 lb. per head in 1956-57 to 87 lb. per head in 1960-61. With production now rising, a larger amount of beef will have to be offered for sale on less remunerative markets overseas if domestic consumption is not improved.

A significant development in relation to the beef industry during the year was the announcement of agreement between the Commonwealth and State Governments on a programme of construction of roads to serve some of the more remote beef cattle areas of the State. The roads covered by the agreement are Normanton-Julia Creek (already under construction); Georgetown-Mt. Surprise-Hann Highway; Mt. Isa-Dajarra; Dajarra-Boulia; Winton-Boulia; and Quilpie-Windorah. Development of these roads will provide better facilities for movement of store cattle from breeding areas to fattening areas and for movement of fat cattle out of the Channel Country to railheads for onward movement to meatworks.

In the past 10 years increasing attention has been focussed on the important role of the brigalow scrub areas of the State in the cattle industry. While there has been considerable development within these areas, there still remain extensive uncleared areas of brigalow. The future development of this region has been a matter for joint consideration by the Commonwealth and State Governments. An investigation of the economics of development of this class of country was made during the year by the Bureau of Agricultural Economics. This indicated that such development would be a sound investment and plans are in hand for Government assistance to stimulate development of the region.

Interest of cattlemen in pastures and fodder crops has been sustained at a strong level in spite of a downward trend in beef prices. It has been shown that, in areas where rainfall and soil are suitable for cropping, the use of existing pasture species and fodder crops can be integrated with the management of native pastures to provide a level of nutrition good enough to ensure almost continuous weight gain.

The regions offering greatest scope for some form of intensive development include the brigalow belt, the open grasslands of the Central Highlands and the Darling Downs, and much of the eastern open-forest country. Activity along these lines is increasing in the Burnett, in the Rockhampton and Mackay hinterlands, and in the Darling Downs, Maranoa and Goondiwindi districts.

THE SHEEP INDUSTRY

Taken over all, the sheep country experienced droughty conditions in the first quarter of the year, the second quarter saw partial relief, the third gave good rains and considerable relief, and further rains in the final quarter made the general outlook for winter favourable. Unfortunately, the drought conditions which have prevailed in the far south-west for some years still exist over much of the region.

Wool sales during the 1961-62 season realised almost £55½ million for 772,997 bales. The amount of wool was slightly less than in the previous year, but an increase in the average price from 53·42d. to 54·64d. resulted in an increase of 2·89 per cent. in the aggregate return.

Japan has firmly established itself as the most prominent buyer of Australian wool, although its buying at one stage of the season was reduced because of the domestic financial position. Strong support at auctions throughout the year came from Italy, France and Britain; U.S.A. and Communist bloc countries bought to a lesser extent.

After graziers had intimated by ballot their assent to a higher levy for wool promotion, the Commonwealth Government amended the relevant legislation to provide for a new promotion levy of 10s. per bale, against the previous levy of 5s. The yield for promotion purposes is approximately £2·4 million per annum. The levy for research yields about half a million.

The report of the Wool Marketing Committee of Enquiry appointed by the Commonwealth Government to enquire into the present systems of marketing and of promoting the Australian wool clip and to report on the merits of other systems or modifications has been given close consideration by Governments, industry and others concerned.

Plate 1.—Applying weedkiller in a blady grass control trial on dairying country at Cooroy.

Plate 2.—Weedicide trial in wheat crop infested with wild oats in the Maranoa.

Slaughtering of mutton sheep was maintained at a high level throughout the year and the total for sheep treated at Queensland meatworks was about 1½ million. Slaughterings of lambs at Queensland meatworks rose by 7·8 per cent. to 338,282, but many of these came from New South Wales.

The level of wool prices in recent years has not been high enough to stimulate widespread interest in pasture improvement. Most of the pasture work has been done where brigalow and gidyea scrub lands have been under development, but there has been activity also in mulga-box country following successful establishment of buffel grass in pushed mulga. Research and extension work on pastures in sheep country has been increased by the stationing of agrostologists at Toorak Field Station in the north-west, at Blackall in the central-west and at Charleville in the south-west. Staff increases at Emerald and Roma will permit increased attention to be given to sheep pastures in the Central Highlands and at the Maranoa.

DAIRYING

Seasonal conditions were generally favourable for dairying, and butter and cheese manufacture were both appreciably higher than in the previous year.

The marketing situation in Britain was highly competitive and returns were at a low level until November. However, butter prices then recovered to some extent and later reached 304s. sterling per cwt., the highest figure for some years. Action was taken by the Australian Dairy Produce Board to limit butter exports to Britain during the ensuing 12 months to 62,00 tons, the average annual disposal over the past few years, but as the exportable surplus was expected to exceed this amount, the Board actively tried to expand sales elsewhere.

Because of high production and weak prices Australia and New Zealand agreed to limit shipments of cheese to the United Kingdom. Indications are that difficulty will arise in disposing of even normal production of cheese in 1962-63.

Much significance is attached to an agreement entered into between the Australian Dairy Produce Board and an Asian company for the joint establishment in some South-east Asian countries of dairy factories which will process Australian dairy produce.

A new Dairy Stabilisation Act passed by the Commonwealth Government deals with bounty arrangements for the industry for the next five years. Bounty has been fixed at £13,500,000 yearly, although the Dairy Industry Committee of Enquiry had recommended a gradual tapering off of the amount. Processed milk products will attract a bounty of £350,000 in the first year.

A proposal that financial assistance be given to certain farms that have a potential for producing 8,000 lb. commercial butter equivalent per annum and have not reached that potential has been under consideration by the Australian Agricultural Council during the year.

The number of commercial dairy farms in Queensland continues to decline, and the fall in 1961-62 was about 1,000 to a total of 16,000. Movement of farmers out of the industry is not proceeding in a uniform fashion throughout the State. There appears to be an accelerated trend away from dairying in those areas where resources are adequate for other types of enterprise such as vealer production, sheep raising and cash cropping.

Another continuing trend is the increase in milk intake of dairy produce factories at the expense of cream intake. Part of this increase is due to an upward trend in the State's consumption of pasteurised and heat-treated milk, particularly in the west.

A major problem of the dairying industry is the decreasing productivity of coastal pastures in areas with a high concentration of dairy farms. The decline is closely associated with declining fertility and the invasion of the areas by poor grasses such as mat grass. Research has been directed to this problem, and the work has been strengthened by a monetary grant from the Dairy Produce Research Committee. Some useful results have been achieved, but renovation costs are considered to be rather high where the farm product is cream.

The increasing use of tropical and subtropical pasture legumes throughout the dairying areas is a good sign. As commercial seed supplies of some of the newer legumes increases, wider sowings will certainly be made.

Matters of considerable interest and importance to dairy farmers are currently under investigation by the Economics Research Branch. In the Wide Bay and Eastern Darling Downs districts, budgetary analysis is being employed to assess the effects of changes in farm practices on capital investment, costs and returns and labour use. The study is yielding information which will be of use to farmers considering possible changes in farm practices, such as irrigation and pasture improvement. One thing that is being underlined by the information being gathered is that managerial ability has a considerable influence on the farmer's capacity to make a profit. In the South Burnett, a study was made of vealer production as a sideline enterprise in order to clarify the economic issues involved.

Departmental work aimed at dairy herd improvement embraces three main aspects—herd recording, artificial insemination and cross-breeding.

The application of herd recording in commercial herds has resulted in a steady improvement in the production levels of recorded herds despite adverse seasonal conditions. Though less than 8 per cent. of all herds in the State are production recorded, much of the information obtained has general application and is being widely employed in herd management in all dairying districts.

Over the past few years, artificial insemination has been encouraged from the point of view of reducing infertility diseases rather than of herd improvement. At the same time, proving of bulls has been going on, and with the progeny of these bulls coming into production it has been possible to measure the value of the bulls in herd improvement. The setting up of the new Artificial Insemination Centre at Wacol will enable proving to be carried on at an accelerated pace and also make available a much larger volume of semen for use by co-operatives.

At the Cattle Field Station at Ayr, facilities are being rapidly developed to enable a programme of breed improvement for the tropics to be actively pursued. First cross stock of Sahiwal x A.I.S. and Sahiwal x Friesian are being assembled from the Research Stations at Biloela and Kairi, and Sahiwal x Jersey crosses are being bred at the Ayr Station. Production recording of the various crosses is expected to begin this year.

CROPS

The 1961 sugar cane crop yielded 1,315,588 tons of 94 n.t. sugar from 9,021,835 tons of cane crushed. The value of the raw sugar produced was £65½ million. Crushing of the 1962 crop began early in June, with an estimated crop of over 11 million tons of cane available.

Matters of primary concern to the industry during the year were overseas markets and the domestic price of sugar.

The suspension of quotas under the International Sugar Agreement for two years, following the breakaway by Cuba, ended for a time the common marketing policy that had operated on an international level since 1937. The British Commonwealth Sugar Agreement assures Australia a market for about a quarter of its present annual production at a negotiated price as far ahead as 1969. The terms of Britain's entry into the European Common Market, if this is effected, will determine the position after 1969. Australia has been able to secure a quota from the U.S.A. which is useful if not entirely satisfactory, and outlets in Japan and Canada have improved the export position to such an extent that it is hoped that the full 1962 crop will be harvested for milling.

The Sugar Inquiry Committee set up by the Commonwealth Government in 1960 to investigate and report upon the necessity or otherwise of a variation in the terms of the Sugar Agreement between the Commonwealth and the Queensland Government presented its report late in 1961.

The Committee found that the relationship and interdependence of the different sections of the industry were a constant spur to greater effort and provided a form of competition as effective as competition from imports was likely to be. It concluded also, that under the market conditions operating at the time of the inquiry, the system of averaging domestic and export returns overloaded the domestic price of sugar, and made a recommendation that would have the effect of reducing the domestic price. Because of the deterioration in the overseas marketing position the Commonwealth Government did not accept this recommendation, and under the new Sugar Agreement Act the domestic price remains unchanged.

Winter grain plantings in 1961 were about 1,000,000 acres, of which approximately 938,000 were retained for grain. A feature of the preparation for various plantings was the big drop in the intended acreage of barley, from a harvested area of 220,000 acres in 1960-61 to a prepared area in 1961-62 of 200,000 acres. The fall can be accounted for largely by the disappointing prices received for the previous year's crop.

The main winter grain plantings were later than usual because of the dry winter. At harvest time, damaging rains and hail were experienced. Added to these disabilities was substantial stem rust attack of late wheat crops. The total harvest was therefore below expectations and wheat quality also was seriously affected. The 690,000 harvested acres of wheat yielded 10½ million bus., 3¼ million bus. were harvested from 165,000 acres of barley, while the canary seed crop yielded 240,000 bus. from 30,000 acres harvested.

Plate 3.—A demonstration buffel grass seed harvester at work in a strain trial near Goondiwindi.

Plate 4.—Redlands Belle, one of the rust-resistant bean varieties bred at Redlands Horticultural Research Station and now in commercial production.

The stem rust position in wheat is a matter for much concern. The industry has been depending largely on three varieties—Spica, which has outstanding drought resistance; Mengavi, which in its first season of extensive planting performed very well in favoured areas; and Gala, which is only slightly inferior to Mengavi. The rust resistance of Mengavi was very satisfactory in the 1961 crop, but unfortunately the resistance broke down completely in summer seed-increase areas. A stepping-up of the wheat breeding programme has been made possible by the intake of further staff.

Staffing arrangements for the new Queensland Wheat Research Institute at Toowoomba were made during the year and the research programme has begun.

The area of grain sorghum retained for grain was estimated at 240,000 acres, and as a result of good growing conditions the crop is estimated to yield 7½ million bus., 2½ million bus. higher than in 1961. Hybrid grain sorghums released by the Department yielded up to 135 bus. per acre, and it is certain that hybrids will be extensively grown as seed becomes available.

There were record sowings of maize on the Darling Downs, but excessive rain and the occurrence of a nutritional disorder dashed the hopes of growers. Total area reserved for grain throughout the State was 155,000 acres and the yield 4½ million bushels. Cob rots caused severe losses in southern areas, and tropical rust destroyed a quarter of the Atherton Tableland crop. The trend towards the use of hybrids on the Atherton Tableland continued and some 80 per cent. of the plantings were of three hybrids.

The 1961 harvest of peanuts yielded 50 million lb. of nuts from 41,659 acres planted, but acreage fell to 36,500 for the 1962 harvest and production was only 34½ million lb. Yield and quality were both depressed by leaf diseases and adverse harvest conditions in the South Burnett. The market for peanuts remains uncertain because of competition from imported peanuts and peanut products and further tariff protection has been sought.

Reasonably early planting of cotton was achieved following general rains in October and most of the total area of 26,500 acres was sown by the end of November. Despite dry conditions in January and February, the main cotton areas (Central Queensland and the Burnett) produced yields up to 800 lb. per acre, but only half the Darling Downs planting of 8,000 acres was harvested for an average yield of about 300 lb. Total yield for the State is estimated at 7,000 bales of lint. Spinners' present-day requirements are not adequately met by the short-stapled varieties that constitute the bulk of the Queensland crop, but other varieties under trial show promise of proving suitable substitutes. As an additional means of improving the varietal position, a Departmental plant breeder has been stationed in the Callide Valley to work on cotton.

The current agreement under which the Commonwealth Government guarantees a minimum price for certain grades of seed cotton expires at the end of 1963. Unless a long-term policy on Commonwealth support for the industry is stated soon, interest in the crop may fall.

The 1961-62 season was a testing time for the tobacco industry. Results of the 1962 leaf sales show that the salutary lesson of disappointing sales of South Queensland and Burdekin leaf in 1961 had been taken to heart.

Analysis of the 1961 sales revealed the following figures:—

Area	Percentage Unsold	Average Price
		d.
Mareeba	2·4	139·6
Burdekin	15·9	88·3
South Queensland	23·4	100·9

All "no bid" leaf was subsequenlty reviewed by a special committee set up by the Commonwealth Minister for Primary Industry, which found that 30 per cent. of this leaf was of reject class and much of the remainder was of limited use in manufacture.

The Department assisted with the machinery of distribution of a grant of £55,000 made by the Commonwealth Government to necessitous Queensland tobacco growers.

A fall in plantings in 1961-62 in the Burdekin and South-western districts was offset by increased plantings in the Mareeba area and around Beerwah. The total planting was again about 15,000 acres. Though leaf quality of the crop was higher than in 1961, overall yields were depressed by wet weather and pest and disease attacks. Total leaf sold in Queensland was 6,769 tons.

The Tobacco Industry Trust Fund continues to finance the major part of tobacco research and extension. Research on pest, disease and nutritional problems is being intensified. There is a strong demand from the industry for more extension service and this is being achieved with the aid of a special Commonwealth grant for leaf improvement activities through extension.

The 1961-62 production of apples reached a record 1,400,000 bus., of which almost 200,000 bushels, mainly Granny Smith, were exported. Experimental shipment in bulk was repeated, some 2,000 bus. being exported in 25 bus. bins. There was an appreciable extension of plantings, mainly on existing orchards which are now employing large-scale production methods. Mechanisation of spraying and bulk harvesting are now established practices, and current planning envisages the use of bulk bins for cool storage.

The 1962 pear crop was one of the best for many years and production reached 52,000 bus. The cannery intake was 15,000 bus. compared with 1,500 in 1961. Overseas exports of Packham's Triumph further relieved the local fresh fruit market, but because of the inferior condition of the fruit on arrival in Great Britain, the future of the export trade is uncertain.

The grape crop was a heavy one, with total production about 250,000 half-bushel cases. The total area under crop was about 3,300 acres.

Pineapple production, which fell rapidly from 1959 to 1961 as an outcome of low factory prices in 1959, recovered in 1962 under the stimulus of rising prices in 1960 and 1961.

Price fluctuations in recent years have caused a pronounced change in the structure of the industry. Producers of less than 1,500 cases per annum found it practically impossible to carry on at the low prices of 1959 and 1960 and production was then largely in the hands of growers of larger areas who were better equipped to improve production efficiency to compensate for lower prices.

Banana production at 650,000 bushels was substantially higher than in the previous year and the large volume of fruit available caused serious glut conditions in the summer period. The banana industry includes a large number of small growers, many producing bananas as a side-line. Only 20 per cent. of growers have more than 10 acres under the crop, while over 50 per cent. have less than 2 acres. This state of affairs is not conducive to efficient production methods, but it must be said that there has been a noticeable improvement in plantation management by the larger, full-time growers.

The banana industry in both Queensland and New South Wales is giving serious consideration to ways and means of curtailing production to conform to market demands. In addition, efforts are being made to promote sales both locally and abroad.

Total citrus production was about 850,000 bus., some 375,000 bus. coming from the Gayndah district. A substantial shipment of Valencia Late oranges was made to Asian markets by one grower, who plans overseas exports. Bulk harvesting has recently been introduced successfully in some of the larger orchards, where the fruit is picked into bulk bins and handled in the shed by large graders and roller-conveyor systems. A recent development has been the use of a dye to enhance the colour of the fruit. Dyed fruit is not yet acceptable on all markets, and where it is permitted stamping of the fruit is compulsory.

Over half the strawberry crop of 3,100,000 lb. was processed, while substantial quantities were air-freighted to southern markets. Mechanical planting has given highly satisfactory results and it may be expected that it will be more widely adopted on larger plantations in the future.

Tomato production in 1961-62 amounted to 1,900,000 half-bushel cases, of which 775,000 cases were produced at Bowen. The green bean crop totalled about 700,000 bus., half of which came from the Gympie and Nambour districts. A new venture in the Bundaberg district was the cultivation of some 170 acres of stringless beans for processing, but this appears to have been an emergency project organised by a processor as a result of partial crop failures in southern States.

The Committee of Direction of Fruit Marketing is considering a project for the quick-freezing of vegetables, and plans are in hand to commence operations on an experimental scale. In view of the proposal, bulking of seed of recent selections of peas and stringless beans is being accelerated to provide stocks for commercial plantings.

The acreage under ginger on the Near North Coast showed a further slight increase. Recent developments aimed at mechanisation of plantings and harvesting, combined with the use of weedicides as a substitute for costly sawdust mulching, could lead to a substantial reduction in production costs.

STAFF AND FACILITIES

Appointments of permanent scientific and technical staff during the year totalled 86, but resignations and other losses amounted to 45, leaving a net gain of 41 officers. There was a net gain of 10 temporary officers. University scholarship holders who completed degree courses and took up appointment with the Department totalled 16. Eleven of these graduated in Agricultural Science, 4 in Pure Science and 1 in Veterinary Science.

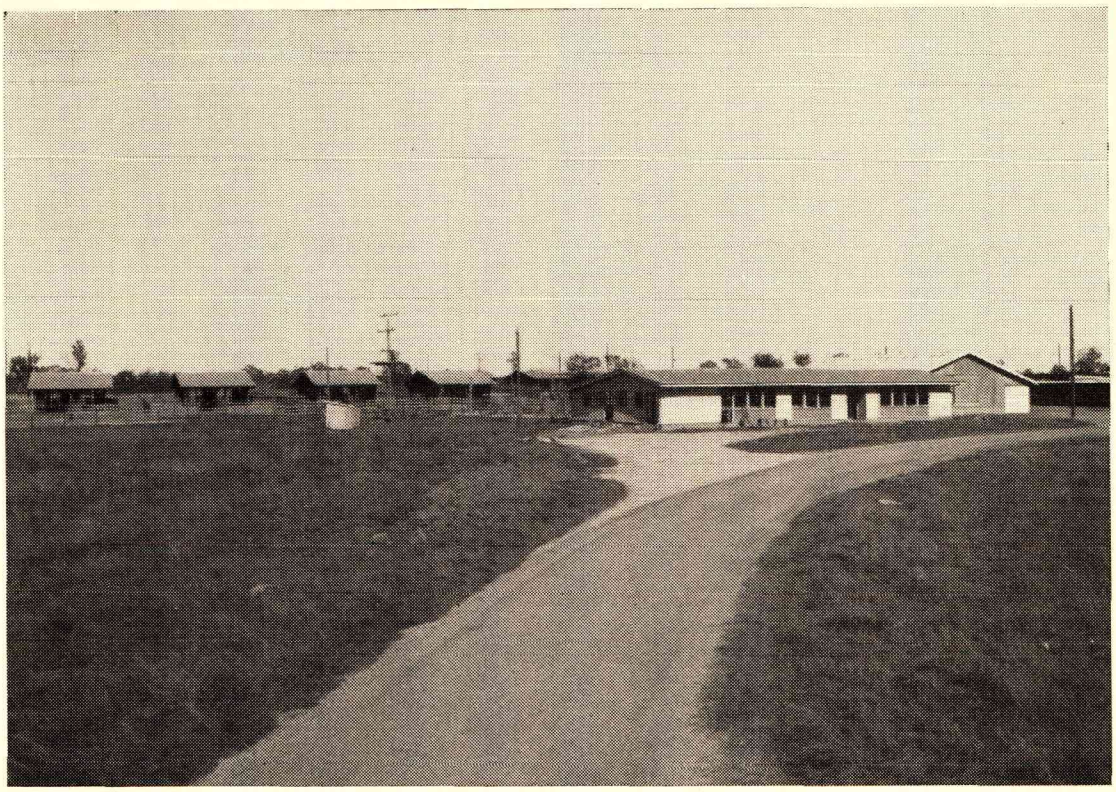

Plate 5.—The new Departmental Artificial Insemination Centre under construction at Wacol.

Plate 6.—Weighing experimental sheep at Toorak Sheep Field Station in the north-west.

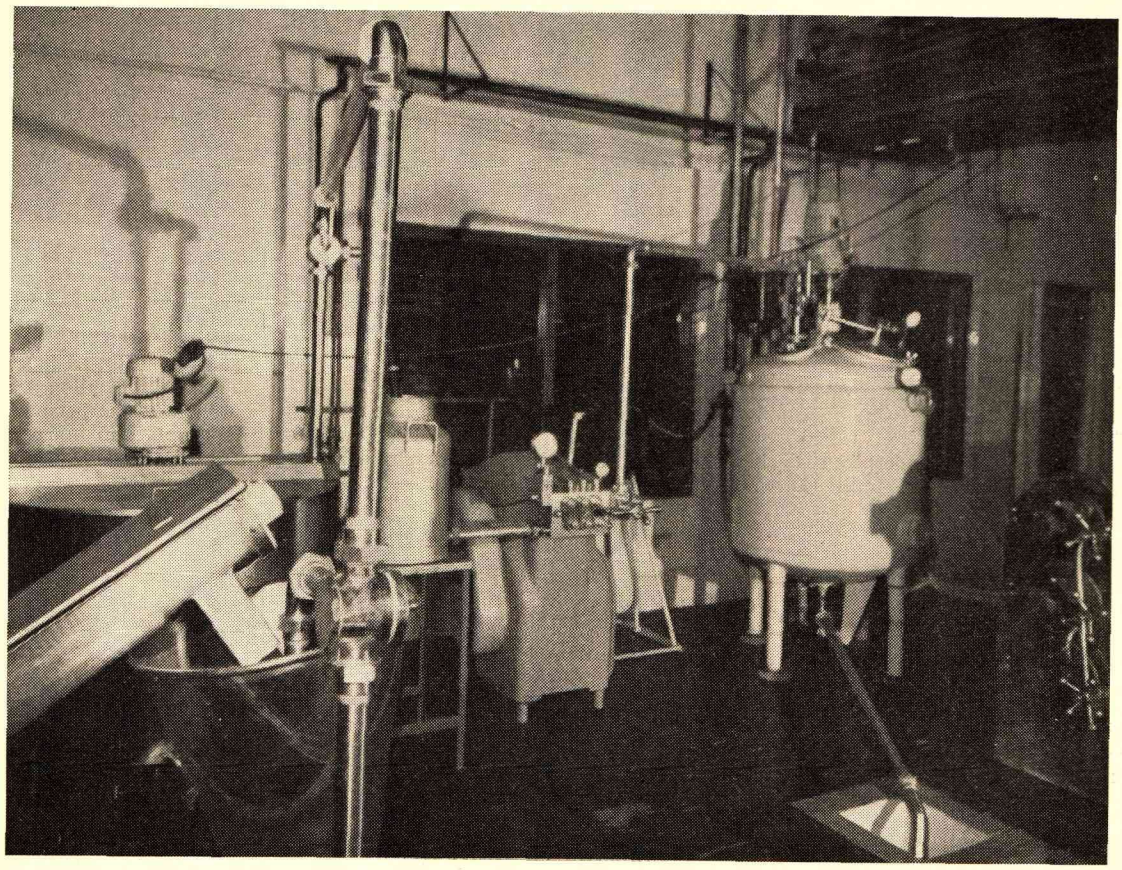

Plate 7.—Pilot equipment used for the manufacture of flavoured milk-mixes and butterfat spreads.

Plate 8.—Flavoured milk-mixes on sale in a Brisbane chain store.

University Scholarships awarded during the year comprised 10 in Veterinary Science, 8 in Agricultural Science, 4 in Pure Science and 1 each in Rural Science, Commerce and Agricultural Economics. Tobacco extension scholarships were awarded to two final-year Diploma of Agriculture students at the Queensland Agricultural College.

It is pleasing to report that 11 officers completed degree courses during the year and a further 4 completed technology courses.

Higher degrees were obtained by Messrs. M. D. McGavin (M.V.Sc.), R. McD. Beames (M.Agr.Sc.), T. J. Beckman (M.Sc.), P. E. Luck (B.Sc. honours) and R. J. Park (B.Sc. honours).

Among officers who retired under the age provisions were Messrs. F. Caine, G. D. Daly, H. S. Hunter, F. Manuel, W. Mitchell and J. W. Munro. All had given very long service to the Department and had made useful, and in some cases very significant, contributions to the progress of the State's primary industries.

Overseas visits were undertaken during the year by four officers. Mr. W. J. Cartmill (Director, Agricultural Chemical Laboratory Branch) left on a tour of U.S.A., England and the continent to examine agricultural chemical methods and soil science matters. Dr. S. A. Trout (Director, Food Preservation Research Branch) has been covering the same area on food preservation problems. Mr. A. C. Peel (Standards Officer) was official Australian delegate to the International Seed Testing Conference at Lisbon, Portugal, and has been visiting other parts of Europe as well as U.S.A. Mr. M. D. McGavin (Senior Histopathologist) secured an assitsantship, tenable for 2½ years at Michigan State University.

The organisation of direction of work on research stations was implemented in part during the year with the placing of the former Regional Experiment Stations under the administration of a Research Stations Board. A Station Committee comprised of regional officers of the Department has been set up for each of the stations and annual plans of work have been drawn up and submitted to the Board for consideration. The Station Committees consist of both research and extension personnel, as it is considered that this will contribute to the formulation of balanced research programmes aimed at the main problems of the area.

DIVISION OF PLANT INDUSTRY

The expanding acreage under cultivation continues to reflect the onward march of the plough in Queensland. Stock-owners, in ever-increasing number, are learning the production advantages which follow the use of fodder crops grown on cultivated land.

The most recent data from the Bureau of Census and Statistics show that for 1960-61 the total area of all crops grown in this State was 3,046,882 acres. Allowing for areas on which two or more crops were grown during the year, the actual land used for crops was 2,996,360 acres. In addition, 522,363 acres lay fallow during the year, making a total of 3,518,723 acres which were turned over by the plough.

As more than 336 million acres were used for grazing, the cultivated acreage is still only a small percentage of the State's lands. There is large scope for increasing cultivation in districts with suitable rainfall.

The expansion in the total area of crops grown over the last 10 years is worth particular note. The area in 1960-61 exceeds that grown in 1950-51 by nearly a million acres and represents the first time that the crop area has topped three million acres. This shows the average yearly increase in crops grown as approximately 100,000 acres over the last 10 years, the increase being mainly in crops other than sugar-cane.

Further expansion has occurred in 1961-62. For example, the harvest of 7,500,000 bus. of grain sorghum from 240,000 acres in 1961-62 was a record. Grain sorghum production should increase further as a result of the new hybrid varieties developed by the plant breeders, which are now going into commercial use.

Queensland, with its predominantly summer-rainfall climate, is well suited to the summer-growing sorghum group of plants. As this group includes grain, grazing and silage types and is certain to play a very important role in the continued development of the State's stock industries, further research into plant breeding and plant nutrition is very desirable.

The rate of expansion in tobacco growing was sharply curtailed in 1961-62, the increase being limited to only 100 acres over the 14,900 acres of 1960-61. For several years prior to 1960-61, the expansion rate was too high and production methods lost some efficiency. In the overall interests of the tobacco industry the check in expansion can be accepted as necessary for a period of consolidation and reassessment of soils and irrigation waters being used for tobacco.

As from 1962 onwards, the Commonwealth Government has made a special grant of funds for additional extension work in tobacco. This will provide the opportunity for a strong effort to be made to improve the efficiency of less experienced growers.

The wheat sowing for 1962 promises to be a record and will exceed 800,000 acres. Wheat growing is extending in Central Queensland and approximately 15 per cent. of the 1962 harvest could come from that area.

RESEARCH FACILITIES

This was the first year that Divisional officers have worked under the new system evolved following the re-organisation of the Branch formerly known as Regional Experiment Stations. A Research Stations Section has been constituted under a Research Stations Board. The purpose of the Board is to provide facilities for research on each Research Station under its control, the initiation and execution of the research work being the responsibility of the officers of the various Branches concerned.

Station Committees comprising local research and extension representatives of each of the Divisions of Dairying, Animal Industry and Plant Industry have been formed for each Research Station to draw up programmes of investigations to meet district needs in particular and zonal needs in general.

To date the new system has operated very satisfactorily and better co-ordination of the research programmes of Plant Industry officers is assured.

The office-laboratory of the Pineapple Research Laboratory on the Maroochy Horticultural Research Station was completed and occupied. The glasshouse is not yet finished but before the end of 1962 all facilities should be in order to enable the planned programme of investigations to be put in train. In addition to the Chief Plant Physiologist, the staff includes two other graduate Plant Physiologists.

A laboratory unit of the Agricultural Chemical Laboratory Branch will be available in a new Court House building at Mareeba in 1962. Arrangements have been made to staff this unit and equipment will be supplied as far as available finance permits.

A laboratory erected and equipped specially for tobacco work is already in operation on Parada Tobacco Research Station, near Mareeba, and the new laboratory at Mareeba will analyse plant and soil samples of pastures and other crops which previously had to be sent to Brisbane for processing.

The Entomological Research Laboratory and associated glasshouse at Indooroopilly were occupied, and investigations on nematodes, storage pests and chemical resistance in insects commenced.

The seed store at Hermitage Research Station was completed and construction of the Indooroopilly seed store is well forward. These storage and work facilities will be very useful for research workers in storing and distributing valuable seed stocks.

Erection of the Queensland Wheat Research Institute at Toowoomba made good progress and the official opening is scheduled for September 1, 1962. This Institute was planned by the Queensland Wheat Industry Research Committee on which wheat growers have majority representation, and costs have been met from accumulated wheat growers' levies. The Queensland Government encouraged an early start by advancing £40,000 as part payment for Stage I of the Institute.

The purpose of the Institute is to provide good research facilities to supplement work already being carried out by the Department of Agriculture and Stock and the Univercity of Queensland. In the early years at least the Institute will be staffed by officers of the Division of Plant Industry. Already arrangements are in hand for a series of investigations on soil-borne wheat diseases and plant nutrition problems. Research facilities at the Institute will also be available for organisations other than the Department of Agriculture and Stock, and the University of Queensland.

EXTENSION

The steady expansion in cultivated land and the ever-widening interest in pasture improvement continued to maintain heavy pressure on the extension services. There were

frequent demands from primary industries for increased extension services but it has not been possible to meet all requests because of the shortage of adequately trained extension officers.

More land under the plough means a greater need for soil conservation services. There is an appreciable lag in giving the required services to the farming community, and expanding agriculture complicates the situation.

Further groups of officers were given special training at extension schools. Most Divisional officers have now been given instruction on how to use the various avenues of communication which are available to channel information on production techniques to land-holders.

In addition to the several advisory committees already working with primary industries, a Banana Advisory Committee was formed and operated for the first time.

Divisional officers assisted with the important Bankers' Conference, sponsored by the Reserve Bank of Australia and held at Rockhampton from April 27 to May 4, 1962. This Conference dealt with the beef cattle industry in Queensland. Utilisation of the brigalow and associated developmental problems for beef cattle production were major subjects of discussion.

STAFF

A total of 13 officers was lost during the year for various reasons. Recruitment of new staff, however, continued to improve, especially University-trained personnel.

New graduate staff included 27 males and 6 females. Of the males, 10 received their University training with the assistance of the scholarship scheme and eight through the Departmental cadetship system. A total of 17 technical staff, most of whom had diplomate or equivalent qualifications, was appointed; four of these are products of the diplomate scholarships awarded from tobacco funds for students of the Queensland Agricultural College.

In 1962, five students were awarded University Scholarships in Agricultural Science and seven Cadets were appointed to undertake Pure Science Degree courses at the University of Queensland on a part-time basis. Nine students pursuing diploma courses at the Queensland Agricultural College were also awarded scholarships.

AGRICULTURE BRANCH

Agriculture Branch is charged with providing an advisory service to landholders in all matters relating to the growth and production of pastures and of field crops other than sugarcane. This service covers soil types, suitable crops and varieties, their planting, cultivation and harvesting, their fertilizer requirements, irrigation where necessary and control of weeds.

Continuing research is required to provide the basis for this advisory service. This research is now carried on at 13 Research and Field Stations as well as in most advisory districts throughout the State. Some of the more important results of this investigational programme are summarised in the following pages.

Advisory services are now provided from 32 district centres, covering not only the major farming areas of the coastal and sub-coastal zones, but also such predominantly pastoral districts as Charleville, Blackall and Julia Creek. Each advisory officer has his own experimental programme to help him interpret research results from elsewhere, and to give him direct backing for his local extension work.

One of the main trends in extension in recent years has been the growing use of press, radio, field days and meetings for the mass dissemination of new information. An important commitment of the Branch in 1961-62 has been its contribution to a considerable number of schools for farmers and graziers.

Another landmark of the past year has been the holding of three technical conferences, the first in Brisbane on cotton, the second at Gatton on potatoes, and the third at South Johnstone on tropical pastures. While these conferences were all convened and organised by the Department, a very important feature has been the participation by other Departments, both Commonwealth and State, and also by industry. They have served an excellent purpose in bringing together the latest available information in each of these important fields, and in the dissemination of the information to both research and extension workers.

AGRONOMY

Wheat.—Highlights of the past year were the generally unfavourable season, with late planting rains, a dry spell at flowering and a wet harvest period; the completion of the 4th year of an 8-year-cycle rotation trial comparing continuous wheat and lucerne pasture on the open plain soils of the Darling Downs; and the appearance of new rust strains capable of attacking all the popular wheat varieties in Queensland.

The plant breeding programme carried out at Hermitage Research Station has been intensified with the appointment of additional staff. Special attention is being paid to stem rust resistance in view of the recent appearance of new virulent races of stem rust, but the necessary agronomic characteristics of yield, flour quality, frost resistance and resistance to lodging are also being kept in mind. Although all the material from the Queensland crosses is susceptible to at least one of the latest stem rust races, five crosses have been bulked for further observation and testing. New strains from the breeding programme were tested at Hermitage and Bongeen on the Darling Downs, and at Gatton Research Station. A number of these have a yield potential at least equal to current commercial varieties such as Spica, Mengavi, Gala, Kenora and Lawrence. The seed purification scheme to provide true-to-type seed stocks for commercial plantings was continued, the current varieties under treatment being Gala, Lawrence and Mengavi.

The four most important races of stem rust in Queensland are 21-2, 21-4, 21-5 and 34-3. Race 21-2, which attacks Gabo and Charter, is the commonest and now occurs all over Australia. Spica and Gala are susceptible to race 21-4, Kenora and Festival to race 21-5, and Mengavi to race 34-3. Thus these three rust races are capable between them of attacking all the present commercial wheat varieties in Queensland.

Wheat varietal trials to compare the yield and quality of standard commercial varieties and new crosses were conducted in the major wheat-growing districts. The usual three trials were conducted at Hermitage Research Station. In the quick-maturing trial, Spica (41.5 bus. per acre) and Gamenya (40.7 bus.) topped the list, with Mengavi (37.6 bus.) filling third place. Kenora in the fourth place yielded 33.3 bus. Spica, in spite of a degree of rust attack, was the outstanding variety in this trial. In the mid-season trial the unnamed varieties 1131 (45.6 bus. per acre) from New South Wales and two Queensland crosses KSUPY (43.7 bus.) and KFD_6K_1-4614 (38.4 bus.) outyielded Gala (36.6 bus.). Both Festival (38.4 bus.) and Gala showed light stem rust and medium leaf rust infestation. The two top strains, however, are being discarded because of poor flour quality. In the late-maturing trial the unnamed Lawrence x Gabo hybrid 5387 topped the list with 44.39 bus. per acre, followed by Hopps (38.90 bus.), Saunders (38.52 bus.), Windebri (38.11 bus.) and Lawrence (35.41 bus.).

Seasonal conditions prevented a build-up of rust in the Gatton Research Station trial and excellent yields were obtained. Gamenya (62.7 bus. per acre.) and Mengavi (61.9 bus.) outyielded LG-5790 (54.5 bus.), Gala (49.0 bus.) and Spica (48.2 bus.).

In the Biloela Research Station trial, yields were reduced to well below the Station average, the main causes being late planting, low soil moisture and a heavy late stem rust infection. Kenora (28.2 bus. per acre), KSUPY (27.9 bus.), Gamenya (26.2 bus.) and Spica (26.0 bus.) were the best yielding varieties.

In the main wheat-growing areas the season was characterised by dry conditions in the early part of the season and by a wet harvesting period. Generally the earlier varieties suffered most from dry weather about flowering time. In particular cases stem rust caused heavy losses. Spica was the outstanding variety this season, especially under the dry conditions. Mengavi and Gala again performed similarly, with Mengavi very slightly superior to Gala, and both gave better results than Spica where conditions were especially favourable. Kenora and Hopps again gave a satisfactory performance.

The fourth season of the pasture/wheat rotation trial on the open plain soils of the Darling Downs was completed successfully. This trial is designed to compare over an 8-year cycle the effects on wheat yield and quality of a lucerne/perennial prairie grass pasture of one, two, three and four years' duration. The wheat variety Spica is being used. Yields of all plots were adversely affected by crown rot. The mean yield for the control (continuous wheat) was 10.60 bus. per acre, while those for first year wheat after 3 years' pasture (15.28 bus.) and second year wheat after 2 years' pasture (13.77 bus.) were both significantly better than the control. As indicated in earlier reports, the grass component disappears entirely after the second year and the pasture is thus predominantly lucerne. Available soil nitrogen in the 0-4 in. zone recorded prior to sowing showed the value of the legume component in providing nitrogen. The figures are as follows:—

3 years pasture, 1st year wheat	81.2 p.p.m. nitrate nitrogen (oven-dry)
2 years pasture, 2nd year wheat	40.4 p.p.m. nitrate nitrogen (oven-dry)
1 year pasture, 3rd year wheat	21.5 p.p.m. nitrate nitrogen (oven-dry)
Control, continuous wheat ..	22.2 p.p.m. nitrate nitrogen (oven-dry)

Similar evidence of the higher fertility provided by lucerne pasture is available from a rotation trial in progress at Hermitage Research Station. Spica wheat following lucerne (1956-1959) outyielded Spica wheat following sorghum by 27 per cent. In another trial at the Station, four years of grass/legume pasture was shown to be superior for wheat culture to four years of annual cropping. Although yields were not improved, grain protein was increased from 12.2 to 15.0 per cent. when wheat followed a legume-based pasture.

Barley.—Both feed and malting varieties of barley have been tested in various districts. A barley varietal trial in the Pampas district gave the following results:—Noyep (19.1 bus. per acre), Prior (18.4 bus.) and Maltworthy (18.2 bus.) significantly outyielded Skinless (14.8 bus.), Cape (13.2 bus.), Albyn (13.0 bus.) and Research (9.9 bus.). This trial suggests that the present commercial variety Prior, or its earlier maturing selection Noyep, is the best malting variety available. In the Warwick district, malting barley yields have decreased markedly over the years while malting quality of the grain has remained reasonably good. The possibility of increasing yields with nitrogenous fertilizers without decreasing malting quality was therefore studied in a trial at Junabee on a 50-year-old cultivation. Soil moisture supplies were inadequate but a substantial yield increase over the control (18.2 bus. per acre) was obtained with ½ cwt. of urea per acre (27.0 bus.) and 1 cwt. of urea per acre (30.3 bus.). The protein content also slightly rose, from control (9.14 per cent.) to 1 cwt. of urea (9.84 per cent.). None of the treatments in this trial gave a fully satisfactory malting quality; this was due no doubt to the season. These studies are continuing to test the effects of added nitrogen under more favourable seasonal conditions.

Maize.—Seed of the following hybrids was produced during the year under the Department's seed certification scheme:—Q23, Q440, Q462, Q526, Q692, Q716, Q724, Q739 and Q790. Queensland-bred hybrid varieties are proving increasingly popular throughout Queensland. In two districts, however, Queensland hybrids are currently outyielded by hybrids produced in New South Wales. DS hybrids are preferred on the south-eastern Darling Downs because of their higher yields and, in the case of some hybrids, because of their earlier maturity. On the Atherton Tableland, Grafton hybrids are preferred to Queensland hybrids because of their superior yielding capacity. In this locality cob and stalk rots are very serious problems, and in recent years tropical rust has also reduced crop yields considerably.

In an endeavour to find a more satisfactory hybrid for the moist Tableland conditions a co-operative testing programme has been carried out comparing inbreds, single crosses and hybrids bred at Grafton Experiment Station (New South Wales) and at Queensland Agricultural College, Lawes. In addition, a plant breeder has recently been stationed on the Tableland to intensify the breeding programme aimed at producing a hybrid capable of withstanding better the climatic conditions. In the 1960-61 district maize varietal trial, all the eight hybrids tested outyielded the local Atherton dent variety (29.6 bus. per acre). Highest yield was given by GM211 (49.7 bus.) followed by GH261 (45.5 bus.), GH265 (42.7 bus.), GH329 (41.2 bus.) and GH128 (40.8 bus.). GM211 has now topped the district trial for the third successive year. GH128, which topped the Kairi Research Station trial with 48.4 bus. per acre, is the present commercial hybrid principally grown on the Tableland and accounts for over 50 per cent. of the annual acreage. Q23 was the best yielding hybrid (45.7 bus. per acre) at Walkamin Research Station. The chief disadvantage of these hybrids, apart from susceptibility to local cob and stalk rots and to tropical rust, is the relatively light husk cover, rendering them liable to heavy weevil infestation.

Of three fertilizer x plant spacing trials completed at Kairi Research Station, significant yield differences occurred in only one trial. A response to 100 lb. P_2O_5 per acre as superphosphate was obtained on ground which had grown maize continuously for 40 years.

Maize grown in trials at Gatton Research Station in the 1960-61 season produced yields of 110 bus. per acre with irrigation and 93 bus. under rain-grown conditions. In an irrigated fertilizer x plant population trial grown on land which had been fallowed for 12 months following a paspalum/clover pasture, no yield response to fertilizer levels as high as 188 lb. N per acre was noted. Plant populations of 16,000 and 20,000 per acre (123.2 bus. per acre) both outyielded the 12,000 plants per acre treatment (116.4 bus.). A second irrigated trial designed to test effects of plant population x row spacing produced no significant difference between yields. Mean yield was 101.1 bus. per acre. In this trial populations of 18,000 and 24,000 plants per acre were tested in combination with 21, 30 and 42 in. row spacings. A rain-grown fertilizer x plant population trial on land fallowed for 12 months following a paspalum/clover pasture gave no yield response to sulphate of ammonia applications up to 4 cwt. per acre. A population of 12,000 plants per acre (96.5 bus. per acre) outyielded the lower 8,000 plants per acre treatment (89.9 bus.).

Sorghum.—The continued success of hybrid grain sorghum is the most important feature of this crop. The hybrid grain sorghum breeding programme has produced and named the first Queensland hybrid. This hybrid, known as Brolga, is made from the cross, Combine Kafir-60 x Alpha.

Fourteen hybrid trials were completed in 1960-61, nine in southern Queensland and five in central Queensland. In southern Queensland the 1960-61 season provided a severe test of the hybrids under drought conditions and it was encouraging to note that average yields of four hybrids, Texas 610, Texas 630, Texas 608 and Brolga, exceeded yields from the best standard varieties Alpha or Early Kalo by 39, 33, 25 and 20 per cent. respectively. The central Queensland trials were in general grown under good soil moisture conditions and no hybrid was shown to be outstandingly superior to the standard Alpha. Average yields, however, were respectively 14, 14, 12 and 11 per cent. above those of Alpha.

Prospects for the 1961-62 grain sorghum season appear excellent. Early results from Hermitage Research Station show that in the hybrid grain sorghum trial highest yields were obtained from the hybrids Brolga (78 bus. per acre) and Texas 610 (73 bus.), while the best standard variety Alpha produced 59 bus. In the Callide district, Brolga, Texas 608 and Texas 630 all yielded 64 bus. per acre, a 33 per cent. increase over the standard Alpha.

A total of approximately 900 acres of crossing plots was planted in 1961-62 by 24 seed growers, and from this area a total harvest in excess of 15,000 bus. of hybrid grain sorghum seed is expected. In addition, 510 acres of standard varieties Alpha, Wheatland and Early Kalo are being grown for certified seed.

Hybrid forage sorghums are being developed and show considerable promise. At Hermitage Research Station grain sorghum x Sudan grass hybrids produced more air-dry bulk than did Sugardrip, Columbus grass (*Sorghum almum*) and Sudan grass in a forage sorghum trial.

Cotton.—The re-appointment of a cotton plant breeder at Biloela Research Station, good yields from a limited area of irrigated fertilized cotton in the Theodore district, and encouraging research results with cotton-growing in a short-season environment at Hermitage Research Station are the bright features in an otherwise disappointing year.

For the second year in succession, seasonal conditions resulted in abandonment of most trials on the Darling Downs. The district average for Callide/Dawson (the chief cotton-growing area in the State) will be only 350-400 lb. per acre, 20 per cent. below the 1960-61 average. Mediocre results only are expected from the Burdekin and Mareeba districts, where trials at both Millaroo and Walkamin Research Stations are in poor condition. Heavy insect attacks in all trials, and dry conditions in rain-grown trials, have obscured

results in most instances at Biloela Research Station. At Theodore, Mundubbera and at Hermitage Research Station on the southern Darling Downs, good yields are expected.

The plant breeder stationed at Biloela Research Station will endeavour to select in the first instance, and breed in the second instance, strains of cotton suited to Queensland conditions which yield well and yet have the fibre characteristics required by the cotton spinners.

At Hermitage Research Station, where the growing season is short, research has been directed at finding suitable early-maturing varieties, ascertaining the best planting period and determining which seed treatment will give best germination under local rain-grown conditions. While standard varieties have given excellent yields in two of three seasons (1,200-1,700 lb. seed cotton per acre), high hopes are held for a new introduction, Paymaster 54B, which has shown promise this season as an early-maturing variety. In the first pick, Paymaster (635 lb. seed cotton per acre) outyielded Dixie King (390 lb.) and Empire (306 lb.). Time-of-planting trials have indicated that planting is risky when the mean screen temperature is less than 60°F., normally prior to mid-October. This season, however, warmer conditions were encountered and the total of the three picks made to date in the time of planting trial indicate excellent yields from September planting. Dates of planting and yields of seed cotton are as follows:—18.9.61, 1,964 lb. per acre; 26.9.61, 2,007 lb.; 7.10.61, 1,689 lb.; 24.10.61, 1,277 lb.; 30.10.61, 1,319 lb. and 8.11.61, 897 lb. Seed treatment studies revealed that the standard "Ceresan" or "Panogen" treatments were as effective as other treatments tested.

In varietal tests throughout the State in the past two years, Dixie King and Deltapine Smoothleaf have shown promise. They have outyielded such standard varieties as Miller and Empire and can, under many conditions at least, produce fibre of the character currently required by Australian spinners.

Nitrogen fertilizer continued to increase yields in irrigated trials at Biloela Research Station. The optimum level of fertilizer appears to be 94 lb. nitrogen per acre, which treatment in the current year is giving yield increases of 52 per cent. over unfertilized plots. Treatments receiving 188 lb. nitrogen per acre have not to date given higher yields and are badly lodged. Time of application, up to the flowering period, does not appear critical. Under rain-grown conditions, no yield response to nitrogenous fertilizer has been obtained for the third year in succession. A number of Theodore farmers are now using nitrogenous fertilizer commercially on irrigated cotton.

Defoliation studies received greater attention because of serious grade reduction associated with mechanical harvesting of the larger cotton bushes resulting from irrigation and fertilizer treatments. Problems associated with achieving adequate defoliation have been largely overcome. In this season, where application was not made until May, "Defolate" (magnesium chlorate) and "Diquat" gave good defoliation, and P.C.P., "Niagara Desiccant" and "Ansar" gave efficient desiccation. Problems associated with effect of time of application on yield, and with effect of defoliation on grade, have yet to be solved. In a large-scale district trial at Theodore, good defoliation (85 per cent.) was obtained with "Folex" and "Def," and good desiccation with "Diquat". However, lint from both treatments was classed "strict low middling" owing to the amount of trash remaining; thus no improvement in grade was evident from the treatments.

Tobacco.—Investigations following the 1961 sales indicated that much of the unsold leaf was produced on new farms with marginal tobacco soils. Crop behaviour and observations on leaf quality during the past season suggest that, on the lighter soils particularly, the effect of heavy irrigation on plant nutrient availability should be closely watched.

Investigations on the Inglewood Tobacco Research Station were continued and provided useful information. The rotation trial again demonstrated that the best quality leaf is produced following Rhodes grass or a fibrous-rooted crop such as grain sorghum. The blue mould resistant variety trial was subjected to a blue mould epiphytotic in January 1962 and the C.S.I.R.O. strain So1 gave an outstanding performance, yielding over 1,500 lb. of good quality leaf per acre. Satisfactory yields of good quality leaf were obtained from the other C.S.I.R.O. strains 1 and 2, while yields and leaf quality obtained from Gowan's Golden Gift and Lea's strains A1 and A2 were slightly lower. The wet season made chemical control of field mould impracticable. A chloride survey of the Macintyre Brook catchment was undertaken. It indicated that two small creeks contribute largely to the chloride content of the Macintyre Brook water supply. A disturbing feature of the survey was that even in high flood the chloride content of the water remained at levels considered unsatisfactory for irrigating tobacco. The survey is continuing.

A source-of-nitrogen trial, using nitrate of soda, sulphate of ammonia, urea, calnitro and nitrate of potash, was conducted. Each fertilizer was applied at the rate of 12 lb. nitrogen per acre, half the plots receiving 12 lb. as a basal dressing and half 6 lb. as a basal dressing and 6 lb. as a side-dressing 4-5 weeks after planting. No differences between treatments were observed and analyses of green leaf indicated no trends in nitrogen content. A source-of-nitrogen trial was also carried out at Parada Tobacco Research Station, comparing urea (applied to soil), urea (foliar), CD urea, nitrate of soda and nitrate of potash. Soil dressings of nitrate of soda and nitrate of potash were made at 20 lb. and 40 lb. nitrogen per acre, urea (soil) at 40 lb. and 80 lb. nitrogen per acre, and urea (foliar spray) at 20 lb. and 40 lb. nitrogen per acre. In the field little difference was noted between the high and low rates of application. The urea (foliar) plots were least impressive, while the nitrate of potash plots, though retarded early, produced the largest and lushest growth. Urea soil application produced good steady growth. As might be expected, the higher rates of nitrogen delayed maturity somewhat and generally depressed grade index figures. Highest yield of 1,830 lb. of cured leaf per acre was given by urea (soil), followed by CD urea, urea (foliar), nitrate of soda and nitrate of potash (1,640 lb.). While there appeared to be little difference in quality between plots, CD urea gave the highest grade index. Soil nitrate and ammonia levels were followed throughout the growth period of the trial. The most persistent fertilizers for both nitrate and ammonia production were urea (soil) particularly, and also CD urea. The nitrate fertilizer treatments also had high nitrate levels eight weeks after planting. Final details of the trial are not yet available.

The effect of plant competition on tobacco leaf yields and quality was also further studied at Parada in a plant spacing and topping trial. Plant spacings in a 4 ft. row were 16, 18, 21, 25 and 30 in. and topping heights were 15, 18 and 21 leaves. During the growth period, closer spacing was observed to produce smaller plants with smaller, more upright leaves. Although final details are not yet to hand the following trends appear. Increasing plant population increased yield of cured leaf per acre from 1,630 lb. to 2,120 lb., and higher topping increased yield from 1,690 lb. to 1,960 lb. Leaf length increased with increasing plant spacing and with lower topping height. Leaf quality, flowering and harvest maturity were generally independent of plant spacing and topping height.

In a topping, spacing and priming trial on the Millaroo Research Station, trends were somewhat similar to those indicated at Parada. Increasing plant population increased yields of cured leaf per acre from 1,302 lb. (30 in. spacing) to 1,423 lb. (18 in. spacing). Low topping (extra 4 leaves) gave slightly higher yields (1,363 lb.) than normal (2 leaves) topping (1,353 lb.). No priming gave higher yields (1,368 lb.) than priming 4 leaves (1,347 lb.).

In the Bundaberg district the two main problems studied were general nutrition, including trace elements, and barn rot. Copper would appear to be deficient in some areas of this district.

Potatoes.—The potato varietal position has not changed, with Sebago occupying about 80 per cent. of the commercial crop and Sequoia filling about 18 per cent. Kennebec and Exton are the only other varieties grown in commercial areas. Several growers tried the new variety Bungama but results were not promising. Varietal trials carried out at the Gatton Research Station indicated that Sebago is the best all-round variety and is most adaptable to adverse conditions of excessive heat and soil moisture. Yields from Sebago are better in spring, while for autumn planting preference could be given to Kennebec and Pontiac. Sequoia often outyields Sebago but quality and appearance are often poor. This variety is most valuable for May plantings in frost-free areas. The two new varieties Murru and Bungama were generally disappointing. Murru is too late-maturing for Lockyer conditions and Bungama tubers tend to be waxy and of poor cooking quality. Topographic and seasonal conditions vary so widely in the Lockyer district that a wider range of varieties suitable for particular local environments seems desirable.

The short growing season adopted generally by Lockyer growers has raised the possibility of using single-eye cut seed in preference to round seed. Trials carried out suggest that for out-of-season plantings and production of early potatoes, single-eye seed gives the advantages of lower financial outlay for seed, earlier and heavier crops of first grade potatoes, a higher percentage of first grade tubers, and less risk of crop failure in very short seasons. Under longer growing conditions, however, single-eye cut seed produces oversize tubers of lower quality and larger cut seed or round seed gives better results.

Soybean.—While the fairly restricted market for soybeans for human consumption has remained, there is increasing interest in soybean as a source of high quality stock food. For the latter purpose seed coat colour is not important and a wider range of varieties is available for testing.

Encouraging results have accrued from soybean trials carried out in widely scattered districts of the State. Recent introductions from Central Africa by the C.S.I.R.O. Plant Introduction Service performed well in North Queensland,

where climatic conditions suit them better. In southern Queensland, varieties bred by this Department in the South Burnett gave best results.

Outstanding results were obtained at Walkamin Research Station in a 1962 harvest, where later maturing varieties Avoyelles (1,656 lb. per acre), Batavian Yellow (1,586 lb.) and C.P.I. 15944 (1,382 lb.) outyielded earlier maturing varieties DEH 124234 (377 lb.), MBH 72113 (321 lb.) and Yelnando (301 lb.).

At Millaroo Research Station, four of the 18 varieties and strains tested in a non-replicated trial yielded in excess of 20 bus. per acre, while Batavian Yellow yielded 34 bus. The variety C.P.I. 15944, which yielded best in the 1961 trial, was third in the current trial and produced 25.6 bus. In a row and plant spacing trial harvested recently at Hermitage Research Station, there was a yield trend in favour of closer row spacing and higher plant populations; for example, yield from 50,000 plants per acre in 14 in. rows was 1,735 lb. per acre, as against 1,361 lb. from 25,000 plants per acre in 42 in. rows. Nanda variety was used in the trial and an overall yield of 1,635 lb. per acre was obtained.

Safflower.—Although only a new crop to Queensland, safflower has quickly gained in popularity over the past few years and in 1961 12,000 acres were sown. The 1961 varietal trial at Biloela Research Station resulted in a moderate average yield of 820 lb. per acre, compared with the 1960 yield of 1,620 lb. Gila (985 lb.) again proved its worth by outyielding the standard Horowitz variety (792 lb.). Oil content of Gila (34.9 per cent.) was also higher than in Horowitz (30.4 per cent.). A safflower versus oats grazing trial in 1961 resulted in higher green yields of Horowitz safflower (5.0 tons per acre) than Benton oats (3.9 tons). On a dry-matter basis, however, slightly greater quantities of oats were obtained (0.87 tons and 0.76 tons per acre respectively). Further trials of the potentialities of safflower as a grazing crop are required before it could be recommended to replace oats. In addition, the replacement of Horowitz by Gila, a spiny variety, may alter the position, as seed of Horowitz is likely to become unavailable and spiny varieties of safflower may prove unsuitable for grazing. Seed increase plots of Gila safflower at Biloela and Hermitage Research Stations produced nearly four tons of seed for distribution to farmers.

Rotations.—A rotation involving 120 acres initiated in 1946 at Kairi Research Station was introduced to demonstrate that the gradual decline in productivity of land on the Atherton Tableland, brought about by maize monoculture, can be arrested. Positive research findings are introduced into the demonstration as soon as they are proven and the results to date are most encouraging. Detailed costing was introduced in 1957 and it is noted that efficiency of operations is improving. Production of commercial butter per acre has increased from 73.1 lb. in 1956-57 to 89.9 lb. in 1960-61. Maize yields have increased from 20-30 bus. per acre to 50-70 bus. Carrying capacity of pastures has increased from 0.33 to 0.44 cow per acre. The main reasons for increased productivity have been replacement of lucerne and Rhodes grass with Tinaroo glycine and green panic, and replacement of Kairi durum open-pollinated maize with GH128 hybrid maize. Man-hours of labour needed to run the farm were reduced from 954 in 1957-58 to 433 in 1960-61. Average gross annual financial return for the last three years was £17 9s. per acre for maize culture and £8 for dairying. Dairying figures are expected to improve as Tinaroo glycine/green panic pastures achieve maximum production.

Weed Control.—The success of previous weed control investigations in the South Burnett has led to the adoption of recommended methods by peanut growers and only a few special weed problems in peanuts now remain.

Post-emergence trials to handle special weed problems in peanuts and maize in the South Burnett were carried out last season. Suitable sites were hard to find because of the widespread commercial use of weedicides in these crops. Weedicides used in the peanut trial were 2,4-D (2 oz., 4 oz., and 8 oz. acid equivalent per acre), 2,4-DB and MCPB (both at 8 oz., 16 oz., and 24 oz. a.e./ac.). Both the sodium salt and the ester of 2,4-DB and MCPB were tested. The ester formulation of 2,4-DB was much more injurious to the peanuts than the sodium salt and was no more effective in controlling the predominant weed, spiny emex (*Emex australis*).

The trial in maize was designed to compare different rates of 2,4-D amine both as "broadcast" treatments above the crop and as "directed" treatments (inter-row spraying). In this trial there was a heavy infestation of Noogoora burr. Although final details of this trial are not yet available, three points seem clear:—at the rates of 2,4-D amine used (½ lb., 1 lb., and 2 lb. a.e. per acre), weed control efficiency was independent of method of application; damage to the crop, which was approximately 2 ft. 3 in. high, was greater in the "broadcast" treatment than the "directed" treatment; and increasing the rate of application of 2,4-D amine increased the efficiency of weed control.

Departmental trials with soybeans in the South Burnett have indicated an advantage in close row spacing (14 in.) for increasing yields. Adoption of this practice would largely eliminate inter-row tillage, and a pre-emergence weedicide trial was therefore carried out to see if chemical weedicides could control weeds in the early growth stages. Monuron and atrazine were applied at 2 lb. active ingredient/acre, and 2,4-D amine, 2,4-DES and 2,4,5-TP at 2 lb. a.e. per acre. Dry weather conditions occurred after establishment and little weed growth appeared until heavy rain fell about one month later. Under these conditions the chemicals had little effect on the weed population, but monuron, 2,4-D and 2,4-DES appear worthy of further investigation. Comparison with the hand-weeded control plots showed that a moderate weed infestation could reduce the yield of soybeans by 22 per cent.

A programme was carried out to clarify and improve existing knowledge on the chemical control of thornapple (*Datura ferox* and *D. stramonium*) in the South Burnett. A major part of the work was carried out using the Chesterford logarithmic sprayer, but two pot trials were also conducted. Atrazine and diuron gave consistent control of both species at all stages of growth when applied as post-emergence sprays at the rate of 1 lb. a.i. per acre. The amine form of 2,4-D at 1 lb. a.e. per acre gave good control of both species when plants were in the prior-to-flowering stage and growing actively. Diquat at the rate of 11 oz. a.i. per acre also gave control of both species when sprayed at flowering.

Bindweed (*Convolvulus arvensis*) is a serious perennial weed of cultivation in the Warwick district and previous attempts to control it with 2,4-D have not been completely satisfactory. The chlorobenzoic acids have shown promise overseas and a trial was therefore laid down in grain sorghum to test their usefulness. Full details are not yet available but at the rates used (⅛ lb. to 1 lb. a.e. per acre) no visible damage occurred to the grain sorghum and no treatment gave complete control of bindweed. Further tests at higher rates of weedicide are proposed.

Wild oats (*Avena fatua* and *A. ludoviciana*) is a very serious weed of winter cereals in Queensland. Fifteen trials were carried out in the 1961 winter season to test methods of controlling wild oats in the three main winter crops—wheat, barley and linseed. Two of the chemicals tested are available commercially—"Avadex" (a pre-emergence type) and "Carbyne" (a post-emergence type). The third group comprises the triazines. Briefly, the trials showed that "Avadex" at 1 lb. a.i. per acre can be effectively used to control wild oats in linseed; 1½ lb. gives more complete control where this is desired. Thorough incorporation of "Avadex" into the surface soil is essential for best results. In a Roma trial the "spray, combine, combine-sow" treatment gave the highest yield. In some trials, effective control of wild oats with only ¾ lb. a.i. per acre of "Avadex" appeared a possibility.

Serious stand reduction occurs when "Avadex" is applied to wheat and barley, wheat being more susceptible than barley. Where the chemical was sprayed and incorporated as for linseed, no wheat appeared in the tractor wheel tracks and the stand was thinned considerably elsewhere.

Overseas work with "Avadex" on wheat and barley has followed two lines of approach. Firstly, a special "Avadex" preparation called "Avadex BW" has been prepared for use with these two crops; secondly, the area is sprayed with "Avadex", which is lightly incorporated into the soil, and planting is delayed for up to four weeks. Both these techniques are being examined locally during the 1962 winter season. In the meantime, the use of "Avadex" for wild oat control in wheat and barley cannot be recommended.

Seasonal conditions were unfavourable for the post-emergence weedicide sold commercially as "Carbyne" and ineffective control of wild oats was obtained. Only a slight thinning of the wheat stand occurred at the maximum dose rate of 10 oz. a.i. per acre. "Carbyne" had no effect at this rate on linseed.

Four triazines were tested on wheat and linseed as post-emergence weedicides and all four reduced the stand of both crops when applied at rates exceeding ¾-1 lb. a.i. per acre. A post-emergence weedicide capable of controlling wild oats in the three main winter crops would be particularly valuable, and "Carbyne" and the triazine compounds will therefore be tested further.

Irrigation Studies.—Studies aimed at (1) investigating the irrigation characteristics of major soil types in the Mareeba-Dimbulah irrigation area, and (2) determining the most efficient irrigation schedules for tobacco are in progress. In particular, the optimum frequency of irrigation together with the most efficient irrigation method to be used on each soil type is being sought. The amount of water required at each irrigation is a function of the vertical root distribution and the available soil moisture capacity of this root zone.

Studies have shown that 80-90 per cent. of the tobacco roots are in the surface 12 in. of soil at maturity and there is evidence to suggest that a satisfactory crop can be grown on most soils by controlling the soil moisture in this layer. Investigations are needed to define the amount of irrigation

water that should be applied at each irrigation on each soil type to satisfy these conditions. Field tests on commercial farms on the left bank Walsh area indicate that tobacco farmers apply more irrigation water than is necessary. The short-term result of over-watering is leaching of plant nutrients, while the long-term result is likely to be waterlogging and consequent drainage problems.

Irrigation frequency is determined by the soil moisture usage by the crop. This varies according to the stage of development of the plant. At no stage should soil moisture be excessively low or excessively high, as plant growth is affected in both cases. Three years' trials at Parada Tobacco Research Station have indicated that moisture stress during the establishment period does not significantly reduce final yield or quality provided the stress period does not interfere with plant maturity. The commercial practice of withholding water for six weeks after transplanting on a heavier soil such as Walsh sandy clay loam would not result in the same amount of moisture stress as would occur in a 3-4 weeks period on a sandy soil such as Algoma loamy sand. More information is needed on the inter-relationship of soil moisture during the main growing period with yield and quality.

A trial to determine the effect of amount and frequency of irrigation on the yield and specific gravity of Sebago potatoes is being continued at Gatton. Specific gravity of the harvested tubers is a measure of potato quality. This is particularly important for processing purposes as specific gravity is proportional to dry-matter content.

The results of the autumn 1961 trial again showed that amount applied was the most important factor in deciding yield, increasing amounts up to an average of 2 in. per week giving increased yields. The specific gravity of tubers, however, decreased with increasing amounts of irrigation. There was also an indication in this trial that reducing the frequency of irrigation towards the end of the main growing season, while keeping the average amount of irrigation water per week constant, may give slightly higher yields together with higher specific gravities. The spring trial carried out in 1961 was a complete failure due to heavy and consistent rainfall towards the end of the crop growth. This is the second occasion on which excessive November rainfall has been responsible for such a failure.

This series of trials is continuing and will later be extended to cover varieties other than Sebago as well as soil moisture/plant nutrition relationships.

Agricultural Engineering.—The most significant current trend in farm mechanisation in Queensland is the increase in fodder conservation equipment. Increased purchases of forage harvesters, mowers, hay-rakes and balers have been noted over the past few years.

Wider use of irrigation for all crops was recorded and firms specialising in irrigation equipment are confident that the demand will continue. The number of holdings on which irrigation was practised at March 31, 1961, was 7,839, the highest yet recorded, and was 950 more than in the previous year.

The autoheader developed by the Department for harvesting experimental plots and built by the Kingaroy Engineering Works has attracted the attention of research workers in other States. This project was financed from funds made available by the Department of Primary Industry. The slight weaknesses in design or manufacture which have come to light as a result of extensive trials are being rectified and the modifications will be incorporated in future models.

AGROSTOLOGY

Pasture investigations and demonstrations were intensified during 1961-62 and 103 new projects were commenced. Many of these have been supported from funds supplied from the Australian Meat Board, the Wool Research Trust Fund, the Australian Dairy Produce Board, the Commonwealth Extension Services Grant, the Queensland Irrigation and Water Supply Commission and Shell Chemical (Aust.) Pty. Ltd.

Pasture Species Evaluation.—New introductions received for testing during the year totalled 163.

The overall performance of certain of the perennial summer legumes in the more temperate parts of the State remains promising. Observations on pilot plots at Boonah, Beaudesert, Brisbane Valley, Lockyer Valley, Mary Valley and Brisbane districts indicated that *Glycine javanica* strains, siratro and *Desmodium uncinatum* made the most rapid and vigorous recovery after the severe winter of 1961. *Lotononis bainesii* made rapid vigorous growth in observation plots established on sandy and waterlogged soils on the south-eastern coast.

Observations on a legume nursery in the Bundaberg district during May and June of 1961 indicated the following order of frost tolerance: *Glycine javanica* strains; centro; siratro.

Further commercial plantings of Townsville lucerne on low-class grazing land reaffirmed recommendations based on accumulated experimental evidence. The legume was readily established in trials at Calliope and Gracemere by strip cultivating once with the chisel plough in the winter and planting in the following November. In trials to date, superphosphate has not been found to be essential for establishment on these soils.

Four selections of elephant grass Q2940 were planted in 14 locations from Toowoomba to Warra during 1961. Good growth and vigorous stooling following frosting indicated that this species may have a place on the Darling Downs.

On the Atherton Tableland, mixtures of guinea grass, green panic and molasses grass with Tinaroo glycine made very satisfactory seasonal growth. In a trial area at Millaa Millaa, the green panic/legume pasture gave the top green weight yield of 18.67 tons per acre over a 5-month period from July to December 1961.

A grass sward trial at South Johnstone conducted over four growing seasons showed highest animal intake from strains of guinea grass, elephant grass and *Setaria sphacelata* Q4423. These strains also produced the most growth.

At Utchee Creek, the substation of the South Johnstone Research Station, the performance of guinea grass/centro pastures was outstanding and the capacity of this mixture to withstand sustained heavy grazing was demonstrated. Under the conditions of the trial, 555 lb. liveweight gain per acre per year was obtained from the guinea grass/centro mixture grazed at the rate of 0.7 acre per beast. A pure stand of guinea grass grazed at the same rate produced 400 lb. liveweight gain per acre. In the case of the guinea grass/centro pasture there was no loss of stand at the end of four years of continuous grazing, while other mixtures under the same grazing treatment lost their identity and were replaced by weeds.

In a grazing trial at South Johnstone, continuous grazing at the rate of 0.5 acre per beast effected a marked loss of stand in the case of a para grass/puero mixture, and this pasture was invaded by weeds and *Brachiaria decumbens.* No loss of pangola grass occurred under similar conditions, but the associated centro stand was rather poor at the completion of the trial.

Satisfactory, if irregular, growth of Tinaroo glycine was recorded at Kairi Research Station in trials carried out during the June-July period of 1960 and 1961. Dry weight production figures for the 7-week periods in each of the two seasons were 13.2 and 8.1 cwt. per acre respectively. Lucerne grown in a pure stand nearby gave negligible growth during the same winter periods.

Pasture Seed Production.—As a result of the 1961 harvest of Tinaroo glycine at Kairi Research Station, 3,000 lb. seed was distributed to 170 farmers and to numerous organisations.

Viable seed is now being obtained at Biloela Research Station from the normally sterile canary grass hybrid, ronpha grass. Seed production of colchicine-treated ronpha grass seedlings is at present in the second-generation stage and counts of viable seed as high as 946 seeds per 100 cm. of panicle, compared with a count of 1,423 seeds per 100 cm. for the commercial strain of canary grass, were obtained.

Pasture Establishment.—Factors responsible for grass establishment failures on black earths on the Darling Downs have been resolved. Further work is aimed at more reliable establishment by improving the quality of seed sown and employing sowing techniques incorporating stubble mulches and permitting accurate depth control.

At Kairi Research Station, May sowings of lucerne gave better plant densities than either February or April sowings. Late sowing (March) depressed Tinaroo glycine emergence, but improved survival, probably due to reduced grass competition. Establishment of this legume was improved by reducing the companion green panic grass sowing rate from 9 lb. to 3 lb. per acre, but serious competition still occurred at the lower rate. Satisfactory glycine pastures were obtained by overseeding Tinaroo glycine into established maize crops. The hormone 2.4-DB gave effective weed control without damage to lucerne but was detrimental to glycine.

Results of a series of sod-seeding trials carried out at Coomera have been collated. The highlight was the capacity of winter legumes, especially purple vetch, to provide bulk protein feed during late winter and spring. Table 1 summarises the results of one such trial carried out during 1960. A basal dressing of 260 lb. per acre of a mixture of equal parts of superphosphate and dolomite was applied at planting on June 3, 1960. This table shows the benefits derived from high seeding rates, and the superior sustained growth of purple vetch.

TABLE 1

RESULTS OF SOD-SEEDING TRIAL AT COOMERA

Legume	1st Harvest 13–9–60 (15 weeks from planting) (lb. per acre)		2nd Harvest 6–10–60 (18 weeks from planting) (lb. per acre)	
	Oven-dry Forage	Crude Protein	Oven-dry Forage	Crude Protein
20 lb. Purple vetch	629	116	1,500	326
40 lb. Purple vetch	1,258	325	3,904	914
20 lb. Golden tares	113	27	339	68
40 lb. Golden tares	274	70	807	182
40 lb. Dun field peas	645	105	all material dead	
80 lb. Dun field peas	2,097	564	all material dead	
40 lb. Grey field peas	645	122	1,194	250
80 lb. Grey field peas	1,565	416	2,468	565

Pasture Management.—In an experiment contrasting the effects of various times of burning and of mowing on pitted blue grass (*Bothriochloa decipiens*) pastures near Texas, burning reduced the amount and increased the proportion of green leaf produced relative to non-burnt pastures. The subsequent summer production of plots burnt in the spring when the soil was moist appeared to be superior to that of plots burnt in the winter, or in the spring when the soil was dry.

A comparison of continuous and rotational grazing systems on guinea grass pastures at Utchee Creek failed to show differences under lenient grazing. When grazing pressure was progressively increased from 1.9 to 0.6 acre per beast, an increase of 15 per cent. liveweight gain was obtained in favour of the rotational grazing system.

Mitchell grass at Toorak Field Station was cut for hay from 1954 to 1961 at the following stages:—tillering, preheading, flowering, seed-ripe and seed-shed. The original basal cover was reduced from 3 per cent. to less than 0.5 per cent. in all treatments, the poorest cover occurring in the plots cut at tillering or at seed-shed stages.

Encouraging results have been achieved in preliminary studies involving the manufacture and quality of silage from tropical leguminous pasture at Kairi Research Station. Green panic and glycine pasture yielding 8 tons green material per acre, when ensiled produced good quality silage of 13-15 per cent. protein on a dry-matter basis. Fine chopping, and to a lesser extent the addition of molasses, improved silage quality.

Fertilizer Requirements.—Marked response by glycine to spot field applications of sodium molybdate at several locations in the Cooroy district indicated that a general deficiency may exist with regard to this legume. This appeared to have been a factor, together with moisture deficiency, contributing to the poor growth of glycine seed-increase areas at Nambour and Pinbarren. These observed field responses have been confirmed by plant analyses from the sites concerned, as follows (values are p.p.m. molybdenum on a dry-weight basis:

Treatment	Nambour	Pinbarren
+ Mo	20	18
Control	2	2

In the Cooroy district, previous trial work on the paspalum/mat grass association showed linear yield responses to applied nitrogen. The main contributor to the extra yield thus obtained was the paspalum component, which utilized more of the available nitrogen and temporarily dominated the inferior mat grass. However, plant ground cover data recorded over a 2-year period shows no change in botanical composition under the regular cutting regimen imposed in this plot work.

Accordingly, in October 1961, a trial was established to evaluate the response to fertilizer under controlled grazing. Four paddocks, each 2¼ acres, are involved. Observations to date confirm the trends quoted above and are summarised in Table 2. These figures indicate that little benefit is to be derived from ripping the sward. Initial growth observed on Treatment 3 was not nearly so good as that from Treatment 2.

TABLE 2

RESULTS OF PASPALUM/MAT GRASS FERTILIZER TRIAL

Treatment per acre October 1961	Green Weight Yield 21–12–61 (lb./ac.)	Grazing Yield Cow hr./ac. 29–10–61—21–12–61	Species Composition 8–12–61 (basal cover) (%)		Presentation Yield 21–12–61 (%)	
			Paspalum	Mat grass	Paspalum	Mat grass
1. 3 cwt. super ..	4,404	Nil (Cattle refused to graze)	17·7	81·8	67·0	33·0
2. 3 cwt. super + 100 lb. N. ..	12,536	473	31·1	68·5	83·7	16·3
3. 3 cwt. super + 100 lb. N. + Renovation	7,115	173	29·7	69·8	88·0	12·0
4. 1½ cwt. super + 50 lb. N. (repeated in March, 1962) ..	6,195	415	25·4	73·7	94·9	5·1

A pot trial carried out in Brisbane in conjunction with the Agricultural Chemical Laboratory highlighted a marked difference in response by paspalum and mat grass to applied phosphate. Both grasses failed to grow in the absence of added phosphate. As the level of applied phosphate increased, the gap in dry-matter production between paspalum and mat grass increased, the former making 2½ times as much growth as the latter. This is a clear indication that the maintenance of a high level of fertility favours paspalum at the expense of mat grass.

A long-term factorial experiment to examine the response of paspalum pastures on a recent alluvial soil at Rocklea to varying levels of applied nitrogen and phosphorus was commenced in the late summer of 1961. The first year's yield results are summarised in Table 3. They indicate responses to nitrogen and to phosphorus, and suggest that the need for applied phosphorus was greater when the nitrogen status of the soil had been improved. Most of the response occurred in the late summer period.

TABLE 3

TOTAL YIELD OF DRY MATTER (LB/AC. 16-2-61–25-10-61), PASPALUM FERTILIZER TRIAL

Super. (cwt./ac.)	Sulphate of Ammonia (cwt./ac.)				Mean
	0	2	4	6	
0	1,785	3,470	3,330	4,150	3,184
1	1,820	2,780	3,855	4,510	3,241
2	2,220	3,185	4,075	4,520	3,500
3	2,325	3,150	4,070	5,140	3,671
Mean	2,038	3,146	3,833	4,580	3,399

Similar results were obtained on kikuyu pasture on a red loam at Mt. Tamborine, although here the response to nitrogen was slightly smaller.

Studies on the zinc/phosphate disorder on Darling Downs soils have reduced some complexities of the problem but the causal factors are still not entirely understood. Cultivation has been shown to be implicated in the field occurrence of this disorder. Zinc is being applied commercially this season for the first time.

Positive effects of lime and of micro-nutrients on lucerne growth and persistence on granitic soils south of Warwick were recorded and the micro-nutrient deficiency is being further elucidated in pot experiments.

A factorial fertilizer experiment on an alluvial silty loam at South Johnstone gave marked responses in the growth of a guinea grass/centro pasture to applications of phosphorus, nitrogen and potash. Applied phosphorus increased the response to nitrogen. Both nitrogen and potash depressed the contribution of centro to the sward. This depression of legume growth by potash, indicating a greater grass need for potash, is of interest.

Applied phosphorus increased the growth of guinea grass fourfold on coastal plain soils near Tully. Some indications were obtained that the response was greater from grass than from centro.

The effect of various fertilizers on establishment of Tinaroo glycine in several latosol soils of the Atherton Tableland was tested in pot and field trials at Kairi Research Station. Phosphorus deficiency was found to exist on all soils tested and there was evidence that symbiotic fixation of nitrogen was inhibited by molybdenum deficiency on one of the latosols tested. Heavy dressings of lime gave beneficial results on two latosols. Nodulation studies showed that a significant relationship existed between plant phosphorus content and nodulation efficiency. Results quoted in Table 4 emphasise the value of phosphatic fertilizer on initial yield and nodule population of Tinaroo glycine grown on soil from Millaa Millaa.

TABLE 4

EFFECT OF PHOSPHATE ON TINAROO GLYCINE

Treatment	Yield of dry matter gm./pot		No. nodules per gram of roots
	Tops	Roots	
Control	0·13	0·12	4
Gypsum 5 cwt./ac.	0·25	0·22	45
Sodium phosphate 3 cwt./ac.	1·10	0·93	108
Superphosphate 2 cwt./ac.	0·98	0·82	171
Superphosphate 4 cwt./ac.	1·47	1·10	199
Superphosphate 8 cwt./ac.	1·67	1·30	162

"Brian Pastures" Pasture Research Station.—Research into pasture species assessment, establishment and management, and the physiology of pasture growth continued this year.

In the original sown pasture grazing trial into which lucerne was resown in 1960, stock productivity was more than three times that from native pasture grazed at one-half the stocking rate of sown pasture. This is similar to the ratios

established in the initial years of the trial. However, pasture dry-matter and crude protein yields are lower and the problem of the decline in grass productivity with time remains unanswered. Stock liveweight figures are presented below:—

	Liveweight Gain per Acre (lb.)	
	3–2–61—9–6–61	9–6–61—24–5–62
Rhodes lucerne	46	87
Buffel lucerne	46	78
Green panic lucerne	49	88
Native pasture	17	26

Sharply contrasting animal productivity was again demonstrated in a native pasture management trial. The fourth group of 2-year-old steers were depastured from November 10, 1960 to November 23, 1961 and the following liveweight gains were recorded:—

Liveweight Gain per Head (lb.)

Continuous grazing (control)	265
Rotational grazing	191
Slashing and deferred grazing	136
Chisel renovation	285
Supplementary winter lucerne	438

A rate-of-stocking trial was commenced on native pasture which is grazed only from December to May. During the first summer, stock mean liveweight gains per head for the three treatments, 1 beast: 1 acre, 1 beast: 2 acres, and 1 beast: 3.3 acres, were 51, 75 and 76 lb. per head respectively.

Results from trials indicate that bloodwood has been killed with 2 per cent. 2,4,5-T butyl ester applied to a basal frill in any month of the year.

In conjunction with the Agricultural Chemical Laboratory, a further trial to study management effects on the growth and nitrogen production of siratro (*Phaseolus atropurpureus*) and *Glycine javanica* was completed. The plants were grown in large boxes. During a period of 5 months, light and heavy defoliation treatments were applied, in which 20 per cent. and 60 per cent. respectively of the leaves were removed each fortnight. Nitrogen production is shown in Table 5.

TABLE 5

EFFECT OF DEFOLIATION TREATMENT ON NITROGEN YIELD (LB./AC.)

Legume	Control	Light Defoliation	Heavy Defoliation
Siratro—			
Shoots	223	336	308
Roots	78	99	53
Nodules	27	20	17
Total	328	455	378
Glycine—			
Shoots	333	377	300
Roots	152	126	48
Nodules	31	26	10
Total	516	529	358

The beneficial effect of light defoliation and the maintenance of shoot nitrogen under heavy defoliation are noteworthy points of interest. This trial was of similar duration to a lucerne experiment conducted the previous year, and the nitrogen production from the tropical legumes was comparable to that from the lucerne.

In studying the physiology of grass growth an attempt was made to apportion the relative influences of the leaf area remaining after defoliation and of the energy reserves of the plant (as represented by the non-structural carbohydrate status) on the regrowth of green panic. The amount of green leaf present was a more decisive influence in controlling growth than the carbohydrate status. Over the growth period of 20 days, an additional 3 cwt. of shoots per acre present at the start of the period produced an additional ton of dry matter per acre; plants bearing an additional ton of roots per acre produced an additional 7 cwt. dry matter per acre.

Attention has also been given to the effect of flowering in reducing grass growth. In experiments with green panic conducted under good growing conditions, removing the heads as they were exserted increased the growth rate by up to 25 per cent. This increase was wholly due to improved net assimilation rate (dry matter produced per unit area of leaf).

Irrigated Pastures.—Studies on growth rates of irrigated temperate pastures in a subtropical environment were carried out at Biloela Research Station. While total annual dry-matter yield of 20,000-22,000 lb. per acre is similar to the best obtained in southern Australia, the seasonal distribution is better under the subtropical than the southern environment. Winter production of the clover/grass pasture at Biloela Research Station was approximately double that of the best reported in southern Australia.

Following grazing, high dry-matter increments were obtained up to a leaf area index value of 4 in the spring period. Net assimilation rate showed a rapid decline with time. The results interpreted for pasture management indicated that an interval between grazings of four weeks would produce maximum pasture yields, but this spelling interval could be increased in the winter. This hypothesis has been substantiated in a grazing trial at the Station, yields of which are given in Table 6. The pasture mixture used was perennial prairie grass and Ladino clover.

TABLE 6

EFFECT OF SPELLING INTERVAL ON ANNUAL YIELD

Treatment	Number of Grazings	Yields of Dry Matter (tons/ac.)
A. 4 weeks grazing interval—grazed throughout year	11	7·92
B. 4 weeks grazing interval—spring and autumn spelling	9	6·09
C. 6 weeks grazing interval—grazed throughout year	7	6·77
D. 6 weeks grazing interval—spring and autumn spelling	6	5·68

At Walkamin Research Station, trials on Mapee clay loam (a low humic latosol) revealed that temperate legumes can be successfully established when superphosphate is applied at the rate of 6-8 cwt. per acre. Tropical legumes can be satisfactorily established using only 2 cwt. of superphosphate per acre. Production figures for the initial nine months in a white clover/prairie grass pasture are given below and stress the necessity for adequate phosphatic fertilizer:

APRIL 1961–JANUARY 1962

P_2O_5 Applied (lb./ac.)	Dry Matter (lb./ac.)	
	Clover	Grass
45	465	744
157	3,311	1,667
270	4,672	3,026
382	4,985	3,016
495	5,395	3,124

At Parada, all the pasture mixtures under test performed well this year. Of the tropical mixtures, para grass/centro and guinea grass/centro appear to be the best, the former being better suited to the heavier clays while guinea is superior on the better drained sandy loams. Paspalum/Ladino white clover is the best of the temperate mixtures, showing promise as an alternative pasture in the August-October period when the tropical mixtures give low production. Seasonal yields of green material (in tons per acre) are given below:—

Mixture	November–May	June–October
Para/centro	34·9	10·8
Guinea/centro	18·4	7·4
Paspalum/Ladino white clover	22·2	19·9

In new sowings in Queensland generally, Ladino and Louisiana strains of white clover have become much more popular than the New Zealand and Irrigation white clovers. The Louisiana strain appears to give much better growth during winter than the other strains. For example, at Gatton in June and July 1961, the growth rate was about double that of Ladino and Irrigation strains. Its free seeding habit and capacity to withstand dry conditions are useful attributes where irrigation is neglected during summer. Ladino is a large-leaved, tall-growing white clover which does well under high-temperature conditions; it has proved the most suitable white clover for the Biloela district in conjunction with perennial prairie and reed canary grasses.

HORTICULTURE BRANCH

The research programme in fruit and vegetable crops made substantial progress during the year. Some of the more significant developments were:—

The construction of a pineapple plant physiology laboratory at the Maroochy Horticultural Research Station and an extension to the existing laboratory at the Redlands Horticultural Research Station. The excellent facilities made available for plant physiological work emphasise the important role of laboratory and glasshouse techniques in horticultural research. They permit a better integration of fundamental and applied research with the day-to-day problems of the grower.

Stock-scion preferences for apples in the Granite Belt are becoming clearer now that trees on Merton stocks are

coming into bearing. Merton 778 is outstandingly the best stock for all varieties of apple on replant land. It is also suitable for the variety Jonathan on virgin land. For Granny Smith and Delicious varieties on virgin land, Merton 793 and Northern Spy are classed as good utility stocks.

A deficiency of potassium is the primary cause of the disorder known as "yellows" in North Queensland banana plantations. A revised fertilizer programme based on a 5/7/23 mixture promises to restore production to normal standards.

Seed of an F1 hybrid tomato produced from Q2 x Salads Special at the Redlands Station for winter cropping is now available commercially. The hybrid has outstanding vigour and shows some tolerance to cool temperatures. It should find a niche in the production programme.

DECIDUOUS FRUITS

Most of the apple orchards at Stanthorpe established prior to 1940 are on Northern Spy stock. In this somewhat marginal climate and relatively infertile soil, it has proved unsuitable on replant land and there has therefore been a strong demand for the more vigorous Merton 778, the superiority of which has been demonstrated at Applethorpe. A recent survey of commercial plantings confirms its utility. Current stock preference would appear to be Merton 778 for all the major varieties on replant land and for Jonathan on virgin land. Merton 793 and Northern Spy are suitable for Granny Smith and Delicious on virgin land.

No significant leads are yet available on the economics of fertilizer programmes in the bearing orchard. Current practice is to maintain levels of available nutrients in the soil at somewhere near conventional levels, correct excess acidity when this becomes pronounced and apply the trace elements zinc and boron with sufficient frequency to avoid gross deficiency symptoms.

Soil management studies in the Stanthorpe district indicate that soil moisture in orchards under sod is consistently lower than in orchards under clean cultivation or under straw mulch. The experimental trees are still young, but differences are such that under the same conditions in bearing trees, cropping would almost certainly be affected. However, the position may improve now that the soil environment under sod has been stabilised.

In thinning trials in the apple variety Delicious, fruit set was generally good and fruit size above normal. Sevin (0·08 per cent.) applied in the calyx and first cover sprays thinned the crop to much the same extent as ANA (10 p.p.m.) and both treatments were more effective than Sevin applied in the calyx spray only.

Thinning trials in Wilson plums followed the usual pattern this year, with DNOC (dinitro orthocresol) giving fairly consistent results when applied at full bloom. Treatment (0.06 per cent.) reduced the labour commitment in hand thinning, and in view of the price premium paid for large fruit, increased net returns per tree. An observational trial at Warwick suggests that the DNOC may also be of value for thinning apricots, the fruit of which is very liable to fall below the minimum grade standards.

Pre-harvest drop in apples is commercially controlled by an application of 2,4,5-TP (2,4,5-trichlorophenoxy acetic acid). However, growers are somewhat reluctant to use this product on the variety Delicious owing to the alleged risk of fruit breakdown in cool store. Further trials in association with the Food Preservation Research Branch confirmed the value of 2,4,5-TP as a thinning agent and demonstrated that the storage life of the fruit is not affected. The incidence of superficial scald was, however, higher in the fruit from treated trees, and protective measures against the disorder may be necessary with this variety.

PLANTATION FRUITS

Pineapples.—The new fertilizer schedule for pineapples based on a pre-planting 0/4/37 mixture applied at the rate of 1,000 lb. per acre followed by urea sprays (10 per cent) applied at periods of eight weeks during the cropping cycle has been widely used by growers. It has proved generally satisfactory except on soils with a low nitrogen status. Under these conditions, more frequent applications of the urea spray or, alternatively, supplementary side-dressings of sulphate of ammonia may be needed. Tissue analyses indicate that the nitrogen utilisation by the pineapple is very high in the November-February period.

Formal trials with 16 of the 32 pineapple clones selected for propagation in 1954 at the Maroochy Station showed marked differences in fruit quality and yield potential between clones. Clone 13 was outstanding and has been reserved for bulk plantings at the Station. The remaining clones are now under test. Surplus planting material from some clones was released for industry appraisal prior to the establishment of regional trials.

The effect of times of planting, types of planting material, size of planting material and times of flower induction were investigated at the Maroochy Station. Plantings after mid-March delayed both flowering and harvesting, while planting before mid-March reduced sucker production by as much as 20 per cent. The use of large planting material was reflected in larger plants, increased fruit weight and increased slip production. A split planting in autumn with one area established in mid-March and the second in early April achieves a crop spread of at least five weeks in the summer plant crop. This enables the grower to use his labour force to the best advantage.

The various forms of PCP used for weed control in pineapple plantations were compared in a trial at Nambour. Weed populations were higher in plots receiving a spray prepared from the liquid concentrates than in plots treated with sprays prepared from the powder and paste concentrates. This result requires confirmation. The significance of the problem is, however, less than formerly now that monuron is becoming increasingly popular as a weedicide in the crop.

Papaws.—In the current varietal improvement programme at the Redlands Station, the better strains selected at Brookfield and Sunnybank have now been purified to the fifth generation. Each has the required degree of uniformity for commercial production. Seed should be commercially available in 1964 if plans made for propagating and maintaining the types come to fruition. Both strains show considerable resistance to ripe fruit rots.

In fertilizer trials at the Maroochy Station, a response to nitrogen was recorded. On virgin soils with a low phosphate status, heavy applications of superphosphate are necessary, but not otherwise. Currently, the effect of potassium applied as a basal dressing prior to planting is being compared with normal practice in which the potassium is applied as a side-dressing. A marked improvement in plant growth has been recorded but yield data have yet to be compiled for critical examination.

Propagation studies demonstrated that raising plants in the seedbeds and transplanting them to field positions delays both flowering and fruit setting. Better results have been achieved by direct sowing or by propagating the seedlings in pots. In the latter case, root injury at transplanting is kept to a minimum.

Topping the young plant at a height of 3 ft. produces a strong branched tree in which each arm carries a crop of fruit. In the 2-crop cycle, yield per tree was less than in single-stemmed trees, probably because topping delayed setting and flowering of the first harvest. Earlier establishment in the field to permit normal flowering for the first crop is now being investigated.

A range of weedicides has been tested in papaws at the Redlands Station. The data indicate that monuron, diuron, atrazine and simazine could be of value in commercial plantations if used with sufficient care to avoid the deposition of spray residues on the stem and leaves of the plants.

Bananas.—Recent trials in the Innisfail area confirmed earlier work which indicated that the disorder known as "yellows" is primarily due to a deficiency in available potassium. Marked responses in plant growth, freedom from yellow leaf and increased bunch weight have followed the use of high-potassium fertilizers. Fertilizer practice in this area is now based on applications of a 5/7/23 mixture. The better growth obtained from planting material ex "yellows"-free plantations still requires investigation. A milder form of the same disorder is recognised in southern Queensland.

Spacing trials in North Queensland show that the optimum spacing for the wet tropics is 13 ft. x 5 ft. in plantations operated on a one-bunch one-follower system. At wider spacings in the row, yields per acre were substantially reduced; at closer spacings, follower development was adversely affected. In southern Queensland, spacing is more variable and must be adjusted to soil type, aspect, systems of management and possibly elevation.

TROPICAL AND SUBTROPICAL TREE FRUITS

Citrus.—Fourteen rootstock trials have been established and two or more are represented in each of the main citrus-growing districts. Experimental data collected during the next few years should provide worthwhile information on stock-scion combinations suited to various soil and climatic conditions. Stocks represented in the trial include sweet orange, citronelle, Emperor mandarin, *trifoliata* and Cleopatra mandarin. Supplementary trials with other stocks are planned for the future.

Some nucellar lines of citrus at Gatton Research Station should provide material of potential value to the Citrus Budwood Distribution Scheme. Work on this project was initiated in 1956 owing to the encroachment of virus diseases on trees used as sources of budwood. However, losses have been less than anticipated and ample budwood is still available in all varieties other than Marsh grapefruit, which suffers severely from stem pitting virus. The potential of nucellar trees is being evaluated in terms of vigour, yield and fruit quality as a preliminary to the establishment of pilot plots in commercial orchards.

A succession of dry years has focussed attention on the acute reaction of citrus trees to high concentrations of salt in the irrigation water. When the water requirements of the trees are supplied almost entirely by irrigation, conventional standards of water quality have little meaning. Decline in tree vigour and premature leaf fall were noted in trees irrigated with water containing as little as 50 grains of salt per gallon. Techniques of using marginal quality waters have been worked out and applied in commercial orchards. Current interest is centred on the salt tolerance of various stock-scion combinations.

Seed supplied to nurseries for propagating citrus trees is normally air-dried and held under refrigeration prior to sowing. Germination, particularly in sweet orange, has been variable and sometimes unsatisfactory. Methods of extracting and storing the seed have therefore been investigated in a joint project with Standards Branch. The results indicate that viability can be maintained for longer periods if the seed is damp-dried, packaged in a polythene container and stored at low temperatures. 8-hydroxy quinoline sulphate is a suitable mould preventive.

Two mandarin varieties—Hickson and Stemp—recommended for orchard trial a few years ago have yet to find a place in the citrus industry. Yield and fruit quality are good but Stemp is rather subject to "winter yellows" while Hickson is prone to crotch breakdown under some conditions.

Avocado.—Scionwood from the avocado orchard at the Redlands Station is fully utilised by nurseries which have adopted approved propagation techniques. These involve sowing the seed in "Malthoid" containers filled with sterilised soil and subsequent grafting under glasshouse or semi-glasshouse conditions. With these techniques, the period from sowing the seed to transplanting the tree is reduced to 12 months and losses in the orchard are negligible.

Scionwood of the variety Duke, a Mexican type with some resistance to Phytophthora root rot, was introduced for propagation. The young trees have now been planted in isolation where there is little risk of cross-pollination with Guatemalan and other types. Authentic Duke seed should become available from this source when the trees come into production.

Growth characteristics of the developing avocado fruit were examined in conjunction with Food Preservation Research Branch. The experimental data indicated that fruit volume is influenced by soil moisture, and oil content readings based on green fruit weight therefore vary with soil moisture prior to sampling. Specific gravity showed a more consistent correlation with fruit maturity than did oil content.

Macadamia.—The Macadamia orchard at the Maroochy Station contains both rough-shelled and smooth-shelled strains which are suitable for commercial propagation. The demand for scionwood exceeds availability and indicates that nurserymen are achieving some success in grafting. Once techniques are standardised, grafted Macadamia trees should be available in sufficient quantity to permit the long-awaited expansion of the industry. Special facilities are necessary to maintain temperatures and humidities at optimum levels for quick callousing of the graft union.

Custard Apple.—The custard apple has been a profitable crop during the past few years. Current research interest is in stock-scion trials at the Redlands Station, where the commercial variety Pink's Mammoth is established on a range of seven stocks selected for vigour and productivity. Supplementary material in the block includes two varieties from India, the fruit of which has an attractive pink blush in the inter-carpellary spaces.

Mango.—With the development of an interstate trade in deep-frozen mangoes, growers have exhibited a renewed interest in this tropical fruit. In order to cater for future needs new varieties were introduced from the United States. They include Manzano, Brooks, Anderson, Nelson and Saigon. After release from quarantine, the trees are to be planted in the dry tropics for observation.

MISCELLANEOUS FRUITS

Selections within progenies derived from crosses between the golden passion fruit, which has some resistance to Fusarium wilt, and the purple passion fruit are being screened at the Redlands Station and at Millaroo Research Station. Some of these are in their fourth generation and approach commercial requirements. Resistance to wilt is satisfactory in the best strains. Progeny selections are tested in the seedbed for disease resistance by inoculation techniques before field planting. The widespread adoption by the industry of grafted vines with a golden passion fruit stock has lessened the urgency of the breeding programme. Fruit quality and other agronomic characters in the selections are therefore being studied in greater detail.

Last year, Majestic, a local strawberry selection from the Near North Coast, outyielded the standard variety Phenomenal in field trials. However, fruit type and plant type are rather variable. Nevertheless, plantings are increasing each year. The impact of this locally selected type on the industry has led to the initiation of a strawberry breeding programme at the Redlands Station and Majestic has already demonstrated its value as parental material.

Mulching trials in strawberries at the Redlands Station included an aluminium-coated polythene sheeting which was recently placed on the market. It proved outstandingly superior to the more familiar black polythene sheeting. Increased yields associated with the use of this material are attributed mainly to more equable soil temperatures, particularly during the June-August cropping period, when temperatures sometimes fall below the optimum for the plant. A clear plastic mulch is of little value in strawberries even when used in conjunction with pre-germination weedicides such as SES (sodium 2,4-diethyl sulphate). Once the effect of the SES wears off, weed growth under the sheeting becomes profuse and unmanageable.

MISCELLANEOUS CROPS

In a ginger trial at Nambour, weed control presented a major problem. The land was formerly under grass and, in spite of thorough tillage and a pre-planting application of monuron, seedling paspalum almost got out of hand in the young ginger. Subsequent PCP-oil sprays gave some control but inter-row tillage had finally to be resorted to in order to save the crop. Incidentally, monuron gave excellent control of thick head (*Crassopetalum crepidoides*), a recently introduced weed which is spreading rapidly in the Near North Coast district.

VEGETABLES

Tomatoes.—In the Redlands district, Grosse Lisse and its strains, including Q2, have met the reasonable requirements of growers for many years. However, all lines of Grosse Lisse are rather susceptible to disease and it is doubtful if any single variety can meet the special requirements of autumn, winter and spring cropping. Two-variety plantings would be an assurance against seasonal conditions which are adverse to a single variety.

Current work is concerned with:—(*a*) evaluating the several strains of Grosse Lisse available commercially and checking alleged differences in susceptibility to catface and in fruit size; (*b*) testing selections from Q2 x 147-3 with acceptable agronomic characters; and (*c*) developing better F1 hybrids for the winter crop. Some of the Q2 x 147-3 selections are under regional trial; fruit type is comparable with Q2, potential yield is rather better and the best of them could go into commercial production in 1963. The present F1 hybrid derived from Q2 x Salads Specials shows tolerance to cool temperatures and has exceptional vigour. Seed is now being marketed through commercial channels. Salads Special, unlike Q2, is highly variable in plant type and various strains within the variety are therefore being investigated as parental material for the production of hybrid seed.

Tolerance of low temperatures is a varietal requirement in tomatoes not only in southern Queensland but also in coastal areas further north where the crop is grown during the winter months. At Bowen, for example, blossom shedding and fruit abnormality due to faulty pollination were troublesome right through to November in 1961. The current research programme in this area is concerned with elucidating varietal susceptibility to the disorder and the effect of nutritional and irrigation practices on its incidence.

Trials at the Redlands Station have failed to provide any justification for high rates of fertilization in the red-brown loams of the district, except perhaps on virgin land with a low phosphorus and nitrogen status. Excessive fertilizer may be a contributory factor to the high incidence of disorders such as blossom end rot and pith rot, which are a recurring problem; both seem to be associated with high NH_4 ion content and an associated induced deficiency of calcium in the plant tissue. A 6 cwt. dressing of a 5/13/5 basal fertilizer is more than adequate for normal needs and a side-dressing is rarely necessary. No response was obtained to side-dressings of nitrogen and there is evidence of a reserve of nitrogen at depth which can be tapped by the root system once the plants are established.

The response to superphosphate recorded in soils—even those with a high available phosphate analysis—is very marked in seedling plants and accurate banding of the basal fertilizer is desirable. Germinating seedlings have a very high phosphate requirement which is not satisfied by normal methods of fertilizer usage.

The effect of various tillage implements on soil compaction was investigated at the Redlands Station. Contrary to expectation, the rotary hoe caused less compaction than tine and disc implements. However, with all tractor-operated implements a tine should be fitted behind the wheels. The degree of wheel compaction is such that development of the root system is retarded in the following crop.

A number of Bowen Red selections derived from natural crosses between Q3 and Lady Cunningham were investigated in a trial at Millaroo Research Station. Fruit set was less affected by low temperatures during the growing

period than might have been expected. Two strains (Wheeler and Payne) were outstanding for yield and tolerance to low temperatures but fruit quality fell below the standard set by Q3.

Beans.—Three rust-resistant varieties—Redlands Belle, Redlands Beauty and Redlands Greenleaf—are now available to the green bean industry. Although all three varieties have a large infusion of Brown Beauty "blood," they differ from that variety in one or more agronomic characters, such as development of fibre in the pod and pod size and shape. The failure of some growers to appreciate this and modify harvesting practices may be responsible for minor complaints of declining pod quality which have been made on some markets. Nevertheless, Redlands Belle and Redlands Greenleaf are both in strong demand.

The importance attached to pod quality by the green bean industry has focussed attention on the breeding programme for stringless beans. This project has been in progress for some years and several selections are ready for regional trials. Most of these perform well when grown under optimum climatic conditions and are of interest at Stanthorpe, where the crop is grown during the summer months, for the autumn crop in coastal southern Queensland, and for the winter crop in North Queensland. In this programme, lack of string in the pod has had to be compensated for by the inclusion of wall fibre in the plant type, a characteristic derived from the variety Blue Lake.

Stringless beans with the same external appearance and palatability rating as the conventional Brown Beauty string bean may lose their identity on the market and fail to command a price premium for quality. From the plant breeder's point of view, it is no more difficult to produce a stringless bean which is distinctive in both pod and shape and palatability than it is to produce a bean which is similar in appearance to Brown Beauty. If the plant breeding programme is to be co-ordinated with industry requirements, an appraisal of consumer demand for each of the two types is essential.

Work on culinary beans during the year was concerned with the consolidation of the varietal position in the Burdekin Delta. Seed lines of types with an economic potential have been purified and their merits assessed under field conditions. The more important of these are Saluggia, Cannellino, Borlotto and Black Eye. Further purification is in progress with Mandalano. Consignments of beans grown primarily for the northern market are being railed to Melbourne for appraisal by southern distributors who handle the bulk of the culinary beans imported to Australia.

Other Vegetables.—Further trials with pea selections from the Redlands Station have been carried out in all producing districts. The best of these are A3, C16P, C16C and B27. Seed is currently being bulked at Kingaroy and Ayr and commercial production should commence in 1963. The selections should prove popular with pea growers supplying the fresh vegetable market. Their potential for processing is of commercial interest to the Committee of Direction of Fruit Marketing through its Northgate cannery.

In the celery crop, the black heart disorder responded to applications of calcium nitrate and calcium chloride sprays applied during the later stages of plant growth. The most efficient schedule recorded in trials at Rochedale comprised weekly applications of calcium chloride (1 per cent. solution). Apart from reducing the losses due to black heart in celery, treatment was associated with a weight increase of ½ lb. per plant and a significant reduction in "bolting."

Tipburn in lettuce, like black heart in celery, is associated with a deficiency of calcium in the plant tissues. However, responses to calcium sprays have been less consistent and more frequent applications (up to three weekly) may be necessary to control the disorder. There are apparently two types of tipburn. That characterised by a marginal scorch in the frame leaves, preceded by necrosis of the terminal portions of the main veins, appears to respond to the calcium spray. The second type, in which marginal scorch is restricted to the heart leaves, is more difficult to control.

A rockmelon trial at Stanthorpe confirmed results from earlier trials at other centres. The crop received a setback in the early stages of growth from molybdenum "burn" induced by high temperatures shortly after application of the spray. Nevertheless, yields were reasonably good. Conqueror and Rio Gold were outstanding for resistance to downy mildew. Plant type in these two varieties is rather similar and both produce fruit of medium size with an attractive flesh. However, the fruit is susceptible to ripe fruit rots and losses in transit to market can be high under some conditions.

Chemical weedicides have so far made little impression on the vegetable industry in Queensland except perhaps in root crops such as the carrot. This is largely due to the difficulties in defining the conditions under which injury to the cultivated plant will occur. This was illustrated by the variable results obtained with Randox in beans during the past two years at Redlands Station. Excellent control of weeds without any adverse effect on the plants was recorded in 1961, whereas in the following year leaf scorch in the germinating seedlings was serious. This problem has led to the initiation of elaborate trials with a wide range of materials at different concentrations in a series of commercial vegetable crops at the Station.

SERVICE PROJECTS

In spite of the increased disease hazard associated with neglected banana plantations in the recent period of rather depressed prices, control of bunchy top presented no major problems during the year. Good spring rains were followed by an increase in the number of infected plants up to December 1961, but grower co-operation in control measures was generally good. Since December, the incidence of the disease has been comparatively low. In the Wamuran Basin, where the disease has persisted at above-normal levels, inspectional services were temporarily strengthened. Bunchy top was recorded for the second time in the Brisbane area since the embargo on plantings was lifted in 1958. The affected plants were promptly eradicated.

The Citrus Budwood and Seed Distribution Scheme functioned normally in 1961, with seed distribution amounting to 283½ lb. and 119,100 buds being supplied to nurseries. The demand for sweet orange seed continues to expand and Emperor mandarin is also increasing in popularity as a stock. Citronelle seed extraction techniques at the Kamerunga Station have been re-organised, with a consequent reduction in costs of production. The demand for virus-free budwood continues to expand but source trees at Mundubbera were affected by frost last year and supplies for propagation on *trifoliata* stock were limited; the deficiency was made good from New South Wales. Orders for budwood of the Glen Retreat mandarin showed a sharp decline from previous years.

Certified tomato seed was produced in rather greater quantities during the year—Q2, 115 lb.; Q3, 77 lb.; and Q5, 25 lb. Sales of Q2 have declined somewhat owing to the reduced demand for this variety in the Redlands district but still amount to some 1,500 oz. per annum. There was a correspondingly increased demand for Q5 seed, which does well on the less fertile soils both at Stanthorpe and along the coast. Fruit type in Q5 is probably superior to that of any other variety currently available in Australia. Bacterial canker is becoming increasingly troublesome in the Granite Belt where the seed is grown, and one crop registered for certification failed to comply with requirements for freedom from disease.

Bean seed production programmes were the major commitment during the year, and in the Burdekin Delta the resident staff had to be augmented during the inspectional period, July-September. Production is more or less confined to the Burnett Valley (Kingaroy and Gayndah) and the Burdekin (Clare and Millaroo) but a pilot field planting was serviced in the Callide Valley. The potential of this area for seed production is considerable even though time of planting is critical. Production for the year amounted to 12,740 bus. from some 1,300 acres registered for approval.

Mother plants (30,000) with the prescribed standard for freedom from disease were supplied to two growers registered under the Strawberry Runner Approval Scheme in 1962. The plants came from special stocks at the Redlands Station. A limited number of approved runners should be available from these crops for commercial planting in 1963. At the moment, the Scheme is restricted to the variety Phenomenal, but in view of the increasing popularity of Majestic on the Near North Coast, consideration is being given to the inclusion of this variety in the Scheme.

EXTENSION

The extension services of the Horticulture Branch have operated under much the same conditions as in previous years, with the main emphasis on farm visits. Group discussions and field days were organised from time to time on the initiative of the Branch or industry organisations in particular districts.

Provision has been made for an improved extension service in floriculture to cater for the needs of nurseries, cut flower growers and organisations and individuals interested in lawn management. The service should, among other things, keep the Department informed on commercial developments in these rather specialised fields.

The re-organised packing instruction service to schools functioned well during the year. District officers were groomed in packing techniques and several are now adequately equipped to handle both teaching commitments and general advisory work on packing methods for the more important commercial crops.

A considerable number of coloured stills have been collected in all districts to illustrate production methods in the more important horticultural crops. These have been recalled to Brisbane, where duplicate sets are being arranged on a subject basis. These will in future be available at short notice for illustrated talks to growers' organisations.

Economic conditions have improved in some horticultural crops, notably in the pineapple industry. Even though returns for some crops are still marginal, growers continue to exhibit considerable initiative in coping with and overcoming production problems. This is indicated by a willingness to adopt production methods which hold promise of reducing production costs. Extension programmes during the year featured drainage in the Stanthorpe district; soil conservation in pineapple plantations; the use of basal fertilizers in pineapples; control measures for banana yellows in North Queensland; propagation of avocadoes in containers; times of planting in strawberries; and potentially useful varieties of tomatoes, beans and strawberries.

Advisory Committees (pineapple, citrus, vegetable, deciduous fruits and banana) are now fully integrated into Horticulture Branch organisations. The Banana Advisory Committee was initiated during the year at a time when the industry faced major marketing problems, the solution of which is contingent on a thorough knowledge of production and marketing practices. The other and older Committees functioned smoothly and have established an effective liaison with research and extension units in the Branch. All are a stabilising influence in departmental-industry relationships. Formation of a similar committee for the floricultural industries has been considered and action deferred for the time being. Periodic conferences are, however, held with nurserymen specialising in fruit tree propagation, rose propagation and the propagation of ornamental plants.

HORTICULTURAL RESEARCH STATIONS

The three horticultural research stations continue to play an important role in the research and extension work of the Horticultural Branch. Regular visits by executive groups from grower organisations are now normal practice and the horticultural industries are therefore reasonably well informed on research programmes, research techniques and methods of interpreting research data.

The Maroochy Station carried out a full programme in plantation crops—pineapples, bananas and papaws. Banana projects were hampered by lack of plant vigour, which is now attributed to root knot nematode; in future, soil fumigation will be practised before planting. The station is now graced with an excellent plant physiology laboratory and glasshouse, the construction of which was financed by the Pineapple Sectional Group Committee of C.O.D. The laboratory is well equipped to make major contributions to our knowledge of the pineapple plant and production methods suitable for Queensland conditions.

The Plant Physiology Laboratory at the Redlands Station was enlarged during the year to cope with its expanding programme of research in vegetable crops. Programme planning is, however, hampered by uncertain water supplies for the irrigation of field crops. This difficulty should be overcome when a projected 10-million gallon dam is constructed alongside Hilliard's Creek. The site has been cleared and excavation should proceed during the 1962-63 financial year. Additional accommodation for administrative and extension staffs is urgently needed; however, at the moment, part of the packing shed is being used for this purpose.

The Kamerunga Station continues to fill a useful niche in North Queensland as a holding centre for tropical plants of potential economic importance and as a suitable location for Horticulturists and Plant Pathologists in North Queensland. The existing buildings are in a bad state of repair and plans are in train for the construction of a new laboratory to serve the two Branches concerned.

PLANT QUARANTINE

The traffic in ornamental bananas has increased to levels which could prejudice control measures for bunchy top in commercial banana plantations. Four of the more important species have therefore been declared pests under the Diseases in Plants Acts. Permits cannot be issued for the removal of these plants, and, where necessary, steps may be taken to eradicate them in areas where bunchy top is endemic.

Until recently, cotton was grown only in Queensland. Vacuum fumigation of raw cotton entering the State from the Americas is therefore prescribed as a safeguard against the introduction of insect pests not represented in Australia. Now that cotton is being grown in other parts of the Commonwealth, uniformity of quarantine practice at all ports seems desirable and the associated problems are currently under investigation.

In Queensland, the importations of logs and sawn timber can only be effected through the port of Brisbane, where adequate facilities are available for inspection and, where necessary, treatment of infested material. Normally, sawn timber presents no problems but borer infested planks have been intercepted on a number of occasions during the year. Some consignments had to be fumigated with methyl bromide.

European house borer is frequently located in the cabin trunks of passengers arriving at Australian ports. In view of the difficulties encountered in the examination of metal-lined trunks of this kind, inspection has been dispensed with and fumigation of all trunks is now obligatory.

Orchid quotas have been reduced from 1,000 per approved importer to 800. The present quota is still in excess of safe quarantine limits and further cuts seem inevitable if the plants are to be properly serviced in post-entry quarantine. Official post-entry quarantine glasshouses in northern and southern Queensland which are planned for next year may ease the position.

Quarantine commitments during the year included the servicing of 778 overseas vessels (passenger and cargo) and 440 overseas aircraft. Goods subject to quarantine inspection comprised, among other things, 14,611 logs, 11,281,755 super. ft.; sawn timber, 5,480,580 super. ft.; plywood and veneers, 2,164,060 sq. ft.; 123 packages containing 22,200 plants; packages ex Parcels Post, 540; and second-hand motor vehicles, 484.

SOIL CONSERVATION BRANCH

Growing interest in soil conservation was reflected in the large increase in requests for Departmental soil conservation services during the year. This trend occurred in all districts and the total of 2,371 applications represents a 50 per cent. increase over those of the previous year. Almost half the requests came from the Darling Downs region.

Staff was appointed to two new centres at Wandoan and Jandowae. Soil conservation activity also increased rapidly in five other new districts, reaching a level of soil conservation development which justifies staff appointments at further centres. For the present these needs are met by visits from officers in other districts.

Twenty soil conservation extension officers travelled more than 120,000 miles and made 4,127 visits to farms in providing advisory services, preparing farm plans and surveying sites for earthworks. Initial visits totalling 657 were made to farms on which soil conservation work was being undertaken for the first time.

In addition to these farm visits, maximum use was made of mass media to stimulate interest. Thirty radio talks were given, 42 press articles released and 11 field days, schools or inspection tours were conducted. Eighty-two meetings were attended and two show displays prepared.

While a substantial proportion of officers' time was devoted to planning and surveying activities, due attention was also given to encouraging the adoption of farming practices to protect and build up the soil. Response in this field is slow because the necessary changes affect economic and management aspects.

RUNOFF AND EROSION CONTROL WORKS

During the year Departmental officers provided the technical services associated with the installation of 105,164 chains of protective earthworks on 34,105 acres of eroded cultivated land, representing a 50 per cent. increase on the previous year's record total. Cultivated lands now protected from erosion-inducing runoff flows total 157,663 acres, or about 10 per cent. of the area estimated to require this type of protection at present. Very satisfactory progress was made in all districts but work done in the Darling Downs (16,175 acres) and Burnett (12,943 acres) regions accounts for 85 per cent. of the State total for the year. The Darling Downs figure is about double the total for that area in the previous year.

There was an expansion in the use of contour cultivation procedures (without contour banks) on gently sloping lands in the Central Highlands, Maranoa and Western Darling Downs, and contour line location surveys were made on 14,778 acres during the year. This is more than treble the area similarly treated during the previous year.

Over 9,600 chains of artificial waterways were designed and constructed during the year, an increase of 40 per cent. on the total for the previous year. Conditions were satisfactory for establishment of grass in these waterways and in this regard the early storms were an advantage. However, on the Darling Downs these storms provided a severe test for recently constructed major waterways. Observations suggest that there may be more uniform flow and possibly less risk of major damage to new waterways on gently sloping land if the vegetative material is planted in longitudinal rows.

A noteworthy trend during the year was the increased use of level interception structures on land slopes of less than 3 per cent. in areas with an annual rainfall of less than 30 inches. The aims are to increase water storage in the soil, to defer the movement of runoff water to waterways and to simplify planning procedures in new settlement areas. Level banks installed during the year at Emerald and Wandoan were subjected to testing rains and their performance was satisfactory.

Double-spaced contour banks have been used to a much greater extent in eastern Darling Downs districts, and although there are disturbing safety aspects there is apparently a very strong farmer demand for this type of design despite the reduction in security.

PLANNING

Planning techniques improved during the year but there was a deterioration in the rate of plan development. Techniques were improved by modification of episcopic projection methods and by expansion of topographic mapping activities.

The 200,000 acres Maclagan mapping project was initiated and vertical control surveys requiring about 300 man-days were almost complete at the end of the year. The Surveyor-General's office is now proceeding with the photogrammetric plotting of topographic data.

The 180,000-acre Mt. Tyson topographic map, prepared in the previous year, assisted materially in expediting soil conservation plan development in that area and resulted in a considerable saving in planning time.

The development of State soil conservation plans (total now 424,000 acres) continues to be a major bottle-neck and the situation deteriorated further during the year. Whereas plans were finalised for 172,000 acres in 1959-60 and 130,000 acres in 1960-61, during the year under review the total was only 74,000 acres. This situation was brought about by the mounting requests from landholders for increased technical guidance in the implementation of programmes; existing staff are unable to cope with both planning and implementation needs. Since 1959-60 effective extension staff strength has increased by 7.5 per cent., but requests for technical assistance during 1961-62 were 50 per cent. greater than in 1959-60 and site surveys for earthworks and contour working have increased by 148 per cent.

The time invested in topographic mapping has also had its effect. The 300 man-days required for this project could have increased the soil conservation plan output by 40,000 acres.

Serious erosion on the sloping tobacco lands in the Mareeba–Dimbulah districts has focussed attention on the need for the early application of soil conservation measures. Preparation of plans was commenced and those for the Price Creek group were completed.

INVESTIGATIONS

Various waterway establishment and design problems were investigated during the year and studies were initiated concerning the practicability of using level detention structures to mitigate runoff, flooding and erosion on the gently sloping soils of the western Darling Downs.

Hydraulic investigations at Yarraman were finalised during the year. These tests were initiated to correlate the hydraulic behaviour of kikuyu grass waterways with the flow characteristics of comparable vegetative channels used in the United States. Once this correlation is determined the comprehensive data available from research at the Stillwater Hydraulic Laboratory may be applied to waterway design in this State without further detailed research. In these tests the retardance effect of kikuyu grass proved to be similar to that of Bermuda grass in the Stillwater investigations. In terms of the retardance curves published by American workers for use in waterway design, a thick stand of very long green kikuyu grass fitted their curve B and the same stand of kikuyu grass grazed to a height of 2–6 in. above ground level fitted between curves C and D. These results are subject to further confirmatory work but a sound basis has now been established for the design of kikuyu grass waterways.

Fertilizer trials were continued on the Darling Downs to determine the effect of added nitrogen on the density of grass cover in waterways. African star grass responded to nitrogen application on all soil types but kikuyu grass responded only on lighter soils.

Establishment of vegetative cover on black soil waterways in the Darling Downs region has been complicated by difficulties in obtaining satisfactory stands of those species propagated from small seeds. During the year work was initiated to determine the value of bitumen mulch as an aid to grass establishment from seed. The first trial on a moist seedbed with good post-germination conditions resulted in a far superior emergence under bitumen mulch. The species used included green panic, common Rhodes and Katamboro Rhodes grasses, and bitumen was applied at the rate of ½ gal. per sq. yd. Further trials using bitumen application rates of from $\frac{1}{16}$ gal. to ½ gal. failed to reproduce the spectacular increases of the first trial, but in these later trials the bitumen was applied over a dry seedbed. It now seems likely that the bitumen mulch is of value only where the seed is planted on a moist seedbed. This work is being continued.

In view of the obvious need to defer movement of runoff water to waterways on gentle slopes below large catchments and to increase the water storage potential of clay soils in these situations, investigations were initiated to determine the effect on crop growth of temporary detention of runoff water. In these trials wheat, canary seed and linseed were used as the test crops; in general, the crops in their younger stages of growth were more susceptible to damage than they were when more mature. Linseed was the most resistant, being only slightly affected at any stage of growth after 5 days of flooding. Extension of the flooding period resulted in a total kill after 14 days at the seedling stage, with 75 per cent. survival at later stages. Wheat at seedling stage was unaffected by flooding for 2–3 days but was killed entirely at 8 days. In later growth stages survival was 30 per cent. after 14 days. Canary seed at seedling and early growth stages was killed after 8 days of flooding. Later stages were only slightly affected by flooding and 90 per cent. survived after 14 days of inundation.

BOTANY SECTION

About 8,000 specimens were received from members of the public, officers of State and Commonwealth departments and visiting biologists. These included some extensive collections from the Cape York Peninsula, the Blackdown Tableland, the Canarvon Ranges and the Cloncurry district and collections of mangroves from several places on the east coast as well as the usual weeds, poisonous plants, fodder plants, grasses, trees and other plants. A total of 150 samples of stomach contents was examined for suspected poisonous plants.

SYSTEMATIC BOTANY

Taxonomic work was continued in the genera *Acacia, Carpobrotus, Eremophila, Melaleuca, Myoporum, Plectranthus, Sarcozona, Scirpus* and *Scleria.* New work was begun in the genera *Crotalaria, Ceriops, Dendrobium* and *Rhizophora.*

A special study was made of species of *Crotalaria* related to *C. trifoliastrum.* This revealed that eight different taxa can be distinguished in this group in Queensland. The distribution of these was mapped from herbarium specimens and a tentative key for their identification was prepared. Further work in the field and herbarium is needed to determine the status of each taxon and to clarify the nomenclature. The recognition of these several taxa helps to explain why discrepancies have appeared in the results of chemical analyses and feeding tests with plants which have been assigned to this species in the past.

An attempt was made to find characters for separating desirable and undesirable types of guinea grass (*Panicum maximum*). It was found possible to distinguish most of the different types in bulk but no characters were found which could be relied upon absolutely to separate all individual spikelets of the different types.

Descriptions of several new species of *Acacia* were prepared for publication. These include some important edible trees with well-established local names which had not previously been named or described botanically.

Identification of the plants from Cape York Peninsula collected by the Archbold Expedition in 1948 was interrupted by the sudden death of the late C. T. White in 1950 and only some specialized families have been examined in detail. It has now been found possible to resume work on the general collection and determinations were completed of plants in 31 families.

Botanical specimens were collected in many parts of the State in the course of field work on brigalow, eucalyptus and weeds. In addition, a general trip was made to the Cairns-Cooktown area to study and collect plants in the genera *Melaleuca, Plectranthus, Dendrobium* and *Cheilanthes.* Extensive collections were made of grasses and annual herbs. Three new species were discovered.

BRIGALOW AND SCRUB CLEARING

Survey.—A preliminary draft was completed of the results of the brigalow control survey begun in 1958. This report describes in detail methods which have been employed to clear brigalow country and makes a critical assessment of the problems involved. It also incorporates recommendations for future research.

Spraying Trials.—Spraying trials were continued on small and medium-sized brigalow suckers which are difficult to handle mechanically and are too dense to be controlled with fire. Most of these trials were carried out with a low-volume power knapsack misting machine. Results of spraying of very young suckers carried out in March 1960 confirmed earlier findings with aerial application that 2,4,5-T at rates as low as ½ lb. per acre is effective on suckers if they are sprayed within about 2 months after they come up following a burn. This technique appears to have great potential for handling suckers in difficult areas.

Because of wet weather it was not possible to make a late assessment of the trials laid down in December 1960 to compare the effectiveness of several different chemicals on brigalow suckers about 4 ft. high. Inspection 12 months after treatment indicated that neither amitrole nor monuron had any appreciable effect on brigalow at the rates used but that 2,4,5-T and 2,4,5-TP appeared to be equally effective. Final assessment of this trial should be possible within the next 12 months.

In another series of trials it was confirmed that brigalow suckers can be killed to ground level at almost any time of year, provided the coverage is adequate and about 1 lb. of 2,4,5-T is applied per acre. Results with low-volume misting were equivalent to those obtained with high-volume wetting where coverage was complete. Quickest defoliation and the most rapid establishment of grass were obtained by spraying during the midsummer months.

A larger scale test with the misting machine was carried out on an area of 30 acres of suckers, using 2,4,5-T at ¾ lb. per acre, some in diesel distillate, the remainder in water at about 3 gal. per acre. Assessment of this result will not be possible for another 12 months.

Scrub Clearing.—A visit to the Nebo district in October showed that large-scale clearing of brigalow and softwood scrubs had brought serious problems, chiefly the danger of soil erosion on some steep slopes and a large amount of suckering in some areas. Clearing of the erodible slopes was apparently done in ignorance of the dangers involved. The wholesale suckering was due partly to the fact that the brigalow itself was of a type difficult to handle, partly to seasonal conditions unfavourable for pasture establishment and partly to the fact that many landholders cleared areas too large to be handled properly with their available resources of capital, labour and knowledge. Inspections of the areas seven months later indicated that some of the sucker infestations were being brought under control but that many large areas still remained a problem. Clearing of erodible slopes had ceased on all except one property but on another property clearing on a large scale of scrubs likely to sucker badly was being carried out despite advice to the contrary and experience of others in the district.

EUCALYPT CONTROL

Small-scale trials in eucalypt control were carried out, one near Gladstone, the other near Texas. At Gladstone, standing trees of gum-topped box (*Eucalyptus hemiphloia*) were treated in November with 2,4,5-T in diesel distillate at a concentration of 2 per cent. Two techniques were used; frilling close to the ground then pouring the solution in the frill, and injecting the chemical directly under the bark with an American tool specially designed for the purpose. Preliminary observations indicate that the treatment is likely to be effective in most cases. Diquat, a chemical normally used for drying up leaves of plants to assist in burning, was also injected with the same tool and early results look promising. This technique warrants further study with a wider range of chemicals and tree species.

Near Texas a low-volume knapsack misting machine was used to apply 2,4,5-T in diesel oil and water to sucker regrowth of three species of eucalypts which have proved difficult to control in the area. The species involved were silver-leaf ironbark (*Eucalyptus melanophloia*), gum-topped box (*E. hemiphloia*) and mountain gum (*E. dealbata*). It is too early to assess the results.

WEEDS

Wild Oats.—Further studies on the mode of action of di-allate ("Avadex") on wild oats showed that effects were not confined to a toughening of the coleoptile as had been suspected from previous work. Mechanical removal of the coleoptiles did not affect the percentage of plants which grew normally. Di-allate was quite lethal when included in a nutrient solution in contact with roots only and also adversely affected the plants when applied to intact coleoptiles of seedlings or to the true leaves of young seedlings from which the coleoptiles had been removed. Development of the primary roots was also much retarded. It now appears that di-allate affects the metabolism of the germinating seed and of plants while they remain dependent on the food material stored in the seed.

A sample field survey was carried out in the Roma district to determine whether it would be practicable to obtain quantitative samples of wild oat populations within a reasonable time, the ultimate objective being to determine the density of wild oats which adversely affected grain crops. Five methods of sampling were employed on a 40-acre field. Results showed little differences in population density figures between any of the methods of sampling but all were considered to be too time-consuming for large-scale application to field populations.

Trials at Samford showed that seeds of different hull colours and morphological types of both *Avena ludoviciana* and *A. fatua* bred true and that there was no natural hybridisation between them.

Field tests on small plots at Hermitage Research Station confirmed other work which indicated that where successive germinations of wild oats occurred due to sporadic falls of rain, di-allate was more effective in the control of wild oats than barban ("Carbyne"). They also showed that the germination of yellow-hulled *Avena ludoviciana* was less than for the other five types of wild oats tested but gave no information about the relative dormancy of any of the hull colours or species tested.

Skeleton Weed.—In conjunction with officers of Agriculture Branch and the Biological Section, Department of Public Lands, a revised programme was planned for the control of an area of skeleton weed at West Wooroolin, the largest known infestation of this weed in the State. Inspections were also made of several small infestations on the Darling Downs and more drastic sterilisation treatment was recommended for these patches.

Milk-Tainting Weeds.—Regular sampling during the development of a new irrigated pasture in the Brisbane district showed that bitter cress (*Coronopus didymus*) reached 17 per cent. of the total ground cover about three months after planting early in June. This species was the only important milk-tainting weed in the pasture.

Grader Grass.—Following representations from Shire Councils and primary producers' organisations, inspections were made of infestations of grader grass (*Themeda quadrivalvis*) in the Mackay-Proserpine district. This is a tall-growing annual grass which has been naturalised in this region since 1935 but which appears to have multiplied very rapidly in the last few years. Inspection showed that the grass grows mainly on disturbed ground and that in most parts of the district it is confined to situations such as road shoulders and water-tables which are graded at intervals. It showed no evidence of encroachment into heavily grassed pastures such as spear grass or Rhodes grass. However, in the Bloomsbury area it has invaded improved pastures consisting of Townsville lucerne and various grasses. The reason for this appears to be that in order to establish and maintain Townsville lucerne in competition with the grasses it is necessary to graze very heavily, thus creating bare spots in the pasture and providing conditions favourable for invasion by grader grass. The plant has also been reported as a troublesome weed in sugar cane in the same district. The Bureau of Sugar Experiment Stations has found that under cultivation conditions it can be killed by two applications of 2,2-DPA (Dalapon) at intervals of about two weeks. In the pasture this treatment has not been very effective, partly because of difficulty of detecting the grass at a stage early enough for the spray to kill the plants before they produce ripe seed and partly because plants which recover can produce seeds at a height of less than two inches above ground. Further work on this problem was suggested.

Noteworthy Weeds.—No new introductions were recorded as naturalised during the year but the following plants were either recorded as weeds for the first time or significantly extended their range:—

Anoda cristata (Anoda weed) is well established as a weed in maize, onions and other crops in the Moreton, South Burnett and Darling Downs districts. This season it was reported for the first time as a weed in cotton at Biloela.

Crassocephalum crepidioides (thickhead), an annual weed which first appeared in Brisbane about 1955, has for some years been increasing in abundance on disturbed ground between about Gympie and northern New South Wales. This season it was reported for the first time from Bundaberg, the South Burnett district and the Atherton Tableland. In these areas it could possibly develop into a serious pest of such crops as peanuts and tobacco. Steps have been taken to have all plants of the weed in these areas destroyed as far as possible.

Ipomoea triloba, a scrambler native to southern Asia, was reported to be one of the common vine weeds in the Ingham district, where it has been found to be susceptible to 2,4-D at 1-1½ lb. per acre. The plant was apparently introduced to Australia with centro seed in the period between 1956 and 1958 but this is the first indication that it has multiplied to the extent of becoming a weed of any importance.

SUSPECTED POISONOUS PLANTS

The number of samples of stomach contents examined for suspected poisonous plants was unusually large, particularly during the second half of 1961, prior to and immediately after spring rains which broke the drought in many districts. More than 50 new entries were added to the poisonous plants files during the year. These included reports of cases of poisoning by several well-known toxic plants as well as new evidence against a number of plants not definitely known to be poisonous.

Of particular interest was the finding of boggabri (*Amaranthus mitchellii*) in rumen contents from sheep which died in the Richmond district of north-western Queensland. Subsequent analysis of plants from the same property by the Senior Toxicologist showed that they contained toxic amounts of oxalate and nitrate. This species is very abundant in some seasons in western Queensland and is generally regarded as a useful fodder.

A study was made of all the plants which had been suspected of poisoning animals in Queensland or from which known toxic substances had been reported. These were classified according to the nature of the evidence. Of the 924 species recorded in the files, evidence against 426 was insufficient to be reasonably confident that they might be toxic, 147 were suspected on strong field evidence but without confirmation by feeding or chemical tests, 166 were known to contain substances which could be toxic although no evidence of toxicity in the field is recorded, 79 have definitely been proved toxic by feeding tests but the toxic principles are quite unknown, and 106 have been proved toxic and the approximate chemical nature of the toxic principles are known. These results were included in a Presidential Address delivered to the Royal Society of Queensland and will help in planning future research on toxic plants in this State.

Many enquiries were received concerning the collection, growing and marketing of *Duboisia* leaf, which yields the alkaloids hyoscine and hyoscyamine, drugs which are in keen demand overseas.

HERBARIUM AND LIBRARY

The rate of mounting during the year was improved, about 6,000 specimens being mounted. A total of 807 specimens was sent on loan to other herbaria in England, Netherlands, Sweden, United States of America and Australia; 66 were borrowed from other herbaria for special study; 2,286 were sent on exchange and 425 were received.

During the year 36 new books and 350 parts of periodicals were added to the library. The set of "Botanische Jahrbücher" was completed by purchase of 10 volumes; three rare second-hand books and two microfiches of old reference works were also added. Binding was completed of 223 volumes. Loans of books and periodicals to officers in other branches, C.S.I.R.O., University and other institutions totalled 206.

Fourteen visitors worked in the herbarium during the year, including botanists from Canberra, Ithaca, Johannesburg, Lae, Leiden, Mareeba and Perth. Mr. D. Koroiveibau, from Fiji, spent almost six months working as assistant in the herbarium to make himself familiar with Australian and New Guinea flora and to further his botanical training.

ENTOMOLOGY SECTION

Pests generally throughout the State were either satisfactorily controlled or upsurges were of little economic importance. Populations of many of the usual pests were low, and crop recovery after summer plagues of caterpillars was good. The tobacco leaf miner (*Gnorimoschema operculella* (Zell.)) continued to cause trouble, particularly in some tobacco areas and in tomato crops. Pests of cotton, in which control difficulties are associated with agronomic problems, are still of some concern.

An extensive programme of research and investigations has been undertaken. Results indicate steady overall advances, those of appreciable economic significance being concerned with some of the nematode, storage, cotton and pasture pest control problems. Pest control demonstration trials, well-planned and allowing for critical evaluation of results, have been carried through successfully in citrus, tobacco, tomatoes and cotton. The value and effectiveness of properly applied recommended controls in these crops were clearly evident.

Although the glasshouse, insectaries and controlled-temperature rooms are not yet available for use, the new Entomology Research Laboratory at Long Pocket, Indooroopilly, was occupied during early June. Additions to facilities for work with marsupials were made at the Hermitage Research Station, Warwick.

Appropriate officers attended the fourth Biennial Conference of Commonwealth and State Entomologists at Perth during October, and the third meeting of the Australian Waterfowl Advisory Committee at Sydney in January.

Deciduous Fruits

In the Stanthorpe district, activities of the major pests, codling moth (*Cydia pomonella* (L.)), *Austrotortrix postvittana* (Walk.), and fruit fly (*Strumeta tryoni* (Frogg.)), were average and controls generally excellent. Bud mite (*Eriophyes vitis* (Pgst.)) damage was common in grapes where the semi-dormant lime sulphur spray had been omitted. Woolly aphid (*Eriosoma lanigerum* (Hausm.)) and mites built up on some orchards late in the season. Considerable grower interest in the use of organo-phosphates is evident. Pest populations in all orchard trials were either light or negligible. Mite biology studies are being continued. *Phylloxera vitifoliae* (Fitch) is increasing in the Myrtletown area.

Tropical Fruits

Field work associated with the first phase of long-term studies of root rots and nematodes in bananas in North Queensland has been completed. Projects either being continued or initiated include nematode investigations in banana plantations and pineapple fields in South Queensland. Firm recommendations have been made for the suppression of nematodes in pineapple crops, and these in many instances are being implemented on a commercial scale.

Citrus

In Near North Coast districts hatchings of white wax scale (*Ceroplastes destructor* (Newst.)) were apparent from early September, and this pest is of most concern to orchardists. The lesser horned citrus bug (*Vitellus antemna* (Bred.)) and the spined orange bug (*Biprorulus bibax* (Bred.)) were active in some districts during January and February, and the fruit-spotting bug (*Amblypelta nitida* (Stal.)) caused heavy falls of young oranges in Brisbane suburban gardens. Attacks by fruit-sucking moths (*Othreis species*) were recorded in North Queensland orchards. A demonstration pest control trial was established at Byfield, Rockhampton district, and differences between treated and untreated trees are now obvious.

Fruit Flies

Again this year these pests were not commercially troublesome to any great extent. As part of a long-term ecological study, routine trapping stations have been maintained throughout the State, and attention to male attractants was continued. The exacting task of evaluating and preparing research data for publication is proceeding.

Tobacco

In the Mareeba-Dimbulah districts some leaf miner (*Gnorimoschema operculella* (Zell.)) appeared during September and again late in December. Burning and leaf deformities in seedbeds were reported: insecticides, particularly telodrin, were implicated. In these districts pest control was the best for many years, and although pest populations were generally light a contributory factor was an increasing realisation by growers of the necessity for careful spray application and complete plant coverage. In the Burdekin district, as elsewhere where such conditions occur, leaf miner was most difficult to control in heavy, green, slower ripening crops and in many instances losses were heavy and controls expensive.

Projects were concerned with screening of insecticides and nematocides, taints due to pest controls, and the effects of nematocides on leaf quality. For the second successive season results from demonstration pest control trials at Parada and Milleroo were outstanding and informative. Recommended spray programmes, properly applied, more than doubled yields of saleable leaf at an outlay of £15–£20 per acre for materials and labour. Pest infestations in the past season's trials were not heavy.

Forestry

Widespread infestations over the State of the processional caterpillar (*Ochrogaster contraria* (Walk.)) occurred on wattles and some species of eucalypts. The eucalypt leaf skeletonizer (*Roeselia lugens* (Walk.)) stripped several species of eucalypts at a time when maximum growth should be occurring and rendered useless for honey production some 1,000 squares miles of south-eastern Queensland, including the Lockyer and Fassifern Valleys. Following favourable rains the young trees resumed normal appearance, but older trees developed new foliage on coppice shoots along the branches. Inspections of fumigated houses for European house borer (*Hylotrupes bajulus* L.) have been continued and no evidence of live borer has been found. Samples of hoop pine (*Araucaria cunninghamii*) forwarded to South Africa for

testing have proved susceptible to *H. bajulus*. The case moth (*Hyalarcta hubneri* (Westw.)) has increased in plantations of *Pinus radiata* at Passchendaele.

Field treatments in the cedar shoot borer (*Hypsipyla robusta* (Moore)) were concluded. Current investigations cover *H. hubneri;* borers, particularly *Dinoderus minutus* (F.) in bamboo products; and the highland stick insect (*Ctenomorphodes tessulatus* (Gray)).

Nematodes

In addition to references elsewhere in this report, research and investigational projects with nematodes include systematics of groups of particular importance to commercial crops, general surveys, a survey of these pests associated with avocadoes, and further work in citrus.

Pastures

Webworms (*Oncopera* species) caused damage to some Atherton Tableland pastures. Funnel ant (*Aphaenogaster* species) trials in this district have been given continued attention, and are providing valuable assistance in on-the-spot discussions with farmers interested in the control of these pests. Plagues of grass caterpillars, including *Laphygma exampta* (Walk), *Spodoptera* species and *Psara licarsisalis* (Walk.), were prevalent during January-March over most of the State east of a line from Mount Isa through Longreach to Charleville. Under conditions prevailing, damage was temporary and regrowth rapid.

Work on the biology and control of funnel ants has been sustained, and some attention was given to mites.

Grasshoppers

The Australian plague locust (*Chortoicetes terminifera* (Walk.)) caused some concern locally for a short time in the Thallon district. This seems to be one of those periodic outbreaks which in Queensland are of little economic importance.

During January, hopper bands of the yellow-winged locust (*Gastrimargus musicus* (F.)) were present in the Georgetown district. Fliers of this species from inland areas invaded the Burdekin delta and other adjacent coastal districts in early January and extensive egg-laying occurred. Hopper bands were soon common throughout the district, and many were destroyed with 20 per cent. BHC. *G. musicus* in much higher populations than usual was reported from the Central Highlands during February and March.

Vegetables

Pests were not severe in most crops. Insects, particularly *G. operculella,* have been prevalent in tomatoes, although in some areas controls have improved, recommended chemicals have been used, and reasonable care was taken with application methods. Particular attention has been paid to these problems, and control demonstration trials were completed during spring in the Redlands and Rockhampton districts. One trial was ruined by disease: in the other, losses of 23 per cent. were due to causes other than insects, checks were a total loss, and spray programmes saved some 60 per cent. Similar trials were established during autumn.

Cotton

Rough bollworm (*Earias huegeli* Rog.) has caused much more damage in Central Queensland during the present season than for many years. It is of interest that early-sown crops virtually escaped the attention of this pest, while late-planted cotton, particularly in the Theodore area, was attacked throughout the season. Crops on the Darling Downs were attacked, in many instances severely, by loopers during January, February and early March. Both *Cosmophila flava* (F.) and *Antarchaea chionosticta* (Ath.) were involved. *Heliothis armigera* (Hb.) and *H. punctigera* (Wallengr.) damaged bolls and squares in fair numbers, and rough bollworm has been active since early March.

Results of demonstration pest control trials in the Central districts during the 1960-1961 season were erratic and reflected agronomic conditions. Four further trials were established this past season. These were late-planted because of soil moisture difficulties, and sprays against both pink bollworm (*Pectinophora scutigera* (Hold.)) and rough bollworm have been necessary. Screening trials against cotton loopers were carried out at Warwick, and it is apparent from both trial results and commercial practice that these pests are particularly susceptible to insecticides. On the other hand, rough bollworm is still proving difficult to control by chemical means. Cultural methods of controlling pink bollworm are being investigated.

Miscellaneous Field Crops

In several districts sorghum suffered minor infestations of the sorghum midge (*Contarinia sorghicola* (Coq.)), yellow peach moth (*Dichocrocis punctiferalis* (Guen.)), *Heliothis* species and armyworms. In one area a small amount of spraying was carried out to control Heliothis in linseed, and in another the lucerne leaf-roller (*Tortrix divulsana* (Walk.)) required attention. Mites (*Aplonobia* sp.) infested peanut crops at Milman, Rockhampton district, during a period of dry weather. This pest was not susceptible to DDT, but disappeared when conditions improved and before other materials could be tested. A heavy programme of trials concerning potato pests was undertaken in the Rockhampton district and at Lawes, where both spring and autumn pest populations were light. Screening trials were established against false wireworms (*Dasus macleayi* (Blkb.)) attacking germinating wheat near Warwick.

Miscellaneous

Severe damage by mites (*Aceria* sp.) to litchi trees occurred in North Queensland. The cineraria leaf-miner (*Phytomyza atricornis* (Meig.)) has been particularly prevalent in most south-eastern districts. The oriental scale (*Aonidiella orientalis* (Newst.)), previously known in Queensland only from Thursday Island, has appeared at Mt. Isa. In both localities papaw was the host, and suitable insecticide phytotoxicity trials were undertaken. The white fringed weevil (*Pantomorus leuceloma* (Boh.)) has now been recorded from the Nambour district. Field trials against red scale (*Aonidiella aurantii* (Mask.)) on passionfruit have been established at Ormiston. Extensive field surveys and trials in silos concerned with storage pests were completed; the results are both informative and of distinct commercial value. Following overseas enquiries, several braconid parasites were bred from *Etiella zinckenella* (Treitschke), a pest in field peas in some countries.

Beekeeping

Conditions throughout the year favoured beekeeping, but only a moderate honey crop was harvested, as the industry passed through a period of recovery from previous droughts. Disease and pest infestations throughout the State were negligible.

Extension work covered 3,230 colonies in 25 districts. In addition, the following mass media were used: talks and film evenings 11, press and journal articles 14, radio and television talks 5, beekeeping schools and field days 4, and agricultural shows 3.

Following efforts to interest migratory beekeepers in white clover pastures of south-eastern Queensland, a significant crop of this honey, which is popular on European markets, was obtained.

At March 31, 1962, 1,454 beekeepers were registered, compared with 1,445 for the previous year.

Flora and Fauna Conservation

By the end of the marsupial skin year (December 31), 1,605 permits and licenses were issued under "*The Fauna Conservation Act of* 1952." A broad survey of the kangaroo industry was completed for publication. Information on the many sanctuaries throughout the State has been compiled and will be available shortly for public distribution. A koala film has been added to the Departmental series entitled "Serving Queensland."

An open season for ducks was declared for Central and North Queensland commencing July 8 and terminating September 24, and for southern Queensland from June 10 to September 5. Relatively few birds were available to shooters, and bags were poor. Compared with the previous two years there was an increase in breeding during the 1962 summer rains. Brolgas (*Grus rubicunda* (Perry)) and red deer (*Cervus elephas* L.) were reported as pests in limited areas.

Extension activities included talks and film evenings 3, press and journal articles 37, radio and televion talks 4, and agricultural shows 1. Eleven prosecutions under fauna legislation were conducted.

Duck and marsupial research projects are making progress.

PLANT PATHOLOGY SECTION

Seasonal conditions during summer and autumn were conducive to the spread of many important plant diseases. As a result there was a large volume of routine diagnostic work to be handled and severe disease incidence provided a rigorous testing for many field experiments.

With the advent of a large number of new fungicides in recent years many aerial fungal diseases are now under good control. This fact has tended to emphasise the importance of the more difficult soil-borne and virus diseases. Disease resistance testing, which provides one of the best avenues

for solution of these problems, now occupies a great deal of the plant pathologist's attention. Critical studies are also being made of the effects of current cultural practices on disease incidence, particularly in field crops.

FIELD CROPS

Wheat.—Heavy rains on the Darling Downs in early summer favoured the spread of wheat stem rust, which was a significant factor in late-planted crops. With the appearance of further new physiologic races of stem rust in 1961, all current wheat varieties grown in Queensland are now susceptible. Spica and Mengavi showed reasonable tolerance in the last main crop but summer seed-increase areas of Mengavi were severely rusted.

Crown rot (*Fusarium graminearum*) was also fairly severe, with the pattern of distribution identical with that of previous seasons. The relative resistance shown by Gala was, however, of particular interest. Growers who have followed recommendations to long fallow and sow to resistant species between wheat crops have been satisfied with the degree of control obtained.

Sorghum.—The lodging of grain sorghums and particularly hybrids as a result of stalk breakdowns was again investigated. *Fusarium* spp. and *Macrophomina phaseoli* have been found associated with the late stages of stalk rotting but so far it has not been possible to show that a fungal pathogen is the primary cause of the damage. The effects of variety, nutrition and associated organisms are receiving further attention.

"Weak neck" was also an important problem. The varietal pattern for the condition is being determined, as it is considered to be generally due to an inherent weakness in the rachis and peduncle.

Maize.—Hot, humid weather contributed to an epiphytotic of tropical rust (*Puccinia polysora*) in maize crops on the Atherton Tableland. Considerable reductions in yield have resulted from the premature defoliation caused by this disease. Diplodia and Gibberella stalk rots and Diplodia cob rot have also been severe in North Queensland. The last was also widespread in the south of the State. It is of interest that the prevalent species of Diplodia in the North was *D. macrospora,* while *D. zeae* was the common pathogen in southern areas.

Maize stripe virus was common in all districts but infection rates were fortunately low. A transmission experiment showed *Sorghum almum* to be an additional host of the virus. Wallaby ear was also widespread and caused severe damage in some late crops. Recovery has been reported following insecticidal spraying which controlled the associated leafhopper (*Cicadula bimaculata*).

Plant breeders' material in various districts was screened for resistance to a number of diseases under rigorous testing conditions.

Tobacco.—Dry weather early in the North Queensland crop retarded blue mould (*Peronospora tabacina*) development, although some late crops experience severe infection following stormy periods. However, the disease was prevalent in southern districts and leaf losses of the order of 40-50 per cent. were experienced in unsprayed crops.

Several seedbed and field fungicidal experiments again demonstrated the efficacy of maneb in controlling blue mould. This was borne out by grower experience where sprays were efficiently applied. Some doubts about the effect of maneb on leaf quality have necessitated further work before a positive field recommendation can be made.

Ascochyta leaf spot (*Ascochyta arida*) again occurred in southern border tobacco crops and was controlled by copper oxychloride, but not by zineb sprays, in the seedbeds. Further laboratory work has shown that tobacco barn rot (*Rhizopus arrhizus*) can survive the highest temperatures in the curing barn. Development of the fungus is rapid during the leaf-colouring period and subsequent exposure to a temperature as high as 170°F. for 32 hours does not kill the fungus on the leaf or strings.

Cowpeas.—The cowpea stem rot (*Phytophthora vignae*) work was stimulated by the appearance of a new race of the fungus which is capable of attacking the previously resistant Blackeye 5 and its hybrid progeny. So far this race has been recorded in a waterlogged site on only one farm. Greenhouse inoculation tests have indicated that Blackeye 5, Caloona and Havana are susceptible as young seedlings but exhibit resistance in later stages of growth. This is in contrast to Poona, which is susceptible throughout its growth cycle, and there is hope that Caloona may possess worthwhile field resistance to the new race.

Peanuts.—Prolonged periods of showery weather in March and April were particularly favourable for peanut disease incidence in the South Burnett. Cercospora leaf spots (*C. personata and C. arachidicola*) caused considerable defoliation and resulted in some premature harvesting. Fungicidal dusting experiments have shown that this disease can be effectively controlled and the economic aspects of treatment are now being considered.

Sclerotium rot (*S. rolfsii*) was also prevalent and caused much rotting of pegs and nuts. An investigation of the effects of P.C.N.B. soil treatment and cultural practices on the incidence of sclerotium rot is being pursued. Verticillium wilt (*V. dahliae*) was widespread on scrub soils and the resultant leaf fall and premature senility of affected plants added to crop damage. Research is at present concentrated on the testing of a varietal collection for resistance to *V. dahliae* and on the question of possible seed transmission.

VEGETABLES

Tomatoes.—The Mason x Manalucie selections have been the most promising types to emerge from the tomato leaf mould (*Cladosporium fulvum*) screening work at Cairns. They appear to be fixed for resistance and will now receive field trial on grower properties. Fusarium wilt is the most serious disease in Central Queensland tomatoes and is also important in susceptible varieties in southern districts. Menalucie has shown good resistance but has deficiencies in fruit quality. Other resistant material is being examined.

Grey leaf spot (*Stemphylium* sp.) has increased in importance in recent years but in common with other fungal leaf spots of tomatoes is well controlled by efficient maneb spray schedules. Of the virus diseases, mosaic, leaf shrivel (potato virus Y) and more recently yellow top, are all widespread. Whereas yellow top incidence may be appreciably reduced by insecticidal control of the vector, leaf shrivel remains a very real problem. Sources of worthwhile resistance have not been located and current work is concentrated on a study of vector behaviour and the spread of the disease in the field.

Miscellaneous.—A further two recordings of Fusarium yellows (*F. oxysporum* f. *conglutinans*) in cabbage and cauliflower crops near Brisbane were made during the year. This disease was first recorded in Queensland in 1960. Glasshouse and field screening of bean progenies for disease resistance was continued. The ultimate aim of this work is to develop an acceptable variety resistant to rust, angular leaf spot, anthracnose and mosaic. The pasture legume siratro (*Phaseolus atropurpureus*) has been found to be a host for bean halo blight (*Pseudomonas phaseolicola*).

Fusarium oxysporum was isolated from wilting rockmelons at Lamb Island and the isolates have proved to be host-specific in cross-inoculation tests. Fusarium wilt of rockmelon is new to Queensland although it has been present in New South Wales for several years. Investigations are continuing in an attempt to establish the causal pathogens responsible for the "autumn wilt" complex in Lockyer Valley potato crops. It appears at present that virus infection and fungal pathogens of the root rot and wilt types are all contributing to plant losses in autumn crops.

FRUIT CROPS

Deciduous Fruits.—Seasonal conditions in the Granite Belt were conducive to severe infection of brown rot (*Sclerotinia fructicola*) in stone fruits. Artificial infection work with peaches substantiated previous findings that most infection occurs in Queensland close to harvest. A fungicidal screening experiment showed that captan was still the best material available for brown rot control although copper omadine and delan approached it in efficacy. The antibiotics griseofulvin and mycostatin were inferior to captan as post-harvest dips for peach brown rot control. A spray timing trial showed that a little latitude is permissible in the application of the final pre-harvest captan spray, which may be made from one to three days before picking without reduction in efficacy.

A start has been made on a programme to improve the health of deciduous fruit trees propagated in Queensland. This will involve at the outset visual inspection of budwood sources for obvious virus diseases and indexing of clonal rootstocks for virus infection. Virus tested scion material will be multiplied as it becomes available.

Citrus.—A further investigation of the etiology of brown spot of Emperor mandarin has tended to confirm recent reports from New South Wales that a species of *Alternaria* may be responsible. Alternaria isolates from brown spot lesions have proved pathogenic to Emperor mandarin and kumquat but not to rough lemon, grapefruit and other mandarin varieties tested.

A number of citrus varieties growing in nutrient solution were inoculated with *Phytophthora parasitica* in an endeavour to assess their resistance to root rot. The increasing order of root-rot resistance in this severe test was:—Cleopatra mandarin (Mildura strain), sweet orange, rough lemon, Emperor mandarin, sour orange, trifoliata and scarlet mandarin. These results resembled those previously obtained in collar rot inoculations with this fungus.

Bananas.—Anthracnose (*Gloeosporium musarum*) was prevalent in banana fruit marketed during the late summer. Several post-harvest fungicidal dips were tested but all failed to show any commercial promise for the control of

this disease. Current work on the control of Cercospora leaf spot and speckle (*Mycosphaerella musae*) of banana includes the screening of various fungicides, oils and wax emulsions, a study of the long-term effects of copper oxychloride-white oil-malachite green treatment, and a nutritional experiment comparing the effects of levels of nitrogen, phosphate and potash on leaf spot infection and development.

Papaws.—Papaw dieback was prevalent in Central and South Queensland during the summer and autumn. Grafts and insect transfers again failed to transmit the disease and the cause remains in doubt. The virus responsible for yellow crinkle of papaw has been transmitted by means of dodder (*Cuscuta australis*) to tomato, with the production of symptoms typical of big bud virus infection. On the grounds of symptoms and incidence in the field, big bud virus has long been suspected as the causal agent of yellow crinkle.

FORESTRY

Five species of *Pinus* were checked for resistance to Phytophthora root rot (*P. cinnamomi*) by inoculating plants growing in nutrient solution. All the species proved susceptible to some degree but *P. taeda* and *P. elliotii* were more resistant than *P. radiata* and *P. caribaea*. *P. echinata* was intermediate between the two groups.

LEGUME BACTERIOLOGY

The routine provision of rhizobium cultures for farmers was discontinued on June 30, 1961. However, Plant Pathology Section continues to supply cultures for use with the less common tropical legumes and for all legumes used in Departmental experiments. Strains of rhizobia for all common tropical legumes are supplied annually to the UDALS organisation in New South Wales for use in the preparation of commercial inoculants. Thorough testing of strains to ensure maximum effectiveness will therefore continue.

Field and glasshouse trials to support tropical legume strain recommendations were carried out. An improved mung bean strain was located which performed well in the field and is also a fast grower on artificial media. Six isolates of centro rhizobium were selected for further study in the desiccation investigations. These are being examined for variation in resistance to desiccation and the implication of this phenomenon in agronomic practice will be further determined.

AGRICULTURAL CHEMICAL LABORATORY BRANCH

The retirement of Mr. C. R. von Stieglitz from the position of Agricultural Chemist on June 30, 1961, and the reconstitution of the Regional Experiment Stations Branch as a research facilities section controlled by a Research Stations Board, have led to a reorganisation of the Chemical Laboratory and its redesignation as the Agricultural Chemical Laboratory Branch. Mr. W. J. Cartmill was appointed Director; Mr. W. R. Winks was appointed Assistant Director; and Mr. W. T. Kelso, was appointed Chief Chemist of the Branch.

The objective of reorganising the Branch was to decentralise its activities. Staff will be trained in the Brisbane laboratory for country laboratories, which will be under the direction of the Agricultural Chemical Laboratory Branch. New laboratories are under construction at Mareeba and, for the Cereal Chemistry Section of the Queensland Wheat Research Institute, at Toowoomba. Staff has been appointed to both these laboratories. The laboratory at the Millaroo Research Station will be staffed by a Soils Physicist and a Chemist. The laboratories at the Tobacco Research Station, Parada, and at Atherton will retain their existing staffs. These laboratories and future laboratories at Research Stations should allow on-the-spot investigation of district problems by a team of scientists. They will provide field training for chemists and bring them into direct contact with field problems through co-operation with extension staff.

PLANT NUTRITION SECTION

Soil Survey.—The detailed survey of Paddy's Green, in the Mareeba-Dimbulah area, was completed. More than 25,000 acres were surveyed, including 5,000 acres which were provisionally mapped to enable the Irrigation and Water Supply Commission to plan a temporary pipeline for 10 existing farms. The early stages of this survey indicated that much of the better tobacco land is on long slopes and that soil conservation measures would be necessary. Arrangements are now in hand for soil conservation officers, in collaboration with the Commission, to give special attention to land where erosion potential is considered to be high. Much of the soil mapped is developed on granite and is regarded as some of the best tobacco land in the State. A reconnaissance soil survey of an area on the right bank of the Walsh River from Tabacum to the Mt. Mulligan railway line was completed.

Reconnaissance surveys were also carried out along the Upper Herbert River, in the Quilpie area, and on a section of the Darling Downs where salting is a problem.

Investigational Work.—The work on tobacco quality gave a considerable amount of information on uptake of water-soluble chlorides. The laboratory work included the use of radioactive chlorine to determine if chlorides were readily absorbed from soil with a moisture content close to wilting point. During this investigation it was noticed that, under glasshouse conditions, leaves on the side of the plant (north) receiving most sunlight had the greatest concentration of chlorides. Preliminary results of a field check of plants in both east-west and north-south rows indicated that this effect does not occur to such a marked extent when tobacco is planted in the field.

A colour meter has been used successfully to separate off-type leaf from normal grades. This instrument records colours in such a manner that not only can experimental results be compared from year to year but the values obtained can be interpreted on an international basis. The meter eliminates personal bias and the necessity to memorise colour.

The study of bromine uptake by tobacco following seedbed and field fumigation for nematode control has been continued in conjunction with Entomology Section. In association with these leaf studies, the effect of fumigants on the level of mineral nitrogen in the soil was investigated throughout the growth of the crop at Parada Tobacco Research Station, at Millaroo Research Station and on several farms in each of the Mareeba-Dimbulah, Burdekin and Glasshouse-Beerwah tobacco districts.

Variation of nitrogen levels within treatments was found to be large, and in the sandier soils in the Mareeba-Dimbulah area, where adequate irrigation water was available for the first time, soil analysis indicated that the available nitrogen was moving down the profile a few inches ahead of the roots. Where this happens, growers tend to harvest leaf which is immature, because the leaf develops a yellow colour which is due to insufficient nitrogen and not to the normal ripening process.

Comparative analyses of a number of samples of imported flue-cured tobacco leaf showed the foreign leaf to be lower in sugars and chlorides but higher in nicotine and potassium than the leaf from some districts in this State.

The problem of salt encroachment on coastal lowlands continued to receive attention. Work near the coast on a tidal flat has shown that a rapid improvement can be anticipated from a combination of a tide gate, surface drains, mole drains and an application of gypsum. A further project was commenced to study salting at the mouth of a shallow valley on the Darling Downs.

Recent work on pastures has made it clear that nutritional requirements of individual pasture species need to be more closely defined, especially for phosphorus. A pot trial initiated to check on the requirements of *Paspalum dilatatum* and *Axonopus affinis* showed a differential response at the first cut made 10 weeks after germination.

The Williams method was used to fractionate soil phosphorus but the results obtained did not explain the apparently anomalous results obtained from applications of phosphatic fertilizer.

A pot trial has been initiated to study the effects of molybdenum on a pasture soil because the paddock concerned was too inaccessible for normal field trials.

The investigation of bulk density, infiltration rates, properties of clays and soil conductivity has been made possible by the appointment of a soil physicist. Projects have ranged from improvement of a sports ground to long-term effects of various crop rotations. Equipment for measuring the infiltration rate of soil was designed and the pilot model tested in the field.

General Analysis.—In addition to the soil survey samples, 5,358 soils, mainly from Departmental trials or from farmers, were analysed. About 200 samples from bowling clubs, golf clubs and other sporting organisations were included in this total.

The 1,626 water samples analysed were submitted mainly by graziers or farmers with small irrigation plants. Many of these samples were rejected for both irrigation and stock because of their high chloride content. Samples from Mary Kathleen which contained about 3,000 grains total soluble solids per gallon, of which 2,400 grains was in the form of sulphates of calcium, magnesium and sodium, were rejected. This concentration of total solids was probably caused by pollution by effluent from the treatment works.

Wallum Investigations.—Preliminary grazing trials (1960) at Coolum had shown that cattle grazing on summer pastures ceased to gain weight about April. They held weight April to June. From June to July, animals on winter pastures based on clover and several winter grasses showed slight weight gains. Later a further improvement was shown when animals grazed on oats alone (0.8 lb. per head per day). When the oats were fed as a supplement to winter pastures, the gain was even greater (1.2 lb. per head per day).

Two oats trials were carried out in the winter of 1961, one a varietal trial to study the progressive yield under cutting from 11 varieties, the other a 4 x 3 x 3 fertilizer trial using Bovah oats and taking yields at four successive cuts. Judged on yield, Floriland, Klein, Alber, Landhafer, and Algerian were the best of the 12 varieties. In the Bovah trial, the response (total yield) to phosphorus increased with increasing amounts of nitrogen, while muriate of potash had no noticeable effect.

GENERAL ANALYTICAL SECTION

A total of 2,984 samples, comprising 1,945 pastures, 764 stock foods and grains, 81 fertilizers, 162 pesticides and veterinary medicines and 32 miscellaneous, was analysed.

The pasture samples included the following experiments:—(1) efficiency of nitrogen production by legumes; (2) assessment of nutritive value of different pasture strains under different conditions and at different times of the year; (3) efficiency of nitrogen uptake from fertilizers; (4) transfer of nitrogen from legumes to the associated grass; (5) establishment of pastures with legumes.

Experiments on lucerne, using various forms of sulphur, are in progress at Warwick and Gatton. In the Warwick trial the lucerne stand was established in 1956 and treatments commenced in October 1961, the first harvest taking place in November 1961. On an analytical basis without regard to yield, all treated plots were higher than the control in percentage protein and total sulphur. The application of sulphur in the form of superphosphate and gypsum gave higher total sulphur percentages than did application of elemental sulphur.

Grain sorghums from variety trials at Capella, Hermitage, Clifton, Allora and from a nitrogen-fertilizer trial at Allora were analysed for crude protein. There was a wide variation in the crude protein for all varieties in any one district and in any single variety between districts. In a nitrogen fertilizer trial at Allora to determine the effects of different rates of fertilizer on grain sorghum, all treatments were higher than the control in crude protein and grain yield; hybrid types gave a significantly higher grain yield than the open-pollinated Alpha.

Agricultural Standards Act Samples.—Eighty-eight of the stock food samples examined for the Standards Officer were deficient in one or more constituents, the main deficiency being in crude protein. In meat-and-bone meals, protein deficiency was commonly accompanied by excess of phosphoric acid and lime. It appears that, under the system of stock food manufacture, there is insufficient chemical control at the factory to check on the composition of the raw materials used.

Twenty-one of the fertilizer samples examined were deficient in one or more constituents, the deficiencies being due mainly to faulty mixing and not to any attempt to replace a high-priced constituent with a low-priced one. Most of the liming materials were of good chemical standard, but the fineness was unsatisfactory. Thirty-one of the pesticides and veterinary medicines examined were deficient.

The installation of an infra-red spectrophotometer has enabled a number of organic pesticides to be examined with greater speed than by chemical methods.

CEREAL SECTION

Wheat.—Work on wheat included quality appraisal of plant breeders' samples, varietal trials and effect of crop rotations; and wheat quality survey in association with the State Wheat Board and Agricultural Show Societies.

Samples were received from various Research Stations. The overall standard of the plant breeding samples was good, with degrees of strength ranging from medium strong to very strong. The only outstanding variety was Spica. In the 8-year cycle crop rotation at Hermitage Research Station, Spica was again of high quality, particularly when it followed lucerne. This is the case on the shallower, less fertile soils as well as on the deeper, fertile soils.

Good quality wheat was obtained using Spica in a pasture crop and soil fertility trial at Hermitage in which wheat followed lucerne and wheat followed lucerne and mixed pasture. A time-of-planting trial at Biloela Research Station, using Spica, showed that a late June planting gave better quality wheat than was given by late April and early May plantings.

The annual wheat quality survey was more representative and covered a larger number of samples than formerly. Physical quality and baking quality were determined on smaller samples and it is hoped to be able to correlate baking quality with the quick, indirect Zeleny sedimentation test. The determination of baking quality, using small weights of flour, is being investigated.

The wheat protein and phosphate contents follow the usual pattern. Progress results on 128 samples were:—

—	Mean	Range
Protein at 13·5% moisture (%)	13·4	9·5–17·7
P_2O_5 at 13·5% moisture (%)	0·71	0·40–0·94

Samples of entries in show classes were received from the following show societies:—(*a*) Royal Agricultural Society, Toowoomba, 105; (*b*) Wandoan 16; (*c*) Chinchilla 10; (*d*) Goondiwindi 10. Judging the competitions involved milling, physical and baking testing. The results are useful for Departmental experimental and extension work.

Barley.—Malting grade barley attracts a premium of several shillings per bushel and experimental work on this cereal has been directed towards increasing the proportion of malting grade barley produced. The approach to this problem was along the lines of grower and depot surveys, time-of-planting trials and fertilizer trials, the trials being in conjunction with Agriculture Branch.

Grower and depot surveys and the information from the survey are used to locate malting grade barley on a depot basis. In general, the protein content for all districts varied from 8.0 to 13.0 per cent. and the best malting grade came from the Southern Downs.

Exploratory time-of-planting trials have been carried out to ascertain if earlier planting will produce good malting grades and good yields. The data obtained will form the basis of future replicated trials. A nitrogen fertilizer trial was carried out in the Warwick area to ascertain the minimum amount of fertilizer which could be applied to increase yields without making the grain protein too high for malting grade. The results of the trial indicated that it should be economical to apply urea at the rate of ½ cwt. per acre.

FOOD PRESERVATION RESEARCH BRANCH

The Food Preservation Research Laboratory, the headquarters of the Banch, was officially opened by the Hon. the Premier of Queensland on July 5, 1961. Since then, approximately 60 projects on the storage, transport and processing of fruits and vegetables have been initiated. Two main fields of investigation are being developed, covering physiological problems associated with the storage and transport of fresh fruits and vegetables, and food technology problems associated with the processing of these products.

Because the keeping quality of fruits and vegetables is largely influenced by seasonal and cultural conditions, most of the investigations are of a long-term nature. A considerable amount of information of importance to the fruit and vegetable industry in Queensland has already been obtained. Unfortunately, some major projects have been held up by delayed delivery of equipment, which will not be installed until late 1962.

PHYSIOLOGY

Delicious Apples.—The Delicious is becoming the major apple variety in the Granite Belt and large quantities are now being cool-stored. As some growers are using stop-drop sprays to prevent pre-harvest drop, investigations were carried out to determine whether these sprays had any deleterious effect on the keeping quality of this variety. Although NAA sprays caused a high incidence of superficial scald, there was no evidence to suggest that stop-drop sprays impair keeping quality. Controlled atmospheres have considerably extended the storage life of Granny Smith apples and this method was tried with Delicious apples. As wastage was increased by treatment, experiments are now in progress to determine whether low oxygen or high carbon dioxide was the contributing factor.

Granny Smith Apples.—There is a good market in the United Kingdom for Queensland Granny Smith apples shipped in February, but these apples sometimes develop bitter pit. Experiments were therefore carried out on methods of control and the detection of bitter pit in overseas shipments. The results suggest that sprays containing calcium chloride applied several times prior to harvesting can effect some control. Storing fruit for 7-14 days at temperatures between 30 and 36°F. induced bitter pit. This pre-shipment treatment could be

used to enable inspectors to reject susceptible consignments at the wharf.

Previous experiments showed that superficial scald on Granny Smith apples can be controlled provided the fruit is treated with a scald inhibitor prior to storage. The 1961 experiments showed that ethoxyquin, which has been approved for Departmental use by the Director-General of Health and Medical Services in Queensland, was a good scald inhibitor when used as a post-harvest dip. Good control of scald was obtained in late picks with pre-harvest sprays of ethoxyquin but the high concentrations which had to be used for early picks caused skin injury to the fruit. Gallic, tannic, and ascorbic acids, which gave promising scald control in New Zealand, were not effective with Queensland Granny Smith apples. Experiments also showed that early picks were more susceptible to scald than late picks and that the most satisfactory storage temperature was 30°F.

Experiments over nine years have shown that a mixture containing 16% oxygen and 5% carbon dioxide is the most satisfactory atmosphere for the storage of Granny Smith apples provided a scald inhibitor such as ethoxyquin or diphenylamine is used. The 1961 results indicated that 36°F. is probably the most satisfactory temperature for the controlled atmosphere storage of Queensland Granny Smith apples. Although more experimental work is still required on source variability, fruit size, maturity, temperature and core flush, sufficient information is now available to enable controlled atmosphere storage to be applied commercially. In this way, fruit can be kept in a much firmer condition and over a much longer period than is possible with ordinary air storage methods.

Avocadoes.—Because of the time involved in carrying out determinations of oil content, which is the prescribed criterion of maturity, the possibility of determining maturity rapidly by specific gravity measurements has been under investigation. Experiments have also been conducted to determine whether Fuerte avocadoes picked before April 14, when this variety is first marketed, can be satisfactorily ripened with ethylene. Fuerte avocadoes picked before this date normally take a long time to ripen and become discoloured and shrivelled. Artificial ripening with ethylene could enable the variety to be marketed at least a month earlier.

Bananas.—In conjunction with officers of the C.S.I.R.O. Division of Food Preservation, the Banana Growers' Federation, the Committee of Direction of Fruit Marketing, the Fibreboard Development Council of Australia and the N.S.W. Railways Department, a series of trials was carried out with bananas packed in fibreboard containers and in wooden cases consigned from northern New South Wales to Sydney.

The two early trials during winter indicated that care would be necessary in stacking the fibreboard containers in warm weather to prevent self-heating of the fruit in transit. Further investigations during the summer months confirmed this finding. The most satisfactory stacking method in summer was obtained by using pea-frame spacers between the stacks. While slight cooling occurred in cases and in cartons during transit, cooling rates were greater in cased fruit than in fruit packed in cartons.

Although wax emulsions are being used commercially in order to improve the appearance and increase the shelf life of the Cavendish banana, the effect of these coatings on respiration rate, time to ripen and shelf life of the fruit has yet to be determined. Laboratory experiments have indicated that ripening behaviour depends on the time of the year when the fruit is harvested, and the concentration of wax emulsion has to be varied accordingly. For example, a concentration of 2 per cent. paraffin is the maximum that can be used for winter fruit without adversely affecting ripening; on the other hand, a concentration of about 6 per cent. increases the shelf life of November "dump" fruit.

Citrus.—Experiments on the incidence of rind injuries on citrus fruits showed an increase in the number of injuries through different processes from time of picking to packing, with most injuries occurring in the packing shed.

Investigations showed that late-season naval oranges could be kept in good condition for 12 weeks when stored at 45°F. With Valencia oranges the most satisfactory temperature range was 40-45°F., giving a storage life of approximately 10 weeks.

Grapes.—Trials indicated that Waltham Cross grapes can be successfully stored at 32°F. for two months with or without sulphur dioxide fumigation. For Purple Cornichon, a storage life of four months was obtained at 32°F. In this variety, losses mainly resulted from shattering and if this can be controlled sulphur dioxide fumigation could result in an extension of storage life from four to five months.

Results of a small-scale trial indicated that rootstock had some effect on storage life of both varieties, but further trials are necessary.

Papaws.—During commercial ripening papaws sometimes develop a brownish skin discolouration which could be caused by a low humidity in the ripening chamber. In a small trial, a number of fruits held at a relative humidity of 40 per cent. developed a brown discolouration. Further work on humidity is proposed for the next papaw season.

Pears.—The major portion of the W.B.C. pear crop in Stanthorpe is held in cool storage for subsequent canning. The effect of maturity and delay before storage on keeping quality was therefore examined. Samples were picked on Jan. 18, Jan. 25 and Feb. 1, one half being stored immediately and the other held for 24 hours at air temperature prior to storage. A 24-hour delay at air temperature prior to cool storage increased the incidence of breakdown. Although there was a marked variation in ripening behaviour and storage life of the fruit according to the source of the fruit, the optimum time of picking was Jan. 25.

About 11,000 cases of Packham pears were exported from the Granite Belt in 1962, the fruit being harvested in late January and early February. Samples of fruit harvested during this period were held at 32, 34 and 36°F. for six weeks following 24 hours' delay at 65–70°F. in order to simulate export conditions. All samples ripened with an excellent quality.

Pineapples.—In conformity with a recommendation of the Standing Committee on Agriculture, a working group on pineapple quality was established in Queensland, and quality measurements are being made on specially selected fruit. In evaluating quality differences it is essential that comparisons should be made on fruit of equal physiological age or maturity. The problem of maturity differences between fruits was overcome by marking plants at the 1 in. red heart stage and harvesting fruit from these plants after definite intervals.

The changes in volatile constituents of these pineapples at various picking dates and the relative importance of each of these compounds in regard to pineapple quality are being determined. The respiratory activity of individual fruits from one clone is also being measured with a view to determining whether changes in respiration occur during maturation.

Stone Fruit.—In experiments, variability both within and between samples was too great to establish any definite relationship between length of storage life and the pectin content of Wilson plums grown in the Granite Belt. The ripening behaviour of Santa Rosa plums was extremely variable and some fruit failed to ripen normally. This abnormal condition was overcome by treating the fruit with ethylene. Both eating quality and keeping quality were influenced by picking maturity, and initial storage at 32°F. followed by storage at 45°F. gave the best storage results for the Santa Rosa variety. Storage results with Elberta peaches were affected by the presence of brown rot.

Tomatoes.—It has been contended that the addition of ethylene is not necessary for the satisfactory ripening of tomatoes. Trials have shown that ethylene will induce a climateric within 2–3 days at 70°F., compared with 6 days for untreated fruit. The results suggest that tomatoes in the advanced green mature stage do not benefit from ethylene. It seems, therefore, that the variable results obtained with ethylene in commercial tomatoes are associated with picking maturity.

Vegetables.—The cool-storage behaviour of lettuce packed in polyethylene bags was studied. Storage life has been terminated by bacterial slime, which has not been controlled by antibiotic dips. The results indicated that a cool-storage life of between 7 and 14 days is about the limit for lettuce.

FOOD TECHNOLOGY

Pineapples.—In Queensland, pineapple juice is pressed from the skins and flesh trimmings, and research work on pineapple juice concentration is concerned initially with the commercial juice. If this juice can be concentrated satisfactorily, little modification to present commercial juice equipment will be required. Unfortunately, the original turbulent thin film evaporator for the pilot plant at the Laboratory did not meet specification requirements; it is to be replaced by a Swiss turbulent thin film evaporator. The balance of the pilot plant has been assembled and extensive tests carried out on 400 gal. of fresh factory juice. Certain modifications to the plant have been necessary and operating conditions have now been determined.

In order to produce a concentrated juice of standard flavour the volatile flavouring constituents of pineapples are being identified by gas chromatography. About 50 gal. of winter juice yielded approximately 0.5 grams of anhydrous flavouring essence, compared with 1.1 grams for summer juice. About 30 individual compounds have been isolated, but methyl beta methyl thiol propionate appears to be an important constituent of both winter and summer fruit, being present in fairly large quantities.

Special apparatus was constructed for the production of vinegar from pineapple juice on a semi-commercial scale and experiments are being conducted on aeration, the addition of

nitrogen and phosphorus and inoculum size. Results to date show that a large inoculum will give a high rapid yield of alcohol.

Strawberries.—Canning trials carried out on the Phenomenal and Majestic varieties grown in the Near North Coast and Redlands districts showed that Majestic had a much firmer texture and a significantly higher drained weight and acidity than Phenomenal. The results suggested that Majestic grown in the Near North Coast district has better processing qualities than the same variety grown in the Redlands district. Spin-cooking, which takes 2½ minutes, gave higher drained weights and a better retention of fruit shape than a commercial atmospheric rotary cooker which takes 10 minutes to process the fruit.

Peas.—Further trials were carried out at the Redlands Horticultural Research Station on locally developed hybrid varieties of peas in order to evaluate their suitability for processing. The experimental autumn crop yielded at the rate of 3,500-4,000 lb. of shelled peas to the acre even though germination was poor. The two varieties grown in the spring trial yielded about 6,000 lb. of shelled peas per acre, equivalent to a pod weight of approximately 15,000-16,000 lb.

Experimental areas planted at Bundaberg and in the Lockyer area in 1961 indicated that peas can be grown successfully in both areas, the optimum months for planting being June and July. The trials have been extended to the Gympie area.

Beans.—Large quantities of quick-frozen beans are imported into Queensland from southern States each year and preliminary work was commenced on the evaluation for processing purposes of new varieties of stringless beans produced at the Redlands Station. The beans are being analysed for both fibre and chlorophyll content and the results compared with the commercial packs from southern States. The two main varieties at present being used commercially are Tendergreen and Pearlgreen.

Pears.—W.B.C. pears grown in the Stanthorpe district and picked at various stages of maturity were canned after various periods of cool storage and the flavouring constituents in the various samples determined. The results indicated that maturity and length of storage have an effect on flavour. Further trials are in progress.

Mandarins.—Out of a total of 16 varieties examined for their suitability for processing as canned segments, only four varieties, namely U.S.S.R., Sovereign, Oonshiu (a seedless variety) and another unnamed seedless type, warrant further investigation. Oonshiu, obtained from Maitland district of New South Wales, was the most satisfactory, having a very attractive appearance and a good flavour which compared favourably with the imported product. Seedless varieties are more satisfactory than the seeded types, which tend to disintegrate when the seeds are removed.

Papaws.—In an effort to improve the quality of papaw used in chutney manufacture, the effect of storage brines containing an initial salt concentration of 12 per cent. combined with various concentrations of sulphur dioxide was studied. The quality of the product produced in this trial was much superior to the normal commercial pack. Further trials are in progress.

Figs.—Attempts were made to produce from the local Brown Turkey variety a fig paste comparable with the product at present being imported from overseas by biscuit manufacturers. The most satisfactory product was obtained by dehydrating the figs at 130°F. and adding sulphur dioxide at a concentration of 55-60 p.p.m. The product obtained was close in colour and texture to the overseas product but the flavour was not so good. It is proposed to test lighter coloured varieties next year.

Bananas.—There may be a market in Japan for banana puree, as fresh fruit is a prohibited import. As banana puree readily turns brown on exposure to air, preliminary experiments are being directed towards determining methods of de-aerating the viscous gelatinous pulp. Results so far indicate that by adding ascorbic acid and then feeding the pulp into a vacuum chamber most of the air can be removed. Experiments are still in progress.

Ginger.—To determine whether the characteristic flavour of imported ginger can be produced in the Queensland product, locally produced ginger syrup was inoculated with yeasts isolated from imported ginger. As the flavour of these inoculated syrups closely resembled that of the syrup from imported ginger, further experiments are being carried out.

Australia imports large quantities of dried ginger for use as a spice and for the production of oleo resins for flavouring purposes. Investigations are therefore in progress to determine the oleo resin content and volatile oil content of ginger grown in Queensland, and the most economic way of drying green ginger.

Macadamia Nuts.—Experiments showed that there is no difference in storage life between *M. tetraphylla* nuts processed by rotary dry roasting and those deep fried in coconut oil. The thiobarbituric acid (TBA) test can be used to measure rancidity, since a rapid increase in TBA value corresponds closely with the first sign of rancidity detected by taste. The use of the dry roasting method, while avoiding problems of rancidity which may arise from the over-use of cooking oil, does not give any increase in the shelf life of the nuts. However, it should permit greater standardisation of the degree of roasting and colour of the finished product, as time and temperature can be carefully controlled.

Cashew Nuts.—Experiments were carried out to determine suitable methods for processing cashew nuts grown in North Queensland. After preliminary drying, the outer shell had to be punctured to facilitate the removal of the phenolic shell oil in the subsequent process. Drying at a temperature of approximately 350°F. for 5 min., followed by washing in a solvent, was used to remove the oil completely. After removing the shell, a short deep fry at 300°F. produced a palatable product. Experimental work is still in progress.

Mangoes.—The six mango varieties which were selected last year as having promising processing characteristics were tested again. It appears that few varieties are comparable to Kensington. The bulk of quick-frozen mangoes produced in Queensland is being consumed in Sydney, but extensive advertising will be needed to expand consumption in Australia.

Accelerated Freeze Drying.—Samples of accelerated freeze dried (A.F.D.) foods from the Armour Company of Chicago have created considerable interest in this process, which provides a means of storing food without refrigeration for long periods and saves freight costs. Such a process can be of paramount importance in the distribution of processed Queensland foods to distant markets. Preparations are being made for the installation of an A.F.D. pilot plant at the Laboratory.

Frozen Food Distribution.—A survey was made of quick-frozen fruits and vegetables in the wholesale and retail trade. The investigation (which included quality evaluation and a study of storage temperatures) indicated that greater attention should be given by retailers to keeping frozen foods at the recommended temperatures in order to maintain good quality.

Sensory Tests.—Although the chemical composition of volatile flavouring substance in foods can be determined by gas chromatographic methods, the effect of these substances on palatability can only be assessed by sensory tests. An officer has therefore been assigned the responsibility of selecting a suitable panel to undertake palatability evaluations of various processing techniques and new products.

DIVISION OF ANIMAL INDUSTRY

From the staff point of view the past year will probably figure on the record as the last prior to a period in which a progressive easing of the situation took place. This is considered likely by reason of the fact that the full impact of the Government's University Scholarship schemes will commence to be felt from the beginning of the next calendar year. It is certainly earnestly to be hoped that such will prove to be the case. The Division has been sorely tried for a long time now in its endeavours to provide the range and standard of services sought by the livestock industries. As a consequence of deficiency of numbers and in some instances inadequacy of training, there has been a heavy burden on some of the more experienced members of the Division's staff.

Shortage of veterinary graduates was again the main concern. Actual numbers of these graduates in the Division remained steady but there is ground for considerable disquiet. The less experienced graduates are being called upon increasingly to try to fill the gaps left by those with extensive experience. It is not a happy situation and it is very important that ways and means be found of retaining the graduate with six to eight years' experience behind him. It is the loss of those in this bracket that is felt so greatly.

Another side to the picture is presented in the case of a Branch that is independent of veterinary graduates. Reference is made especially to the Biochemical Branch, but to a lesser extent to Husbandry Research also. Here staff has been built up over the last few years to the point where laboratory

space has become an acute problem. Excessively cramped conditions are militating against the more effective use of the staff and apparatus now available.

It had been hoped the former veterinary school buildings at Yeerongpilly (made available by reason of the transfer of the school to St. Lucia) would overcome the problem; but costs of repairing and altering the buildings to meet requirements were so out of proportion to their value that the project was abandoned. Plans are now in preparation for a new building to house the Biochemical and Husbandry Research Branches. Its erection is not, however, expected to commence until the 1963-64 financial year.

DEVELOPMENTAL WORK ON FIELD STATIONS

Developmental work was commenced at Swan's Lagoon Cattle Field Station in the Burdekin River basin. The southern end of the run has been fenced and foundation breeding stock placed on the property. The year 1962-63 should see a yards and buildings erection programme well under way and much improved water facilities provided for both man and beast.

Two graziers (nominated by the U.G.A.) have given invaluable help by visiting the property and advising on plans for its development and stocking, not to mention the investigational work proposed.

Substantial financial assistance for the progressive development of Swan's Lagoon has now been assured from the Australian Beef and Cattle Research Committee. This is a matter for deep satisfaction.

Yards and buildings were in an advanced stage of construction at the Ayr Cattle Field Station and the tropical breed of dairy cattle project based on Sahiwal blood well under way.

At Toorak Sheep Field Station plans are in hand for further subdivision of the property, the provision of additional water supplies and facilities and another set of yards. Without the help and stimulation of a trio of graziers (again nominated by the U.G.A.) it is doubtful whether these plans would have been more than a vague idea at this stage. When the plans are implemented, a much stepped-up programme of investigational work will be practicable.

At Wacol an area of 112 acres of land with a frontage to the Brisbane River was acquired. The main aim of this acquisition was to provide additional facilities for an expanding programme of tick fever research. However, the area being adjacent to the Artificial Insemination Centre, the opportunity will be taken to devote portion of it to an irrigated pasture project. This is intended for grazing bulls from the Centre while not in actual work.

PROHIBITION ON THE USE OF TICKICIDES

A happening of outstanding importance was the prohibition placed on the use of chlorinated hydrocarbons for treatment of cattle. Reference to the matter will be found in the Veterinary Services Branch and Biochemical Branch reports. Action followed discussions and agreements between the States and the Commonwealth. At the year's end the prohibition had not been extended to sheep, but such was being seriously considered.

An immediate consequence of the prohibition was the need to get more precise information on the efficiency, stability and toxicity, if any, of the organic phosphorus compounds available for use as substitutes for the chlorinated hydrocarbons. Reference to this matter is made in the reports of the Veterinary Services Branch, Biochemical Branch and Pathology Branch. In general, it can be stated that although very efficient at killing cattle ticks, their residual effect suffers by comparison with the chlorinated hydrocarbons. Somewhat similar remarks apply where the buffalo fly is concerned. There have been some deaths of calves following their treatment with organo-phosphorus compounds.

The matter of residues in animal fat from the use of these compounds was under investigation in the latter part of the year, as discussed in the Biochemical Branch report. These investigations are continuing.

ARTIFICIAL INSEMINATION SERVICE

The Division has been a continuing advocate of the advantages of artificial insemination to the livestock industries and particularly the dairying industry. It is unfortunate therefore that another year should have gone by without the Department's large-scale artificial breeding collection centre at Wacol coming into operation. However, as at June 30, 1962, it was clear the end of construction was in sight and it is anticipated the centre will be operating, at least on a restricted scale, in the final quarter of the year 1962.

Three co-operative groups operated distribution centres during the year under review. In the case of two of these semen was obtained from the artificial breeding centre at Berry, N.S.W. Other groups were in the process of forming. All this indicates interest on the part of many dairy-farmers. However, the financial side of the operation of such groups is a matter for deep concern. Like most worthwhile things in this world, artificial insemination is not cheap. If groups commence operating before an adequate number of cows is assured, then financial troubles are certain. Inadequate numbers are inevitably followed by the necessity to charge higher prices. Hence demand for the service falls off and a vicious circle is created.

EXTENSION

Major extension activities of the Division during the year included participation in a Bankers' Conference at Rockhampton, a Beef and Meat Marketing School at Roma and a Beef Cattle Management School at Taroom.

Such activities require a great deal of prior preparation and planning and for that reason are self-limiting so far as the number that can be handled in any one year. At the same time, the Division is fully persuaded of their value and supports them to the limit.

THE ANIMAL FACTOR IN PASTURE EVALUATION

In no segment of the Division's activities is a more attention-arresting prospect opening up than is the case with pasture evaluation studies being undertaken with the Division of Plant Industry. Reference to these will be found in the reports of the Biochemical, Husbandry Research and Sheep and Wool Branches. It is evident that at least in some areas animals can selectively graze a pasture so as to make up a diet that is substantially higher in protein that is available from the pasture as a whole. The hazards involved in evaluating pasture on chemical analysis alone, without regard to the actual intake of the animal, are thus revealed.

Some long cherished beliefs relating to pasture management also appear due for critical reappraisal in some directions. Rotational grazing, for example, is not to be preferred to net stocking in all circumstances, and with the application of nitrogenous fertilizers worthwhile benefits cannot be relied upon under all conditions.

UREA IN LIVESTOCK FEEDING

Urea is steadily increasing in importance as a stock feed. The use of this substance in conjunction with low-quality roughages has been under investigation at the Animal Husbandry Research Farm, Rocklea, for several years. Some of the findings have been taken into the field and reference to trials with urea-containing salt lick blocks will be found in the Cattle Husbandry Branch and Sheep and Wool Branch reports.

The full explanation as to how urea increases the intake of unpalatable roughages is still lacking. Digestibility studies are being undertaken at Rocklea in an endeavour to throw further light on the matter.

SLAUGHTERING

The newly formed Slaughtering Section was kept very busy throughout the year. Abattoir construction and operation was very much to the fore and increasingly the Department, and hence this Division, is being looked to for advice and support.

The pattern of livestock slaughtering and meat marketing becomes ever more intricate and complex. This is due in large measure to rising interest in the domestic market in recent years on the part of meatworks operators who were previously quite content to concentrate on the export trade. The need for staff that is specially well informed in this field is greater than ever before. Some of the legislation covering these matters is under challenge and the final results have yet to be determined.

DISEASE SITUATION

A milestone in the bovine tuberculosis control programme was the closure of the slaughteryard at Goodna specially set apart for the destruction of positive reactors to the tuberculin test. These have fallen off to such an extent that there is no longer the need to make special arrangements for their destruction.

Two diseases of pigs diagnosed for the first time in Queensland during the previous year—inclusion body rhinitis and oedema disease—were detected on a number of occasions during the year under review. They did not, however, present a major problem.

No fresh cases of equine infectious anaemia came under notice.

A viral encephalitis of calves was diagnosed for the first time.

Tick fever was more than ordinarily troublesome in some areas and anaplasmosis, an uncommon form of the disease, was reported over a wide area. Research work on tick fever was sustained at a high level throughout the year. Details of this will be found in the Pathological Branch report.

The Queensland segment of the National Bovine Contagious Pleuro-pneumonia Eradication Programme entered upon its second year. There has been a truly amazing falling off in the incidence of the disease. Details of the overall position and work carried out in terms of the Programme will be found in the Veterinary Services Branch report. Results of an extensive series of complement fixation tests are given in the Pathology Branch report.

It is not for a moment suggested that the Programme has achieved this position thus early. Mention is made of it so as to indicate the present situation and show that the Programme has been started at a particularly opportune time.

SWINE FEVER AND COMPENSATION

Following continued outbreaks of swine fever in New South Wales, a matter referred to in the Veterinary Services Branch and Pig Section reports, the State Government brought down a Swine Compensation Bill. This is designed to assist in eradicating the disease should unhappily it effect an entry into Queensland. A Swine Compensation Fund is the central feature of the Act. It is based on a duty payable on the sale of pigs. It is pleasing to be able to report that the Act has been well received by all sections of the pig industry and related trades.

Two distinct rates of compensation are provided, one, the higher, being for "exotic" disease (such as swine fever) and the other for "disease" (meaning diseases ordinarily present in Queensland). The only disease in mind for compensation at present is swine fever, it being considered provident to first build the fund up to sizable proportions as a reserve against a disaster from disease.

A total prohibition of the introduction of pigs from New South Wales was imposed by Order in Council dated October 26, 1961, and a similar prohibition applied to pigs from Victoria, by Order in Council, dated December 7, 1961.

VETERINARY SERVICES BRANCH

STAFF

One Divisional Veterinary Officer and one Veterinary Officer resigned during the year. Only one new Veterinary Officer was appointed. One Inspector and one District Inspector retired and one Inspector resigned. Five Inspectors were appointed. A Divisional Veterinary Officer was seconded to pleuropneumonia work together with a District Inspector and a number of experienced Inspectors. Some classifications in the Slaughtering Section were increased by the appointment of a Chief Inspector and an additional Senior Inspector of Slaughterhouses. The lack of senior veterinary staff is hindering the efficient operation of the Branch.

DISEASES OF CATTLE

Bovine Contagious Pleuropneumonia.—The BCPP eradication project which was commenced in April, 1961, was continued from July to October, when, due to adverse seasonal conditions, stock movements and (to a large extent) mustering had ceased. Most of the export meatworks in central and northern Queensland had also closed as no further slaughter cattle were available. Staff was then withdrawn from special duties except for two officers who were retained in Central Queensland to supervise inoculation of travelling and station cattle. The project was recommenced in April, 1962 with 14 experienced officers, including a Divisional Veterinary Officer.

The objects of the project are to supervise inoculation of travelling cattle, encourage and supervise inoculation of station cattle, extend the "protected" and "free" pleuro areas and follow up on any evidence of pleuro found in meatworks cattle.

During the April/October 1961 period more than 300,000 cattle were inoculated. More than half were travelling cattle, most of which were inoculated under supervision. The balance were station cattle inoculated under the supervision of pleuro officers. Visits were made to more than 800 properties either to supervise and/or arrange inoculation programmes or to follow up meatworks findings.

Regular observations on travelling and station cattle, together with information from slaughter cattle, failed to reveal any evidence of pleuro in the Dawson Valley. The "protected" area was therefore extended to include the Dawson Valley, and conditions of entry into the "protected" area were made more restrictive. Similarly, observations have indicated that there has been no active pleuro in the country south of the Charleville railway line between the Maranoa and Warrego Rivers during the past five years and this area has now been added to the pleuro "free" area.

The incidence of suspect pleuro lesions in slaughter cattle was again given special attention during 1961. Specimens of all suspect sequestra or active cases of pleuro were forwarded to a Departmental laboratory for examination. Material from several suspect active cases and 45 sequestra was involved. Two of the cases were confirmed as being active pleuro. One animal originated from a Queensland property and the other from an adjoining territory. A check on the Queensland property failed to reveal any further suspicion of pleuro. A number of sequestra gave indications that they could have originated from earlier cases of pleuro, but only three were confirmed as still being active and capable of transmitting the disease. Each of the properties from which the active sequestra originated was placed under quarantine restrictions and very careful observations were made, but no further evidence of pleuro could be detected.

Information on the presence of adhesions in slaughter cattle was again collected and this continued to reveal a definite correlation between suspect properties and high incidence of adhesions.

An intensive survey of possible pleuro incidence was made in two areas with the object of having them removed from the suspect area and included in the "free" section of the State. These areas comprise (1) the country south of the Rockhampton/Longreach railway line between the Expedition and the Great Dividing Ranges; and (2) the south-western corner of the State. The programme included field and slaughter cattle inspections and preventive inoculation programmes. Interstate co-operation to include inspection of slaughter cattle from the above areas in New South Wales and South Australia was arranged. No positive evidence of pleuro could be confirmed in either area. A similar finding in the 1962 survey, which is now in progress, could result in the transfer of these areas from the suspect to the "free" section of the State.

The 1962 programme is continuing satisfactorily. To date only one active case of pleuro has been detected and this was in a slaughter animal at the Roma meatworks. The mob from which it originated was immediately slaughtered but no other evidence of the disease could be found. The property has been placed under quarantine restrictions.

The incidence of active BCPP in the field during 1961 was the lowest recorded during recent years and probably the lowest ever recorded since the disease was introduced into Queensland. No active cases were found in travelling cattle or station cattle on properties. Only two individual cases were recorded at meatworks and one of these originated directly from another State.

As at June 30, 1962, only three properties were under quarantine restrictions and two of these were due for release. The quarantines were imposed because of suspect meatworks specimens and not on the finding of active disease on the properties concerned.

Tuberculosis.—Details of tuberculin testing conducted during the year are given in Tables 1 and 2. No new areas have been gazetted but one vacant zone (Laidley-Lowood) has been filled by an approved veterinary surgeon. The number of reactors under the compulsory scheme for dairy cattle has been maintained at a satisfactory low level, while reactors detected by Government Veterinary Officers have been considerably reduced.

TABLE 1

SUMMARY OF COMPULSORY TUBERCULIN TESTING BY APPROVED VETERINARY SURGEONS, 1961-62

Division	No. of Herds	No. of Tests	No. of Reactors	Percentage of Reactors
Cairns	236	12,785	5	·04
Townsville	8	623	..	..
Rockhampton	384	28,844	4	·014
Maryborough	1,295	75,015	25	·03
Brisbane	1,564	107,343	148	·14
Toowoomba	1,472	80,098	15	·15
Totals	4,959	304,708	197	·065

TABLE 2

SUMMARY OF TUBERCULIN TESTING BY GOVERNMENT VETERINARY OFFICERS, 1961-62

Division	No. of Herds	No. of Tests	No. of Reactors	Percentage of Reactors
Toowoomba	14	1,230	17	1·4
Maryborough	38	4,844	15	0·31
Cairns	2	209	1	0·5
Townsville	11	2,732	31	1·1
Brisbane	11	809	13	1·6
Rockhampton	25	1,870	9	0·5
Totals	101	11,694	86	0·74

Tick Fever.—Following the dry winter and minimal tick burdens a considerable number of outbreaks of tick fever occurred in ticky areas. This phenomenon, although reported in 1960-61, was even more evident in the past summer. Anaplasmosis was diagnosed in individual outbreaks at Pentland, Cloncurry, Ipswich, Biloela and Roma and in the Burnett.

Trichomoniasis.—At the beginning of the year, five herds were under quarantine restrictions for trichomoniasis. One of these has been released and a further four quarantined. No direct connection has been traced between the herds recently quarantined and earlier outbreaks. Two of the recently encountered herds have been artificially bred for some time but there is some stray bull trouble in the neighbourhood. Three of these infections were detected during a complete herd survey for infertility diseases, all animals being examined. The ratio of positives to herd animals examined ranged from 1 to 120 samples to 5 to 136 samples. It is extremely unlikely that trichomoniasis would have been detected in at least two of these herds unless a complete survey of the herd had been made. In a third herd, *T. foetus* was detected in an aborted foetus and subsequently in another cow.

Vibriosis.—Work on diagnosis and control of vibriosis has been continued. This disease is of major importance, as it causes widespread infertility in dairy cattle. Its significance is not so clear in beef cattle but there is considerable reason to believe that it is widely distributed.

Brucellosis.—Some slight improvement is being noted in the acceptance of Strain 19 vaccination, especially in the Toowoomba and Gympie areas, but herds are still reported in which brucellosis is the major cause of infertility and abortion. Total vaccinations reported were 58,000. The great majority of vaccinations were performed by practising veterinary surgeons.

Sawfly.—Heavy losses of cattle were experienced on individual properties in July/August 1961 from the ingestion of sawfly larvae. These were most severe north-west of Taroom. Districts affected were the Upper Warrego, Upper Maranoa, Injune and Taroom. Individual losses of up to 200 head were reported. Although sawfly have been again reported from these areas and north of the Carnarvon Range late in the year under review, there is as yet no indication they will reach plague proportions. One of the difficulties of sawfly investigations is that mortalities are very sporadic in any particular locality and frequently occur in very isolated areas. However, endeavours are being made to obtain the co-operation of land holders in demonstrating various control techniques and in obtaining further specimens for toxicological and biochemical work on the toxic principle.

"Dying" Disease.—This disease is characterised by paralysis and death of cattle on phosphorus-deficient pastures in North Queensland. It is regarded as being very closely allied to, if not identical with, coast disease. Toxins of *Clostridium botulinus* types C and D have been isolated from some cases of this disease. Annual vaccination with type C toxoid has generally given good control of coast disease but seems to be much less effective as a preventive of "dying" disease. It is intended to set up trials at Townsville and Maryborough, using a toxoid prepared from mixed strains of *Cl. botulinus* as soon as it can be made available. Phosphorus supplementation as a means of control will also be demonstrated. The estimated loss in the Townsville/Charters Towers area last year from this disease was 800 head. It is probable that the series of dry seasons experienced in this area over the last three years has accentuated the aphosphorosis and precipitated these losses, which are the heaviest reported.

Mastitis.—Trials with udder infusions of 100,000 units penicillin combined with Edicol Supra blue and green dyes showed that a withholding period of 72 hours was adequate to remove demonstrable concentrations of penicillin and that the excretion of the marker was reasonably well related to the excretion of penicillin. Unfortunately, owing to a manufacturing error, the original concentration of the marker dye was considerably below that originally intended. It was shown that the excretion of oxytetracycline was reasonably comparable to that of penicillin while that of chlortetracycline and streptomycin was considerably slower.

Pasteurella multocida was again responsible for severe mastitis, with systematic symptoms and deaths. Species of *Klebsiella* were isolated from acute cases. This organism is undoubtedly responsible for a considerable amount of severe mastitis in this State.

Miscellaneous.—St. George disease was prevalent in the endemic area and cases were reported at Augathella, Jandowae and Miles. A congenital enlargement of one or both hind legs of Hereford calves on a Jandowae property was shown to be due to a developmental failure of the lymphatic drainage. Sporadic cases have been recorded from this property and it is believed that the condition may be hereditary. Calf diphtheria caused heavy losses of young calves near Millmerran and was reported sporadically in other areas. Mycotic dermatitis was particularly prevalent after the good summer rains in the south. Good response was obtained to treatment in the early stages, but advanced cases in long-haired animals are hard to arrest. Virus diarrhoea was reported spasmodically from most divisions of the State.

DISEASES OF SHEEP

Ovine Brucellosis.—Strict application of early weaning and isolation of ram lambs is enabling good progress to be made in known infected flocks by test and slaughter of adult rams.

In conjunction with the Australian Society of Breeders of British Breeds of Sheep, a survey of the incidence of breeding diseases in British breed studs was carried out. This survey was extremely well supported by stud owners, who willingly made their sheep available for examination. All stud rams, flock rams and weaner rams on each property were clinically examined and bled, and all stud ewes were bled. Almost 5,000 sheep were involved. While a critical examination of the results has not yet been made, it would appear that the incidence of ovine brucellosis will be less than 2 per cent. These preliminary results appear to indicate that a positive approach to eradication would be warranted in British breeds studs.

Enterotoxaemia.—With the development of crop feeding in the fat lamb industry, enterotoxaemia is becoming much more prevalent where prophylactic measures are not employed. Outbreaks are most common in the Dalby-Warwick area and three outbreaks were confirmed at Millmerran.

Miscellaneous.—Pregnancy toxaemia was fairly commonly reported and a loss of 1,100 out of 1,800 sheep was ascribed to this cause. In general, drenching with glycerol gives good results if done in the early stages.

DISEASES OF PIGS

A survey of pig diseases investigated during 1961 showed that 50 per cent. of outbreaks and 70 per cent. of losses from infectious disease were due to salmonellosis and pneumonia (including virus pneumonia). These diseases accounted for almost 35 per cent. of disease investigations of pigs for any cause. Erysipelas and oedema disease were responsible for 8 per cent. and 10 per cent. of infectious disease losses, Glassers disease 4 per cent., streptococcic septicaemia 3·5 per cent., and tetanus and piglet anaemia 2 per cent. each. Salmonella and pasteurella were responsible for 27 per cent. of infectious outbreaks but only 23 per cent. of losses, while pneumonia was responsible for 23 per cent. of outbreaks but 48 per cent. of losses.

Swine Fever.—Following reported investigations of severe pig losses in the Northern Rivers area of New South Wales and the occurrence of swine fever at Inverell, it was considered necessary to prohibit the introduction of all pigs or pig meats of New South Wales origin into this State. As it appeared that the disease may also have extended into Victoria, similar action has been taken in regard to that State. All possible precautions are still being taken to prevent the introduction of the disease into this State, particularly in small goods. Close surveillance is being maintained over the boiling of swill. All deaths of pigs showing any symptoms suggestive of swine fever are carefully investigated but so far no evidence of the disease has been discovered. Diagnosis is based on clinical history and bacteriological, pathological and histological examination. It has not yet appeared necessary to apply serological tests nor to carry out transmission tests.

Infectious Rhinitis.—This disease was first confirmed by the demonstration of inclusion bodies in specimens from the Rockhampton area. Similar demonstrations were made on specimens from Mt. Murchison, Brisbane (4), Mungindi and Monto. Quarantine restrictions have now been lifted from three of these properties. Additionally, a number of cases of purulent rhinitis were reported in which it was impossible to demonstrate inclusion bodies. On some properties the typical atrophic form, with stunting and economic loss, was demonstrated following the acute attacks.

Oedema Disease.—Outbreaks of oedema disease showing typical symptoms have now been reported from most pig-raising areas.

Erysipelas.—Apart from field outbreaks, this disease causes up to 1 per cent. condemnations of quarters at some bacon factories. Examination of sera and joints of suspected pigs on slaughter, where regional lymphatics are involved with an arthritic condition, has given definite proof that many of such cases are caused by erysipelas infection. Vaccination against this organism is giving good results and is fairly widely practised in endemic areas.

DISEASES OF POULTRY

Infectious laryngotracheitis caused heavy mortalities on two broiler-raising properties following cessation of vaccination after regular use for some five years. Some 50,000 birds were vaccinated against this disease throughout the

State. Chronic respiratory disease was troublesome on a number of properties, particularly in broiler chickens and on started chick farms. Nephrosis was common in chickens up to half-grown. In one unusual outbreak, 30 per cent. of chicks died although the shed was new and the property had not carried chickens before. Experimental transmission of the infection was demonstrated. A disorder on two broiler farms resulting in extreme nervousness and poor growth after the birds were one month old was apparently not associated with infection, but litter eating is suspected to be at least partly responsible.

A variety of disease problems were investigated, such as coliform infections in young chickens, staphylococcal infection in colony cages, avian encephalomyelitis in young chickens, leucosis in broilers and adult stock, proventricular disorder, coccidiosis, histomoniasis, roundworm, scours in laying hens, cannibalism, fowl pox, infectious synovitis, yolk sac infection and bumble foot. Several incubator problems, one of which involved bacterial infection of the embryo, were investigated.

Botulism in poultry, coccidiosis, vitamin A deficiency and worms were commonly diagnosed. *Aspergillus fumigatus* was isolated from lungs and a trichomonad from the oesophagus. Poultry tick is commonly seen in some areas.

DISEASES OF HORSES

No serious infectious troubles of horses were reported. Sporadic cases of walkabout and Kimberley disease occurred but there was no major outbreak. Botulism was suspected on clinical grounds near Oakey. Trombiculid mites caused severe leg irritation at Biloela.

POISONING

Arsenic was again responsible for many stock losses, most cases being associated with careless use of dip materials. Forty-five out of 250 mixed cattle died after being held in a yard in which the dip had apparently overflowed during wet weather. In another case 29 head died following spraying with an insecticide mixture, the water for which was obtained from an old arsenic drum. Symptoms and analysis were consistent with arsenical poisoning. Losses occurred when a barrel of arsenic commenced to leak after storage for upwards of 20 years. Although sheep may be safely dipped in arsenic under normal conditions, heavy losses frequently follow when they cannot dry rapidly. One example was the loss of 500 sheep from a mob of 900 in humid weather.

For the first time, urea in the form of lick blocks was extensively used and a number of deaths were ascribed to its use. In most cases carcases were found in close proximity to the blocks but a number of animals were seen showing symptoms compatible with urea poisoning.

Following the widespread use of organic phosphorus compounds as tickicides, particular attention has been paid to their toxicity. In general, it may be said that while the general risk is low, these compounds can, under certain conditions, be fatal to calves. Heat, humidity and exertion appear to be predisposing causes. The toxicity to adult animals is extremely low. The majority of affected calves recovered without treatment, so the value of atropin therapy is difficult to assess. As there appear to be considerable differences in toxicity of the various organic phosphorus tickicides available commercially, this factor will have to be taken into account with efficacy in determining the most suitable medicament for general use.

Weir vine (*Ipomoea calobra*) caused major losses in sheep and cattle in the south-western downs area. Wax flower (*Hoya australis*) caused deaths in cattle, and rock-fern (*Cheilanthes sieberi*) in sheep. White cedar (*Melia dubia*) berries were reported to have killed pigs in several areas. Boggabri (*Amaranthus mitchellii*) is suspected of causing the deaths of 500 sheep in the Hughenden district. Samples examined showed moderate concentrations of nitrate and high concentrations of oxalate. Red spinach (*Trianthema triquetra*) was implicated in calf losses at Julia Creek. Ergot poisoning was noted with water couch (*Paspalum distichum*).

Millet containing 23 per cent. Budda pea (*Aeschymonene indica*) was fed to 90 pigs. Sixty per cent. were affected, showing vomiting, inco-ordination, muscular twitching and coma. Five died and the others only partially recovered.

Owing to dry conditions, losses from common poison plants such as poison peach (*Trema aspera*), yellow-wood (*Terminalia oblongata*), bracken (*Pteridium aquilinum*) Noogoora burr (*Xanthium pungens*), lantana (*Lantana camara*), Ellangowan poison bush (*Myoporum deserti*), green cestrum (*Cestrum parqui*), and gidyea (*Acacia georgina*) were commonly encountered. Other plants which were implicated in one or more poisonings were nut-head (*Epaltes australis*) with horses; Mexican poppy (*Argemone mexicana*) with poultry; oleander (*Nerium oleander*) with cattle; striped rattlepod (*Crotalaria mucronata*) with sheep; black bean (*Castanospermum australe*) with cattle and donkeys; *Phyllanthus gasstroemii* with cattle; Brazilian nightshade (*Solanum seaforthianum*) with pigs; mother-of-millions (*Bryophyllum tubiflorum*) with cattle; *Crotalaria aridicola* with horses; and species of *Macrozamia* with cattle.

INTERNAL PARASITES

Owing to dry conditions, worm burdens in calves were generally low, although some severe infestations with hookworms and lungworms were encountered. Organic phosphorus compounds have given excellent results in controlling ill-thrift of calves on the Atherton Tableland, thought to be due mainly to heavy Cooperia infestations.

Thiabendazole trials in lambs gave promising results. Considerable losses occurred in sheep on the Darling Downs from haemonchus infestation. Some investigations have also shown heavy trichostrongyle burdens. After four dry years the conditions in this area changed and became extremely favourable to worm propagation and it appears that many sheepmen had neglected usual precautions. Considerable difficulty has been experienced in controlling infestations once established and thiabendazole has been very useful in this regard.

Thiabendazole has also given good results in North Queensland in the treatment of strongyles in horses.

Stickfast Flea.—This parasite may now be regarded as established as a pest on backyard poultry throughout the western areas of the State and in many parts along the coast, but has not caused trouble in any major poultry-raising area.

Scrub Tick—Losses have been reported in pigs and calves but on a much smaller scale than in 1960-61. Heaviest losses were in the Crows Nest and Killarney districts.

EXTERNAL PARASITES

Cattle Tick Infestation—The occurrence of storms over a comparatively wide area of tick-infested and marginal country during the spring of 1961 produced conditions which were very favourable for cattle tick propagation early in the season. These conditions continued during the summer and autumn months, with the result that the unusually high incidence of ticks recorded early in the season continued through until late autumn.

Infestations in the recognised infested country were heavier than usual, resulting in greater economic loss and requiring more regular treatments. Infestations were also recorded in marginal country, part of which, during the previous year, was regarded as being tick-free. These infestations could have resulted from the over-wintering of the ticks and/or spread from the known infested areas. Several tick outbreaks were also recorded in tick-free country adjacent to the marginal areas, mostly in the South Burnett and the Darling Downs divisions. Appropriate control and elimination methods were introduced.

The prospects of cattle tick eradication in Queensland were reviewed at the request of stock owners' organisations and it was accepted that the time is not yet opportune for eradication in this State.

A Departmental survey of cattle tick control measures and facilities in Queensland was carried out during July/December, 1961. This revealed that chemical control by the use of insecticides in dipping vats and sprays is still the most commonly practised method of keeping ticks in check. Biological methods of control, namely strategic dipping and rotational grazing to prevent the build-up of larval ticks in pastures, are being more extensively used in association with chemical control measures.

It was decided during the year, due to a possible build-up of chlorinated hydrocarbon residues in the meat of dipped cattle, to discontinue the use of these insecticides on cattle in Queensland except for the use of limited quantities for buffalo fly control. The regulations under the Stock Acts were amended accordingly and the prohibition became effective as from May 1, 1962. Warning of this proposed action was given and there was a gradual voluntary swing away from chlorinated hydrocarbons for several months prior to the gazettal of the regulations.

All Departmentally charged dips which previously had been charged with DDT were emptied and recharged with an organic phosphorus insecticide during the first four months of 1962. Many stockowners followed the Department's example during this period. The survey of 1961 revealed that 40 per cent. of privately owned dips were charged with chlorinated hydrocarbons at the end of that year, but a large proportion of these dips had made the change-over prior to completion of dipping in the late autumn of 1962. It is anticipated that most, if not all, of the remaining dips will change to an approved alternative insecticide before the recommencing of dipping in the spring.

The relative efficiency of organic phosphorus and chlorinated hydrocarbon dips is being investigated, particularly in relation to biological efficiency, toxicity and stability in vats. A check on the possible development of resistance to organic phosphorus insecticides is being maintained. No resistance has yet been detected. Results to date on the biological efficiency, etc. have been favourable to the organic phosphorus dips, although there has been some evidence of toxicity to young calves as a result of dipping under unfavourable conditions in the summer months.

Buffalo Fly—Very little activity was experienced in buffalo fly movements. Although the cold winter and dry spring of 1961 were unfavourable to fly activity, seasonal conditions in the summer were generally favourable to spread. However, the dry conditions generally experienced in the Rockhampton area until late April, together with Departmental control policy, prevented the fly reaching more favourable southern areas in the Burnett.

Trials with commercially available organic phosphorus compounds have indicated that although they kill buffalo fly efficiently the residual period against this parasite is much inferior to the residual period with DDT.

Lice—Extremely heavy infestations of cattle lice were reported in several Divisions. In one case the infestation caused sufficient loss of weight to interfere seriously with a weighing trial. The parasites are easily controlled with the normal tickicides. Heavy infestations of sheep lice were noted in the Roma division during the winter of 1961. Trombidiosis was reported in the Hodgson-Muckadilla area.

BRANDS

Details of brands registration, etc. during 1961-62 are as follows:—

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	22,490
Horse and cattle symbol brands registered	164	4,008
Horse and cattle brands transferred	1,617	95,506
Cattle earmarks registered	568	41,482
Sheep brands and earmarks registered	123	16,370
Sheep brands and earmarks transferred	209	11,507
Distinctive brands registered	21	1,395
Alterations of address	207	..
Brands cancelled	18	..
Earmarks cancelled	135	..

The monthly averages of registrations and transfers of horse and cattle brands and earmarks were slightly below those of the previous two years, with the exception of symbol brands, which showed an increase in registrations. The number of registrations and transfers of sheep brands and earmarks was approximately the same as the previous year and was well below the average of the last 10 years.

Printing of the revised edition of the Horse and Cattle Brands Directory by private printers will be sought to expedite publication. At the same time, the opportunity has been taken to revise the Directory format and so curtail printing costs. The Sheep Brands and Earmarks Directory has been revised to the end of 1961 and printer's copy is being prepared for early submission to the Government Printer.

STOCK MOVEMENTS

Interstate stock movements are set out in Table 3.

TABLE 3

INTERSTATE MOVEMENTS OF STOCK, 1961-62

——	Cattle	Sheep	Swine	Others
Entered from Northern Territory	85,195	..	..	..
Entered from New South Wales	51,841	545,591	1,221	1,219
Removed to Northern Territory	238	..	..	..
Removed to New South Wales	208,580	323,601	39,063	4,048

EXTENSION

This Branch was closely associated with other Branches in a 4-day meeting with graziers at Tinaroo. In place of formal lectures, the subjects were dealt with by a discussion group technique. Branch personnel were represented at important farmer and grazier conferences such as the Bankers' Conference at Rockhampton, the Dairy Farmers' School at Biloela and the Livestock and Meat Marketing School at Roma. Field days and discussion groups were organised in most areas and at some Agricultural Colleges.

SLAUGHTERING SECTION

The newly-formed Slaughtering Section, which became fully operative during the year, is responsible for the State meat inspection service as a safeguard to public health. The main duties include inspection of meat for freedom from disease and for wholesomeness, provision and maintenance of high standards of hygiene in meat-processing establishments, and classification and branding of meats to enable the consumers and the trade to readily identify the better quality meat.

District abattoirs, bacon factories and other centralized works killing for the local trade are staffed by full-time Departmental Inspectors, who undertake routine inspection of all stock slaughtered. The following stock for local consumption were inspected at these establishments and the public abattoir at Cannon Hill:—215,475 cattle, 155,430 calves, 1,153,667 sheep, 419,623 pigs. Common diseases and conditions causing condemnation of carcases were—

Cattle: tuberculosis, emaciation, fever, bruising, gangrene.

Calves: immaturity, arthritis, fever, jaundice, pneumonia.

Pigs: arthritis, fever, tuberculosis.

Sheep: emaciation, fever.

Details of stock slaughtered for local consumption are given in Table 4.

TABLE 4

STOCK SLAUGHTERED FOR LOCAL CONSUMPTION, 1961-62

——	Bullocks	Cows	Calves	Sheep	Swine
Brisbane Abattoir	63,909	40,498	91,795	803,670	49,481
District Abattoirs	36,301	15,284	16,348	267,889	26,333
Bacon Factories	31,246	30,997	45,915	106,171	350,180
Other Centres	181,965	110,884	156,886	481,880	83,073
Total	313,421	197,663	310,944	1,659,610	509,067

Actinomycosis, abscesses, cysts and other parasitic lesions, septic wounds, cancers, inflammation and fibrosis were common conditions for which parts of carcases and organs were condemned.

The Slaughtering Section works in conjunction with the animal disease control service by providing information on the incidence of disease in stock at slaughter. Officers of the Commonwealth Department of Primary Industry also assist in this way. Information on the incidence and distribution of such diseases as tuberculosis and bovine contagious pleuropneumonia is regularly collected. The occurrence of septic arthritis, a disease of high incidence in slaughter pigs, has been relayed back to field officers for control measures.

The Section is suitably placed to keep abreast of local trade requirements, which indicate that the demand is for beef from light-weight, youthful cattle with an even but not excessive finish so that there is a minimum degree of fatty waste. The heavy, aged, overfat beast is not wanted by the trade.

The voluntary system of classification and blue ribbon branding of quality beef at Cannon Hill has expanded. "Choice" has been introduced as a second qualification to the existing "Prime". The scheme has proved popular, as 90 per cent. of the domestic kill at Cannon Hill is now voluntarily graded. Prime branding of beef is also being undertaken at the Townsville District Abattoir on a voluntary basis, and can be expanded into all District Abattoirs as required. The Department has prepared an attractive poster to promote the advantages of blue ribbon branded beef. These are being distributed for display by all butchers' shops at which prime or choice branded beef is sold.

The classification and marking of various classes of meat at Cannon Hill and District Abattoirs has continued. The ribbon branding of lamb and hoggett has allowed the consmuer to easily recognize the true nature of the article being purchased. Cows, heifers and yearlings are also identified for the wholesale trade.

Judging of carcase competitions held in conjunction with Shows at Brisbane, Toowoomba, Ipswich, Goomeri, Eidsvold and Mackay has been undertaken.

District Abattoir development is progressing favourably. Approval was given for the establishment of a District Abattoir, with limited export facilities, at Mackay. A District Abattoir area was formed at Gympie and a Gympie District Abattoir Board is now in the process of being formed. The Rockhampton District Abattoir Board is giving close consideration to the construction of a District Abattoir. Close association has been maintained with the Callide/Dawson Co-operative Meat and Bacon Assn. regarding the completion of an abattoir at Biloela. It is of interest to note the change-over to on-the-rail dressing of cattle at most major meatworks. This system has many advantages which can be incorporated in future District Abattoir developments.

The Section undertook all poultry slaughtering duties during the year. Details of slaughterings appear in Table 5.

TABLE 5

POULTRY SLAUGHTERINGS AT ABATTOIRS IN THE BRISBANE–GOLD COAST AREA, 1956-57 TO 1960-61

Year	Chickens (Broilers)	Hens	Total Slaughtered (Including Ducks, Turkeys, &c.)
1956–57	348,922	400,105	734,952
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

PATHOLOGY BRANCH

One of the functions which the Department of Agriculture and Stock can undertake most effectively is that of mass testing leading to control and eventual eradication of animal diseases. To achieve this result the activities of several Branches must be combined.

In the previous report the considerable amount of laboratory work, including the use of new tests and intensified pathological examination, to support the bovine pleuropneumonia control campaign was mentioned. Two new projects were commenced in the past year. The first of these, in which the Veterinary Services, Sheep and Wool and Pathology Branches participated, was a survey of infertility diseases of the British breeds of stud sheep, with particular emphasis on ovine brucellosis. This was undertaken at the request of the breeders. The great bulk of breeding sheep of those breeds in this State were sampled, revealing a level of infection which should not be difficult to eradicate. Details of the test are set out elsewhere. In the second project, 39 herds of dairy cattle were submitted to full herd tests, involving 3,971 animals, for the several infertility diseases. This work was done by the Cattle Husbandry and Pathology staffs. This type of work makes heavy demands not only on the personnel responsible for testing the large numbers of samples involved but also on the "kitchen" staff in keeping up supplies of glassware.

The figures for the major activities of the Branch are given in Table 1, while Table 2 lists the numbers of samples submitted to the various serological examinations.

TABLE 1

SUMMARY OF PATHOLOGY BRANCH ACTIVITIES, 1961-62

Laboratory Activity	Yeerongpilly	Oonoonba	Total
Diagnostic specimens examined ..	5,453	827	6,280
Stud cattle immunised	167	141	308
Bleeders sold	161	13	174
Vaccines dispatched—			
C.P.P.	209,800	347,050	556,850
Tick fever	95,051	18,943	113,994
I.L.T.	72,600	..	72,600
Brucella abortus Str. 19	8,887	..	8,887

TABLE 2

SEROLOGICAL TESTS, 1961-62

Test	Yeerongpilly		Oonoonba	Total
	Routine	Survey		
Complement fixation tests—				
Contagious pleuro-pneumonia—				
cattle	2,194	5,655	1,303	9,152
Actinobacillosis—sheep ..	1,461	1,586	..	3,047
Melioidosis—sheep	597	..	334	931
Brucellosis—sheep	1,179	5,149	..	6,328
Serum agglutination tests—				
Brucellosis—				
cattle	6,908	3,910	1,633	12,451
pigs	2,778	..	259	3,037
Leptospira pomona—				
cattle	5,315	..	1,499	6,814
pigs	1,043	..	186	1,229
Leptospira hyos—				
cattle	5,315	..	472	5,787
pigs	1,043	..	126	1,169
Mucus agglutination tests—				
Vibriosis—cattle	4,727	3,371	876	8,974

In addition to the figures given in Tables 1 and 2, it should be mentioned that in carrying out the routine and experimental work the bacteriology section used 83,709 items of media, the haematology section did 20,000 tests, the parasitology section carried out 2,475 examinations, the histopathology section prepared 6,134 sections for examination, and the protozoology section examined 716 blood and tissue films from suspected outbreaks of field tick fever.

DIAGNOSTIC WORK

Some of the more common and important conditions diagnosed during the year are set out below.

Cattle

Tick Fever.—There was a marked increase in the number of field outbreaks of tick fever. *Babesia argentina* was confirmed on 208 occasions. The seasonal incidence of babesiosis is of interest. During July to September there were 13 cases; October to November, 43; January to March, 103; and April to June, 49. Over the years a pattern similar to this, in which the maximum occurrence of this disease does not correspond with the spring rise in the tick population, has been noted.

Encephalitis of Calves.—A sporadically occurring encephalomyelitis has been seen occasionally over several years. During the past year nine further cases were examined. Virus has not been isolated from these and attempts at transmission have failed. In the absence of virus isolation it is not possible to prove that the aetiology of this disease differs from that of the transmissible viral encephalitis mentioned in the last report and described later under Research. However, the sporadic occurrence and the somewhat different microscopic lesions support this idea.

Other conditions in which there were nervous symptoms and which must be differentiated from the above conditions included lead poisoning, cerebral babesiosis, weir vine poisoning and ergot poisoning. Also, a heifer examined had a disease suggestive of bovine malignant catarrh. On microscopic examination a non-purulent encephalitis and aggregations of lymphocytes in the liver and kidney were seen.

Virus Diarrhoea.—At a time when there were field reports of clinical virus diarrhoea in dairy cattle around Brisbane, several cattle at this Institute showed a persistent profuse malodorous watery scour which did not respond to gastro-intestinal astringents and sedatives, antibiotic and fluid therapy. Serum samples have been collected from these and from field cases and also from pigs inoculated with blood and faeces from affected cattle. These will be examined for antibodies to the virus diarrhoea complex.

Bovine Contagious Pleuropneumonia.—A total of 62 lungs was examined and *Mycoplasma mycoides* was isolated from five.

Abortion.—*Brucella abortus* was isolated from 11 foetuses and *Vibrio fetus* from one. One *Br. abortus* isolation was from a foetus from a herd in which all classes of stock (including adult cows) were vaccinated with Strain 19 the previous year. Other cows were reported to have aborted.

Coast Disease.—In North Queensland, 10 batches of specimens were examined from animals suspected of dying of coast disease. From these *Clostridium botulinum* types C and D toxins were demonstrated in the small intestine contents of one animal. An unidentified mouse-lethal toxin was recovered from the bowel of another animal. In central Queensland a toxin similar to botulinum toxin was demonstrated in the soil surrounding dead carcases in a paddock where 25 cattle, mostly adult cows, had died. The variation in the syndrome of coast disease, the irregular recovery of botulinum toxins and the difficulty in producing toxic cultures from putrefying material or bowel contents leave the aetiology of this condition obscure.

Poisoning.—Arsenic poisoning was confimed on 54 occasions, lead on 13 occasions and phosphorus on one. Sawfly poisoning was prevalent on some properties in the silver-leafed ironbark country in the Taroom district.

Leucosis.—On 10 occasions lymphoid tumours were seen in organs submitted from cattle killed at abattoirs or autopsied in the field. Following a histopathological diagnosis of leucosis in a cow at Kin Kin, haematological examination on the remainder of the cows in the herd showed an abnormally high lymphocyte count in several of them. Elsewhere, bovine leucosis is divided into (*a*) a sporadic type characterised by enlargement of the lymph nodes and sometimes the presence of lymphoid tumours affecting both young and aged cattle, and (*b*) a herd type which is seen only in older animals and is associated with a high lymphocyte count in a percentage of the herd. It would appear that the "herd type" of leucosis is present in the Kin Kin herd while the other cases fall into the sporadic group. Further tests will be done on the herd at Kin Kin.

Sheep

Drenching Injuries.—In two instances in the Warwick and Clermont districts sheep died following drenching with a commercial preparation of arsenic, copper sulphate and piperazine. Toxicological examination of internal organs indicated that death was not due to arsenic or copper poisoning. All sheep examined had trauma necrosis and oedema of the pharyngeal region with oedema of the intermandibular space in some. It was considered that death was directly related to the damage following mechanical injury at drenching.

Mycoplasma Infection in Lambs.—The pathogenicity of strains of this organism varies and there is considerable controversy about the significance of its recovery from pathological conditions in the various species of domestic animals and fowls. In 1956 a mycoplasma was recovered from the peritoneal exudate from a goat and was subsequently proved pathogenic to sheep on experimental inoculation. A species of *Mycoplasma* was isolated from a fibrino-purulent exudate in the spinal canal of a lamb which developed posterior paralysis following docking. Mycoplasma were also isolated from a nasal swab from an in-contact lamb which developed a persistent cough.

Poison Plants.—These remain important as a cause of mortality in sheep. During the year deaths were reported due to dwarf Darling pea (*Swainsona luteola*), rock-fern (*Cheilanthes tenuifolia*), streaked rattlepod (*Crotalaria mucronata*) and *Amaranthus mitchellii.*

Pigs

Salmonellosis.—Salmonellosis remains the most severe infection in pigs. There were 26 outbreaks of this disease, with 101 reported deaths and a further 68 pigs reported sick at time of submission of specimens.

Oedema Disease.—Since it was first reported in 1959-60, oedema disease has become more frequently recognised. It now appears as one of the major diseases in south-eastern Queensland. All breeds and sexes of pigs were affected; most were in the 12–20-weeks age group, although pigs 3 weeks old were affected. Pigs on various diets were affected. The haemorrhagic syndrome was seen less frequently than the syndrome in which there is oedema in the viscera and subcutis. Haemolytic *E. coli* were recovered from 9 of the 13 cases diagnosed.

Inclusion Body Rhinitis.—Examination of pig snouts has often shown a chronic rhinitis but inclusion bodies have been demonstrated in six only. The positive cases were reported from the Biloela, Mungindi and Brisbane areas. All piglets affected were in the 3–12-weeks age groups and were Large White or Large White cross. Some of them had concurrent infections with Salmonella, Pasteurella, oedema disease and virus pneumonia.

Swine Fever.—Histological examination was done on the brain of all pigs necropsied in the laboratory and on the brains from several pigs necropsied in the field. No changes characteristic of swine fever were seen.

Avitaminosis A.—Two pigs showing ill-thrift and lameness were autopsied. The vitamin A levels of both pigs were less than 1 microgram per gram of liver.

Bordetella bronchiseptica.—This organism was isolated from a pneumonic lung. This is the first occasion on which it has been isolated from pigs in Queensland.

Horses

Oesophageal Disease.—This was diagnosed in two horses in North Queensland which had access to *Crotalaria aridicola.* Histological examination showed that the ulceration had penetrated to the muscular layer in the oesophagus. The liver from both horses showed biliary stasis, activation of the periportal tissue and fatty degeneration.

Abortion in Mares.—Foetal material from two cases of abortion on the Darling Downs was received. Histological examination failed to confirm the suspicion of viral equine abortion.

Psoroptic Otocariasis.—A maladorous copious discharge from one ear of a stallion stationed at the Animal Health Station, Oonoonba, was found to be due to *Psoroptes hippotis.*

Poultry

A total of 1,374 autopsies was done on fowls. As judged by the specimens examined, leucosis and respiratory diseases are easily the most important causes of loss to the industry.

Leucosis.—Leucosis was noted in birds only six weeks old, this being much younger than normally recognised. This disease has caused heavier losses than have been experienced for some years.

Infectious Laryngotracheitis.—Two outbreaks were recorded in the Cairns district. In one flock there was evidence that deaths were occurring in fowls previously vaccinated. It is probable that all of the affected birds were vaccinated when very young. Trials are being done to check the efficacy of vaccination of day-old chicks.

Miscellaneous

Serratia marcescens was isolated from inside the shells of eggs which had a pink colour throughout the egg. This condition is rare, although the micro-organism is not unusual in the soil. *Melioidosis* occurred in an orang-outang kept for four years at the Townsville Zoo. Autopsy showed lesions in the lungs, liver, kidneys and spleen. *Psittacosis* was diagnosed in a rosella parrot, one of several which had died in the Brisbane area.

RESEARCH

New, more rapid and more specific techniques are constantly being introduced in the laboratory. After testing their use and adaptation to local conditions on an experimental level, they become part of the routine diagnostic procedures. During the year a visit was made by Mr. C. G. Ludford (Senior Serologist) to the John Curtin School of Medical Research, Australian National University, Canberra, to learn the techniques used in immuno-fluorescent microscopy. This is a method of specifically detecting antigenic material in tissue or tissue fluids. It is much more sensitive than other staining techniques as it is much easier to detect microscopically a small amount of fluorescence against a dark background than to detect colour against a light background.

Tick Fevers of Cattle

Immuno-fluorescent Microscopy.—This method is being used in the study of babesiosis, and fluorescein-antibody conjugates have been prepared against *Babesia argentina* and *B. rodhaini.* Each conjugate readily stains its homologous organism, and no other, in blood smears. Non-specific staining of tissue components has given trouble when searching for babesia in tissue smears, but methods described for its removal are being tried.

In addition to immuno-fluorescent methods, staining of babesia by the fluorochrome acridine orange has been investigated. This substance stains only nuclear material, making it suitable for demonstrating parasites in erythrocytes. Blood to be examined is collected into preservative, and can be kept for a long time. Smears made from preserved blood, stained with acridine orange and examined with the fluorescence microscope show babesia as brilliant reddish objects in blue fluorescing erythrocytes. They are easily seen under low-power magnification. Babesia have been demonstrated in preserved blood up to three months after collection.

There is every reason to believe that very useful practical applications of these methods will be developed.

Vaccine Experiments.—Work is in progress to improve the tick fever vaccine. This work now explains some of the past failures of vaccine used under field conditions. It appears that the effectiveness of vaccine may diminish because (1) babesia are fragile organisms and may be killed by excessive handling at room or higher atmospheric temperatures; or (2) antibodies present in vaccine at the same time as parasites can sometimes make the parasites non-infective.

It also appears that there is a minimum number of parasites required to cause a reaction. At the present time, there is no control over the number of parasites in tick fever vaccine. If these numbers are low, the vaccine may be readily rendered ineffective by unsatisfactory handling or by the action of a high antibody level. Present investigations are directed towards providing a vaccine to contain sufficient parasites to enable the vaccine to retain its effectiveness despite depletive effects and if possible to reduce the depletive effects. Other findings to emerge from this work are that (1) the time between the inoculation and the reaction can be varied by inoculating different numbers of parasites; and (2) varying the parasite numbers over a large range (10,000 to 100,000,000) does not affect the severity of the reaction.

Immunity.—Work done, mainly with *B. bigemina,* has shown that immunologically different strains exist. Experiments with laboratory strains of *B. bigemina* have shown that a sterile immunity against one strain can be produced, but this immunity can be broken down by inoculation with a second strain to which the animal has not previously been exposed. When cattle carrying one strain (a non-sterile immunity) are challenged with a second strain about three months after the primary attack, the challenged cattle show relatively high resistance. Even though parasites can be found and temperature rises may be recorded, these and any other clinical effects are transitory. The effect of this phenomenon on the immunity of cattle to babesiosis in the enzootic area has not been assessed.

Work was carried out at Oonoonba to show that young calves of immune mothers are protected against *B. bigemina* infection by antibodies they receive from their mothers presumably through the colostrum. A similar finding was previously recorded for *B. argentina.*

In the present work, mothers were immunised either with a tick strain or with a blood-maintained strain of *B. bigemina.* The calves were all challenged with the tick strain. Those from mothers immunised with the tick strain were resistant, whereas those from mothers immunised with the blood-maintained strain were as susceptible as control calves. This showed that strain specific antibodies had been transmitted to the calves. This work throws light on calfhood resistance in babesiosis.

Natural History of Infection.—The brain smear technique provides a simple method for detecting carriers of *B. argentina* infection. Samples can be obtained from animals slaughtered at an abattoir, or the live animal can be sampled by a simple operation in which a small portion of the cerebral cortex is removed. This material is used to make a tissue smear which is examined in the usual way. The method has shown that cattle may still carry *B. argentina* two years after they have entered tick-free country.

Although the cattle tick spends approximately three weeks on its host, there is only a short period at the end of its parasitic life during which it can become infected with *B. bigemina.* This is shown by the following observations:—(1) if the host has a patent parasitaemia during the last day when the tick undergoes a rapid final engorgement, infection invariably occurs; and (2) when ticks are exposed to patent parasitaemias during the larval, the nymphal and the early part of the adult stages, the infection occurs irregularly and, when it does, this can be attributed to sufficient parasites still being available to the tick when it is almost mature.

B. bigemina was demonstrated in lamb's erythrocytes, following its infection from ticks carrying this organism. Attempts have been made to establish *B. argentina* in neonatal mice. Transitory infections have been produced.

Treatment of Tick Fevers.—A newer preparation, Amicarbalide ("Diampron" M.B.), is effective against both *B. bigemina* and *B. argentina.* Its toxicity is very low and no untoward side-effects have been observed. The 8-aminoquinoline antimalarial "primaquine" is effective against the erythrocytic stages of *Theileria mutans,* whereas "chloroquine", a 4-aminoquinoline, is not.

Initial work has been done in an endeavour to adapt the "Capchur" gun to field use for the injection of tick fever specifics.

Anaplasmosis.—The records of the examination of field smears submitted from tick-infested areas south of Mackay show that *A. marginale* has occurred in all such areas. Three field strains of *A. marginale* isolated from central and southern Queensland appear to differ in virulence. One strain has produced fatal, fulminating infections in two splenectomized calves, while two similar animals have survived infection with a second strain.

These extracts on various aspects of the research programme on tick fevers show the progress that has been made in the understanding of these diseases.

Tick Control

The organic phosphorus insecticides that are available commercially and are in field use are being checked for overall efficiency and stability in plunge dips. Throughout last summer "Asuntol" proved quite satisfactory for field tick control. Monthly dippings of a dairy herd kept the tick population down to low levels and no gross infestations occurred during the wet periods of the late summer and autumn. The dip was very efficient in killing ticks. Engorging nymphs showed some resistance but very few of them developed to adults. The residual effect of the dip in preventing attachment of larvae was variable, ranging from 2 days to 7 days, with an average of 4-5 days. The short periods were associated with periods of heavy rain, which may have removed the insecticide from the hair even though the animals dried after dipping before being wet by rain.

Buffalo Fly Control

Stalled cattle were sprayed with various organic phosphorus compounds and hair samples collected at intervals and tested against *Siphona exigua.* "Bercotox", "Dagadip" and "Neocidal" were effective for 3–6 days after spraying. "Asuntol" had some effect for 9–12 days. Low fly populations prevented this work from being repeated under natural conditions.

Viral Encephalitis of Calves

A nervous disease which occurred in calves in the Gayndah district was reported previously. The signs of the disease included depression, rapid loss of condition, muscle tremor, circling and abnormal posture. Post-mortem examination showed no macroscopic changes. Microscopic lesions were demonstrated in the brain and to a less extent in the spinal cord.

Work done in collaboration with Dr. E. L. French of the C.S.I.R.O. virology unit in Melbourne has isolated a virus in tissue culture. This virus produced the disease in experimental calves inoculated intracerebrally and when it was instilled into the nose. The virus was again recovered from the brains of the affected experimental calves and in one case from the intestines. The relation of this virus to others isolated in Australia and overseas has led to the conclusion that this is a hitherto undescribed virus.

Leptospirosis

A strain of *Leptospira hyos* isolated from a foetus aborted by a sow was used to experimentally infect a calf. This was followed by only a mild fever even though leptospiruria was detected until the 72nd day post-inoculation. This contrasts with the severe disease which can be produced in calves similarly inoculated with *L. pomona.* Serology done on leptospirosis is reported below.

Sheep Diseases

Muscular Dystrophy in Sheep.—Five sheep from the Goondiwindi district were kept under observation for three years. Throughout they have had a stiff proppy gait. The autopsy findings were similar to those seen in affected lambs obtained from the property over the past four years. The most severely affected muscle is the vastus intermedius, which may be completely white. Microscopic changes were seen in a large percentage of the muscles of the fore and hind limbs. These changes consisted of thickened sarcolemma, various stages of degeneration and fatty replacement. This disease does not appear to be the same as the white muscle diseases which have been described elsewhere.

Sheep Blowfly.—Experiments to determine the relative efficiency of the newer organic phosphorus insecticides in preventing body strike in sheep have been continued.

Sheep were jetted along the back with various concentrations of the test insecticides and the persistence of the insecticide measured at weekly intervals by a larval implant method. Insecticides showing promise last year were checked again this year and only one new insecticide included. Again the most promising insecticide proved to be Bayer 1751, which is now available as the active principle in the commercial formulation known as "Lujet". When applied at a concentration of 0.05 per cent. it was effective for 17 weeks and at 0.1 per cent. for 27 weeks. Other insecticides used at the same time gave the following results:—Nankor at 0.05 per cent. was effective for 24 weeks, Nankor at 0.1 per cent. for 27 weeks, and diazinon at 0.026 per cent. for 27 weeks, while Shell S.D. at 0.05 and 0.1 per cent. had started to lose efficiency when checked 5 weeks after jetting. These protective periods are abnormally long, even for trials of this type, and the results must be treated with caution. From previous work diazinon at 0.026 per cent. would be expected to be effective for 12–15 weeks.

Surveys

As mentioned in the introduction to this report, a considerable amount of the work of the laboratory has been in disease surveys in cattle and sheep and a minor survey in pigs. Each survey has required close co-operation between personnel of various branches.

Bovine Contagious Pleuropneumonia.—To extend the boundary of clean areas of B.C.P.P. in the overall plan to eradicate this infection from cattle in Queensland, the sera of all cattle slaughtered from an area in central Queensland are tested. Of 5,045 sera examined, only two had positive reactions.

Leptospirosis Titres in Beef Cattle.—A total of 1,766 bovine sera from nine cattle properties in central Queensland was tested for the presence of serum agglutinins against *L. pomona* and *L. hyos.* Of these 502 (28.4 per cent.) had titres ranging from 1 : 30 to 1 : 10,000 against *L. pomona,* with the remaining 1,264 sera negative. Also 844 (47.8 per cent.) had serological titres in the same range against *L. hyos,* with 922 negative. All properties had some reactors to both serotypes. The serological results of 127 cows were similar to those of 101 bullocks from the same property.

Infertility Diseases in Dairy Cattle.—The female animals over 18 months of age in 39 dairy herds near Brisbane are being examined serologically for brucellosis, leptospirosis and vibriosis. Vaginal mucus was cultured for *Trichomonas foetus* and a *per rectal* examination of the genitalia done. The heifers under 18 months were bled for brucellosis and leptospirosis. A total of 3,971 animals was examined. Approximately 10 per cent. of the cows had positive titres to vibriosis. These were in 29 herds. One aspect of the work is an attempt to assess the importance of this disease. Seven cows from three herds were infected with trichomoniasis.

Infertility Diseases of Sheep.—During four months serum samples were collected from the majority of British-breed stud sheep in Queensland. A total of 4,884 sera was collected from 57 flocks, comprising 306 stud rams, 238 flock rams, 3,289 stud ewes, 447 maiden stud ewes and 604 weaner rams. These samples are being tested for brucellosis, actinobacillosis, leptospirosis and toxoplasmosis antibodies and will be stored as a bank of future reference sera. At present only the tests for brucellosis are complete. Only 1.6 per cent. of total sheep tested had titres for brucellosis. These were in 13 flocks. This includes 4 per cent. reaction in stud rams, 3 per cent. in flock rams, 1.3 per cent. in stud ewes, 0.2 per cent. in maiden stud ewes and 2.4 per cent. in weaner rams. The low incidence of reactions makes an eradication programme practicable.

Toxoplasmosis.—It is intended that the serum samples collected from the stud British-breed sheep will be examined for toxoplasmosis. Preliminary work has been aimed at the development of a more satisfactory test. Sera have been available from experimentally infected sheep and negative animals. An indirect haemagglutination test which is more rapid and easier to read than the cytoplasm-modifying test used overseas is being investigated. There has been good correlation between the two tests.

Poultry Diseases

Respiratory Diseases.—Since 1960 an attempt has been made to clarify the respiratory disease syndromes in fowls. During that year an infective agent was recovered from the respiratory tract of broilers. This agent readily produced respiratory disease within two days in chickens experimentally infected by instilling exudates from the trachea of affected birds into the tracheae of experimental birds or by simply exposing them to an aerosol of the exudate for about 10 minutes. The infective agent also caused deaths of chick embryos when inoculated by the yolk sac. It behaved very much like a virus in that it readily passed through filters

designed to prevent bacteria passing through them and it could be grown only in living cells of chick embryos or fowls. It was decided therefore to seek further information on it and sera from recovered birds before and after infection were sent to Professor Bankowski, University of California. From his tests he showed that the agent was not Newcastle disease, infectious bronchitis, CELO or Myxa strain Y virus. The sera from recovered birds, however, agglutinated the antigen prepared from *Mycoplasma gallisepticum*. Meanwhile, this antigen became available in Australia and the Branch has now been able to show that the disease in question is *Mycoplasma gallisepticum* infection (commonly referred to as chronic respiratory disease). It appears to be the most common respiratory disease in Queensland and is particularly severe in broilers. Further work is being planned but already the means for attempting control by segregation into age groups is at hand.

Coccidiosis.—An attempt was made to clarify the identity of the various species of coccidia infecting the intestines of poultry. Isolation of single oocysts and the propagation of the coccidia in pure culture have shown *Eimeria acervulina, E. mitis, E. necatrix* and *E. brunetti* to be present. *E. maxima* was not isolated in this study though it is probably present in this State. There is some indication that many of previous outbreaks of intestinal coccidiosis attributed to *E. maxima* were in fact due to *E. brunetti.*

Poison Plants

Cycas media.—The following observations are reported:—

(1) Feeding fruits.—One feed of 1¼ lb. of green immature fruits was toxic to a 780 lb. steer. The steer died on the 23rd day after feeding, with a severe diffuse fibrosis of the liver.

(2) Feeding mature green leaves.—An 18-months-old heifer weighing 480 lb. was fed 672 lb. of mature leaves in 153 days without producing ill-effect.

(3) Feeding young leaves.—An 18-months-old steer weighing 500 lb. ate 43 lb. of young leaves (regrowth following fire) in 39 days. It showed weakness and staggers from the 37th to the 41st day, when it died.

Humpyback.—To determine if humpyback in sheep is merely a stress syndrome, nine full-woolled ewes varying in age from 15 to 46 months were stalled and fed on a high-protein diet for 6 weeks. They were then subjected to severe exercise each day for 7 days when atmospheric temperature was approximately 90°F. and humidity approximately 50 per cent. On the third day one sheep showed poor exercise tolerance and a mild ataxia which was due to degenerative changes in the semitendinosus muscles. There is no record of these changes in field cases of humpyback. *Solanum esuriale* and *Malvastrum spicatum* are being fed to experimental sheep.

Crotalaria mucronata.—An 80 lb. ewe drenched with a total of 6 lb. 9 oz. of a mixture of mature and immature pods over 5 days showed no ill-effect. An 80 lb. ewe died in 22 hours following drenching with 1 lb. 11 oz. of leaves. There was marked hydrothorax and oedema of the lungs.

Swainsona luteola.—Ingestion of this plant was the cause of death of several rams at Augathella. Two rams from the flock were examined and histology of the brain revealed extensive neuronal degeneration. This has not previously been described. An attempt was made to produce the condition by experimental feeding but supplies of plant were exhausted without producing symptoms.

PUBLICATIONS

During the year 10 papers were published in scientific journals and several others have been submitted for publication.

STAFF

Following on the Branch policy of interchanging the graduate staff between the Oonoonba and Yeerongpilly laboratories, a number of staff transfers were made during the year. Messrs. W. T. K. Hall and L. Laws, who had completed a 5-year term of duty at the northern laboratory, returned to Yeerongpilly and Dr. L. Tammemagi and Mr. L. A. Y. Johnston replaced them. To strengthen the staff, Mr. D. Griffith (Parasitologist) was also transferred to Oonoonba in 1961 but he subsequently resigned. Arrangements are in hand to transfer Miss M. Lucas, B.V.Sc., to Oonoonba as Bacteriologist.

Mr. M. D. McGavin, M.V.Sc. (Senior Histopathologist) left during the year to undertake two years' post-graduate study at the Michigan State University. Mr. W. Thomas, A.I.M.L.T. (Laboratory Technician, Div. I.) returned to duty after having completed two years in Sarawak on a Colombo Plan appointment.

Although the graduate staff numbers 18 and technical staff 21, there has been a considerable turnover of staff during the year, one graduate and four senior technicians resigning. Although junior technical staff are more readily available, the Branch's work demands a considerable degree of experience as well as academic training, and stability is necessary for maintaining the work of the Branch at a satisfactory level.

HUSBANDRY RESEARCH BRANCH

The main facilities for research under the direct control of the Branch are those suitable for cattle and are located at the Animal Husbandry Research Farm, Rocklea. The modification of some of the animal accommodation in the former Veterinary School buildings at Yeerongpilly and the co-operation of other Branches has permitted officers of the Branch to be associated with work on all species of major economic importance. Work involving detailed carcase studies has been made possible by the acquisition of equipment suitable for the preparation of whole carcases for sampling and chemical analysis.

Experimental work undertaken with cattle includes feedlot studies, effect on animal production of fertilizer application to paspalum pastures, supplementation of weaners, effect of urea on digestibility of sorghum silage and rations containing different silage/grain ratios, effect of tick fever on semen quality, and effect of excitation on blood constituents. Projects with sheep relate to the effect of a low plane of nutrition on carcase composition, digestion in different parts of the gastro-intestinal tract, animal behaviour, effect of supplements of molasses/urea blocks and toxicity studies with urea. Studies with pigs include a genetic analysis of the Large White breed, palatability of different sorghum varieties and comparisons of whole and kibbled sorghum in rations. An experiment with poultry to compare the utilization of dietary protein of two pure breeds and reciprocal crosses of these breeds was recently commenced. Much of the work listed above is carried out in collaboration with other Branches, viz Biochemistry, Agriculture and Pig and Poultry.

Building of the artificial insemination centre at Wacol is still in progress. The hayshed, workshop and garages have been completed and the bull pens and laboratory are well advanced. The technical staff required for the initial operation of this centre is available and has now had considerable experience. The officer in charge of this aspect of the Branch's activities obtained additional information during a short visit to southern artificial insemination centres.

The main findings of completed experiments, progress results of some of the studies in progress, and data relating to artificial insemination are detailed in the remainder of the report.

INVESTIGATIONS

Feedlot Studies

Due to the interest being shown by producers in feedlot fattening of cattle, this Branch during the past year undertook the first study in Queensland of feedlot fattening under controlled conditions.

Because of Queensland's potential for the production of sorghum grain and sorghum silage, these fodders were used as the basis of the feedlot rations. Two variables were investigated in this first study—the grain/roughage ratio (ratio of sorghum grain to sorghum silage), and the effect of the addition of urea to these rations.

Six groups each of six steers, 18 months of age, were fed to appetite until the mean weight of each group approximated 900 lb. A seventh group of six comparable steers was slaughtered as a control before fattening. The change in body composition due to lot-feeding was measured by comparing the carcases of the control and the fattened animals. The grouping of the animals and some of the results are presented in Tables 1 and 2.

TABLE 1

RESULTS OF THE FEEDLOT EXPERIMENT

FEED CONSUMPTION AND BODY-WEIGHT CHANGES

Group	Approximately Final Ration (dry-matter basis)			Group Mean Body-Weight (lb.)			Weeks in Feed Lot	Dry Matter Consumption (lb./head/day)		Feed Required per lb. Gain
	Sorghum Silage (%)	Sorghum Grain (%)	Urea/Head/ Day (g)	Initial	At Slaughter	Gain/Day		Silage	Grain	
1*	..	..	..	568	568	..	..	..	..	..
2	60	40	..	565	810	1·53	23	9·6	6·0	10·5
3	60	40	60	563	904	2·21	22	11·0	6·9	8·2
4	40	60	..	574	900	2·22	21	7·6	10·0	8·2
5	40	60	60	577	915	2·54	19	8·6	10·5	7·8
6	20	80	..	564	897	2·27	21	5·7	12·6	8·3
7	20	80	60	568	903	2·99	16	7·6	12·4	6·7

* Pre-experimental slaughter group.

TABLE 2

CARCASE DATA FROM FEEDLOT EXPERIMENT

Group	Hot Carcase Weight (lb.)	Yield from Right Half of the Carcase (lb.)			Gain in Carcase Weight as Per Cent. of Body-Weight Increase
		Meat*	Fat**	Bone	
1	260	82·7	11·0	33·6	..
2	428	151·8	21·6	41·4	68
3	477	165·6	28·2	40·4	64
4	470	165·3	27·8	43·3	64
5	490	171·6	28·3	41·7	68
6	468	161·1	28·3	42·9	62
7	485	165·6	31·3	40·1	67

* Meat expressed as yield of fat trimmed wholesale boneless cuts suitable for the local trade, for Groups 2 to 7. For Group 1 it is expressed as meat suitable for the boneless export trade.

** Fat expressed as fat trimmed in the preparation of the wholesale cuts.

The main findings of the experiment can be summarised as follows:—

(1) The mean time of the two groups on each grain/roughage ratio to reach slaughter weight decreased as the percentage of grain in the ration increased.

(2) Similarly, the mean efficiency of feed conversion increased as the proportion of grain in the ration increased.

(3) At all grain/roughage ratios, 60 grams of urea per head per day caused a marked increase in daily feed intake, rate of body-weight gain and efficiency of feed conversion.

(4) The group fed 60 per cent. silage without urea had such a slow growth rate that it was slaughtered before the mean body-weight was the 900 lb. desired.

(5) Dressing percentage was apparently independent of the ration fed.

(6) In all cases (except Group 2) there was approximately a doubling of the meat yield on the right half of the carcase as a result of feeding. The quantity of fat trimmed in the preparation of the meat cuts increased markedly with fattening, but the yield of bone increased only slightly.

(7) The gain in carcase weight due to lot-feeding accounted for between 62 and 68 per cent. of the increase in body-weight.

(8) By applying local economic considerations, e.g. cost of producing grain and silage and the price of feeder cattle, to these basic data, the economic practicability of engaging in the feedlot business could be considered.

Digestibility studies with a view to further investigating the mechanism whereby urea increases feed intake are in progress. A further experiment in feedlot fattening, using rations of higher grain percentages than those used in this experiment, is planned.

Effect of Fertilized Pasture on Animal Production

Although a marked increase in pasture production following application of nitrogenous fertilizers has been demonstrated in Queensland, the conversion of this increased pasture to animal products is an aspect requiring considerable research. An experiment designed to examine some aspects of the effect of application of nitrogenous fertilizer to predominantly paspalum pastures on the growth rate of cattle was commenced in March 1961. A comparison is being made at two grazing intensities of the productivity of untreated pastures and those fertilized with ammonium sulphate at the rate of 150 lb N per acre per annum. Studies are also being made on yield and the chemical and botanical composition of the pasture. The quality of pasture being eaten by cattle is being assessed from regressions based on faecal analyses.

The initial body-weight and body-weight changes during periods of the experiment are given in Table 3.

TABLE 3

BODY-WEIGHTS IN NITROGENOUS FERTILIZER EXPERIMENT

Group	Stocking Rate per Acre	Initial Body-Weight (lb.)	Body-Weight Change (lb.)			
			15–3–61— 10–5–61	10–5–61— 19–7–61	19–7–61— 17–8–61 **	9–11–61— 9–5–62
No nitrogen ..	1	490	+85	+12	−10	+188
No nitrogen ..	2	488	+62	−39	−56	+245
Nitrogen* ..	1	492	+88	+ 6	− 5	+202
Nitrogen* ..	2	479	+78	−32	−45	+207

*Applications of nitrogenous fertilizer, each 75 lb. N per acre, in mid-January and October, 1961

** All animals removed from paddocks on August 17 and returned on November 9, 1961.

When cattle were introduced to the pasture in March 1961, yield was high in all paddocks, the yield and protein percentage being higher in nitrogen-fertilized pastures. Despite these initial differences, in the period from March to August 1961 the body-weight status of cattle on comparably stocked pastures, whether treated or untreated with nitrogen, was similar. The animals stocked at 2 per acre commenced to lose weight in May, the rate of decline increasing during July. All animals were removed from the paddocks in mid-August, due to negligible amounts of pasture in all heavily stocked paddocks.

When the cattle were returned to the experimental paddocks in November, growth rate was rapid in all groups. Pasture yields in nitrogen-treated paddocks were much higher than in untreated paddocks. However, because the cattle on the nitrogen treated pastures were not able to keep the grass short, protein percentage was lower than in the non-treated pastures. Growth rate of cattle was highest in the non-treated heavily stocked paddock from November to early May; and animal production per acre was more than double that of the groups stocked at 1 per acre. Pasture yield in these paddocks is now very low; body-weight losses are anticipated soon.

It is evident from this year's data that to obtain maximum benefit from the application of nitrogenous fertilizer to paspalum pastures, either fodder must be conserved, or a higher stocking rate used during the early summer growing period. The latter would be difficult to achieve under most farming systems.

Blood Constituents in Beef Cattle

In nutritional experiments at Rocklea, particularly those associated with a study of survival requirements, the concentration of various blood constituents has been used to obtain more information on the physiological status of the animals. To provide a basis for comparison, blood samples were obtained on three successive days at 2-monthly intervals from a group of grazing Hereford cattle. The mean age of the animals at the commencement of sampling was 6 weeks. The 3-year study was completed recently and the results are being examined to determine the effect of age, sex and season on various blood constituents.

It became apparent during the course of this work that excitement and struggling associated with bleeding may affect some of the values. Studies were therefore commenced to examine this effect. The insertion of a long polythene cannula into the jugular vein allowed "resting" blood samples to be obtained without the animal being aware of the operator. Initial results indicate that with normal bleeding haemoglobin, haematocrit and red cell count may be markedly higher than "resting" values, whereas blood inorganic phosphate, plasma chlorine, sodium, and potassium, serum calcium, magnesium, total protein, albumen, and globulin are little affected. Preliminary determinations made on splenectomized animals indicate that the change in haemoglobin, haematocrit and red cell count is primarily a splenic effect.

Urea Blocks for Sheep

Progress results of an experiment to investigate the effect of providing molasses/urea/salt blocks to cattle being fed low-quality hay were recorded in the 1960-61 Report. Since that time, similar blocks were used extensively by graziers as a supplement to grazing cattle during the winter of 1961.

An experiment is now in progress to study some aspects of the supplementation of sheep with three experimental blocks of this type. Four groups of 20 sheep are receiving a basal ration of hay of approximately 3 per cent. crude protein. The treatments and progress results for the first 13 weeks of the experiment are given in Table 4.

TABLE 4

PROGRESS RESULTS OF EXPERIMENT ON SUPPLEMENTATION OF SHEEP WITH UREA BLOCKS

Group	Treatment	Body-Weight (lb.)		Hay Intake (air-dry basis) (lb./head/day)	Lick Intake (g/head/day)	Urea Intake (g/head/day)
		Initial	After 13 Weeks			
1	Hay *ad lib.*	65·4	57·1	1·25	..	..
2	Hay *ad lib.* + molasses-urea-salt block (35% urea)	65·4	61·0	1·51	21·8	7·6
3	Hay *ad lib.* + molasses-urea-salt block (20% urea)	66·0	66·0	1·54	27·0	5·4
4	Hay *ad lib.* + urea-salt* block (35%)	65·3	63·6	1·46	17·0	6·0

* Note—molasses is not incorporated in this block.

The results to date indicate a definite response in feed intake and body-weight in all groups provided with urea blocks. The group mean urea intakes are considered satisfactory. However, variation in individual block intake, as with cattle, could be responsible under field conditions for some deaths due to urea toxicity. To obtain some data on this aspect, the range of individual intake is being studied by incorporating chromic oxide in the blocks and collecting and analysing the total faecal output of individual sheep for a 5-day period.

Utilization of Sorghum Grain by Pigs

Palatability.—Studies on preference shown by pigs for sorghum grain of different varieties grown on different soil types and from different areas of the State have been continued. In each comparison, the different varieties obtained from one property were presented simultaneously in separate self-feeders. The positions of the feeders were rotated twice weekly in order to eliminate possible effects of feeder position, and to allow this effect to be studied. No feed other than sorghum was available to the pigs during the course of each experiment.

Although there were some minor variations among orders of preference from the different properties, the general trend in decreasing order of preference was: Texas 630, Texas 610, Texas 608, Early Kalo and Alpha. There were indications that the pigs preferred the feeder nearest the sleeping quarters.

The design of the experiment also involved the successive removal of the most preferred variety. There were indications that total feed intake declined as removal of the varieties proceeded. Texas 630 is now available in quantities sufficient for pen trials. It is planned to compare the effect of this variety and Alpha in commercial-type rations on the feed intake and performance of pigs.

Comparison of Whole and Kibbled Sorghum.—Data available from various agricultural research stations in U.S.A. have indicated that whole sorghum when fed *ad lib.* is only slightly inferior to kibbled or crushed sorghum in promoting growth of pigs. With restricted feeding, whole sorghum compared less favourably with crushed sorghum than when the grains were fed *ad lib.* The differences under the two feeding regimens have been attributed to inefficiency of mastication associated with competition under restricted feeding conditions.

Because of economic considerations involved in the cost of grinding grains, a pen trial to compare whole and kibbled sorghum fed *ad lib.* in association with a restricted amount of a protein concentrate was initiated. Two groups of seven pigs were fed from a mean body-weight of 56 lb. to approximately 140 lb. The weight gain per head per day was: whole sorghum, 1·55 lb.; kibbled sorghum, 1·66 lb. The feed conversion figures were 3·8 and 3·4 lb. of feed per lb. of gain for whole and kibbled respectively.

The digestibility of whole and kibbled grain fed both *ad lib.* and restricted to two feeds of 15 minutes per day has been compared. Results for mean digestibility of dry-matter based on eight pigs per treatment were as follows: whole *ad lib.*, 88·4 per cent.; whole restricted, 84·6 per cent.; kibbled *ad lib.*, 88·4 per cent.; kibbled restricted, 89·7 per cent. These differences are not likely to be statistically significant because of the variability between pigs.

The daily intake of pigs being fed whole grain on a restricted time basis was much lower than that of pigs fed kibbled grain on the same regimen. This, together with general observations made at feeding, indicates that under the individual system of feeding in metabolism cages, pigs still tried to masticate their grain, even though time was limited.

Genetic Analyses of Large White Pigs

A genetic analysis is being made of the Australian Large White pig breed, using data extracted from the 1911 to 1960 herd books.

The breed has a hierarchial structure, herds occupying certain strata according to their popularity. Herds use breeding stock either from their own stratum or from the one immediately above. By this means improvement disseminates downward throughout the whole of the breed. Improvement becomes largely the responsibility of a few herds occupying the top stratum. These include some of the best and longest established herds of the breed.

A study of changes in the pedigree population with time indicates a steady increase to the start of the Second World War. During the war the number of registrations declined but since then has increased. Since the number of pedigree Large White herds has remained fairly constant since the war, the expansion was due to an increase in the number of pigs registered per herd.

Litter size has remained constant at 10.8 pigs since first recorded in 1926. This, together with the fact that boars and sows are registered from the same size litters, suggests there has been little effective selection for increased litter size in the breed. About one-third of the herds registering each year are making either their first or their last entry. This instability of the breed is important, since short-lived herds cannot contribute significantly to the improvement of the breed.

Sheep Behaviour

A study was made of the individual behaviour of sheep on three feed regimens. Three groups of sheep were fed a mixture containing equal parts of lucerne and crushed sorghum grain. One group was fed *ad lib.*, one fed restricted to bi-weekly feeds and one the same restricted amount in daily feeds. It was found that a social ranking was established among sheep within each group. Animals of high social rank were able to feed longer than those of low rank, although there was no effect on growth. Individual feeding behaviour measurements indicated that sheep which ate fastest and selected the most sorghum from the mixture had better growth performances.

ARTIFICIAL INSEMINATION

General.—The bull proving projects continued with only minor modifications to previous years. The period of insemination for Jerseys at Nambour was from Sept. 18, 1961, to Jan. 19, 1962, and for A.I.S. at Kingaroy from Sept. 18, 1961, to Feb. 9, 1962. Semen was also supplied to the Samford Training Unit and the Beaudesert disease control area throughout the year.

Numbers of cows inseminated with semen from Rocklea in the Nambour, Kingaroy and Samford areas are given in Table 5.

TABLE 5

INSEMINATION DATA FOR YEAR ENDING FEBRUARY 28, 1962

Location	Volume of Semen Dispatched (ml.)		First Insemina-tions	Total Insemina-tions	First Insemina-tions 60–90 Days Non-return Rate (%)
	Chilled	Frozen			
Nambour	4,325	..	1,382	1,923	64·7
Kingaroy	4,955	..	1,061	1,596	54·8
Samford	6,800	144	1,545	2,475	70·5

Chilled semen was used exclusively at Nambour and Kingaroy, but the Samford figures include 131 first inseminations using deep-frozen semen. The 60–90-day non-return rate with deep-frozen semen was 68.9 per cent.

The conception rates in these three areas are considered satisfactory. This year for the first time bulls used in the bull proving projects were two years of age compared with previous use at approximately 18 months. The improvement in conception rates at Kingaroy compared with previous years is further evidence that A.I.S. bulls do not reach maximum

fertility until after 18 months. Part of the improvement, however, must be attributed to the use of 1st day semen on one day per week, made possible by modifying the despatch routine.

Daughters sired by Jersey bulls used in 1957-58 have now completed their first lactations. The production data, obtained by the Herd Recording Section of the Division of Dairying, were analysed by Cattle Husbandry Branch. On the basis of the results obtained, two bulls have been retained.

One of the bulls retained from the 1955-56 proving year died from traumatic peritonitis during the year. A supply of his semen is available from deep-frozen storage. Arrangements were made during the year to use these "proven" bulls on selected cows to obtain sons for future proving.

In addition to the usual selection of Jersey and A.I.S. bulls for bull proving, five Friesian, two Guernsey and two Hereford bulls calves were purchased in anticipation of demand when the Wacol Centre becomes operative.

Experimental.—Studies to date do not indicate any major adverse effects of tick fever on semen quality. These results were based on small numbers of bulls and on weekly semen collections. A further study using more frequent sampling is necessary before any accurate conclusions can be made.

A study of the storage life of spermatozoa in new diluents was instigated with a view to increasing the useful life of chilled semen. Laboratory assessment of motility showed that semen extended in two types of 20 per cent. egg yolk/glycine diluents stored significantly better than semen extended in 50 per cent. egg yolk/citrate or 10 per cent. glycerol in milk. Limited use of these diluents with semen used for insemination has given encouraging results and it is proposed to commence a controlled field trial in the near future.

A rapid method for deep-freezing semen was compared with the conventional method. Results showed that the rapid method results in inferior quality semen. From the data obtained in this experiment it also became apparent that the major decline in percentage motile spermatozoa in deep-frozen semen occurs during the first 3–4 weeks of storage in solid carbon dioxide.

BIOCHEMICAL BRANCH

Each year increasing demands are made on this Branch. This has been met partly by the shift towards automation with newly installed equipment and partly by the appointment of some additional staff. The present serious limitation is laboratory space. This will have to be provided if the Branch is to continue its dual role of service and research.

This dual role is now firmly established. Firstly, it collaborates with other Branches to provide a diagnostic service. Secondly, it associates with all research projects which require biochemical data.

The diagnostic service has an extensive coverage. It embraces biochemical aids in the recognition of dietary deficiencies or excesses which affect adversely the productivity of livestock. It includes the identification of biochemical changes which may be related to known disease entities in animals. It covers the chemical evaluation of the nutritive value of the wide range of fodders used by livestock in Queensland. It ensures economic and effective use of acaracides in dipping vats by providing a chemical analytical service to vat owners.

The research function is equally extensive. This is understandable, as in many cases investigations are undertaken as a direct result of information gained from the diagnostic service. In all cases investigations are made only when the problems are considered to be of economic importance to the livestock industry in this State. Virtually all research with which this Branch is now associated is of a collaborative nature and may involve a number of Branches within the Division of Animal Industry. In some cases the research team may also include staff from the Division of Plant Industry.

TOXICOLOGY SECTION

Diagnostic Service

Specimens were received from 386 cases where poisoning of livestock was suspected. Analyses confirmed arsenical poisoning in 61 cases and lead poisoning in 15. The major cause of arsenical poisoning is related to the use of arsenic as an acaracide, and includes access of stock to discarded "empty" containers, unlabelled powders, or pasture growing in areas adjacent to dips. Lead poisoning was due almost invariably to the use of paint containing lead on either outbuildings or farm machinery, the latter being a source not usually suspected. A number of fodder crops and herbage plants were examined in connection with stock losses. The presence of lethal levels of prussic acid, oxalate or nitrate was confirmed in relation to 10 separate mortalities.

Salt poisoning was suspected on several occasions but could not be confirmed by the analysis of organs. A constant feature in the analysis of a number of earth samples, taken from areas where earth licking by cattle was prevalent, was the presence of appreciable levels of soluble chloride. This does not infer that the depraved appetite was due to salt deficiency, but suggests that the attractiveness of the area selected for licking may be related to its salt content.

There was a further increase in the submission of samples from dipping vats. Of the 1,131 samples analysed, 90 were arsenical preparations, 623 were based on organic phosphorus compounds and the remainder were chlorinated hydrocarbons. The marked increase in the use of tickicides based on an increasing number of organic phosphorus compounds has meant further study to develop analytical procedures. The purchase of a recording spectrophotometer, covering both the ultraviolet and visible spectral regions, has facilitated this work.

Investigations

Pesticide Residues.—The finding of unacceptable pesticide residues in meat in New Zealand has led to an examination of the residue problem resulting from the use of acaracides to control both cattle tick and buffalo fly in Queensland. The problem was studied in three stages.

The first and most urgent was to determine the magnitude of the pesticide residue in fat of cattle which had been exposed to normal dipping or spraying procedures with chlorinated hydrocarbons, used either in the control of cattle ticks or the management of cattle prior to slaughter. It was found that any exposure of cattle to dipping vats containing DDT resulted in DDT residues in fat which exceeded the 7 p.p.m. tolerance permitted in the U.S.A. Subsequently, legislation was introduced to prohibit the use in Queensland for cattle of acaracides based on chlorinated hydrocarbons.

The second and almost equally urgent step was to examine the magnitude of the residues in fat resulting from the use of acaracides based on the organic phosphorus compounds. It was found that for proprietaries based either on Delnav or Bayer 21/199, normal dipping or spraying procedures used either in the control of cattle ticks or the management of cattle prior to slaughter did not result in residues in fat which exceed the 1 p.p.m. tolerance permitted in the U.S.A.

The third stage was related to the examination of residues resulting from treatment procedures, other than dipping, which could be used in the control of buffalo fly in Queensland. Field observations have indicated that normal dipping practices for the control of cattle tick using proprietaries based on organic phosphorus compounds are not effective in the control of buffalo fly. This is in direct contrast to the very adequate buffalo fly control obtained when DDT was used in the dipping vat. On the other hand, current field studies have shown promising results by control measures based on the use of small quantities of DDT applied to the back of the neck and withers. Residues within the 7 p.p.m. tolerance have resulted from repeated treatments at monthly intervals with 0·25 pints of 0·3 per cent. p,p'DDT. Residues exceed this tolerance when treatments involve 1 pint of 1 per cent. p,p'DDT. Current investigations using repetitive fat biopsies are designed to evaluate the residues resulting from 0·5 pint of 0·5 per cent. p,p'DDT applied at 3 weekly intervals.

Selenosis.—As detailed in the report for 1960/61, the three known selenosis problem areas in this State are defined as a portion of the Cape York Peninsula, a small acutely toxic area near Richmond and a vast area associated with the Tambo formation in central Queensland. Current studies have been concerned with the chronic effects of selenosis in sheep and are related to field observations on large-scale intermittent outbreaks of fleece shedding in some areas now known to be potentially seleniferous. Essential findings at this stage are:

(1) A ration containing 50 p.p.m. Se as sodium selenate is hepatoxic and relatively unpalatable.

(2) Rations containing 20 p.p.m. Se and 10 p.p.m. Se as sodium selenate are palatable and daily intakes of 1 Kg of these rations were tolerated for 4 months.

(3) Rations containing either 50 p.p.m. Se as sodium selenate at restricted intake or 20 p.p.m. Se as sodium selenate at 1 Kg daily intake for 4 months result in tender wool and this tenderness is due to follicle disfunction and not lowered tensile strength of the fibre.

(4) Daily drenching with 20 mg Se as sodium selenate resulted in anorexia by the 12th day and death after drenching ceased on the 17th day. Gross liver damage was evident.

(5) Daily ingestion of 40 mg. Se as naturally occurring plant material resulted in anorexia after the 2nd day. Dosing was continued by means of rumen fistula for a further 8 days. Histological examination of a liver sample obtained by biopsy showed marked damage but no wool follicle abnormality was evident.

(6) Daily ingestion of 20 mg Se as naturally occurring plant material produced no apparent effect by the 28th day, but histological examination of a liver biopsy sample showed swelling of the hepatic cells. The follicles remained normal.

Poison Plants.—The toxic principle in the leaf, pod and seed of *Acacia georginae* has been isolated and identified as fluoroacetic acid. These findings have been accepted for publication in the *Queensland Journal of Agricultural Science.* A quantitative analytical procedure has been developed. This involves extraction with ethanol, partition into sulphuric ether, purification by silicic acid column chromatography and quantitative estimation by gas chromatography. A major problem in the isolation of this toxic principle is related to the low concentration of fluoroacetic acid even in seed. The bulk material used in this investigation contained the equivalent of 25 mg sodium fluoroacetate per Kg compared with the equivalent of 789 mg. sodium fluoroacetate per Kg reported in *Dichapetalum cymosum* from South Africa. More recent analyses on immature seed of *A. georginae* from a known toxic area have shown the equivalent of 400 mg. sodium fluoroacetate per Kg. This high level is in keeping with field experience of rapid death in livestock on some occasions after very limited exposure to a toxic area.

Other poison plants under study include *Gastrolobium grandiflorum, Cestrum parqui and Myoporum desertii.*

NUTRITIONAL BIOCHEMISTRY SECTION

Diagnostic Service

Partial or complete stock food analyses were made on 1,330 samples submitted during the year. These included pasture and crop silages, individual pasture and crop species, rations and ingredients of rations used in feeding experiments with pigs and poultry, and a wide variety of samples related to field trials by other Branches.

Chemical tests to evaluate silage quality are made routinely on all silage samples submitted. On the basis of these tests, together with information gained from research experience in this field, advice is given on procedures which should be adopted in the future to improve the quality of silage.

Another service which this section has expanded is the application of chemical analysis as a quantitative measure of carcase composition. At present such analyses are being used largely as a research tool to measure the effect of different planes of nutrition on carcase composition. In the majority of cases this is determined by the analysis of selected rib cuts and the use of published regressions to relate these data to the whole carcase. In some specialised cases, whole or half carcases have been processed and body composition determined from analysis of representative samples. A total of 715 samples was processed during the year. In the absence of freeze-drying equipment, which has been ordered but not yet received, it has been necessary to report average values for a number of replicate analyses on small samples. At the same time, a considerable amount of work has been devoted to the development of improved sampling and analytical procedures.

Increased interest in the measurement of the digestible energy of fodders has necessitated the use of bomb calorimetry. This has been facilitated by the conversion of the Branch's unit to a semi-automatic adiabatic type.

Investigations

Conserved Fodder.—Initial studies using experimental tower silos of 0.75 ton capacity have shown that additives such as molasses and sodium metabisulphite have improved the quality, digestibility and palatability of silage made from predominantly *Paspalum dilatatum* pastures. These findings from investigations covering two years have been submitted for publication in the *Queensland Journal of Agricultural Science.*

Further studies to evaluate the use of additives for silage prepared from essentially paspalum pastures, harvested by either flail type or cutter-bar type of commercial harvesters, have now been completed. The addition of molasses and the use of the type of harvester to give the maximum fineness of chopping result in the best quality product. These findings may be related to the low sugar content of *paspalum dilatatum* in this environment. The data are being assembled for publication.

Current studies are based on previous findings and are directed towards the application of these findings to the ensiling of lucerne. Both harvesting procedures and the use of additives are being evaluated.

Food-Faecal Relationships in Grazing Cattle and Sheep.—Investigations have been expanded to determine the nutritional status of the diet selected by grazing livestock in a number of localities in Queensland. The basis of this work has been the development of regressions relating to protein, phosphorus and calcium levels in food and faeces and the application of these regressions to the analytical levels of these constituents determined in the faeces from a representative number of grazing animals. The areas under investigation are at the Animal Husbandry Research Farm at Rocklea in the Brisbane district, "Brian Pastures" in the Gayndah district and Toorak Field Station near Julia Creek.

The basic experiment at Rocklea has been to evaluate animal productivity in terms of body weight changes in Hereford heifers following the use of nitrogenous fertilizer, as ammonium sulphate, in two applications per annum, each at the rate of 75 lb. nitrogen per acre. Comparative treatments include a moderate and a heavy stocking rate. The experiment commenced in March 1961. Insufficient pasture, particularly in paddocks which did not receive nitrogen and which were heavily stocked, necessitated the withdrawal of all cattle from Aug. 17 to Nov. 9. Fertilizer treatments were applied on Jan. 17 and Oct 23, 1961. Essential findings from this experiment are:—

(1) There was a marked increase in pasture yield following each nitrogen application and initially an increase in the protein content of the total pasture available.

(2) From the application of regressions to the analytical values obtained on faecal samples collected at 14-day intervals conclusions are:

(*a*) In all treatments cattle were selecting a diet which had a protein content up to 5 per cent. greater on a dry-matter basis than that of the total available pasture.

(*b*) From March to August the protein content of the selected diet tended to be higher in animals from the fertilized paddocks. From December the protein level was higher in the diet selected in the untreated paddocks. The latter finding is related to the greater bulk of mature pasture in treated paddocks during this season.

(*c*) At no stage was the protein, phosphorus or calcium content sufficiently low in the selected diet to be a major factor limiting productivity.

(*d*) Differences in animal productivity between treatments were due to the quantity rather than quality of the selected pasture.

(3) From the liveweight data on experimental cattle conclusions are:

(*a*) There is little if any response to nitrogen fertilization as measured by animal productivity at the moderate stocking rate.

(*b*) At the high stocking rate there was an initial response; there is also an indication that the greater bulk of pasture following nitrogen treatment delayed the onset and lessened the magnitude of body-weight losses in winter; however, there was a period in late summer when the greatest animal productivity was from the short pasture in the non-treated paddocks.

(*c*) The greatest animal productivity per acre resulted from the high stocking rate.

(*d*) To obtain the maximum benefit from nitrogen fertilization either stocking rate must be varied with season or pasture conservation must be practised.

The native pasture management trial at "Brian Pastures" has been in progress for several years and was designed to compare management systems involving set stocking, rotational grazing, pasture renovation and supplementary grazing on lucerne. The current investigation has been to determine whether differences between treatments, in terms of body-weight changes in experimental Hereford heifers, are due to differences in the quality or quantity of the diets selected. Essential findings are:

(1) A satisfactory regression relating food and faecal composition has been developed for grazing cattle in this environment.

(2) The application of this regression to the analytical data on faecal samples shows that in the year under review the protein level in the native pasture diet selected by cattle was below their maintenance requirements for approximately six months from April to October.

(3) At no stage was the phosphorus level in the selected diet a major factor limiting production.

(4) There is a marked relationship between rainfall, protein content of selected pasture and body-weight change.

(5) Differences in animal performance between treatments are due primarily to differences in the quality of selected pasture. It might be expected that the very low protein content of selected native pasture in winter would also limit pasture intake under all management systems.

(6) Even the treatment of supplementary feeding with lucerne did not ensure maintenance protein requirements in the winter of 1961.

The study at Toorak Field Station has a threefold objective—to provide information on the nutritive value to sheep of the major pasture and herbage species in this environment; to define nutritional factors which may exert a seasonal influence on wool production; and to examine the relationship between plane of nutrition and fertility of sheep. Data are being collected on chemical composition of faeces and of selected pasture species, changes in botanical composition of pasture and body-weight, wool yield and oestrus pattern of experimental sheep. The study commenced in January 1962 and will continue for several seasons. The analytical findings to March indicate a selected diet high in protein, phosphorus and calcium.

CLINICAL BIOCHEMISTRY SECTION

Diagnostic Service

Blood inorganic phosphate analyses were made on 578 samples representing 116 individual properties. On 22 of these properties a diagnosis of phosphate deficiency was confirmed while on a further 7 the phosphate status was marginal.

Liver copper analyses were done on 52 samples representing 32 different properties. A diagnosis of copper deficiency was confirmed on 7 properties and 3 showed a marginal status. Blood copper levels were determined on 519 samples representing a further 99 properties. A diagnosis of copper deficiency was confirmed on 5 of these properties.

Liver vitamin A analyses confirmed the field and pathological diagnosis of vitamin A deficiency in fowls from 4 properties and in pigs from 7 properties. A marginal vitamin A status was indicated on a further 2 pig farms.

Suspected metabolic disorders involved the analyses of 179 sera for calcium and 109 for magnesium. Hypocalcaemia was confirmed on 5 occasions, twice in association with hypomagnesaemia and twice in association with hypermagnesaemia. There were two instances of hypomagnesaemia when the calcium levels in blood were normal.

Of the 5,000 miscellaneous samples analysed, some 600 were concerned directly with the diagnostic service and the remainder with investigations by Pathology and Husbandry Research Branches. Analyses included blood haemoglobin, haematocrit, glucose, copper, molybdenum and inorganic phosphate; plasma chloride, sodium, potassium, ammonia, urea and carbon dioxide; serum calcium, magnesium, total protein, albumin, globulin, uric acid and bilirubin; liver copper and vitamin A; blood volume plasma volume and extra-cellular fluid volume; rumen fluid and duodenal chyme, total volatile fatty acids, molar percentage of individual fatty acids, lactic acid, ammonia, pH, volume, nitrogen, ash and dry-matter; semen fructose; urine samples for a variety of tests; and bones for ash, fluorine and mineral content.

Investigations

Trace Elements.—The Branch has been associated with field trials to evaluate copper and cobalt therapy in beef cattle grazing on marine plains in the Rockhampton and Townsville districts.

Essential findings from the Townsville experiment are:

(1) There is a growth response in weaners to copper but not to cobalt therapy.

(2) Copper deficiency in cattle in this locality is not due either to a low copper status in the pasture or to an excess of molybdenum.

(3) To maintain copper reserves in liver, copper therapy by subcutaneous injection of copper glycinate should be given at intervals of not greater than 3 months.

(4) There is an indication of improved fertility in heifers which received copper therapy during the 12 months prior to mating. All data on this aspect have not yet been evaluated.

(5) Data on the growth rate of calves are as yet incomplete.

The findings for the Rockhampton experiment are similar, but less marked. This could be due to adverse seasonal effects. An additional finding in this area has been a seasonal reponse to cobalt plus copper. Further experimentation is in progress to evaluate copper and cobalt therapy for both calves and weaners in this locality in another season.

Studies on Ruminant Digestion.—The Branch is collaborating with the Husbandry Research Branch in a number of basic studies. These have been designed with the objective of explaining the results obtained from certain management practices, including feeding for optimum production and feeding for survival. Factors which are being investigated are: (1) the utilization of all grain rations by different classes of cattle; (2) the maximum quantity of grain that can be fed for optimum performance; (3) the value of urea as a supplement both to survival and production rations; and (4) dietary factors to minimise urea toxicity.

Biochemical techniques used in these studies include the measurement of volatile fatty acid composition in rumen liquor; the determination of blood and rumen ammonia; the determination of blood glucose and liver glycogen; quantitative measurements on changes in the volume and composition of blood and body fluids; the measurement of both digestibility and metabolizable energy and the recording of changes in carcase composition.

Normal Biological Values for Beef Cattle.—This is a 3-year study, the objective of which is to establish normal values for a number of blood constituents and to examine changes in these values with seasonal conditions and with age in cattle. The data are being assembled for statistical treatment. Current studies are designed to measure the influence of various degrees of excitation. Blood haemoglobin, packed cell volume and red cell count are markedly increased by the degree of excitation. Other constituents are affected to a lesser extent. These changes do not occur in splenectomized animals.

SHEEP AND WOOL BRANCH

EXTENSION

Staff.—Difficulty has been experienced for years in recruiting and retaining suitable staff, both in experimental and extension capacities. The already understaffed situation in the Branch was further accentuated in 1961-62 by the decease of the Husbandry Officer at Toorak and the resignation of the Husbandry Officer from Longreach. These losses reduced the graduate strength of the Branch to two officers. Toorak, Longreach, and the previously staffed centres of Barcaldine and Hughenden are at present without sheep extension officers.

It has for some time been felt that the higher the standard of efficiency existing in an extension service, the greater the industry acceptance, with increasing co-operation between producer and extension. Since extension is basically an exposition and translation of what from the lay view is frequently regarded as findings of scientific research that are somewhat obscure into the more useful form of practical application, a strong nucleus of graduate officers throughout the Branch is highly desirable to leaven and strengthen the advisory service. In the light of this aim, planning envisages the inclusion of scholarship holders at present attending universities to provide two graduates in early 1963, and one each in 1964 and 1965. Diploma holders from Agricultural Colleges being recruited as field assistants for the Toorak Field Station should in later years provide a small but steady stream of field advisory officers.

A handicap to staff recruiting and retention in the past has been the shortage of suitable housing for officers. The policy in recent years of providing houses of adequate standard is now aiding the situation considerably.

Extension Work.—Mules operation continues to afford a valuable basic method of limiting blowfly populations and reducing incidence of strike. The year has been comparatively free from serious blowfly trouble. No development of resistance by blowfly to the organo-phosphate insecticide, diazinon, has been observed, nor has resistance by internal parasites to currently used anthelmintics been reported.

An increase in the incidence of mycotic dermatitis was reported from the Maranoa and marginal Darling Downs districts in May and June. A fairly high incidence of internal parasitism has existed during that part of the year when climatic conditions were more than usually favourable to survival and development of sheep worms in the free stage. A promising new anthelmintic is passing through the field test phase, having given good research findings. Results are of a nature to hold out promise of offering greater control

of sheep worms in general than has previously been experienced. The high cost would tend to limit its use, but its efficiency may prove adequate to warrant its use as a strategic drench as well as in combating outbreaks.

A dissection of field officers' activities for the year is as follows:—

Subject	Advice and Demonstrations	Percentage of all Activities
Sheep breeding and flock management ..	1,825	38·8
Sheep nutrition	684	14·5
Marketing	256	5·5
Parasite control	1,765	37·6
Land utilization	167	3·6
	4,697	100·0

Eighteen Field Days were conducted during the year. Extension media of radio broadcasts on national and regional coverages, Journal and news articles, film showings, tours, meetings, and show exhibits were used to good effect.

Advisory officers from Charleville and Warwick attended the Refresher School for extension officers of all States conducted in February by the Wool Research Committee, at Prospect, Trangie, and the University of New England.

INVESTIGATIONS

Fertility.—Working in collaboration with a private practitioner, the incidence of oestrus in ewes in the Longreach district was studied at different periods during 1961-62.

In a group of over 5,000 ewes, 81 per cent. were marked by 1 per cent. of teasers during a 21-day period between January 19 and February 8, 1962.

During a 21-day period in July 1961, only 331 ewes of a group of 670 ewes which had failed to conceive during joining in January-February 1962 showed oestrus. Forty-eight of these ewes were hand-served, using two rams, and 283 were artificially inseminated during the 3-week period. The predicted conception rates from 21-day non-returns to service after hand-mating or A.I. and ewes judged wet on inspection on January 2nd, 1962, 160 days after the completion of joining are shown in Table 1. Teaser rams were used. This reveals a good correlation.

TABLE 1

DATA FROM FERTILITY STUDIES, LONGREACH DISTRICT

—	Hand Service	Artificial Insemination	Total Hand Service and Artificial Insemination
Ewes mated	48	283	331
Ewes mustered on 2–1–62	44	260	310
No ewes wet 2–1–62	28	162	194
Wet ewes as percentage of ewes mustered 2–1–62	63·6	62·3	62·6
Predicted conception rate from 21-day non-return to service after mating	64·4	68·0	67·7

The ewes lambed at the end of a prolonged dry spell and lamb losses were high. Only 79 lambs survived. This represents 25·5 per cent. of ewes mustered (310) or 40·7 per cent. of wet ewes (194). That is, 59·3 per cent. of the ewes that lambed had lost their lambs.

These findings indicate the risks run in lambing in early summer in the district concerned and emphasise the need to make special arrangements for the feeding of the lambing ewes if those risks are to be offset.

Field Urea Supplementation.—Results in a Longreach district field trial conducted by the Sheep Husbandry Officer with 200 wethers having access to urea blocks (35 per cent. urea) and a control group of 200 without access indicated that while paddock feed was reasonably nutritious body weights were maintained in treated sheep while regression occurred in untreated.

During the early part of the trial the daily intake of a 35 per cent. urea block material was 0·34 oz. per head per day to six weeks after the beginning of the trial. As the trial progressed into the dry spring, when the natural feed available was deteriorating, the intake of urea block suddenly increased to 1·1 oz. per head per day. At this time body-weights fell rapidly in both groups but more rapidly in the supplemented than in the control group. This suggested that the supplemented sheep spent a longer period at the blocks, thus reducing their grazing time.

Two sheep were considered to have died from the toxic effects of the blocks during the first week of the trial, but no further lossess occurred during the trial.

Wool weights in treated and untreated sheep are to be obtained at shearing.

Cobalt Deficiency.—Unthrift in young sheep being common in western Merino sheep flocks induced owners' requests for investigation into the possibility of cobalt deficiency being a contributory factor. A trial was run in the central-western sheep area.

On November 15, 1961, 200 2-tooth wethers were random drafted into two groups, ear-tagged for identification, and drenched with phenothiazine for pre-trial worm control. One group was given proprietary cobalt pellets per os. The other group remained untreated. Body-weights were recorded. Further weighings were made December 21, 1961, and March 11, 1962. Weight differences were examined statistically. Results showed no significant variation between treated and untreated. Rainfall during the trial was 18·06 in. and summer growth of pasture was heavy. Pink-eye and flystrike occurred in sheep in each group during the trial.

Table 2 shows the statistical results:—

TABLE 2

RESULTS OF COBALT FEEDING TRIAL

—	Cobalt Treated		Controls	
	No.	Weight (or gain) (lb.)	No.	Weight (or gain) (lb.)
Initial weight (15–11–61)	100	67·7	100	64·8
Gain (15–11–61 to 23–12–61) ..	100	10·1±0·5	99	10·9±0·5
Gain (23–12–61 to 11–3–62) ..	95	5·7±0·5	92	5·4±0·6
Gain whole period	95	15·8±0·6	92	16·4±0·6
Excluding pink eye affected sheep				
Gain (15–11–61 to 23–12–61) ..	88	10·4±0·5	96	11·1±0·5
Gain (23–12–61 to 11–3–62) ..	87	5·4±0·6	89	5·2±0·6
Gain whole period	87	15·6±0·7	89	16·4±0·7
No significant difference between groups.				

Sheep and Wool Officers in Warwick and Dalby districts also co-operated with the C.S.I.R.O. observers regarding cobalt status of sheep in those areas.

Anthelmintic Thiabendazole.—Thiabendazole (MK360), a new anthelmintic, has shown outstanding activity against sheep internal parasites. It has a wide margin of safety and is non-wool-staining. The estimated cost is higher than that of other anthelmintics.

A field trial to test its usefulness conducted by the Sheep and Wool officer at Warwick commenced in late March at a Warwick district property. Groups of approximately 70 weaners, ear-tagged for identification, were variously treated with anthelmintics and run together. Treatments were 2 groups phenothiazine, 2 groups Thiabendazole, and a control group, which because of management requirements was at the commencement treated with Eludon. Observations to be taken were:—

(1) Body-weight monthly;

(2) Faecal samples from 5 random sheep each group, to be taken monthly before drench;

(3) Fleece weights—(a) First shearing; (b) Second shearing;

(4) Observations re general health, scouring, fly.

First drenchings, body-weights and faecal samples from 5 sheep in each group were taken on March 26. Second drenching, body-weights and faecal samples from 5 sheep in each group were taken on April 12. At this drenching control sheep were treated with phenothiazine as a management measure.

Counts of faecal samples taken on April 12 when compared with those taken at commencement indicated significant reduction of eggs per gram in groups treated with Thiabendazole. All sheep in Thiabendazole-treated groups showed reduction of eggs per gram to 200 or less, while much higher counts were found in the other groups. In an 8-week period following drenching, groups drenched with Eludon or phenothiazine showed mean body-weight gains of 4-5·5 lb., whereas Thiabendazole-treated groups showed mean body-weight gains of 7-8 lb. The trial is proceeding.

TOORAK FIELD STATION

The inception of the Toorak Field Station Technical Committee with its industry representatives appointed by the United Graziers' Association has in the past year strengthened the approach towards further development and work on this Station. Liaison has been close and cordial. However, staff difficulties have reduced the Station's activities.

Seasonal.—Dry feed conditions approaching drought existed at the end of the September quarter, but 1·22 in. of rain fell in November and 2·68 in. in December and except for one large paddock all paddocks had some green feed at the end of December, Good rains fell in January and February and just under 8 in. of rain fell in March 1962, putting all pastures in good order, with seeding grass and good herbage. The earth tank, which had received 4 ft. of water in January, was well-filled by the March rains. A total of 300 acres of the cultivation area was planted in March, 200 acres with sorghum,

and 50 acres each with cowpea and sudan grass. During the April to June quarter light rains did some damage to standing pastures. Fireploughing was carried out in the heavy body of dry pasture. The pastoral outlook by the end of May was not very good.

Performance of Nucleus Ewes.—The following are the season's results of a long-term trial with approximately 550 ewes, aimed at securing information on wool production; hand serving and lambing performance; and wrinkle scored group *v* plain and random. Joining took place in April-May 1961 and the performance of ewes (excluding maidens) was as follows:

—	Plain	Random	Wrinkled	Total
Ewes present at joining ..	146	127	157	430
Ewes showing oestrus at joining	113 (77%)	89 (70%)	113 (72%)	315 (73%)
Ewes lambed—number ..	69	49	52	192
Ewes lambed as a percentage of ewes present at joining ..	47	39	33	45

Subsequent lambing performance was: lambs born, 204; lambs survived to marking, 123, representing 60 per cent. of lambs and 29 per cent. of ewes present at joining; single birth, 63, 46, 49, total 180 (including 22 unknown ewes—lambs found but dams not identified, records lost and misread tags); sets of twins, 6, 3, 3, total 12; lambmarking percentage (based on ewes present at joining), 31, 27, 23, total 29 (including 8 lambs of the 22 born to unknown ewes). Lambmarking percentage for 107 maidens was 2 (7 plain and 1 random showed oestrus during joining).

Ram performance is shown as follows by number of ewes lambed to service to number of ewes served.

—	Plain Ewes	Wrinkled Ewes	Total
Plain rams (5) ..	73 out of 120 =61%	9 out of 24 =38%	82 out of 144 =57%
Wrinkly rams (6) ..	18 out of 24 =75%	62 out of 153 =41%	80 out of 177 =45%

Results from one of the plain-bodied rams have been excluded as this ram proved to be almost completely infertile. One ewe lambed to service from this ram, and 7 ewes lambed to unobserved services.

Winter Joining Trial.—A group of ewes has been joined in July-August for the second successive year to observe the lambing percentage from ewes joined in the coldest months. The results for the two years are as follows:—

—	July/August 1960 joined	July/August 1961 joined
Ewes present	98	97
Showing oestrus during 6 weeks joining ..	84	93
Showing oestrus in first fortnight	58	84
Ewes lambed to service—		
In first fortnight	42	53
In second fortnight	22	6
In third fortnight	2	2
Total ewes lambed	66	61
Lambs survived	46*	17†

* To first fortnight after completion of lambing.

† To first week after completion of lambing. The main loss in this group was attributed to predators.

Oestrus Trial.—An experiment to observe the percentage oestrus in 200 ewes running continuously with vasectomised rams (teasers) and in 3 groups, each 100 ewes, spending 2 months with teasers and 4 months away, was commenced on July 18, 1961.

Figure 1 shows the percentage of ewes running continuously with Siro-sine harnessed teasers marked by them during the six weeks prior to the dates shown to the left of the horizontal lines in the figure. The percentage oestrus subsequent to the period marked x and xx is probably higher than that shown, due to conceptions following the accidental access by entire rams to the flock during December and again in March-April. Correction for these variations will be made when identification of ewes lambing to service from the entire rams referred to is obtained.

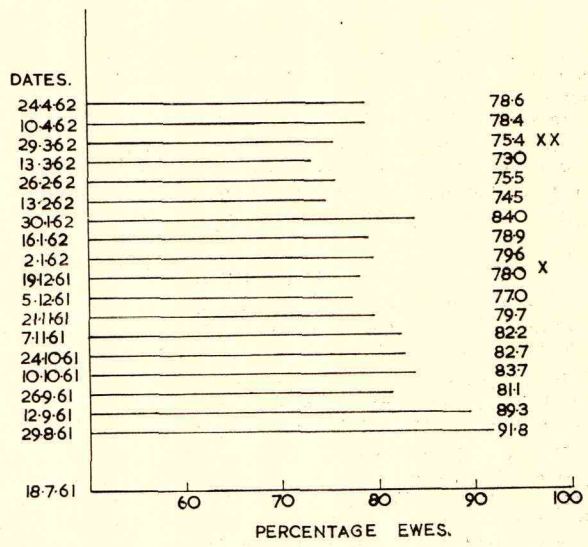

Fig. 1.—Percentage ewes showing oestrus during the 6 weeks ending at the dates shown. X—2 entire rams gained access to ewes between 19-12-61 and 2-1-62. XX—1 entire ram gained access to ewes between 29-3-62 and 24-4-62.

The lowest percentage of ewes showing oestrus during the spring and early summer during a 6-weeks' period is 77, which occurred during the 6-weeks' period ending on December 5, 1961.

Figure 2 deals with groups of ewes which, following a period of at least four months away from rams, were introduced to the teasers for a period of eight continuous weeks. The percentage of ewes showing oestrus one or more times, recorded at fortnightly intervals after being introduced to the teasers, is shown progressively for a period of 8 weeks. For example, group II ewes were first run with teasers on 18-7-61 and 70·3 per cent. of the ewes were marked by the teasers when examined on 1-8-61. A fortnight later (15-8-61) an additional 8·8 per cent. had been marked for the first time,

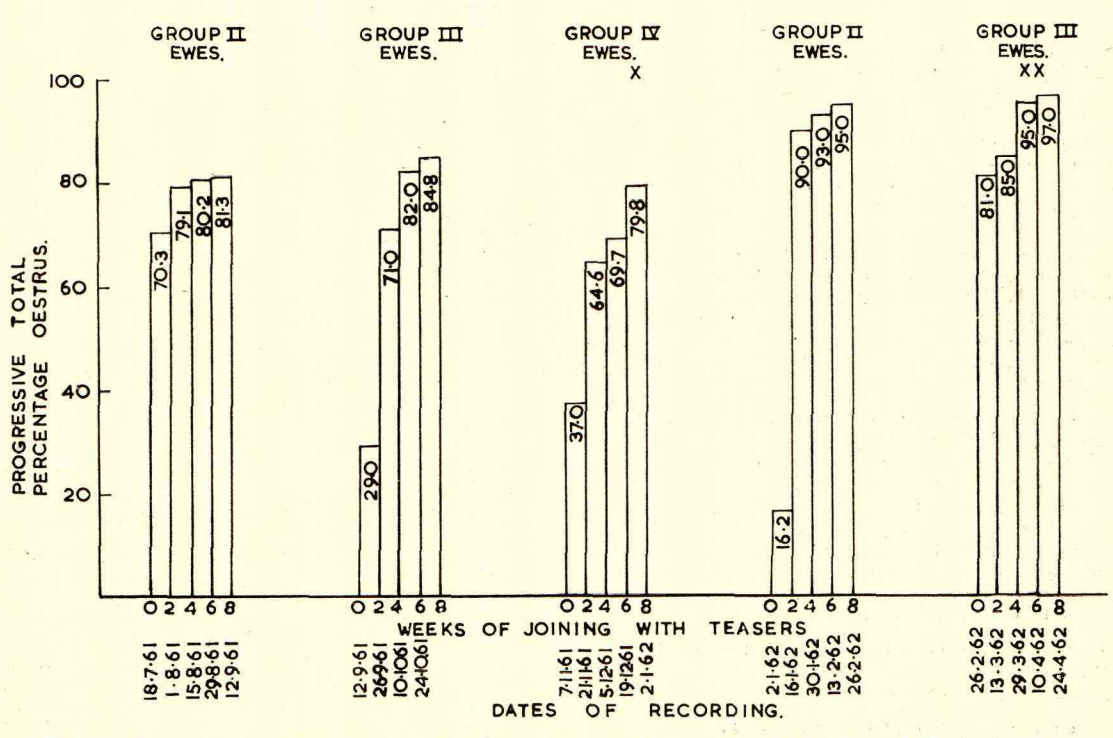

Fig. 2.—Progress percentages of ewes showing oestrus up to 8-week periods. (X and XX as in Fig. 1.)

making the total for the 4 weeks 79·1 per cent. During the following two fortnightly periods a further 1·1 and 0·8 per cent. respectively were marked, giving progressive totals of 80·2 per cent. on 29-8-61 and 81·3 per cent. on 12-9-61. Similarly, with group III first joined on 12-9-61, 29·0, 42·0, 11·0 and 2·8 per cent. were marked for the first time during the fortnights ending 26-9-61, 10-10-61, 24-10-61 and 7-11-61 respectively, giving progressive totals of 29·0, 71·0, 82·0 and 84·8 per cent. at these dates.

Low percentages—e.g. 29, 37 and 16·2 per cent. marked during the 14 days prior to 26-9-61, 2-11-61, and 16-1-62 respectively would indicate that a high percentage of ewes were not showing recurrent oestrus cycles when first joined with the rams. The higher percentages—70·3 per cent. marked in 14 days prior to August 1, 1961, and 81 per cent. marked in 15 days prior to March 13, 1962.—indicate that a high percentage of ewes were showing recurrent oestrus cycles at those times.

The continuation of these observations over a number of years will be necessary to confirm these results. For instance, the low percentage of ewes marked during the first 14 days between January 2 and January 14, 1962, was contrary to expectation. Field observers were of the opinion that the teasers had been quite active during this period.

Ram Semen Observation for Seasonal Fertility.—Periodical observations of semen quality in a small group of rams by obtaining semen by electrical ejaculation and evaluating its quality were made. Evaluation is on the basis of motility, morphology, live/dead percentage and colour. The plane of nutrition available to the rams followed the usual pattern in North Queensland. Effective rain fell in February 1961 and no further useful rain occurred until December. Effective rain fell in January, February and March 1962. The rams were therefore on feed which was decreasing in quality from February to December 1961, and on good green feed from December 1961 to April 1962. As assessed on percentage alive, morphology and motility, the rams produced good quality semen throughout the spring but the quality deteriorated markedly during January, February and March, and showed slow recovery during April and May.

Seasonal Wool Growth Studies.—A long-term project to study the variation in wool growth throughout the year in north-western Queensland was started after shearing in July 1961. Mid-side wool samples were taken from 16 dry ewes which formed part of the oestrus trial flock and ran continuously with vasectomised rams from July 18, 1961. Wool samples were taken on October 30, 1961; January 2-3 and February 27-28, 1962.

Because the mid-side areas were not sampled at regular intervals it has been necessary to calculate the amount of wool produced per unit area per unit of time between the sampling dates. Results for clean and greasy wool production per 10 sq. cm. per 28 days during the period between sampling is shown in Figure 3. For example, between July 12, 1961, and October 30 the average greasy wool production for the 16 ewes was 474 milligrams per 10 sq. cm. per 28 days and the clean wool was 294 milligrams. Between October 30 and January 2 the greasy and clean wool production per 10 sq. cm. per 28 days fell to 310 and 205 milligrams respectively. This was followed by a rise to 528 and 371 milligrams respectively for the period 2-1-62 to 28-2-62.

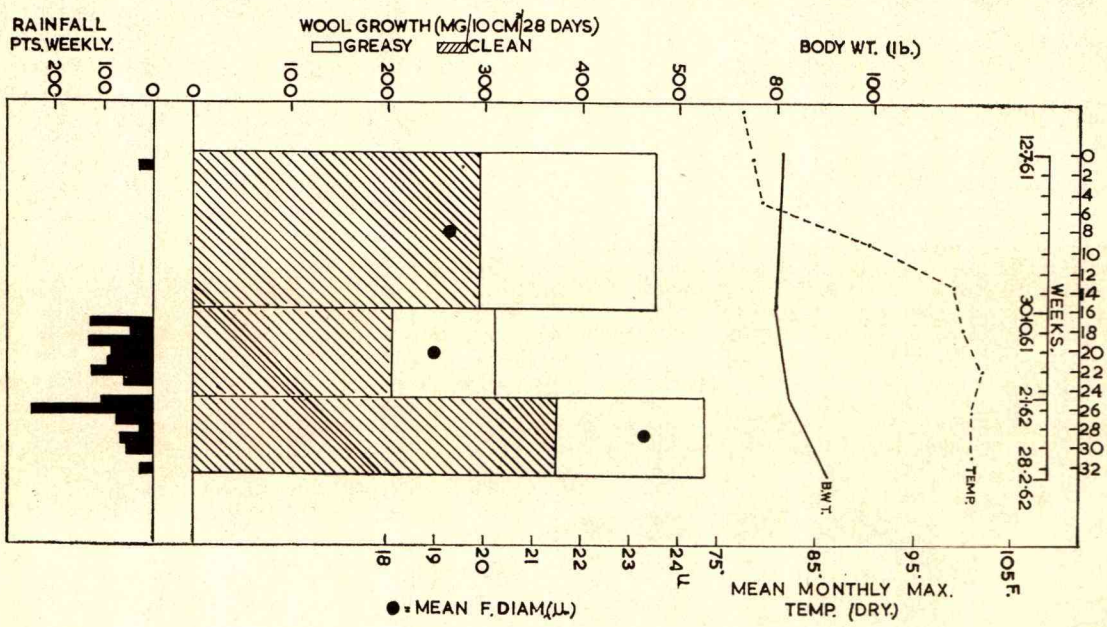

Fig. 3.—Diagram showing clean and greasy wool production per 28 days over a period of 32 weeks.

Fibre diameter, body-weights, weekly rainfalls, and mean monthly maximum temperatures are also shown in the figure. Mean fibre diameters are indicated by the dots in the rectangles, and show an increase in fibre diameter as the monthly wool production increases. Of the factors that have been suggested by research as influencing wool growth, e.g. nutrition, temperature, light, and parasitical infestation, helminth influence is considered negligible in this trial, as faecal samples have shown that egg counts did not rise above 200 eggs per gram.

As in trials in other climatic environments, the amount of wool produced was related closely to the quality and quantity of pasture available.

Pasture Intake Studies.—To endeavour to estimate the feed selected by sheep on native pasture in north-western Queensland, a trial was started during January 1962. In this trial the Biochemical and Agriculture Branches are co-operating with this Branch. An attempt is being made to establish the plants and parts of plants eaten by sheep at different periods through the year. The chemical analysis of some portions similar to those selected, whole plants and the faecal output is being done. Body-weights and wool production are being recorded at intervals throughout the year.

From the records it is hoped that a reliable estimate of the plane of nutrition may be obtained. The results so far available indicate that, as expected, the diet selected during the wet summer period is more than adequate in protein but the content falls as pastures mature and dry off. Further data will become available during the dry winter and spring periods. The ash content of faecal samples obtained in January was about 50 per cent. but by April it had fallen to slightly more than 20 per cent.

WOOL BIOLOGY LABORATORY

The fleece measurement service provided by the Wool Biology Laboratory to stud and flock masters of Queensland has completed its ninth year. The number and identities of the studs and flocks using the service has altered very little, but the number of samples tendered decreased to 2,698 for the year, a decline of 9 per cent. on last year's total. Samples for determination of percentage yield, clean scoured fleece weight, fibre diameter, crimp, and staple length measurements were correspondingly fewer.

The 2-monthly seasonal wool growth samples taken at Toorak Field Station have been processed by the laboratory to determine the wool production for 10 sq. cm. of skin surface calculated on a 28-day basis for both greasy and clean wool. Fibre diameter measurements and coefficient of variation determinations have also been carried out. These determinations are being continued on a long-term basis.

The semen morphology examinations in the monthly ram fertility survey at Toorak are also being carried out in the Wool Biology Laboratory. To ensure an aseptic technique the collection apparatus used in the survey is regularly returned to the laboratory after use for cleansing and sterilization.

Technical enquiries, both direct and through field officers, were received concerning the treatment and effect on wool of processes such as Siroset, also tanning of wool skins by

various methods. Wool samples showing the effect of parasites such as foot louse, body louse, and environmental conditions of copper deficiency, dogginess in wool, fleece rot and mycotic dermatitis were examined.

Twelve Colombo Plan Fellows spent several days during August 1961 in the Wool Biology Laboratory.

The measurement of the thickness of the skins of sheep after varying duration on drought rations is being studied. In the early stages a great deal of difficulty was experienced in removing all the wool from the skin surface. In the case of wrinkly skins particularly, clipping or shaving was unsatisfactory. A method of fellmongering using sodium sulphide and lime has been employed which appears to be successful as it removes the wool and does not appear to affect the skin. Sufficient results are not available from which to draw conclusions but measurements are being continued.

CATTLE HUSBANDRY BRANCH

EXTENSION

A continuing and prime responsibility of the Branch is to make available to dairy and beef producers, information and advice on recent research and technology in livestock husbandry. This phase of field work has in recent years, to an increasing degree, not only taxed the Branch resources of manpower but also has demanded constant review by the individual field officer of his local work programmes and their organisation.

A satisfying and important feature of extension in recent years has been the increasing demand of producers for technical assistance in an effort to keep abreast of recent advances in sundry research fields and to adapt production methods to meet the changing economic circumstances of the particular industries and of the economy generally.

The participation and attendance of beef producers at regional schools of several days' duration have been outstanding examples in this industry of the desire for technical assistance. During the year the Branch provided lecturers at two such schools or conventions for beef producers—in the Maranoa district at Roma and in North Queensland at Tinaroo. In a similar way, the Branch participated with speakers, papers and discussion leaders at the Conference for Bankers, organised by the Reserve Bank, in Central Queensland.

The dairying industry has for some time, of course, participated in a direct way in extension at the district level through the medium of the several Dairy Extension Advisory Committees. These, jointly comprising district dairying representatives and Departmental officers, have demonstrated their utility as media for the more rapid dissemination of technology and husbandry to the producer. The marked recent upward movement in fodders conserved on farms is an example of significant magnitude of what can be accomplished by the principle of joint consultation and the co-operative promotion of worthwhile objectives.

A particular field of extension that will require special applications and methods in the immediate future is the promotion and encouragement of artificial breeding services in the dairying areas. Financial stability in the semen distribution units, most of which are expected to function on a co-operative basis, will be dependent on efficiency in the planning of field operations and also on effective promotion. The promotion must be directed to the rapid acceptance by the local dairy community of the breeding procedure and the advantages in disease control, and ultimately as proven bulls become available, of the opportunity for herd improvement that are attendant on the method.

DAIRY INDUSTRY

Dairy Farm Surveys

This programme, supported by funds from the Australian Dairy Produce Board Research Committee, was outlined as to objectives in the 1960-61 Report. The appreciation, quantitative where possible, of the available resources and of the production methods employed on farms in selected districts has proceeded by sample surveys of farms, with associated interview and discussion with farm owners, in several large and relatively homogenous groups. The group of farms in East Moreton which supply milk directly to metropolitan treatment plants has already been considered. A sector of farms in the eastern Darling Downs, considered to be representative of a much wider farming situation, together with other homogenous groups in the coastal forest region and the scrub lands of the South Burnett, have also been included for independent study.

Dairy Nutrition Studies

It is readily apparent that the major production problem on most dairy farms involves the continuous provision of fodder in sufficient quantity and of adequate quality to maintain satisfactory production levels throughout the course of the lactation. With a view to the formulation of more suitable fodder production and utilisation programmes for the more common dairy farm situations, observations and records on selected and representative farms are being made to evaluate present feeding regimens. Due to the need to cover the normally expected range of seasonal conditions the ultimate objective may take several seasons to achieve.

It is already apparent that the general nutritional plane on the Darling Downs declines very sharply following a rather brief summer peak to reach its lowest level by April. Production thereafter recovers slowly until September. A further trough of variable duration and severity occurs in spring before the following summer peak. The decline in nutritional status during late summer could be associated with inadequate protein levels in the predominantly summer pasture and cereal forages combined with a depression in forage intake and digestibility. A possible solution lies in the use of forage legumes. Cowpeas have been initially selected for trials and observations on a much greater scale and over longer periods than previously practised.

Dairy Output Patterns

Since approximately 60 per cent. of the dairy farms in this State achieve output levels of less than about 6,000 lb. of commercial butter, the small-output farms are of considerable interest to all concerned with the industry if for no other reason than that they represent a relatively large proportion of the total dairy-farming community. The position of the low-output dairyman, especially in relation to the possible barriers to dairy output expansion, is now being examined in various districts.

For a total of 280 dairy farms in a sector of the South Burnett the frequency distribution of farms by output ranges for the year 1960-61 is as follows:—

Output Range (lb. commercial butter)	Percentage of Farms
2,000 or less	13·1
2,001–4,000	25·5
4,001–6,000	25·9
6,001–8,000	20·9
8,001–10,000	6·7
Over 10,000	7·8

The most important apparent barrier to output expansion was sought from samples of farms in the output classes up to 8,000 lb. per annum. In this particular region, a versatile agricultural area, it seems that in most cases low levels of dairy output are the product of a seasonal and opportunist industry. This does not imply that the farmers are necessarily maximising profits nor making optimum use of resources. However, it is apparent that 58 per cent. of sampled farms were choosing to follow a reasonably extensive cash cropping programme at the expense of arable land in cow forage. On 15 per cent. of low-output farms, not otherwise lacking in natural resources and opportunity, an aspect of labour, either age or physical incapacity, may be the principal barrier. Farms requiring additional basic development, many having recently commenced in dairying, account for a further 17 per cent. of these small-output farms.

It seems that few farms in this region are seriously restricted by inadequate land resource. This is in contrast to what would appear to be the situation in parts of the Moreton area, and possibly other coastal and near-coastal areas. While it is not suggested that the majority of the farms in this region with low dairy outputs are achieving satisfactory levels of income or even making the best use of their resources, it does seem reasonable to conclude that "problem" farms cannot be identified by their level of dairy output in a situation where other forms of production are practical.

Infertility Investigations

The infertility survey was extended to include 39 herds in which a detailed investigation of the incidence of infertility diseases is being made in co-operation with the Animal Research Institute. The object is to evaluate the disease component in infertility as compared with the management component. Preliminary data are presented in Table 1 for 31 of the study herds. No leptospirosis results are available.

TABLE 1

INCIDENCE OF INFERTILITY DISEASES

Number of Herds Positive	Number of Herds Negative	Number of Positive Herds Containing Various Percentages of Reactors			
		Less than 15%	16–30%	31–50%	Over 50%
Brucellosis—34	5	19	8	4	3
Vibriosis—27	12	26	1	..	..
Trichomoniasis—4	35	4	..	..	..

The diagnosis of trichomoniasis in four herds suggests that this disease may be more common than was suspected. The utility of the whole-herd survey in infertility investigations is also apparent. The presence of *Vibrio fetus* reactors in herds which have been using artificial insemination for a number of years is of interest.

Further analysis of 1953-1956 data from surveyed farms throughout seven districts of the State indicated:—

(1) There is no significant difference in fertility, as measured by first service conception rate, between districts.

(2) First service conception rate following an abnormal parturition, i.e., abortion or birth of a dead calf, is depressed by approximately 10 per cent. This depression continues for four services, with an apparent levelling at fifth service.

(3) The irregular cycle is not necessarily evidence of a diseased condition of the reproductive tract judged by results obtained from examination of fertility of service return cycles of varying length.

(4) Early mating after calving depresses first service conception rate by 20 per cent for cattle mated under 35 days.

(5) Prolonged withholding of breeding, particularly in a flush season, may lead to infertility associated with long cycle returns.

(6) Observations on anoestrus cattle tend to support the view that this is essentially a stress phenomenon, associated with inadequate nutrition during late pregnancy and early lactation.

(7) Hormonal induction of oestrus in conditions of inadequate nutrition tends to give unsatisfactory results due to affected animals relapsing into an anoestrus state.

Proving Dairy Bulls and Artificial Insemination

The bull-proving projects for the identification of sires capable of genetic improvement of progeny were continued at Nambour and Kingaroy. The insemination season extended from September 1961 to January and February 1962, respectively.

An additional Jersey bull was proven, with the rating of +8·6 lb. butterfat, making a total of three Jerseys in which confidence can be placed as herd-improving sires under A.I. conditions. These bulls will be mated by A.I. to selected cows in stud herds to provide future bulls for proving.

Some extension of A.I. in the State occurred during the year, and indications are that with the opening of the new Departmental A.I. centre at Wacol in the near future, further considerable progress will be made. Semen from bulls of Jersey, A.I.S., Friesian, Guernsey and Hereford breeds will be available from Wacol. Co-operative artificial breeding associations commenced operations at Beaudesert and Dayboro in June 1961. The Tablelands Co-operative Artificial Breeding Association increased its membership and volume of inseminations. The Nestlé Co. (Aust.) Ltd. is increasing the area covered by its A.I. service. A small unit is being maintained by the Department in the Samford area for inseminator training and research. Very good conception rates have been achieved in this area with both chilled and frozen semen.

Costs have been closely investigated in the light of the experience of distributing centres already functioning. Factors such as cost of semen, number of inseminations, and distribution of membership must receive careful consideration by groups intending to commence an A.I. service.

Throughout the State, 10,914 first inseminations were performed by inseminators employed either by a co-operative association or by the Department.

Vealer Production on Dairy Farms

During the past two years there has been a trend from dairying to vealer production. The Darling Downs is one area where considerable movement in this direction has occurred and a case study has been made on a property which has substituted vealer production for butter production. The study has now extended over two years.

The property of 780 acres varies in type from light sandy soils to heavy black soil flats. Cultivation, much of which is for cash cropping, accounts for 375 acres and there are 190 acres of sown rain-grown pastures. The milking herd consisted of 40-50 head of good quality A.I.S. cows, averaging 230-240 lb. butterfat. In 1959 a Poll Shorthorn bull was introduced as a vealer sire. Additional calves are purchased so that each cow rears two calves simultaneously. Heifers were not given a second calf but were allowed to rear their own calf. During the early phase of the new enterprise the second calf was sold for slaughter at approximately 3 months of age but the later policy has been to carry both calves to 8-11 months of age, even though this may involve some hand-feeding for topping-off.

To date, the return per cow annually from veal production has been a little higher than it had been from dairy produce. However, when comparing the financial effects of the change-over it has to be borne in mind that meat prices are subject to considerably greater short-term fluctuations than are prices for dairy produce. Price fluctuations have a profound effect on the net result and this vealer enterprise commenced during a period of record high prices for veal.

Vealer production is much less labour-demanding than dairying and the additional labour resource available has been devoted to farm development. This is an important, but not easily measured, point in favour of the veal enterprise.

Physical data obtained during the course of the study are shown in Table 2.

TABLE 2

GROWTH RATE OF VEALERS

Type of Animals	Number of Animals	Average Age (days)	Average Birth Weight (lb.)	Average Total Gain (lb.)	Average Gain per Day
Male vealers	48	298	84	566	1·9 (range 1·4–2·8)
Female vealers ..	20	325	82	570	1·7 (range 1·3–2·2)
Males ex. A.I.S. heifers	7	339	80	583	1·7 (range 1·6–1·9)
Females ex. A.I.S. heifers	7	353	81	580	1·6 (range 1·5–1·7)

A key productive aspect of vealer production is the frequency with which the vealer mother produces a calf. An examination of the records of 94 cows during the last two years shows that the calving interval for 90 per cent of the cows was less than 13 months:

Interval (months)	Percentage of Cows
Less than 11	17
11–12	38
12–13	35
13–14	4
14–15	3
15–16·5	3

BEEF INDUSTRY

Carcase Studies

Carcase Gain in Crop Fattening.—Actual carcase gain by crop-fattened steers was measured in a trial in the Warwick district. Yearling Hereford steers in store condition were taken to a local property and paired into two groups after a settling-in period of one week. One member of each pair was slaughtered and its mate was fattened on crop. The group slaughtered when in store condition had an average property weight of 580 lb. The crop-fattened group gained 217 lb. in 114 days on crop, or 1·9 lb. daily. Procedure at slaughtering was the same for both groups—all practicable offal weights were recorded. Table 3 summarises the results.

TABLE 3

WEIGHT DATA FOR STORE AND CROP-FATTENED CATTLE

—	Initial Group	Fattened Group
Average final liveweight on property ..	580 lb.	797 lb.
Average liveweight at works prior to slaughter	543 (93·6%)*	748 (93·9%)*
Average hot dressed weight	281 (48·4%)	429 (53·8%)
Average chilled dressed weight	274 (47·2%)	423 (53·1%)
Average offal weight	231 (39·9%)	260 (32·6%)

* These weights are expressed as a percentage of final liveweight.

The actual gain in liveweight during the fattening period was 217 lb., while the increase in chilled carcase weight was 149 lb. The dressing percentage increased by 5·9 per cent.

Loss of Weight in Transit.—Eighty-six head of 2-year-old and 3-year-old bullocks at the Bureau of Tropical Agriculture, South Johnstone, were selected and divided into two groups of 43 pairs on the basis of liveweight and condition. One group of 43 was slaughtered locally at Innisfail (about 10 miles from the Bureau) and the other group was railed to Brisbane for slaughter. The latter group was loaded on to the train on Nov. 2 and spelled for one day at Garbutt and one day at Bajool. The cattle arrived in Brisbane on Nov. 7 and were slaughtered on Nov. 9. Slaughter of the other group took place at Innisfail over the period Nov. 13-22. Details of liveweights on the propetry and prior to slaughter and of the hot dressed weights are:

—	Brisbane Group	Innisfail Group
Weight at pairing (lb.)	836	836
Final property weight (lb.)	850	859
Weight prior to slaughter (lb.)	727	859
Hot dressed weight (lb.)	424	458

The animals trucked to Brisbane lost 123 lb. in liveweight during the journey and had a carcase weight 34 lb. lighter than the cattle slaughtered locally.

Out of each group of animals six head were selected for more detailed carcase observations. On these animals the weights of all offal were recorded and chemical analyses were done on selected cuts from the carcase to give estimates of the proportion of bone, muscle and fat in the carcase and of the content of water, protein and fat in the edible carcase. The data on the chemical analyses were too variable to give any firm conclusions, but along with other evidence from the carcases, they indicated that the difference in carcase weight between the two groups was due both to loss of water from carcase tissues and to loss of fatty tissue. Of the two, the former appeared to be the more important contributing factor.

Effect of Method of Fattening on Carcase Components.—Available progeny from the 1960-61 time-of-calving trial at "Brian Pastures" Pasture Research Station are being used in carcase studies designed to measure the quantity of edible meat produced by animals of a known growth rate and fattened by the feedlot method. One group fattened on grass has also been slaughtered. Slaughtering and boning-out are done at a Brisbane meatworks. The efficiency of fattening under feedlot conditions is being studied closely. Some information is given in Table 4.

TABLE 4

CARCASE STUDIES, "BRIAN PASTURES" STOCK *

Group	Average Liveweight "Brian Pastures" (lb.)	Liveweight Oxley (%)	Hot Dressed Weight (%)	Weight of Offal (%)	Weight of Bone (%)	Weight of Meat + Fat (%)
Slaughtered pre-treatment—						
Males	493	87·2	43·8	39·6	11·3	31·4
Females	469	84·6	43·3	38·4	10·9	30·9
Feed Lot—						
(*a*) Early-mated—						
Males	890	92·8	55·6	36·6	9·1	45·1
Females	834	97	57	36·2	9·0	48
(*b*) Normal-mated—						
Males	871	98·7	53·6	35·8	6·5	44·5
Females	831	94·1	52·1	36·1	6·3	43·2
(*c*) Late-mated—						
Males	883	92	53·2	36·1	8·9	44·3
Females	788	92·6	50·5	38·6	8·5	40·1
Grass-fattened (Females from early-mated)	762	92·3	48·0	39·5	9·0	38·0

* All Weights Expressed as a Percentage of Final Liveweight on Property.

The information gained to date is not sufficient to permit any conclusions regarding the differences in yield of edible meat of feedlot-fattened and grass-fattened cattle. However, the one group of heifers which were slaughtered off grass took approximately eight months longer to reach the same weight as the heifers fattened under lot conditions. The steers of the same age on grass will not reach the desired weight for a further 12 months due to the seasonal pasture growth. Table 4 shows that the cattle fattened under lot conditions appear to have a lower content of offal, largely due to reduced paunch content.

Milk Production of Cows, 1961-62 Trial

Quite appreciable differences have been observed in the growth rates of calves from the cows in the time-of-calving trial at "Brian Pastures". The calves from the early-mating group have given very high performance, with those from the normal-mating group next and late-mating group last in growth rate. In order to determine the reasons for this superior performance of the early-mated group, the milk production of 10 cows from each group has been determined at intervals of 30 days by weighing the calf pre-suckling and post-suckling following a fasting period and then obtaining residual milk by hand. The average production of cows in each of the groups at each determination appears in Table 5.

TABLE 5

AVERAGE MILK PRODUCTION OF COWS IN THREE GROUPS

Average Stage of Lactation (days)	Average Milk Production (lb.)			*Total* Calculated (gal.)
	Date	Day	Calculated for Period	
Early-mated—				
30	7–9–61	7·7	231	
60	3–10–61	7·0	210	
89	1–11–61	8·8	255	
116	28–11–61	9·9	267	
137	19–12–61	9·6	201	
172	23–1–62	8·4	354	
200	20–2–62	7·2	201	172
Normal-mated—				
29	30–11–61	13·9	403	
49	20–12–61	13·4	268	
85	25–1–62	11·6	417	
113	22–2–62	8·5	238	
141	22–3–62	8·5	238	
183	3–5–62	5·7	240	
200	22–5–62	4·6	78	188
Late-mated—				
26	21–2–62	13·3	..	
54	21–3–62	12·9	..	
95	1–5–62	9·8	..	
125	31–5–62	6·1	..	

Indications to date are that milk production from the early-mated group is maintained at a relatively uniform level. In the remaining groups production dropped sharply in May, irrespective of stage of lactation. The early-mated group produced no marked peak of production compared with the normal-mated and late-mated groups. These milk productions appear somewhat confusing, as there is a higher total milk production from the normal-mated cows. However, the superiority of the early-mated group lies in the higher milk production of these cows late in lactation, when the calf can utilise the additional milk of its dam. High levels of milk production early in the lactation are largely wasted, as the young calf cannot handle the amount of milk produced.

More intensive studies of factors affecting reproductive behaviour are in progress.

Supplementary Feeding Observations

Field trials involving low-level supplementation of young stock have been described in previous reports. Such trials have indicated a level of supplementation which ensured animal survival. More recently some trials have been conducted to assess the effects of a higher rate of supplementation. A summary of this work appears in Table 6. The data indicate a marked response to supplementation. The economy of the operation varies according to local and market conditions.

TABLE 6

SUMMARY OF SUPPLEMENTARY FEEDING TRIALS

Trial	Average Initial Weight (lb.)	Average Weight at End of Supplementation (lb.)	Change (lb.)	Length of Feeding Period (days)	Supplement (lb. per day)
A	412	463	+51	201	Nil
A	411	620	+209	201	½ lb. cottonseed meal for 60 days 2¾ lb. cottonseed meal for 141 days
B	382	380	−2	117	Nil
B	381	446	+65	117	2½ lb. cottonseed meal
C	371	435	+64	97	Nil
C	382	514	+132	97	1·7 lb. linseed meal

Supplementary Feeding and Early Weaning

The effect of supplementary feeding combined with early weaning has been the subject of two field trials in North Queensland.

In Trial A the treatments were—

Group 1.—Calves weaned in mid-June and weaners supplemented with cottonseed meal at the rate of 1 lb./head/day fed twice weekly.

Group 2.—Calves weaned in mid-June—no supplement.

Group 3.—Calves weaned October 6—no supplement.

The performance of the calves from each of the three groups is shown in Table 7 for two periods, the first covering the supplementation and the second a period of 6-months' post-supplementation.

TABLE 7

PERFORMANCE OF CALVES IN EARLY WEANING-SUPPLEMENTATION TRIAL

Group	Gain—18/6 to 6/10 (lb. per animal)	Gain—6/10 to 16/4 (lb. per animal)	Gain—Whole Period (lb. per animal)
1	64 ± 4	169 ± 6	233 ± 7
2	17 ± 4	182 ± 6	199 ± 8
3	40 ± 4	177 ± 8	231 ± 10

The weight changes of the cows up to Oct. 6 were considered after making adjustments for stage of pregnancy. The cows from the two early-weaned groups gained 33 ± 12 lb. more than the cows from the late-weaned group. This difference is significant at the 1 per cent. level. Further work is planned to evaluate the economic effect of the extra body-weight on breeding cows.

In Trial B supplementation consisted of cottonseed meal fed twice weekly at the rate of 1 lb./head/day. The results are summarised in Table 8.

TABLE 8

SUMMARY OF WEANING AND SUPPLEMENTATION TRIAL—CHARTERS TOWERS

Group	Average Weight 13–7–61	Average Weight 14–9–61	Average Weight End of Supplementation 17–11–61	Duration (days)	Average Weight Change (lb.)
Supplemented (weaned 13–7–61)	279	310	342	127	+63
Non-supplemented (weaned 13–7–61)	278	268	246	127	−32
Supplemented (weaned 14–9–61)	270	280	302	127	+32

Supplementation with Urea Blocks

Blocks containing 35 per cent. urea have been offered to weaner stock in field trials over the last two winter/spring periods in the Charters Towers district. The stock were grazing native pastures and were in lean but strong condition at the commencement of each trial. The results of both trials appear in Table 9. Both groups lost weight in both trials but it was evident that the supplemented group in both years would have been able to survive a longer period had nutritional stress continued. There were no deaths due to urea toxicity during these trials.

TABLE 9

RESPONSE OF WEANERS TO SUPPLEMENTATION WITH CONCENTRATED UREA BLOCKS

Year and Group	Average Initial Weight (lb.)	Average Weight End of Supplementation (lb.)	Change (lb.)	Advantage to Supplemented Group (lb.)	Duration (days)	Average Consumption of Lick (oz./day)
1960—	27–8–60	21–11–60				
Supplemented	265	249	−16	+16	86	3·3
Non-supplemented	259	227	−32	..	..	..
1961—	22–6–61	17–11–61				
Supplemented	291	278	−13	+25	148	2·2
Non-supplemented	294	256	−38	..	..	..

Crop Fattening

A summary of key data of the results of a 4-year study on fattening of cattle on crops in winter, carried out in conjunction with the Bureau of Agricultural Economics, appears in Table 10.

TABLE 10

SUMMARY OF DATA ON ECONOMICS OF CROP FATTENING

—	1958	1959	1960	1961*
Number of properties	18	23	20	12
Average area of crop (acres)	139	178	195	194
Range (acres)	55 to 360	36 to 509	17 to 513	22 to 502
Average liveweight gain per acre (lb.)	209	115	183	149
Range (lb.)	111 to 365	Nil to 255	67 to 308	4 to 303
Average total cost of fattening per acre (£)	4·15	3·50	4·12	4·99†
Range (£)	2·63–8·24	1·86–5·03	1·25–10·74	1·55–23·53
Average total additional net income per acre (£)	13·48	6·17	7·84	3·31
Range (£)	2·64–26·75	−4·61 to 26·10	−3·28 to 24·33	−19·53 to 18·64
Estimated Prices per 100 lb. Carcase Weight—				
(*a*) Stores (£)	6·15	8·97	9·56	7·84
Range (£)	5·34–7·01	7·65–10·34	8·19–11·34	6·50–9·28
(*b*) As fats (£)	7·37	9·67	10·78	8·34
Range (£)	6·25–8·74	7·94–11·42	8·60–13·70	7·48–8·95

* Subject to revision.

† Small-scale irrigation and mechanical harvesting added large components to this cost through interest and depreciation charges.

PIG SECTION

Once again the year was a difficult one for pig-raisers. Generally there was ample feed, but the low prices offered for pigs during most of the year were a source of worry to producers. Many were undecided whether to continue current production or restrict activities. Most producers who bought all feed requirements worked on very small margins.

The volume of dairy by-products was barely adequate in spring, and at times grain shortages were averted by timely harvests, but there were no serious feed shortages. In contrast to the previous year, protein supplements were readily available.

In all districts pig feed from dairying increased rapidly following early summer rains, and reached an earlier peak than usual during January. Thereafter there was a steady decline, and in the drier areas milk supplies were inadequate by June. In the North Burnett, dairy production was below average and failed to supply protein needs on most farms. The Darling Downs followed the general pattern, but the Beaudesert district experienced an earlier and longer dairy season than usual, with sufficient milk to provide protein needs for most of the year. Moreton district had fair milk supplies for the latter half of the year.

Dried milk products were readily available, but their prices placed them beyond the economic limits for pig raisers. Due to the more favourable climatic conditions there was not a strong demand for protein-rich supplements, and supplies met demand readily except in the case of imported fish meals. Meat-and-bone meal of all grades was readily available, but many lines were still of poor quality for pig feeding. There were price reductions on a number of these lines with a low biological value. One manufacturer started manufacturing a 55–60 per cent. crude protein meal in 1962 and already demand has exceeded the supply.

Due to the large quantities of meat-and-bone meal available there was no demand for vegetable proteins. One feed manufacturing firm is encouraging growing of soybeans as a source of protein meal; regular supplies of this meal at competitive prices would be of considerable value to the pig industry.

Importations of fish meals from South Africa continued. These meals of high biological value have given excellent results, but irregular supplies and high prices in country areas have turned some producers back to meat-and-bone meals. Whale meatmeal, whale meat-and-bone meal and dried whale solubles (sold as whale protein meal) were available from the local whaling industry. The first two have given good results in Departmental trials but irregularity of supply limits their use except in emergency.

In North Queensland maize was plentiful throughout the year, but the price range of £40–£32 per ton was too expensive for pig feed. In Central and Southern Queensland sufficient barley and wheat were available to meet needs. Subsequent sorghum and maize harvests contributed considerable amounts of grain to reserves and caused prices to ease. In the Warwick area in particular there were appreciable amounts of rain damaged cereals for pig feed. The heavy rains adversely affected grain crops in portions of the Beaudesert and Moreton districts. In spite of crop reductions here and in other areas with light rainfall, grain was generally plentiful and priced reasonably.

Green feed became available after the early summer rains and varied in quality and quantity thereafter according to seasonal conditions. Producers realising the value of good grazing have provided better pastures; others used irrigated crops or pasture for green feed.

Prices for all grades of pigs throughout the year were a source of discontent amongst producers. The decline in values evident at the end of last year continued until almost the end of the current period, when values had dropped below 1s. 5d. per lb. for baconers and 1s. 4d. for porkers. As only a small portion of the reduced values were passed on to consumers by retail butchers, and bacon factories eventually reduced bacon prices, producers felt that prices for pigs could have been held more in their favour. Weaner and store values were in line with those for slaughter pigs, and prices for purebred stock also fell. The Northern Pig Marketing Board was forced by declining southern values to reduce its guaranteed price for the first time in several years from 2s. 5d. to 2s. 2d. per lb.

A sudden firming in pig values at the very end of the year gave producers hope of improved returns. Many felt that the pig-price cycle was about to take the upward trend. Under pressure of low prices a number of "opportunist" producers ceased production. There were reports of restricted production by other producers.

Production figures of recent years show an overall increase, with more pigs produced in the winter months than previously.

DISEASE

Due to the dry winter and spring, and the absence of prolonged wet periods, the general health of pigs was good. Diseases of a seasonal nature occurred in most districts, e.g., photosensitization during showery summer weather and sarcoptic mange and parakeratosis during winter and spring.

Leptospirosis was reported from all districts and caused some losses in piglets at birth, as well as infertility and upsets to breeding programmes. Scours in suckling pigs was common to all areas. It was frequently noted on properties with concrete floored pens, and a high standard of hygiene, feeding and management. Infertility in sows arising from a number of causes was noted, including vitamin A deficiency. Post-parturient fevers were also reported on a number of properties. Erysipelas was common to all districts, and a number of farmers complained of condemnations for arthritis. Vaccination of pigs for protection is being practised more. Pneumonic complaints and virus pneumonia were widespread but no heavy losses were reported. Several herds were aiming at virus-free status.

Other diseases reported were salmonellosis, ascariasis, paratyphoid, Glassers disease, oedema disease, spirochaetosis and rhinitis. Rhinitis, on a central Queensland property, appears to be seasonal, affecting winter farrowed pigs each year. In the Warwick area, feeding of copper sulphate as a growth stimulant appeared to have reduced the incidence of "arthritis", possibly indicating a previous mild copper deficiency.

Pig Section staff have participated in inspections and other measures to check for swine fever.

RESEARCH

Trials and demonstrations were continued at the three Research Stations, and the equipment and herds were used fully, except at Kairi.

Kairi.—Owing to lack of suitable staff, experimental work was restricted to continuance of the feeding scales and records for the sow performance trials. Some of the older crossbred sows were culled, and a Landrace boar and three young sows were introduced. The breeding herd at the end of the year consisted of one boar and 11 sows.

Biloela.—A high level of trial and demonstration work has been maintained during the year, with very satisfactory results from this aspect as well as in terms of general management and performance.

Sow numbers have been maintained at 12–16. There was an average of 12·5 pigs born and 9 weaned per litter from 25 farrowings. Disease was successfully checked by prompt treatment, so no serious difficulties arose. Maintenance, improvements and extensions to buildings and equipment have been effected.

Sow performance studies were continued, with a change from the low to the high level of feeding during the year. The change appeared to have a slight adverse effect on the numbers born and total weight at weaning. Other trials and comparisons were concentrated on protein supplementations, grazing, and hogging-down of sorghum. From the work on supplements, it was evident that fish meal produced consistently good results in terms of performance and economy of gains. Future work will aim at finding a mixture of more readily available proteins which will equal these results. Hogging-down trials gave useful details of the economy of this method of feeding, and provided the basis of practical advice on methods to be used. Grazing trials have provided information on the value of grazing to feeding pigs.

Hermitage.—Breeding stock numbers have been well maintained, but losses at farrowing and afterwards restricted the number of pigs available for trial work early in the year. Recent farrowings were more successful. A normal amount of trial work was in progress at the end of the year, although feeding facilities were limited.

Sow performance trials continued, with the feeding scale changed from the high to low plane, and the sows were gradually losing excessive condition. Piglet losses experienced will make interpretation of results difficult, but they may have been aggravated by the high feeding scale. The main trial work involved comparison of the palatability of various sorghum varieties; the lighter coloured Texas 630 variety proved most palatable. A trial with 250 p.p.m. copper in the ration was nearing finality. Although results were not available, no ill-effects had been observed.

Pig Testing Station, Rocklea.—Official pig testing has been in operation at the Rocklea Pig Testing Station for two years. Results obtained by boars tested have been gratifying, but the number completing the test during the past 12 months was very disappointing. The Station has at no period during the year under review worked at full capacity, not because of the lack of response received from stud breeders to have boars tested, but because sows entered for testing have either not produced litters of sufficient numbers or the piglets have not averaged the required weight at nine weeks of age. It is considered the Station rules provide for minimum requirements which should be expected. Applications for 48 groups (4 pigs to a group) to enter the Station were received, representing 12 boars, but of these only 19 groups (39·58 per cent.) were successful in gaining admittance. This state of affairs does not auger well for the industry and constitutes a challenge to all stud breeders to see that such happenings do not continue.

Three boars were scheduled to complete the test during the year, but in one case, because of the lapse of time between the entry of the first group of pigs and the possible entry date of the fourth and final group was too great (approximately two years), the test was terminated. Provided no further cancellations are received, applications to hand are sufficient to occupy the accommodation available until February 1963.

Sixteen experimental pigs were on hand at the beginning of the year and a further 20 were received.

Adjustment of the mineral mixture in the rations appears to have overcome the lameness apparent in some test pigs in the past.

GENERAL

Producers complained about the apparent inconsistency of carcase grading between factories. While grading is based solely on depth of fat showing when the carcase is split, errors must occur, as no recognition of the meat in a carcase is made by this method. To eliminate some of the error, the Mareeba factory does the conventional grading at the scales, followed by a check grading in the cutting-up room next day. At this grading a small percentage of carcases has been regraded. Other factories similarly are finding that cut surfaces across the carcase often show excessive fat or too little meat not revealed when graded. A grading system based on meat as well as fat in the carcase would benefit both producer and processor.

Since the introduction of Landrace pigs to Queensland four years ago the breed has spread to all districts. Insufficient culling was practised early due to the desire of many breeders to recoup heavy initial outlay as soon as possible. Consequently there are undesirable types in use, but the best specimens of the breed compare very favourably with the other breeds. Growth rate is generally very good, but legs are often faulty. A number of farmers and bacon factory workers have complained of too much fat in bacon-weight carcases from pigs of this breed, either purebred or as cross-breds.

The litter recording scheme was revised and reintroduced during the year to encourage the practice of keeping accurate and informative records, which could be used to assess fertility, stock management and other practices. The previous loose record sheets were replaced by a book containing single page records for each litter. The new method of recording was publicised by means of radio broadcast and news items in the *Queensland Agricultural Journal* and the country press. As a result, books have been issued to approximately 80 producers throughout most pig-raising districts who asked to participate in the litter recording scheme.

In spite of reduced financial returns, many pig-raisers effected housing improvements or planned to do so as soon as returns improved. There was a gerenal realisation of the value of good piggery equipment in securing economic returns.

Swine fever in New South Wales caused some concern among producers and the establishment of the Swine Compensation Fund was well received.

Production for the year may exceed the pervious year's figures. A noteworthy feature of greater production over the last few years is the increase in turnoff during winter and spring months. This appears to follow a greater use of grain sorghum for feed during this period, and less dependence on dairy by-products.

Demand for services of Branch Officers again increased. The transfer of a cadet on promotion to Beaudesert, and appointment of an additional officer (to the Dalby district) relieved pressure on neighbouring officers. Appointment of an additional cadet should enable the Kairi piggery to function usefully. Some of the larger districts require additional staff to provide more effective service.

POULTRY SECTION

EGG PRODUCTION

Egg production in south-eastern Queensland, as measured by intake at the Egg Marketing Board, showed an increase of some 6 per cent. over the recorded production for 1960-61. Actual production would be higher, for a considerable volume of eggs was not forwarded through legal marketing channels. While the net return to producer was only slightly higher, 3s. 3·71d. as compared with 3s. 1·29d. for 1960-61, a plentiful supply of grain sorghum and maize at prices up to £10 per ton cheaper than in the previous year and a reduction in the cost of locally produced meat-and-bone meals resulted in a general reduction of approximately 10 per cent. in mash feeding costs. This has provided temporary relief to commercial egg producers, who have been faced with high feeding costs and low returns since 1960.

Few new farms have been established in the Brisbane area. Expansion has taken place on the Darling Downs, particularly in the Pittsworth area, where large laying cage plants with capacities of over 15,000 layers have been established. There would appear to be a trend also to install sizeable laying cage units of at least 1,000-bird capacity on some grain farms to provide additional income from home-produced grain. This is a similar trend to that which took place in the sorghum-growing areas of Central Queensland some few years ago.

In Central Queensland, production has declined somewhat due to the lower net return to producers following over-production in that area. Egg production in North Queensland remained relatively static, the only increase being noted in the Cairns-Atherton Tableland area, where transport costs are far less than in Townsville because of the proximity to grain supplies.

TABLE POULTRY PRODUCTION

The production of broilers (table chickens) continued to rise during the year. In the Brisbane-Gold Coast area, production rose by approximately 40 per cent. Much of this increase has been due to expansion by one company, which now produces nearly 70 per cent. of the total output in this area. This company is now geared to produce two million chickens during the coming year from its own resources and from contract growers. In the Maryborough district another large company is also rapidly increasing broiler production through a system of contract growing. It is estimated that the combined output of these two firms will account for nearly 60 per cent. of total Queensland production. Mention must be made of the efforts by leading poultry processors in the field of product development to ensure a high quality product and at the same time cater for all tastes; also, in the field of publicity, to stimulate consumption of chicken meat.

While liveweight prices have not reached the level of two years ago, the efficient broiler grower has found it to be a profitable venture. It is of interest to record that increased feed efficiency and a quicker turnover of birds due to their reaching a marketable weight at an earlier age have enabled profit margins to be maintained despite a fall in liveweight prices. It seems likely that as competition increases for available markets, liveweight prices may fall further, but this fall would be largely compensated by further improvements in feed efficiency and a larger and earlier throughput of stock. Mention must also be made of the increased labour efficiency, for with adequate shedding and good brooder and feeding equipment, two people can handle an output of 100,000 chickens per year.

The number of hens processed was slightly higher than in 1960-61; this was possibly due to the incentive of higher prices generally operating during the year, which meant that fewer layers were retained for a second year of production. Interest has been shown in turkey production and further developments are expected in the coming year. It would seem that there will be a swing towards the younger bird of 14-16 weeks which is more suited to the housewife's cooking appliances.

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 1961 was 7,743,404. The number sexed (4,341,936) was slightly fewer than in 1960. Over three million unsexed chickens were supplied to broiler growers by registered hatcheries, a goodly portion of these being the synthetic meat-breds available from some of the larger Queensland hatcheries franchised to parent breeding organisations in New South Wales. The export of day-old chickens from Queensland is assuming an international flavour. In the past 12 months, apart from New Guinea, chickens were sent to Indonesia, Singapore, the Philippines and Borneo.

REGISTRATION OF STOCK SUPPLIERS

During the year, 11 stock suppliers registered under the Poultry Industry Acts did not renew their registrations. These included 7 engaged in the business of hatching chickens for sale, 2 in the business of supplying fowl eggs for hatching, and 2 in the business of a poultry dealer. New registrations effected were 2 for the business of hatching chickens for sale, 4 for the supply of fowl eggs for hatching and 1 as a poultry dealer. The number of registered stock suppliers is now 170.

POULTRY ADVISORY BOARD

This Board met on three occasions. Matters considered included the amount of precept to be levied on Marketing Boards, further consideration of proposals for marking and grading eggs, change in random sample testing procedures, the establishment of a broiler random sample test, and various reports dealing with experimental programmes and investigations by the Poultry Section.

QUEENSLAND POULTRY IMPROVEMENT PLAN

The Queensland Poultry Improvement Plan has succeeded, in its five years of operation, in encouraging breeders to use more scientific methods of breeding in place of selection based solely on the appearance and conformation of breeding birds. At the implementation of the plan, two main types of selection programmes were suggested, viz. selections based on the performance of (*a*) full-sib groups and (*b*) half-sib groups. While the former system is more efficient and thus gives greater response, the latter was more widely used as less labour and few facilities were needed. Of the 11 participants in the Plan, only one has used the full-sib method. It would appear that if the remaining breeders are to bring about the rapid improvements needed to meet the challenge of a highly competitive day-old chick market, they must be prepared to set up the necessary facilities for more thorough testing and be prepared to employ additional labour.

Mention has been made of the competitive nature of day-old chick production, for a number of parent breeding organisations in New South Wales which employ geneticists to direct their breeding programmes have allotted franchises for the sale of day-old chickens derived from their developed breed strains and crosses to a number of the larger hatcheries, some of whom include breeders in the Queensland Poultry Improvement Plan, in this State. The system of accreditation for breeders meeting the required "standards of excellence" apparently leaves much to be desired, for it does not appear to be statistically sound. For these reasons alone, it is necessary that the overall policy of the Plan established in 1956 be reviewed in the light of present trends.

The fourth random sample test terminated early in December 1961. The results obtained were rather disappointing, the hen-housed average being considerably lower than in the previous year. Possible reasons for the lowered production were:—

(1) *Date of Hatch.*—The chickens were hatched a month earlier than in previous tests, so the effects of a seasonal decline in autumn and winter of 1961 were more noticeable. The hatching date was changed in this test to conform more closely with the hatching times of random sample tests in other States.

(2) *Disease Incidence.*—Although the percentage adult mortality was lower than in any other year, it is thought that an early outbreak of encephalomyelitis (epidemic tremor) may have had some effect on later growth and production.

(3) *Sample Tested.*—In previous tests, random sample hatching eggs were derived from the actual families in the breeding scheme. In this test, the eggs were taken from the general flock, which would be one generation in improvement behind the family breeding nucleus.

In the test to commence in 1962-63, Poultry Improvement Plan co-operators will be allowed to enter samples of the stock for which there is greatest demand, i.e. crossbreds and strain crosses.

EXTENSION

Although the overall staff position has improved due to the appointment of two cadets and a temporary assistant adviser, the lack of experienced staff precluded the full use of all extension techniques. An outstanding feature of the year's extension work was the organisation of a Poultry Industry Field Day in co-operation with the Queensland Broiler Grower's Association and the Egg Marketing Board Suppliers' Organisation at the Poultry Section, Rocklea Animal Husbandry Research Farm. Commercial firms were invited to set up trade displays showing the latest in equipment, housing, feeds, etc. Over 350 people from most of the major poultry districts in Queensland attended this function.

EGG QUALITY INVESTIGATIONS

At the request of the Egg Marketing Board, a survey of farm conditions conducive to the production of "black rots" in eggs was undertaken. The survey was conducted from January to March, a period when most "rots" are expected due to the prevailing hot, humid conditions. It was soon apparent that the "rots" were coming from a very small percentage of growers (approximately 3·5 per cent.) and that some of these growers had defective eggs in a number of consignments. The main cause appeared to be infrequent collection of eggs from hidden nests and semi-intensive yards due to eggs being in contact with dirt, moisture and manure for a long period. The practice of washing was widespread, but except in one instance did not appear to be responsible for the production of "black rots."

Field experiments are now under way to test the cleaning powers of various proprietary detergent sanitisers for use in egg-washing machines. Evaluations are also being made of the effect of these compounds on keeping quality at various washing water temperatures and on their bactericidal properties.

From the work that has been carried out to date, the cleaning action of some of the commercial preparations leaves much to be desired and it would seem that the temperature of the water in the washing machine plays an important part in the "keeping" quality. A washing temperature of 120°F. has so far proved more effective than 110°F. and further work is planned using temperatures higher than 120°F.

RESEARCH

Egg Pigmenter Trial.—Experimental work carried out in 1960-61 on the effect of synthetic carotenoids fed at levels of 10, 20, and 30 grams to every 2,000 lb. of mash was continued during the year under review. In addition, natural sources of egg yolk pigment such as maizemeal and lucerne meal were also tested to determine minimum quantities required to produce a satisfactory yolk colour.

As a result of this work, the provender miller or the home mixer can use anyone of the following to produce good yolk colour—40 grams of synthetic carotenoid per ton, 30 per cent. maizemeal, or 5 per cent. lucerne meal. If he wishes, the following combinations can be applied to give similar yolk colour results:—20 grams of synthetic carotenoid per ton plus either 15 per cent. maizemeal, or 2·5 per cent. lucerne meal; or 2·5 per cent. lucerne meal, plus 15 per cent. maizemeal.

Fish Meal in Chick Starter Rations.—A trial was carried out on the use of "white" fish meal imported from South Africa in chick starter rations. This protein was added at the rate of 4, 8, and 12 per cent. with or without the addition of Q.M.I.B. meat-and-bone meal to give an overall protein content of 18 per cent. A second series of rations with fish meal added at the rate of 5·66, 11·33, and 17 per cent. were fed with or without the addition of Q.M.I.B. meat-and-bone meal to give an overall protein content of 21 per cent.

In the lower protein ration series, very highly significant differences in weight of chickens were noted where fish meal was a ration component. The weight differences in favour of fish meal were not so clearly defined on the 21 per cent. rations. The possibility of off-flavours due to fish meal was tested by cooking some of the chickens from the various groups. Even at the highest level of 17 per cent. fish meal, no off-flavours were noted.

Soybean Meal in Chick Starter Rations.—Soybean meal is now being imported from the United States for inclusion in broiler rations. In order to note whether any benefit is derived from its use, a trial was conducted using total crude protein at levels of 18 and 21 per cent. In the 18 per cent. series of rations, soybean meal was included at the rates of 4, 8, and 12 per cent. respectively with or without the addition of Q.M.I.B. meat-and-bone meal. Soybean levels of 6, 11, and 17 per cent. with or without Q.M.I.B. meat-and-bone meal were used in the 21 per cent. series of rations.

The addition of soybean meal to the lower protein rations, even at the 4 per cent. level, resulted in highly significant differences in weight in favour of the soybean meal inclusion. At the higher protein ration level (21 per cent.) these differences were not so apparent. Nevertheless, it is considered that soybean meal makes a valuable addition to broiler rations by complementing some of the marginal amino-acid deficiencies present where meat-and-bone meals are the main protein component of the ration.

Value of Forced Moulting in Second Year Production.—Previous work by this Section has shown that it was not a payable proposition to keep layers for a second year of production. However, two sets of circumstances of recent origin in the commercial egg industry, viz. the low carcase value of hens following the development of the broiler industry and the emphasis on large egg size due to revised Egg Board grade standards, have indicated the need to re-examine this question.

Forced moulting, which has been used by some skilful farmers in the past, may offer some benefits. At the Rocklea Poultry Section, five groups each of 80 crossbred hens approaching the end of their first year of lay were subjected to five treatments as follows:—Treatment 1, no forced moulting; Treatment 2, no forced moulting but given morning artificial lighting; Treatment 3, force moulted, water restriction for 36 nours, morning artificial lighting after moulting; Treatment 4, force moulted, feed restricted to 1 oz. of grain per day, morning artificial lighting after moulting; and Treatment 5, force moulted by both food and water restriction followed by morning artificial lighting after moulting. Forced moulting commenced on January 22 and production in Treatments 4 and 5 dropped from over 50 to under 4 per cent. within a fortnight. The layers on Treatment 3 (water restriction) did not show the same sudden drop. Layers on Treatments 3, 4, and 5 were returned to normal watering and feeding respectively for a fortnight following the drastic fall in production. Early morning lighting was then switched on five weeks after the commencement of the trial.

Table 1 sets out the results obtained to May 27 and suggests that, while the trial is in no way complete, there may be an economic advantage in using one or either of the forced moulting techniques as described to improve second year production, particularly during the period when higher egg prices are prevailing.

TABLE 1

EXPERIMENTAL RESULTS USING FORCED MOULTING
(22-1-62 TO 27-5-62)

Treatment	Net Return per Layer	Hen-Housed Average Production	Percentage Mortality
	s. d.	eggs	
1	6 1	37·07	2·5
2	8 2	44·60	3·75
3	10 6	51·70	..
4	9 10	47·40	2·5
5	9 10	47·80	1·25

PULLORUM TESTING AND ACCREDITATION

The pullorum testing figures for the year are set out in Table 2. Although the number of stock suppliers' flocks was lower, due to a number of people giving up day-old chick and fertile egg production, the number of birds tested was about the same, indicating an increase in a number of registered stock suppliers' flocks.

TABLE 2

PULLORUM TESTING

—	1959–60	1960–61	1961–62
Total number of fowls tested	258,583	291,118	300,343
Number tested for registered stock suppliers	253,226	284,067	290,297
Number of registered Stock Suppliers' flocks tested	118	118	108
Number of flocks with no reaction at test ..	73	78	75
Percentage reaction for State	·16	·11	·11

The number of stock suppliers who were accorded "Pullorum Free" accredited status for their flocks or associated hatcheries was 27, while a further 40 were granted a "Pullorum Clean" classification. Pullorum accreditation in respect of 1962 is now under way and already 31 suppliers have been granted "Pullorum Free" accreditation and a further 42 "Pullorum Clean" status.

DISEASE CONTROL

Leucosis in its various forms has once again, after apparent quiescence for several years, become a major problem in both the egg industry and the broiler industry. Neural and ocular leucosis seem to be the more prevalent and have been seen in broiler chickens as early as nine weeks of age. This is a major hazard for the broiler grower, for there is little that can be done to control it, as the standard recommendation of rearing in isolation is virtually impossible in intensive broiler producton.

As regards other disease hazards faced by the broiler grower, it is very apparent that the contract grower who sells his various age groups in large batches, and can thereby clean out pens and disinfect equipment before the next intake, breaks the chain of infection. Rarely is disease of major consequence seen on these farms. On the other hand, the independent broiler grower who supplies chickens continuously without a break in production is in a very vulnerable position.

DIVISION OF DAIRYING

The research and advisory programmes of the Division were continued at rising tempo towards the attainment of their objectives of assisting producers and factory managements in increasing the efficiency of their operations, improving the quality of dairy products and developing new products. There was collaboration with other Divisions in various extension projects, use of herd recording data and farm demonstrations under the Dairy Industry Extension Grant. Much assistance was also given in co-operative efforts with various industry organisations and in training courses.

Regulatory work was connected with the administration of the Dairy Produce, Margarine and Filled Milk Acts and included the licensing of milk sellers, which was transfrom the Department of Health and Home Affairs to this Department. Previously licences were issued in notified areas, but the new system provides for the licensing of all milk sellers within the districts notified in the Dairy Produce Acts; this virtually covers all dairying areas of the State. The conditions of the licenses now issued necessitated careful checking of all applications in the changeover period.

The mounting demand for advisory services and research is straining resources of manpower, but the policy in recent years of active participation of industry leaders in joint planning of projects has been clearly of benefit, not only in assessing priorities, but in the acceptance of recommendations of technical officers. The research work of the Division is also being assisted by grants which are now being made available under the Dairy Industry Research Scheme sponsored by the Australian Dairy Produce Board. During the year £13,700 was expended in this connection on Divisional propects.

MILK PRODUCTS

The prospect of Britain joining the European Common Market and the standards prescribed by some countries which afford potential market expension leave no grounds for doubting the necessity for substantially raising the proportion of choice grade butter. The achievements in quality improvement in the market milk and cheese sections of the industry in recent years are equally possible for cream and butter quality. The fundamental approach to this problem, which must be tackled by integrated team-work by all groups concerned with butter quality, is a State-wide programme, the cardinal points of which would be quality-conscious management backed by sound factory hygiene, rigid adherence to cream grading standards, systematic keeping of records of defects, the provision of adequate facilities and their efficient use on the farm, and an effective field follow-up service. The success of individual efforts by two butter factories in raising their choice grade butter by about 30 per cent. affords evidence that the desired improvement is well within the capacity of producers and factory managements. It would also constitute an important supporting role in the sales promotion scheme which is currently being undertaken in Australia by the Australian Dairy Produce Board.

The cheese industry has made rapid progress during the past decade in improved quality, better market presentation, and the widening of the varieties produced. This progress continued during the year under review, and a gratifying feature was that the official gradings were slightly better than the previous record achieved last year.

An exhaustive survey of the quality of milk supplies to cheese factories was undertaken; it involved almost 50,000 platform and over 10,000 laboratory tests. The results and those of two earlier surveys which are summarised below show that milk quality has appreciably improved, with a closely corresponding improvement in cheese quality.

	First Grade		Second Grade	
	Cheese	Milk	Cheese	Milk
1938–39	40·5	48·0	59·5	51·3
1940–41 to 1943–44	71·3	69·0	28·7	31·0
1960–61	92·4	92·0	7·6	8·0

Alterations to the buildings and installation of equipment for the manufacture of casein were made at the Gympie factory of the Wide Bay Co-operative Dairy Association, and production will begin early in the new year.

About 40,000,000 gallons, or one-seventh of the milk produced in the State, is now utilised for the market milk trade, which is expanding steadily with the increasing population and the extension of the distribution of pasteurised milk to most urban areas of the State. Tests which were regularly made in the laboratories show that quality has been improved, and that a safe supply of pasteurised milk of good keeping quality is available to consumers.

The trend in recent years for diversification of products made by the industry is a healthy sign. It is helping in facing up to the difficulty of disposal of butter and cheese on overseas markets.

DAIRY FARMING

Bulk farm refrigeration and road tanker collection of milk from farms was inaugurated at two centres. A considerable amount of preliminary work was associated with these schemes in which Divisional officers closely collaborated, and an investigation is in progress on the resultant influence on milk quality and other aspects. Performance tests were conducted on 11 prototype farm bulk milk coolers. The gradual expansion of these schemes can be foreshadowed.

In the rebuilding of dairy sheds, the trend continues on large farms having 60 or more milkers for the replacement of the walk-through bails by herringbone sheds, and the changeover from dairying to other agricultural pursuits, or amalgamation of farms, was continued.

Information of value not only to farmers whose herds are production-recorded, but to dairy farmers generally and other Divisions of the Department, is being increasingly accumulated from the surveys of data connected with the herd production recording schemes. Preliminary work was also undertaken on the recording of milk solids as well as butterfat. The importance of these solids is now becoming increasingly appreciated throughout the world, and in some countries milk is already paid for on the basis of its solids content.

LABORATORY TESTS

Nearly 600,000 tests were carried out in the laboratories in connection with research and control schemes, and there was close integration of the work of the field and laboratory officers in the implementation of the various schemes for the improvement of milk and cream on farms and the manufactured products in the factories.

FIELD SERVICES BRANCH

FIELD SURVEYS AND INVESTIGATIONS

An appreciable part of the Branch work has been directed to carrying out surveys of, and investigations into, various features of practical dairying. The aim of this aspect of the Branch's activities has been not only the solving of problems but also to assist in dairy industry development within the State.

The primary requisite for diversified dairy manufacturing is the receipt of wholemilk in factories, and as the trend towards diversification develops in Queensland, more and more factories are receiving wholemilk at the expense of cream intake. For many farmers this has meant the loss of skim-milk for pig feeding. It has been important, therefore, to carry out surveys of the relative returns to dairy farmers from supplying wholemilk as against cream. The first survey has indicated that there is no obvious financial gain to the farmer by supplying milk for manufacturing purposes, but data from more farms will be required before a final assessment is possible.

Casein Production.—One Queensland factory has now been manufacturing hydrochloric acid casein for more than a year, using a package plant developed and produced in Victoria. The ready market which exists for this product of skim-milk has aroused the interest of a number of dairy companies. The work of officers of the Branch in respect to the existing plant has helped considerably in the successful establishment of this section of the industry and will be invaluable in piloting and assisting other dairy companies embarking in casein production. A second co-operative company has now ordered the necessary plant and expects to process some 8,000 gal. of skim-milk daily by the end of 1962.

Bulk Handling of Farm Milk.—Recently two factories commenced receiving farm refrigerated milk in bulk. One factory is engaged in cheese production while the other factory serves the metropolitan pasteurised milk trade. Officers of the Branch have carried out the testing of all refrigerated farm milk tanks of both direct expansion and ice bank types for their compliance with standards. Trials have

also been carried out to examine the quality of milk delivered under this system. Advice and assistance have been given to farmers and companies in the planning and setting up of bulk collection units. Consideration has also been given to the requirements for, and training of, tanker drivers, who must carry out grading, measuring and sampling of milk on farms which are units of bulk collection schemes. The expansion of the method of bulk pick-up of farm-refrigerated milk seems imminent and can be assisted by extension of farm electrification. It may be advisable in the near future to introduce legislation under Dairy Produce Acts to cover some aspects of farm refrigerated milk.

Sediment Testing.—New methods of testing for visible dirt and extraneous matter in milk have been examined and a new vacuum operated sediment tester procured for the work. This machine is superior to previous apparatus used and its use is being extended throughout dairying districts. Reference standards for use with this machine are being prepared for distribution to and use by field officers.

Efficiency of Farm Separation.—Under the Research and Promotion Grant for Dairying a survey has been carried out on the efficiency of milk separation on Queensland farms. An appreciable number, approaching 20 per cent., of milk separators are not skimming milk as efficiently as might be expected. A source of serious financial loss on some dairy farms has been revealed, and follow-up work is being carried out to pinpoint reasons for inefficient fat separation.

Antibiotics in Milk.—Trials have been carried out, in collaboration with the Dairy Research Branch and the Division of Animal Industry, to determine the rate of excretion of antibiotics in milk after experimental udder infusion, using both the disc assay and a field test for antibiotic detection. It has been shown that penicillin (100,000 units dosage) is excreted within 72 hours, "Terramycin" within 72 hours, streptomycin within seven days, "Aureomycin" within eight days, and "Streptopen 500" within 10 days. In the case of "Terramycin" and "Aureomycin" (tetracyclines) systemic feed-back from treated to untreated quarters occurs for two days, but no evidence of such feed-back was noticeable with the other drugs. Dye-marked penicillin preparations were used in the trial but the concentration of dye was too low to give colour perception after the second day following administration. It is considered that the use of dye markers in antibiotics for udder infusion would have distinctly useful possibilities at higher concentration levels. The results of these trials are being used in consideration of recommendations for the control of residual antibiotics in dairy products.

Trials with New Materials.—Trials have been completed with respect to the usefulness of a large range of new products in dairying, including stainless steel milking lines, plastic tubing of various types to replace milking machine rubberware and metal down-drops, plastic and fibreglass milk vats. In addition, new materials for use as cleaners and sterilants have been tested in the field after laboratory examination.

Cream Payment on Butterfat.—The Commonwealth Government's decision that payment of bounty in New South Wales and Queensland be made on a butterfat basis instead of on commercial butter to create uniformity with other States has made it necessary to carry out numerous field trials. The position has raised the question of volumetric versus gravimetric testing for butterfat in addition to the use of formulae for cross calculation. The initial work carried out indicates that considerable advantage would accrue from the industry in Queensland changing from volumetric testing to a gravimetric system, but some sections of the industry feel that the time is not appropriate to introduce such a change, despite the wide discrepancy which can occur in respect of individual cream samples when tested by the two methods. Following initial work which was carried out in the Dairy Research Branch, field trials have been conducted to show the efficiency of various formulae for conversion of payment on the two bases involved. These trials will be continued during the course of the next year and in the meantime the industry and the Commonwealth Government, together with the Equalisation Committee, have agreed to use one of the formulae for the purpose of bounty calculations.

Milking Techniques.—Using apparatus previously developed by an officer of the Branch, studies have been continued into milking techniques adaptable to Queensland farms which will increase the milking rate and production on dairy farms. The work has shown that a total period of 1 minute from the commencement of cow stimulation to the commencement of milking is desirable in order to achieve a maximum rate of milking and maximum milking efficiency. Cow preparation which involves washing and massaging of the udders, which normally is completed within 30 seconds, is not sufficient in itself to give maximum milking efficiency; a period of approximately 30 seconds must be allowed to permit the complete manifestation of the let-down phenomenon. Many aspects of milking techniques need to be studied and it is hoped that this work will be aided by a financial grant from the Farm Research Programme of the Research and Promotion Grant for Dairying. A paper covering some aspects of this work has been submitted for publication in the *Queensland Journal of Agricultural Science.*

Sire Surveying.—The data obtained from herd production recording has been used to assess the worth of bulls used in herds recorded under the recording schemes conducted by this Branch. This surveying has been divided into two sections: (*a*) bulls used in stud herds, and (*b*) bulls used in grade herds. Surveys of bulls used in stud herds has given valuable information to the owners of the herds and to the industry in selecting young males sired by proven bulls and produced from consistently high producing cows. A brochure is issued annually to interested farmers. The overall results of these surveys of purebred bulls have shown that of 80 bulls tested, 46 were raising production of the herd, 30 were lowering production and 4 were maintaining production. The results of surveys of bulls used in grade herds are not published but are forwarded to the herd owner for his information. There is an increasing demand for these surveys as farmers become conversant with their value. A total of 428 bulls which had 10 or more recorded daughters was assessed. Of these 35 per cent. were raising, 38 per cent. were maintaining, and 27 per cent. were lowering production.

A.I. Bull Proving Scheme.—The use of proven bulls in commercial A.I. centres will ensure that semen provided from these centres will be capable of increasing production of the herd. Bulls for proving are selected on the production record of their close female relations as obtained from herd recording data. Selection of suitable bulls available is made on the farms by a representative of the breed societies and officers of the Field Services Branch and Cattle Husbandry Branch. The proving of the bulls selected is carried out by the Herd Recording Section by a comparison of the daughters of each bull. During the year 8 bulls, 4 Jersey and 4 A.I.S., were proved.

Effect of Month of Calving on Production.—Work on this subject has been continued. It has been shown that cows calving in certain months of the year yield more than cows calving in other periods. Records over the past five years show that, owing to changing farm management practices, the optimum months have changed slightly from those previously shown. This survey has permitted field officers to draw attention of farmers to the optimum months of calving for their areas, and the noticeable trend towards increased calving in these months indicates the success of the extension work carried out. A brochure has been prepared to aid extension work in this matter and the whole study has been submitted as a manuscript for publication in the *Queensland Journal of Agricultural Science.*

Testing for Total Solids.—Most herd recording organisations are still concerned with the production of milk and fat, but there is a noticeable trend in the industry towards the utilisation of solids-not-fat, which necessitates testing for total solids. In order to establish a suitable field testing technique and obtain some data on a breed basis, the testing of some herds in the purebred scheme has been undertaken. Breeds tested were A.I.S., Ayrshire, Friesian, Jersey and goats. The variation of the percentage of solids-not-fat and fat in respect of each breed from month to month has been studied. The results show disproportionate levels of fat and solids-not-fat as the trial progressed. This work is continuing.

Effect of Test on Production of Milk and Fat.—This survey was conducted according to breed and shows that there are certain test ranges peculiar to each breed which are conducive to high yields of milk and fat. As the fat percentage of milk is hereditary, the information obtained from the survey is useful when planning the production programme.

Correlation of Type and Production.—A survey was made of the correlation between type and production of Jersey cows, type being assessed on the classification rating of recorded Jersey cows and production from their test records. The results show that, although type can be compatible with high production, the breeding for type in Jersey cattle by no means assures high production. It is concluded that type classification should never replace production as the primary consideration in dairy cattle breeding. A manuscript covering this work has been submitted for publication.

Value of Cow Families.—The importance of cow families in a production programme is being investigated. Preliminary work indicates that selection of herd replacements from high-producing families is preferred to selection from individual cows, provided that the sire has been proved satisfactory.

Lactation Curves.—The use of lactation curves indicates weaknesses or strength of farm management in addition to individual herd and cow production. Typical lactation curves have been prepared for a number of districts and are being studied as to their application in extension work.

Continuous and Discontinuous Recording.—A detailed analysis of herds which have been recorded continuously since 1949 has been made and compared with production records obtained from herds which have been recorded irregularly. The results show that where herds have been recorded continuously there has been a steady increase in production. Where irregular testing has been carried out, only slight increase is shown which is not comparable with the increase obtained in the continuously recorded herds.

Alternative Means of Testing.—Trials have been made to find a quicker, safer and cheaper method of testing fat than the Babcock method. The Gerber method has proved faster but the cost of materials and reagents is high. Another method (TeSa), which eliminates the use of acid and requires no costly centrifuge, has been tried under field conditions. It relies on the use of special detergent mixtures which give faster working speeds than the Babcock test. The method is successful and applicable under field conditions for use by Herd Recorders. At present the detergent is much too expensive to consider its replacement of the Babcock test.

Farm Work Study.—In an attempt to reduce work time involved in milking, studies have been made of the milking operations on seven farms with herds ranging from 28 to 140 cows and employing one to three operators. Officers of the Information Branch have co-operated in the planning of the work. Time and motion studies, flow process charts, and string diagrams have been used. It is hoped from this work to provide field officers with a set of standard times, suitable forms and techniques which are applicable to dairy farms generally.

Research Stations.—The reconstitution of the directorate of departmental research stations under a Research Stations Board will facilitate the carrying out of field trials at two research stations, Biloela and Kairi, where there are dairy herds. Projects are now being planned for both stations.

QUALITY OF DAIRY PRODUCE

Total production of butter for the 10 months period from July 1961 to March 1962 was almost 29,000 tons, representing an increase of 4,000 tons over the corresponding period of the previous year. Of this total, 21,600 tons were submitted for grading, yielding 45 per cent. choice and 48 per cent. first grade, a result almost identical with the grade percentages of the previous year. This matter of relatively low percentage of choice butter and an almost static position in overall grades is of some concern. It is apparent that no improvement in butter quality occurred despite improvements which have taken place in factory processing and production methods.

Much butter marketed locally in the State is not submitted to grading. During the year an assessment of the quality of this butter was obtained from pat samples collected from 20 butter factories in the State. A total of 96 samples was examined, showing an average grade score of 90.7 points with a range from 88 to 93 points. It was necessary to draw the attention of those factories marketing butter below 90 points quality to the requirement of the Dairy Produce Acts.

Cheese quality, on the other hand, has reached an all-time high. The percentage of choice and first grade has risen from 92 to 95 and reflects great credit on both the industry and Departmental officers who carry out regular surveys of all factories.

DAIRY FARM FACILITIES

There were fewer new dairy premises constructed during the year, the total being 263, compared with 285 during 1960-61. On the other hand, there were a greater number (503) of renovations of dairy premises than during the previous year (308). There are indications that dairy farmers are making greater use of building bricks, both concrete and clay, for the construction of dairy buildings.

Statistics obtained from each dairy officer's district throughout the State have shown that there has been an overall improvement in all aspects of dairy farm facilities and hygiene. A total of 335 new dairy refrigerators has been installed, bringing the total to approximately 4,500 and representing approximately 28 per cent. of all dairy farms.

DAIRY FACTORY ESTABLISHMENTS

Three new dairy factories were registered during the year and one cheese factory (Moola) ceased operations. Dairy Associations spent more than £436,000 in rebuilding and renovating their factories and replacing worn and obsolete equipment. There are indications of the greater awareness by dairy companies of the need for such replacement in the alacrity with which many companies carry out field officers' recommendations. In some instances the industry has acted before attention is drawn to the need.

The milk intake to factories continues to increase at the expense of cream. There has been an upward trend in the State's consumption of pasteurised and heat-treated milk, particularly in western areas.

DAIRY FARM MACHINERY

Officers have continued to give service to dairy farmers in respect of dairy machinery. This service has covered milking machines, separators, refrigerators, sterilizers, and water heaters. Most attention has been given to milking machines. A total of 1,532 machines was tested with the S.E. air-flow meters and vacuum recorders. The importance of this work is shown by the fact that only 8 per cent. of machines were without fault. Officers were able to correct 338 machines (22 per cent.) immediately; the remainder required machine-shop repair.

Close liaison has been maintained with manufacturers and distributors of dairy machinery and many manufacturing firms have been assisted in producing improved equipment. All firms co-operate in submitting new materials and equipment for Departmental trial and approval.

HERD PRODUCTION RECORDING

Two separate herd recording schemes are conducted—one for the stud breeder and the other for the commercial dairy farmer with a grade or unregistered stud herd. In all, 1,301 herds were recorded, representing 7.5 per cent. of all herds.

Pure Bred Production Recording.—The dry conditions prevailing in 1961 caused the withdrawal of some herds. In all, 140 herds were recorded, a decrease of 10 from the previous year.

A total of 3,162 cows completed recorded lactations of 270 days or less. The average yield was 6,218 lb. milk and 268 lb. fat. The average fat content of the milk was 4·3 per cent. During the year a number of meritorious yields were recorded. The outstanding performance was that of the A.I.S. cow "Sunny View Little Princess 30th", which, when calved for the third time at the age of 3 years 11 months, produced 22,740 lb. milk. and 906 lb. fat in the one lactation. This represents a Queensland record for any cow at that age. Another noteworthy achievement is the lifetime production record of the A.I.S. cow "Trevor Hill Bonnie". This cow was born on 20-3-44 and in 13 lactations has given 196,068 lb. milk and 8,500 lb. fat, this yield of milk being a record for any Australian cow.

Merit Stud Register.—Stud herds which have 40 per cent. or more of the cows over the age of 4 years are eligible for the title of "Merit Stud". This indicates that there should be bulls from Merit Register cows available for sale from such herds. A total of 12 herds qualified for entry on the results of the 1960-61 recording year—seven A.I.S., one Ayrshire, one Guernsey, and three Jersey herds.

Register of Merit for Dairy Cows.—The effect of the introduction of rules requiring the whole of the herd to be recorded is now being reflected in the increasing number of cows qualifying for entry into the various sections of the Merit Register. Farmers are now seeking herd sires from cows with a number of lactation records rather than one only. Table 1 shows the number of cows of each breed which qualified for entry into the various sections during the year, together with the total entries in each section.

TABLE 1

NUMBER OF COWS ADMITTED TO MERIT REGISTER IN 1961-62

Breed	Section of Register		
	Elite	Lifetime	Intermediate
A.I.S.	5	37	81
Ayrshire	1	1	6
Friesian	..	1	1
Guernsey	2	8	15
Jersey	5	33	80
Total for year	13	80	149
Total entries in Register to date	35	281	720

Goat Recording.—During the year goats from eight herds were tested for milk and fat production. A total of 13 goats completed recorded lactations. Their average yield was 1,478 lb. milk and 49 lb. fat.

Group Herd Recording.—During the recording year which ended on September 30, 1961, cows from 1,196 herds were submitted for recording. From this total 40,550 cows from 1,161 herds completed recorded lactations. The average yield was 390 gal. of milk and 162 lb. fat. This result represents a decrease of 13 gal. of milk and 7 lb. fat from the previous year. This decrease is attributed to drought conditions which prevailed throughout the herd recording year.

Despite the adverse conditions, the average length of lactation increased from 243 to 250 days. When group recording commenced in 1948-49 the average length of lactation was only 220 days (about 7 months). This meant that as most cows calve once a year, they were dry for five months, or 40 per cent. of the period. The average length of the dry period has now been shortened to four months.

Calf Identification.—During the year 7,812 calves from 662 herds were tattooed by Herd Recorders for identification purposes.

EXTENSION WORK

As would be expected, the work of extension is a major function of the Branch and officers are constantly striving to obtain wider application of improved methods on dairy farms and in factories. The abilities of officers in this aspect of their work have been improved by newer methods of extension taught in the Departmental extension schools. On farms, extension work has been aimed at increased production and improved quality of produce. It has become apparent that on many farms increased production will bring with it the desired improvement in quality.

Dairy Production.—It seems clear that increased dairy production as a step towards increased farmer income can be achieved only by farm planning involving the whole field of dairying. Officers have been encouraged to approach farmers with farm planning in view. There are some indications that this approach is appreciated and used by dairy farmers. An important basis for such planning lies in herd production recording, which provides a measure not only of the worth of each cow in the herd but also of the whole farm programme.

A great deal of attention has been given to how best to advise farmers to interpret and use the results of herd production recording. This is now being done by preparing progressive annual herd analyses in summary form, which list the production of each cow. These summaries make it possible to grade each herd into three production categories and permit the study of cow families. Cows in the lower group are identified for culling as opportunity arises, while the breeding programme is based on the families of cows in the top third of the herd and, if necessary, in the middle third. The same summaries provide information on calving patterns, length of lactation period between calvings and length of dry period. These summaries are discussed with farmers and the farm programme examined.

Officers have co-operated with factory managers to plan calving patterns which will ensure a continuity of supplies of milk throughout the year and at the same time make the greatest use of the optimum calving period. The results of herd production recording for the State have been published in the *Queensland Agricultural Journal,* press, *Recording Notes* and special bulletins. In addition, numerous herd recording meetings have been held and radio talks given. *Recording Notes* is a monthly publication which is forwarded to all recording farmers and the press. It has proved useful as a means of disseminating information on the results of surveys and other dairy information. The Pure Bred Annual Report and the sire survey bulletin are eagerly sought by dairymen as an aid to selection of herd sires.

Despite the reduction in the number of dairy farms, the acreage of improved pastures has remained substantially the same as during the previous year. Nevertheless, this position is not so good as desired and a greater increase in acreage laid down to irrigated and dryland pastures is being sought. On the other hand, there has been an increase by some 20 per cent. in the amount of fodder conserved on dairy farms in the form of hay, silage, and grain. This position is heartening and must result in improved nutritional levels for dairy stock.

Quality Improvement.—Extension work directed towards quality improvement is made difficult by low farm income from dairy products on many farms and the very narrow differentials in payment which exist between choice, first and second grade cream. It is worthy of note that two dairy companies have voluntarily increased the price margin between first and second grade cream from 1d. to 6d. per lb. commercial butter, while another association has resolved not to accept second grade cream in one of its factories. The impact of these measures on quality improvement has been very great. In the case of cheese milk the legislated compulsory differential of at least 2d. per lb. of fat between first grade and second grade milk is having a beneficial effect, particularly where some companies have widened the margin beyond 2d. However, payment for much liquid milk for the pasteurised trade is made entirely on a gallonage basis without any differential for quality.

Nevertheless, in the face of these difficulties some advance in quality improvement is being made steadily. There have been improvements in dairy buildings and equipment and a wider application of cooling and refrigeration on farms. More farms are now complying with the required hygienic standards in regard to both equipment and methods. The wider electrification of dairy farms has assisted in this improvement.

Officers conducted 454 field days, evening meetings, farm tours, and demonstrations during the year. In addition, officers made more than 26,000 farm visits and dealt with more than 10,000 enquiries. A large number of pamphlets, press articles, extension notes and radio talks were prepared.

Dairy Education.—A further buttermakers' school was conducted for senior factory operatives at Gatton College. This was achieved with the co-operation of the Department of Education, the Australian Society of Dairy Technology and the Australian Dairy Factory Managers and Secretaries Institute. This was the third such school conducted and the attendance of nine students was somewhat disappointing in view of the promised support of the industry. There are still 16 butter factories in the State which have not been represented at these schools.

The training curriculum provided embraced lectures in basic dairy chemistry and bacteriology, processing and manufacturing techniques, quality control schemes and staff supervision. In addition, there were laboratory practical periods and conducted tours of selected factory plants.

Attention has also been given to the standardisation of dairy certificates of competency issued by the various State Departments of Agriculture. This work was initiated on an Australia-wide basis by the Society of Dairy Technology and the Institute of Dairy Factory Managers and Secretaries.

Consideration is now being given to the setting up of short-term winter courses for dairy personnel embracing a period of some 3–4 months' study and laboratory experience for each of two consecutive years. It is felt that such a course is needed in the industry and will form a parallel to similar courses available in other States and dairying countries.

Dairy Extension Advisory Committees.—Officers have continued to act in the capacity of secretary to the Dairy Extension Advisory Committees constituted in the major dairying districts of the State. These committees are continuing to carry out useful work in assisting in the wider application of improved dairying practices. During the year the West Moreton D.E.A.C. was responsible for the setting up of the Laidley Dairy Development Committee, which consists of farmer representatives, the factory manager, and a representative of the Managers of local banks, with the Departmental Dairy Officer as secretary. The constitution of this committee represents a new approach to the co-operative solving of farmer's problems. In its work the committee obtained quick and spectacular success in raising the percentage of choice grade cream supplied to the Laidley factory. It is hoped that this Committee may be taken as a pattern for co-operative development in other dairying areas.

COMMONWEALTH DAIRY INDUSTRY EXTENSION GRANT

The number of pasture demonstrations has shown a decline in recent years, while there has been an increase in silage demonstrations, particularly the self-feeding bunker (or clamp) type. Farmers are ever seeking cheaper and easier ways of feeding silage. Water harvesting demonstrations are proceeding and valuable cost detail is being collated. On several farms it was shown that the rapid decline in dairy production in late summer could be arrested by grazing the herd on a crop of cowpea. This practice could be more widely adopted when good supplies of wilt-resistant cowpea seed become available.

At the beginning of the year there were 103 farm demonstrations. Twenty-six projects were terminated during the year and 33 new ones approved, leaving 110 at the end of the year.

Cheaper methods of farm cooling of milk and cream have been demonstrated. A great deal of interest was displayed in a converted domestic type refrigerator for use as a drop-in unit in a farm-built concrete tank. This adaptation has permitted refrigeration on smaller farms for as low as £65. Modifications have been made to the reinforced concrete plaster water tank developed under the Grant. The principal modifications involve methods of reinforcing, and a new pamphlet covering these has been produced. This tank has created considerable interest throughout the State from property owners in all spheres of agriculture.

Grant funds were again used to prepare an exhibit at the Royal National Association Exhibition. The exhibit featured milk and milk products. This exhibit has also been displayed at the main provincial shows. Smaller package exhibits have also been prepared featuring cheaper farm refrigeration and the reinforced plaster water tank.

DAIRY RESEARCH BRANCH

The scientific and technological advances taking place in so many directions in dairying today suggest new frontiers for the industry aided by research. Important changes have also occurred in the pattern of living of consumers of dairy products, which have brought a challenge for the industry to adjust itself to new concepts of costs and competition. This adjustment is posing problems which inspired the industry to provide its own national research programme and for which the activities of the Branch have now been fully geared.

Restrictions on exports of butter to the United Kingdom have necessitated the industry seeking new outlets. Achieving a more effective use of the important constituents of milk has been a major objective of the research of the Branch.

Research has continued on new dairy foods which incorporate milk constituents which are now wasted or not used to most advantage. The trend towards pre-packaging of dairy foods with a greater emphasis on quality has continued. There are also possibilities of improving existing products and adapting them to modern eating habits.

Both the research and quality control schemes have been orientated to assist in the supply to other countries of high quality dairy produce which complies with the prescribed bacteriological and chemical standards. Almost 550,000 milk tests were performed by factories and the Branch to ensure the highest quality market milk for human consumption and 30,000 tests were made on butter to assist improvement of quality. About 28,000 cheese and cheese starter examinations were made as aids for improvement of cheese quality. In order to assist the further improvement in quality of egg pulp, a chemical and bacteriological service for the South Queensland Egg Marketing Board was continued.

The Government has approved the establishment of research laboratories and pilot plant for dairy research and plans and specifications have been completed. It is expected that construction will begin shortly and when completed will help to meet the greatly expanded research activities of the Branch and intensified laboratory quality control services.

RESEARCH

The main lines of research which have been continued include the utilisation of butterfat in new food forms; the alleviation of the weed taint problem in dairy produce; the development of new cheese varieties, their improved packaging and mechanised manufacture; and the bacteriology of cheese, cream and butter with a view to improving flavour.

Butterfat Spreads.—Because of problems in the disposal of exportable butter surplus, alternative uses of butterfat and milk protein in other food forms have been investigated. New dairy foods developed in this way have included hot and cold concentrated milk-mixes for use as flavoured milk drinks, savoury soups, butterfat spreads for use as frostings, toppings and fillings, recombined sweetened condensed milk, and shortenings for the baking industry. The methods of production have embodied reconstitution, emulsification and homogenisation. By pressure and temperature control during heating and cooling of the mixes, products with good texture and flavour have been developed. Difficulties due to mould, fat crystallisation and sandiness presented problems but these were corrected by modifications in processing and packaging. Cake toppings containing 12½–30 per cent. of butterfat were successfully made on a laboratory scale; the higher the amount of fat the better the texture of the topping.

Consumer trials in three chain stores indicated the popularity and sales potential of the concentrated milk-mixes in preference to soft drink beverages and sales were extended to 17 chain stores. The method of dispensing for retail sale uses a self-serving, refrigerated dispenser and cartons.

Sales of these products on the local market could prove helpful in increasing consumption of butterfat and skim-milk powder. They should also prove popular in South-East Asian countries.

Removal of Weed Taint from Butterfat.—Weed taint in dairy produce is a major problem in Queensland and research has continued with a view to alleviating the problem. As reconstituted milk products are becoming increasingly used in many countries, the removal of such taints from butteroil is of major importance.

Following the successful pilot scale removal of weed-tainting substances from butteroil last year, work has continued with a view to developing the process commercially. The various methods examined were those calculated to break emulsions occurring in dairy products and withdrawing the oil and water fractions separately. In-line dosing equipment and nozzle-type centrifuges have been obtained and a continuous treatment process has been developed for large-scale trials during the approaching weed season.

Because of objections to the phosphoric acid treatment and its effect on flavour and keeping quality of the weed-free oil, treatment with sodium hydroxide followed by an in-line addition of sodium chloride and a water-wash through an hermetic separator is now being used. To improve the flavour and keeping quality of the oil, all equipment has been made of stainless steel.

In order to further simplify the above methods and reduce costs, high-temperature heating devices are being developed to break the cream emulsion. Using a nozzle-type separator, weedy cream has been converted to a weed-free oil. Other methods for breaking the cream emulsion are also being examined. Some of the fundamental chemical aspects of the extraction process are being examined by the Chemistry Department of the Queensland University and the C.S.I.R.O. Dairy Research Section.

Alleviation of Weed Taints in Milk and Cream.—Research has continued with a view to determining methods of prevention of weed taint on the farm. It was found that in well-fed cows in good condition, weed taints in milk and cream were more difficult to produce than was first believed, and that small quantities of weed did not produce taint in the milk supply.

Cows receiving only weedy pasture produced weed-tainted milk at the afternoon milking, but milk produced the following morning by these animals was free of detectable taint. Only certain cows within the dairy herd were weed grazers and the extent to which they produced taint varied from day to day. Also, weed cows tend to follow a set pattern in grazing weedy pasture. It was concluded that it is not only the amount of weed ingested that determines the severity of the taint but the proportion of weed to weed-free material ingested. Well-fed cows in good condition possess the ability to "store" weed taint in their body tissues and it requires extra weed or a greater proportion of weed before taints are detectable in the milk. Where cows have access to weedy pasture for up to 2 hours following the morning milking and then either rest or graze in a weed-free area for at least 4 hours prior to the afternoon milking, there will be little, if any, carry-over of taint to the subsequent afternoon or morning milking.

As the study was somewhat limited during the last weed season due mainly to unfavourable weather conditions, it is proposed to repeat some of the experiments during the 1962 weed season. Both irrigated and dryland aspects will be studied on the one farm before extending the practices to other areas.

Improved Butter Flavour.—In recent years, as a result of intensive processing and low neutralisation, there has been a tendency for butter to lose some of its flavour. Starter butter possesses some of the desirable flavour characteristics but offers problems if salted and presents difficulties in manufacture from high-acid cream.

A series of experiments were carried out to study flavour production in cream with cultures of *Streptococcus diacetilactis* to determine the effect of time and temperature of incubation, percentage inoculum, and initial pH on growth and diacetyl production. The results of this work were published. In the course of these experiments it was found that starter growth in bulk factory cream which contained a large proportion of farm-ripened cream was slower than in low-acid cream. An investigation of individual farm supplies showed that 50 per cent. of the acid creams were inhibitory to starter growth and that this inhibition was due to the presence of large numbers of inhibitory streptococci.

Experiments were made concerning the growth of mixed starter cultures composed of organisms previously isolated from cream and also of the components of these cultures in low-acid cream. Growth and diacetyl production of the components and mixtures was slow as compared with the faster growing *S. diacetilactis* cultures.

A study was made of the effect of neutralisation on the diacetyl concentration in cream after culturing. In most cases the amount of diacetyl in the butters after one week's storage at 5°C. was higher in the butters made from neutralised cream.

Experiments were also made on a laboratory scale to investigate methods of giving better flavour to butter without acidity production. Cream was cultured with 0.5 per cent. culture and held overnight at 10°C. before churning. Butter flavour was improved and the grade raised from 93 to 94 points. If the culture was added to the cream immediately before churning, it did not influence the butter flavour. Similar experiments were also made with first quality cream in an attempt to improve the flavour of the resultant butter. Again, the small amount of culture gave the better, fuller flavour to the butter.

Investigations have now been commenced to study farm contamination of cream and the effect of different types of organisms and of temperature of ripening on flavour development.

Psychrophilic Organisms in Butter.—A survey was made to determine the incidence and types of psychrophilic organisms in Queensland butters and the results have been prepared

for publication. Butters from 35 factories were examined. The majority of isolates were classified and of these 29 out of 33 produced defects in butter. The most active genera were *Pseudomonas* and *Vibrio*. The majority of psychrophiles were very active biochemically and most could produce rabbito, rancidity, tallowy or mouldy flavour in butter. Investigations have now been commenced to determine the source and extent of psychrophilic contamination in factories.

Delayed Acid Development in Cheesemaking.—The multiplication of the bacteria used in cheesemaking can be stopped or retarded by a number of factors. This problem has been examined in association with a characteristic fermented flavour in cheese which has resulted in considerable degrading during the two previous years, but which was not of serious incidence during this year.

A number of factors in relation to this defect in cheese has been investigated, including pH, bacteriophage, antibiotics and effect of bacteral contaminants. When the highest incidence of fermented cheese occurred, it was observd that certain pairs of starter cultures were linked with "ferment" on every occasion they were used. In studies at three cheese factories it was observed that bacteriophage in certain starters persisted for a long time and that a 4-day rotation was not long enough to prevent a build-up of bacteriophage in the factory. An extended rotation of single-strain starters used singly improved this aspect and has proved successful in raising cheese quality. In numerous instances no delay in acid production was observed in the vat and it appeared that inhibition of starter activity took place in the green cheese. In all affected cheese the most significant feature was the rapid die-out of the starter.

There is no doubt that gross contamination of cheesemilk will cause flavour defects, including fermented flavour, in the cheese and studies are now proceeding on the effects of the contaminant population in relation to the rapid die-out of starter cultures in green cheese. Work was also commenced to identify the types of contaminants present and their effect.

As a number of antibiotic preparations other than penicillin are being used in many cheese districts, their effect on starter cultures and cheese manufacture is being examined.

Some aspects of this research work are now being prepared for publication.

New Cheese Varieties.—A promising market exists for non-cheddar varieties of cheese in this country. Queensland conditions suggest that the hard and semi-hard cheese varieties are more suitable and research has been centred on these varieties. As a result several types have already been introduced to the stage of commercialised production on a small scale. They include Gouda, Edam, "Broodkaas", Spiced and Flavoured "Smokey" and Blue Vein cheeses.

Investigations into the manufacture of stirred curd cheese have shown that careful control of moisture content and acidity is necessary to consistently produce cheese of good quality. A typical "shot hole" texture can be made quite close by hooping the curd in the absence of air. Plans have been prepared for a vertical cheese vat to aid in mechanisation of manufacture. A slurry pump for pumping curd and whey and an automatic recording pH meter have been obtained to aid in this work.

Blue vein cheese is now in regular production at one factory and an excellent flavoured product of desirable texture and body has been developed. Samples have been examined chromatographically in order to establish chemical pathways by which normal and abnormal flavour is developed. The different degrees of flavour intensity recorded for fatty acids and amino acids indicate the importance of controlled ripening conditions and manufacturing techniques. The lipase activity of milk and of cultures of *Penicillium roqueforti* was also determined. Different cultures have been tested and those showing the highest lipolytic activity have proved most successful in manufacture. The milks were also examined after various heat treatments to determine the extent to which milk-lipase survives the pasteurisation temperatures used. The aim of this work was to bring about the development of the full-matured flavour of blue vein cheese in a shorter time.

The most restrictive factor in regard to blue vein cheese production could be the high manufacturing cost. For this reason, endeavours have been made to mechanise the process as much as possible. A small cheese turning machine intended for automatic operation has been developed and successfully operated under manual control.

Open-texture in Cheddar Cheese.—Open-texture in cheddar cheese has been a problem for many years. The effect of the exclusion of air from the curd when hooping in relation to this defect is being studied. Two trials have shown that a completely close cheese can be obtained by excluding air from the curd by such means as hooping under the surface of a liquid (e.g. brine) or by slowly pouring the curd through the liquid into the submerged hoop. The results have an important bearing on the design of mechanical hooping equipment such as vacuum hooping devices.

Surface Defects of Cheese.—Surface defects continue to be a problem in export cheese. Efforts have been made to introduce better control of humidity in cheese curing rooms and pre-drying rooms. Trials with metal shelving at one factory have proved these shelves, with slight modifications, to be successful. Much work has been done during the past year on the development of a suitable blend of wax for coating export cheese. The blends used at present, apart from two commercial blends, have insufficient flexibility and become crazed and cracked when stored at low temperatures. A new blend with satisfactory flexibility has been developed, using low melting point paraffin wax (Match wax—melting point 110-115°F.) to replace the higher melting point paraffin used at present.

Trials have also been carried out on the use of sorbic acid as a mould inhibitor incorporated in the wax blend. These results are at present inconclusive and trials are continuing.

Lipases in Cheddar Cheese.—Enzymes such as lipases play an important part in flavour development in cheese ripening. A knowledge of their origin, activity, behaviour and types may hold the key to more uniform and rapid flavour development in cheese. The work done on this project was concentrated on an improved method for measuring the lipase activity of cheddar cheese. Improvements have been made with regard to the extraction of the enzymes from the cheese and the digestion of the substrate. The results indicate that there is a rise in lipase activity during ripening. It is intended now to attempt fractionation of the lipase enzymes in cheddar cheese by using electrophoresis equipment. There is good evidence for believing that a method using radioactive isotopes may give more accurate and more rapid results, and this is being examined.

Antibiotics in Dairy Produce.—Concern has been expressed by public health and dairying authorities at the incidence of antibiotics in dairy products and their potential effect on public health and the quality of dairy produce. As a result, every effort has been made to ensure that milk of cows treated with antibiotics is free from such substances before being included in supplies sent to factories.

Laboratory and field testing for antibiotics is now a regular procedure. Over 6,500 tests were conducted on individual supplier's milk, tanker milk, and bottled pasteurised milk. Individual cheesemilk supplies have also been examined regularly. In addition to the disc assay, a modified non-acid test has been developed using equipment normally available at factories. This test appears to be capable of detecting concentrations as low as 0·02 I.U. of penicillin per ml. of milk. It is also sensitive to antibiotics other than penicillin. Preliminary work was also undertaken with a view to determining the incidence of antibiotics in cream supplies used in the butter industry. This covered examination of butter granules, buttermilk and wash water from the butter churns. Results of work so far carried out suggest that antibiotics other than penicillin may be present in individual milk supplies.

Keeping Quality of Market Cream.—There is room for improvement in the quality of market cream. Investigations were commenced on samples of cream pasteurised commercially to determine the effect of the post-pasteurisation contamination on keeping quality. This work is an extension of that previously carried out on cream which was pasteurised in the laboratory. The results show that the amount of coliform contamination present has a marked influence on keeping quality and suggest that a dye reduction test using resazurin may be suitable for use with cream.

FARM RESEARCH

Trials were continued on farms with a view to determining more efficient and economical techniques for improvement of the chemical and bacteriological quality of milk.

Milk Composition.—Trials on two farms have shown that the feeding of small supplements of organic acids offers promise for improving the compositional quality of milk. Where the ration fed was nutritionally sound with regard to protein, roughage and mineral requirements, the addition of a small acetic acid supplement resulted in an improvement in the fat percentage of the morning milk.

Sampling and analysis were carried out for a month before the trials began and were continued for a month after concluding the feeding of the acid supplement. The milk from the twin fed the acid supplement showed a more uniform butterfat percentage. Other organic acids are now being tried to determine their effect on other milk constituents, especially the solids-not-fat percentage.

Cheap Farm Refrigeration.—Trials on eight farms with immersion systems of farm refrigeration for milk and cream cooling continued to show their suitability, efficiency and economy. The most recent activity in the field of farm refrigeration has been towards converting the condensing units from old or superseded domestic refrigerators to drop-in units for cream cooling on farms. Farm-built insulated concrete tanks were used in all cases. Four such

units are now operating and four more are to be installed. Costs have not exceeded £75 for the tank and unit complete. Cooling capacity is around 2 gal. of cream per hour through a 50°F. range, while running time to allow for heat transfer from outside only requires a few hours' running per day even during hot summer weather.

Use was made of one installation to conduct an investigation into the necessity or otherwise for the shock cooling of cream with a view to further economy. The results have shown that pre-cooling of milk or cream over a surface cooler prior to immersion cooling is unnecessary, thus saving almost 50 per cent. of the total cost.

Improved Detergent-Sanitisers.—As quality of milk and cream is still mainly affected by contamination from dairy equipment, trials on 40 farms with improved detergents and chemical sterilants were continued. For the effective cleaning and sterilizing of dairy equipment, sodium metasilicate with a wetting agent has proved most suitable with the majority of hard farm water supplies. Sterilization was then effected with boiling water after milking and hypochlorites before milking.

Trials with a combined detergent-sanitiser were conducted in co-operation with 38 suppliers and three other types of detergent-sanitisers are currently being tried. They include a quaternary, iodophor and a chlorine-detergent mixture. As none cause corrosion of equipment, they can be left on equipment and rubberware till the subsequent milking, thereby ensuring effective sterilization.

LABORATORY QUALITY CONTROL SERVICES

The laboratory quality control services were intensified to assist in producing products which satisfy the prescribed requirements for butter, cheese and milk powders of some countries, particularly Japan.

Butter.—Examination of butter samples under the Butter Improvement Service was continued during the year to provide information for both control and advisory services. A total of 21,671 tests was performed on 2,808 samples. The average chemical composition was—moisture 15.68 per cent.; salt 1.43 per cent.; curd 0.89 per cent.; fat 82 per cent. Moisture and salt control by Queensland butter factories has been steadily improving in recent years.

A change in the bacteriological tests was applied to butters and in the advisory standard for total count. As previous work showed the inconsistency of the test for casein digesters, this was deleted and the standard for total count was reduced from 100,000 to 50,000 per ml. The Bacteriological Quality Index was reduced accordingly from a possible 400 to 300. The average B.Q.I. for the 10 months in which this new scale has been operating was 246, which compares very favourably with that of 326 on the old scale for the previous year.

In order to give a more realistic standard of factory hygiene, a new index called the Hygiene Quality Index has been introduced. This combines bacteriological results and extraneous matter tests under the one classification and avoids the anomaly of a factory with poor extraneous matter results being placed at the top of the results for bacteriological quality. The average H.Q.I. for this year was 339 out of a possible 400, which shows a good standard of hygiene by most butter factories.

Testing for coliform bacteria in butter was continued to satisfy requirements for export to Japan and a high percentage of negative results was obtained. The results indicate a good standard of factory hygiene with minimum post-pasteurisation contamination.

Considerable quantities of initially choice butter at two factories were degraded for oxidised flavour. Traces of copper were shown to be responsible for the defect. A problem of oxidative rancidity in butter and cream was traced to the presence of lipolytic and psychrophilic bacteria.

In order to assist improvement of butter quality, overcome problems of refrigeration, raise efficiency of water treatments or test steam consumption, 33 visits were made to butter factories.

Cheese.—In addition to carrying out routine laboratory examinations of samples of milk and cheese, specific factory and farm problems were investigated.

The number of starter cultures distributed (416) was considerably less than in previous years owing to the widespread use of commercial mixed cultures. The tendency to associate late phaging of single-strain starters with the development of a fermented flavour in the cheese caused this change to commercial mixed cultures. However, the use of an extended rotation of individual single-strain starters is expected to prove a much sounder practice than the continuous use of the one mixture culture. An advisory leaflet incorporating the results of recent investigations on starters was prepared for distribution to factories. Both freeze-dried and liquid cheese starters were regularly purified and tested for activity before being distributed to factories. Large numbers of freeze-dried cultures were also supplied to one Association for making cottage cheese. A total of 230 factory starter cultures was tested for purity and of these 12 were found to be contaminated.

Intensive advisory work in relation to the methods of propagating starters, the maintenance of a high standard of hygiene in the factory, and the best techniques of cheese manufacturing has continued to bring about a rise in the general level of cheese quality. Second grade cheese is becoming more rare and choice grade cheese more common.

A large number of cheese samples (749) was analysed. Although most factories exercised fairly good control over the composition of the cheese, there were some, notably those supplying most of their cheese to the local market, which produced cheese with a moisture content higher than desirable. As in previous years, it was noted that the incidence of cheese with less than 50 per cent. fat in the moisture-free substance was greatest in the spring months of the year.

On the local market the old-style rinded cheese is now an uncommon sight and has been replaced by attractively packaged rindless cheese; advice was given to factories on its production and packaging. London reports on rindless cheese were generally good although there were occasional criticisms of openness of the surface and the presence of a white crystalline surface deposit (probably calcium lactate). A study of the factors responsible as well as the influence of mould spore content on mould development in packaged cheese is being made.

There is need for greater uniformity in cheese flavour, and paper chromatography is being used to study flavour defects and desirable flavour development.

In the course of the above work and in the conduct of various investigations, a total of 236 visits to cheese factories was made. Investigations included the cause of slow vats, degrading of cheese, detergency, refrigeration, air-conditioning and water treatment problems. In most instances, while slow vats were found due to bacteriophage, there was one instance where residual antibiotics caused abnormal vat workings. In another case, bacteriologically poor water supplies were responsible for poor cheese quality.

Market Milk.—The regular testing of samples of milk and cream and examination of smears from milks with low methylene blue reduction times has continued. A summary of examinations made is set out in Table 1.

TABLE 1

SUMMARY OF MILK AND TABLE CREAM EXAMINATIONS

	1960–61	1961–62
Raw Milk—		
Methylene Blue Tests at Depots—		
Number	265,067	373,945
Per cent. below 4 hr.	1·5	2·0
Fat Tests at Depots—		
Number	122,210	130,410
Per cent. below 3·3	3·5	1·5
Bulk Tanker Samples Tested in Laboratory—		
Methylene blue tests—number	885	959
Fat tests—number	899	1,141
Raw Milk from Vendors—		
Methylene blue tests—number	373	330
Fat tests—number	384	331
Thermoduric Tests at Depots	11,363	32,692
Microscopic Examinations	1,547	2,637
Examinations for Mastitis	..	3,921
Miscellaneous Samples	..	399
Bottled Pasteurised Milk—		
Plate Counts—		
Number	1,929	1,994
Per cent. over 100,000/ml.	35	40
Coliform Tests (10 ml. and 1 ml.)—		
Number	3,107	3,125
Per cent. positive in 1 ml.	8·6	23·6
Phosphatase Tests—		
Number	1,604	2,010
Per cent. positive	0·2	0·2
Keeping Quality Tests—		
Number	1,189	1,356
Per cent. failure	1·5	0·9
Fat Tests—		
Number	1,501	1,757
Average fat per cent.	3·8	4·1
Bottle Pasteurised Cream (35% fat)—		
Plate Counts—		
Number	..	313
Per cent. over 100,000/ml.	..	17
Coliform Tests—		
Number	..	310
Per cent. positive in 1 ml.	..	39
Phosphatase Tests—		
Number	..	293
Per cent. positive	..	4·4
Fat Tests—		
Number	..	318
Average fat per cent.	..	40·5
Solids-not-fat Tests—		
Number	1,635	1,779
Average S.N.F. per cent.	8·7	8·7
Freezing Point Tests	2,023	1,524
Factory Surveys	82	49
Shop Samples—		
Number	..	24
Per cent. failure on keeping quality	..	37

TABLE 1—*continued*

SUMMARY OF MILK AND TABLE CREAM EXAMINATIONS—*continued*

	1960–61	1961–62
Bottled Pasteurised Cream (42% fat)—		
Plate Counts—		
Number	435	282
Per cent. over 100,000/ml.	17	10
Coliform Tests—		
Number	519	566
Per cent. positive in 1 ml.	17·8	49
Phosphatase Tests—		
Number	296	288
Per cent. positive	31·8	9·7
Fat Tests—		
Number	296	299
Average fat per cent.	43·8	43·8
Bottled Pasteurised Cream (18% fat)—		
Plate Counts—		
Number	265	288
Per cent. over 100,000/ml.	42	34
Coliform Tests—		
Number	512	574
Per cent. positive in 1 ml.	41	78
Phosphatase Tests—		
Number	291	294
Per cent. positive	2·1	2·7
Fat Tests—		
Number	290	305
Average fat per cent.	21·9	20·8

There was an increase in the numbers of methylene blue tests carried out at pasteurisation plants and country receiving depots and only 2.0 per cent. of milks failed to reach the advisory standard of 4 hours. These results show the high quality of raw milk supplies as judged by this test.

There was a marked increase in the numbers of thermoduric counts carried out at depots and in the number of depots carrying out such testing. Twice as many tests were made as in the previous year. Almost all country milk receiving depots have now set up their own facilities for thermoduric testing and it is hoped that all depots will soon be carrying out this testing regularly.

The testing of bulk tanker milk supplies to the Brisbane depots was continued and 883 samples were examined for methylene blue reduction time, thermoduric count, fat, milk solids and freezing point. Testing of samples from raw milk vendors was continued.

A total of 2,415 milks was examined for adulteration with water and 28 suspected samples were reported.

There was an improvement in the chemical composition of raw milk, only 1.5 per cent. of milks failing to reach the 3.3 per cent. fat standard, compared with 3.5 per cent. in the previous year.

Bacteriological examinations of farm-refrigerated bulk milks indicated the possibilities of the method in raising market milk quality.

The quality of pasteurised milk was well maintained, less than 1 per cent. of samples failing the phosphatase test or the keeping quality test. Many factories also had very satisfactory results for bacterial counts.

The average value for solids-not-fat of samples of pasteurised milk which were analysed was 8.7 per cent., the same as for the previous year, but the average fat percentage of 4.1 was a slight increase.

The regular testing of samples of 42 and 18 per cent. cream from Brisbane depots and of 35 per cent. cream from country factories was continued. The overall bacteriological quality of this cream was not satisfactory.

Several experimental batches of flavoured cultured milks prepared from skim-milk, buttermilk and recombined milk proved promising and trials are continuing with a view to producing these products. One Association is already supplying cultured buttermilk in small commercial quantities. Cultures were also supplied for the purpose of making yoghurt—a fermented milk.

A close watch is being maintained on possible effects of radioactive fallout on milk quality and samples are being taken regularly at Brisbane and Townsville in association with the Atomic Weapons Tests Safety Committee.

ANALYTICAL

A total of 6,426 samples was submitted to the laboratory for examination. These included brines, butteroils, cheese, cream, casein, detergents, egg pulp, milk, milk powders, milk concentrates, margarines and factory and farm waters. The analytical work involved the performance of over 12,000 individual tests.

High standards of chemical quality of dairy produce are being demanded by overseas countries and every precaution has been taken to ensure freedom from such substances as pesticides, antibiotics, hypochlorites, detergents and other extraneous matter.

Regular chemical analyses of casein have been carried out to help uniformity of quality and high standards have been attained.

Over 300 skim-milk powders were examined to ensure conformity with standards desired by importing countries and a high standard of quality was achieved.

New and promising tests for the more convenient and rapid estimation of fat, protein and total solids in milk were examined and further work is continuing.

The responsibility for testing of volumetric glassware for use in dairy factories was transferred to the Weights and Measures Department. Glassware conforming to the specifications of the Standards Association of Australia was approved under the Dairy Produce Regulations. Of the glassware tested prior to transfer to the Weights and Measures Department, only 1,143 pieces of 3,571 pieces tested were approved.

PUBLICATIONS

Twenty-four research and advisory papers, 15 radio talks, and 21 addresses were prepared for various conferences and schools, and 22 press releases were made.

STATISTICS

Table 2 summarises the expansion in services performed as compared with the previous year.

TABLE 2

SUMMARY OF TESTS PERFORMED

	1960–61		1961–62	
	No. of Samples	No. of Tests	No. of Samples	No. of Tests
Cheese Improvement Service	6,000	24,000	7,000	28,000
Analytical	14,000	32,000	12,000	27,000
Butter Improvement Service	5,000	29,000	6,000	32,000
Laboratory Quality Control of Market Milk	10,100	31,400	17,000	41,300
Analyses Associated with Various Research Projects	30,000	65,000	37,000	69,000

DIVISION OF MARKETING

As in previous years, the activities of the Division of Marketing through its three Branches have been associated with the promotion, development and supervision of organised marketing of primary produce; the determination, supervision and enforcement of prescribed standards for agricultural seeds, stock foods, fertilizers, pest destroyers and veterinary medicines, and farm produce; and the investigation of economic principles and farm practices as applied to rural industry.

In the sphere of organised marketing, attention in this and other States has been focussed on the problems associated with the evasion of marketing boards by certain producers under the protection of Section 92 of the Commonwealth of Australian Constitution Act or by the use of strategems aimed at giving the transactions a pseudo-interstate character. In this connection various marketing boards have been active in establishing closer co-operation on a Commonwealth basis.

The question of stabilisation of the pineapple industry continues to occupy the attention of the Committee of Direction of Fruit Marketing, and leaders in the industry have seen fit to remind the growers of the dangers inherent in an expanded pineapple acreage. The problem, however, is a complex one and an easy solution cannot be expected.

The Brisbane Market Trust, on which the Director-General was represented by Mr. H. S. Hunter (Director of Marketing), was successful in raising its loan fund allocation of £274,000 towards site preparation, paving and drainage and the installation of gas, electricity, telephone and sewerage. However, delays in completion of road and drainage work retarded initial earthworks on the site, which did not commence until October 19, 1961. Unseasonably wet conditions have caused further setbacks. The successful tender for the initial earthworks contract was £29,988 19s. 3d. Tenders for the installation of underground services, &c., were called in May by the Department of the Co-ordinator General of Public Works. The successful tender was in the amount of £246,000. During the year, assistance of a clerical nature was given in connection with this preliminary planning by Mr. N. H. Hall (Marketing Officer), who acted as Secretary of the Trust.

COMMODITY MARKETING BOARDS

A detailed description of the activities of the Marketing Boards operating in Queensland will, as formerly, be given in the Annual Report by the Director of Marketing to the Minister for Agriculture and Forestry as required under *"The Primary Producers' Organisation and Marketing Acts,* 1926 *to* 1957."

As appeared inevitable, the Onion Marketing Board went out of existence by the effluxion of time on February 28, 1962. No representation was made for its operation to be extended in accordance with the marketing legislation.

Action is proceeding to effect an amalgamation of the two Queensland Egg Marketing Boards, which of course will be subject to a poll of growers concerned on the question. Discussions on the proposal have taken place between the Boards and Marketing Branch officers and a basic constitution for the proposed Joint Board has been agreed to. If growers are agreeable to the proposal, the new Joint Board will be set up from January 1, 1963.

AGRICULTURAL STANDARDS

Following the appointment of additional staff, activities in the fields of seed testing, seed certification, and agricultural standards inspection, and fruit and vegetables inspection were further expanded. The resulting increased efforts by market inspectional staff in implementing the requirements of the Fruit and Vegetable Grading and Packing Regulations at both wholesale and retail establishments has been reflected in produce of improved quality being made available to the consumer.

Exports of fruit and vegetables from Queensland showed a rapid expansion, with 199,258 bushel cases of apples and 11,344 cases of pears being shipped to the United Kingdom, while orange shipments to Singapore and Continental destinations set a record of 15,949 bushel cases.

The Standards Officer (Mr. A. C. Peel), as the Australian delegate, attended the International Seed Testing Association Conference at Lisbon, Portugal, and with the seed Analyst (Mr. E. T. Prodonoff) represented Queensland at the Australian Seed Testing Conference at Adelaide.

Improvements in the field of seed testing has followed the installation of a large alternating-temperature germinator and an automatic cloth drier for maintaining hygienic cloth germination pads, and the appointment of three full-time cadets to the Seed Laboratory has paved the way for experimental testing of a wide range of subtropical and tropical pasture seeds.

The Standards Branch again was responsible for organising and conducting a course of instruction in seed testing and crop improvement for Asian representatives under the World Seed Campaign.

With the imposition of fees for seed certification services and the projected inclusion of hybrid grain sorghum in the certification scheme, an additional staff appointment was made to this section.

Agricultural Standards Inspectors are now offering advice on many aspects of crop and pasture seed purity and eventually this service will benefit considerable numbers of seed producers and seed merchants in this State.

ECONOMICS RESEARCH

Activities of the Economics Research Branch have been concentrated mainly on the dairying industry. With the support of the Dairy Extension Advisory Committees in the Wide Bay and Eastern Darling Downs districts, investigations are proceeding into the economic implications of various farm practices which are in use or recommended for adoption in these districts. A preliminary report on the Wide Bay work was issued during the year, some of the findings from which are discussed in the Branch report, and a similar report is in course of preparation for the Eastern Darling Downs.

The Poultry Management Study is now entering its third year and is furnishing valuable information on costs and returns. Costs on a poultry farm are so dominated by the feed bill that any economy shown in this item leads to a much greater proportionate increase in farm income. For this reason, attention is being given to determining the lowest price feeding ration in any set of varying prices for the ration ingredients.

Staff of the Economics Research Branch was increased by the appointment of two Agricultural Economists in January, 1962, bringing the professional staff to 6, excluding the office of Director of Economic Services which became vacant following the resignation of Mr. C. H. P. Defries on March 27, 1962.

Mr. A. L. O'Neil (Agricultural Economist) attended, as Queensland Government representative, the Conference of the Australian Regional Groups of the Royal Institute of Public Administration in Canberra in November 1961.

MARKETING BRANCH

MARKETING ORGANISATION

During the year the terms of operation of certain commodity marketing boards operating under *The Primary Producers' Organisation and Marketing Acts,* 1926 *to* 1957, were extended as follows:—

The Broom Millet Marketing Board from November 1, 1961 to October 31, 1967.

The Butter Marketing Board from January 1, 1966 to December 31, 1980.

The Central Queensland Egg Marketing Board from January 9, 1962 to December 31, 1962.

The Navy Bean Marketing Board from November 7, 1961 to November 6, 1967.

The Northern Pig Marketing Board from January 1, 1962 to December 30, 1967.

The Tobacco Leaf Marketing Board from January 1, 1964 to December 31, 1969.

The terms of operation of The Butter Marketing Board and The Tobacco Leaf Marketing Board were further extended at this stage to enable the Boards concerned to enter into necessary long-term marketing arrangements, to attract and give staff security and to embark on any necessary long-term building plans.

Triennial elections of growers' representatives on The Broom Millet, Grain Sorghum, Navy Bean, Northern Pig and Peanut Marketing Boards were conducted, in addition to elections to fill casual vacancies on The Tobacco Leaf Marketing Board and State Wheat Board.

As regards The Tobacco Leaf Marketing Board, the Constitution was amended by Order in Council to provide separate representation on the Board for growers in the Bundaberg, Miriam Vale and Near North Coast areas and an election conducted to fill the additional representation.

The Onion Marketing Board, which was constituted for three years from March 1, 1959, expired by effluxion of time on February 28, 1962. No request was made for an extension of its term, as it was evident that the Board had failed to retain grower support.

On the initiative of the Marketing Branch, a proposal to amalgamate The Egg Marketing Board and The Central Queensland Egg Marketing Board has been receiving consideration of the Boards concerned, as a solution to many of the marketing difficulties which The Central Queensland Board has encountered from time to time in meeting the requirements of the market in Central Queensland, and more recently, in the disposal of surplus seasonal production. Accordingly, the term of operations of The Central Queensland Board was extended from January 9, 1962, to December 31, 1962, to enable a ballot (if demanded) to be taken on the question of setting up a Joint Board from January 1, 1963. It was also found necessary, as a result of the complete lack of support from poultry farmers in the area, to excise the City of Mackay and the Shires of Broadsound, Sarina, Mirani, Pioneer and Proserpine from the Central Queensland Board's area of jurisdiction. Concurrently, another District, comprising the City of Rockhampton and the Shires of Fitzroy and Livingstone, was divided into two Districts separated by the Fitzroy River.

A ballot conducted by the Department following a petition from suppliers to the Victoria and Macknade sugar mills on the question of a levy on cane for the purposes of meeting the cost of the promotion and investigation of mechanical cane harvesting in the Herbert River District, resulted in defeat of the proposal.

At the request of the Queensland Dairymen's State Council, provision was made by Order in Council making mandatory the convening of an Annual State Conference of the Dairyman's Organisation comprising representatives of District Dairymen's Councils and also of Annual District Conferences. The Honourable the Minister for Agriculture and Forestry also approved the continuation of the Sectional Milk Producers' section within the Queensland Dairymen's Organisation until June 30, 1964.

In connection with their duties as Government Representatives on various Marketing Boards, Branch officers attended 145 Board meetings, apart from associated industry conferences and growers' meetings. The Director, as Chairman of the Brisbane Milk Board and the Director-General's representative on the Brisbane Market Trust, attended regular meetings of these bodies throughout the year.

MARKETING INTELLIGENCE SERVICES

During the year the Branch published 45 reports and forecasts. Total circulation amounted to almost 29,000, compared with 26,000 copies in the previous year, when 43 reports were issued. These reports continue to provide to Government departments, financial institutions, machinery firms or businesses supplying farmer's requirements, produce dealers, and also to producers themselves, up-to-date information on crop progress and production and market trends for primary production. Copies were also mailed on request both interstate and overseas.

Forecasts were issued on Winter Grain and Seed Crops (comprising wheat, barley, oats, linseed and canary seed), Summer Grain and Seed Crops (comprising grain sorghum, maize, white French millet and setaria (panicum)), and on peanuts, potatoes and onions. Quarterly reports on the poultry industry in south-eastern Queensland were also continued.

To improve the system of forecasting, which depends on the co-operation of farmers in the growing areas, officers of the Branch visited the South Burnett district and the Atherton Tableland, and as a result the cover for grain crops in both areas was strengthened by the appointment of new honorary crop correspondents. With a fall in the number of correspondents for other commodities, particularly poultry, the total overall number of correspondents remains at approximately 600.

The forecasting system is based on a grid sampling technique applied to the growing areas. In some areas the sample needs revising and strengthening and further field work will be required in the coming year. In this connection two physical surveys were made during the year, one for potatoes in the Lockyer and Fassifern Valleys, and one for canary seed on the Darling Downs. These surveys were found necessary to supplement the advice contained in reports from correspondents, and to supply reliable information in answer to urgent demands. The sample of poultry correspondents in particular is in need of revision, and will require basic research as well as extensive field investigation. The sample of potato growers is also in need of overhaul.

The "Report on Production Trends" continued to be published monthly. The reports give an up-to-date picture of the situation in the agricultural, pastoral and dairying industries of the State. Circulation of this publication was also increased during the year. Regular distribution is now made to all overseas countries to which there is appointed an Australian Trade Commissioner. The value of "Grain Abstracts" has been favourably reported on by farmers. Both the foregoing publications were used extensively by newspapers circulating in farming area.

In addition to preparing and distributing the regular reports and forecasts, officers of the Branch were required to provide a variety of information on trends in various rural industries and estimates of rural income and production. Many requests were received for marketing information from marketing boards, farmers, banks, businesses and students.

The publication of daily and weekly market price reports for fruit, vegetables and farm produce has continued, and circulation lifted to meet demand. The reports, available within a few hours of the close of sales, are the official basis of the daily reports issued by newspapers and radio stations. A report on fish prices supplied by the Fish Board is also issued daily. Approximately 500 copies of the daily market price reports are issued, 175 copies of the weekly report and 100 copies of the daily report on fish prices.

PRIMARY PRODUCERS' CO-OPERATIVE ASSOCIATIONS

During the year a further two artificial breeding co-operatives were registered under the Primary Producers' Co-operative Associations Acts. The Tablelands Co-operative Artificial Stock Breeding Association Limited, after a period of experimental operation without registration, obtained incorporation under the Acts and is now firmly established with dairymen on the Atherton and Evelyn Tablelands. Towards the close of the year, dairymen in the Bundaberg district grouped together to form the Bundaberg and District Co-operative Artificial Breeding Association Limited.

ECONOMICS RESEARCH BRANCH

Branch activities have been concentrated largely on management problems of dairy farmers in the Wide Bay district and poultry farmers in the Brisbane area. Progress reports were published in respect of both of these projects. As this Branch is still in the process of development, staff training and project planning have been important activities during the year.

INVESTIGATION OF DAIRYING PRACTICES

A study of the economics of dairying practices in the Wide Bay and Eastern Darling Downs districts continued throughout the year. This work is being carried out at the request of the Dairy Extension Advisory Committees in the respective areas.

Budgetary analysis is being used to examine the effects on capital investment, costs and returns, and labour usage, which might be expected to follow changes in farm practices on a number of typical farms. Data for the budgets are obtained at joint meetings between each farmer and officers of the Divisions of Plant Industry, Animal Industry and Dairying, and the Economics Research Branch, at which technically feasible lines of development for the farm are discussed.

The purpose of the investigation is to produce economic data which will be of assistance to farmers and field officers when considering possible changes in farm practices. Although the research is being conducted on a limited number of 50 farms in each district, these farms have been carefully selected by the respective Dairy Extension Advisory Committees as representing typical farm types in these districts. This was to ensure that the information obtained would have a wide general application.

As a preliminary step in the investigation, a survey was made of the sample farms. The purpose of this survey was to arrive at a clear picture of the existing situation on these farms, of the practices adopted, resources available, and their economic strengths, weaknesses and problems. Each farm was treated in considerable detail, as the data collected in this preliminary survey formed the basis for initial consideration by the inter-branch panel of ways in which to improve farm income. A report on the preliminary survey in the Wide Bay area was produced in the first half of the year.

A comparison of the economic structures of the sample farms was made in an attempt to gauge the extent to which profitability was affected by the size of various factors of production. It was found that generally speaking larger scale operation tended to result in higher farm incomes than smaller scale operation. However, after providing for a reasonable return on capital invested and a reasonable wage for unpaid labour, the resultant return to management appeared to be unaffected by size. For example, analysis produced no evidence that farms with larger areas or greater capital investment are more efficient, in terms of return to management, than farms with smaller area and capital investment. The same considerations applied to the amount of available labour and the stocking rate.

It is clear that management ability is an important factor in determining a dairy farmer's profit-making capacity. This is the most likely explanation of the sometimes wide variations in returns to management from farms of similar size, capital structure and natural resources.

There was one factor which was found to be closely associated with returns to management. This was the level of production per cow. Farms on which the production of butterfat per cow was above average tended also to have returns to management above average, and vice versa.

The preliminary survey supported the contention that the first step necessary in raising the level of efficiency on many farms in this area is to concentrate on increasing productivity per cow. For those sample farms on which low output per cow appears to be the main obstacle to satisfactory returns, budgets are being prepared to examine the financial aspects of improved feeding practices recommended by the panel of Departmental advisers. Included in the practices being analysed are silage, improved dryland pastures, irrigated pastures, water harvesting, the feeding of concentrates, and supplementary cropping.

It should be emphasised, however, that the investigation is not being confined to methods of increasing production per cow. In some cases this is the only way to achieve a reasonable standard of living. On other farms in the sample, production levels are satisfactory and the best prospects of improving their financial returns are by reducing costs, perhaps by alternative methods of feeding, and in some cases by greater diversification, such as expanding some activity other than dairying.

Completion of this investigation is still some distance away, but it is proposed early in the coming year to issue an interim report, presenting summarised budgets of a number of case-studies completed to date. Information collected in the preliminary survey in the Eastern Darling Downs is in process of analysis and a report similar in form to that prepared for the Wide Bay area will also be issued during the coming year.

POULTRY MANAGEMENT INVESTIGATION

A management study of poultry farms in the Brisbane area is being carried out on a continuous basis. This work was commenced in co-operation with 9 farmers on July 1, 1960. The same farmers have continued their co-operation during the 1961-62 financial year, and it is hoped to increase this number for the coming year.

An analysis of costs and returns for 1960-61 was completed and published during the year for general information. Findings were also discussed with each co-operating farmer. These farmers have welcomed the opportunity of comparing their results with those of others in the group. This type of comparison is a sure method of drawing attention to relatively inefficient aspects of the farming business. Progressive figures for 1961-62 provide evidence that serious attempts are being made by some farmers in the group to overcome weaknesses which were apparent in the 1960-61 figures.

Income and costs fluctuated widely on these farms, caused mainly by variations in flock size, laying rate and feed cost. The cost of feed has a highly significant effect on the profitability of poultry farming. It was found that feed costs were almost 80 per cent. of the total cash costs on these farms during the year, and about three times as great as the average cash surplus, which is the difference between cash receipts and cash payments. It is clear from this that a given percentage saving in the feed bill would give a more than proportionate increase in cash surplus, provided the nutritive level remained unchanged. For example, if it was possible to reduce feed costs by 10 per cent. without reducing output, the average cash surplus would be increased by more than 25 per cent., and on some farms would be doubled.

It was found that although the farms with the highest feed cost per layer had the highest rate of lay, their cash surpluses fluctuated widely. At the other end of the scale, the farms with the lowest feed cost per layer had only average rates of lay, but their cash surpluses were consistently high. This sensitivity to the feed bill makes the poultry industry eminently suitable for econometric analysis.

Analytical work involving the use of linear programming has yielded promising results in the determination of a set of "least-cost" rations, one of which would apply in any given feed price situation. It is intended that further analytical work will be carried out into the costs of feed, the practice of flock replacement, culling, and other aspects of poultry farm management.

EXPERIMENTS IN COST CONTROL

As in former years, a number of farmers and graziers were given assistance in preparing annual and partial budgets and in setting up appropriate recording systems. Most of these farmers are co-operating in continuous experiments in budgeting and recording techniques. In this type of study, determination of the economic results of the farm's operations is not of primary interest. The aim is to test the hypothesis that certain recording and budgeting practices will, over a period, improve the farmer's efficiency.

One of the most interesting of these case studies concerns a partnership in the Granite Belt producing carrots, tomatoes and celery under a highly intensive system of production, with a large full-time labour force. At the request of this firm, an enterprise cost accounting system was designed and installed at the commencement of the 1960-61 financial year.

The main problem in costing products on a mixed farm is in the allocation of labour cost. This has been overcome on this farm by the use of Time Cards, which are completed daily by each employee. The work of analysis and preparation of cost statements for 1960-61 was carried out in the Economics Research Branch during the first part of the year under review.

Time and expense involved in intensive recording systems such as this can only be justified if the information brought to light leads to considerably improved performance. This will not be known until the 1961-62 and possibly the 1962-63 figures have been analysed.

Farmers are the last of the major entrepreneurial groups to realise that budgeting and cost control are indispensable tools to successful business practice. It is hoped from these experiments to produce case-study evidence which will assist in making farmers aware of this fact.

VEALER SIDELINE ENTERPRISE

A method of diversifying activities which is being considered by some dairy farmers is the adoption of a vealer sideline. Unless there are unused resources of land, and introduction of vealers into a dairying programme normally involves a reduction in the milking herd. The farmer's decision as to whether he will divert portion of his herd from milker to vealer production or not depends on his estimates of what the net income from vealers will be, compared with the reduction in net income from the milking herd.

A study aimed at clarifying the economic issues involved in this type of diversification was completed and published during the year, to assist farmers who are facing this decision. The study took the form of a budgetary analysis of alternative enterprises and practices on a farm relying almost entirely on native pasture in the Murgon district.

Findings from a single case study do not necessarily apply generally, as each farm has different characteristics. Detailed studies of individual cases do, however, reveal the main points which should be considered by farmers thinking of taking similar action. The interest which this report has aroused clearly indicates that farmers are looking for this type of guidance.

FARM MANAGEMENT ACCOUNTING GROUPS

During the year, a method was formulated for obtaining a continuous supply of farm records to serve as primary farm management data. There is an urgent need for a continuing supply of this data, as many farm economic investigations lack the element of continuity.

With the co-operation of the South Burnett Dairy Extension Advisory Committee, a service known as Farm Management Accounting Groups is to be inaugurated. Under this system, groups of farmers will maintain records which will enable each farmer to be supplied with a detailed analysis of his own business operations and a comparison of his operations with the averages of the group. Departmental officers who are members of the Dairy Extension Advisory Committee will join with an officer of the Economics Research Branch in discussing the comparative statements with farmers at the end of each financial year.

The establishment of this scheme is a significant step in this Branch's development. Similar work is common in countries where farm economics research is well established, and experience has proved its worth, both to co-operating farmers and to the institution conducting the service. Although the system will be operating in the coming year as a special project for the South Burnett Dairy Extension Advisory Committee, it is hoped that years to come will see an extension of the work into many fields of Queensland primary industry.

EXTENSION

Although research is its primary function, the Branch believes that it can also play an important role in developing an appreciation of economic principles within the rural community. All technical officers have attended a Departmental Extension School, and every available opportunity has been taken to further this end.

During the year, 2 articles were contributed to the *Queensland Agricultural Journal*, and 11 notes for the feature page "Profit and Loss". Two duplicated reports were published, and articles were prepared for the press and a rural publication. Talks were delivered to a Junior Farmers' School at Gympie and to a Winter School in Agricultural Science at Gatton. There was one A.B.C. Country Hour Talk, and a number of short talks were tape-recorded for country broadcasts.

In addition, advice on economic principles and assistance in their application has been freely given on request to farmers and officers of other Divisions of the Department.

STANDARDS BRANCH

Following the appointment of additional staff, Branch activities were expanded during the year to ensure that standards of quality for agricultural produce and for materials used in agricultural production were maintained at a satisfactory level.

SEED TESTING

Seed samples examined by the Seed Laboratory act as routine checks on the quality of all crop, pasture and vegetable seed offered for sale in this State. Thus 11,410 germination and experimental tests were carried out on a wide variety of

seed samples received from merchants, seed producers, Government departments, seed certification officers and Standards Branch Inspectors.

The changing and demanding pattern of the grazing industry, with accent on pasture development, has emphasised the necessity to intensify and develop new laboratory techniques for testing a wide range of subtropical and tropical pasture seeds. Progress with grass seed testing reached a high peak, with 1,700 samples being submitted for purity and germination determinations.

Long-range experimentation with dry-conditioned vegetable seeds continued to demonstrate the efficacy of aluminium foil and sealed can packaging techniques. During the year 863 germination tests on this class of seed confirmed early expectations that quality vegetable seeds will now be available for use in subtropical and tropical regions in this State and for export to markets in the South-west Pacific area.

All seeds imported into Queensland were examined in connection with Commonwealth plant quarantine activities, while 1,073 samples representing 221,000 bags of bird seed grain were examined for purity requirements prior to export to the United Kingdom, the Continent and Japan.

Details of seed testing activities are given in Table 1.

TABLE 1

SUMMARY OF SEED SAMPLES EXAMINED

Source of Samples	1960–61	1961–62
Inspectors of the Branch	2,911	1,964
Seed certification	307	652
Experimental projects	629	657
Submitted samples—		
(i) Merchants	5,389	4,723
(ii) Farmers	193	253
(iii) Government Departments	1,290	895
Total	10,719	9,144
Germination Tests Carried Out	10,033	11,410

SEED CERTIFICATION

Seed certification continues to play an important role in increasing the production of Queensland crops. Certified seed of hybrid maize, grain sorghum, sweet sorghum, sudan grass, French beans, tomatoes and buffel grass enjoys a ready market both in this State and with interstate interests. Standards Branch continues to be responsible for the overall administration of the seed certification scheme, and for the integration of the many phases of seed production involving farmer co-operation and the many field activities handled by seed certification officers attached to both Agriculture and Horticulture Branches.

As a buoyant market exists for maize grain as stock food, ready sales of certified hybrid maize seed totalling 16,333 bus. were made in the past season. High germination was a feature of all hybrid maize seed, with 96 per cent. of seed being certified with a germination of 90-99 per cent. An important advance saw the introduction of a voluntary scheme by the Queensland Certified Hybrid Maize Growers Association whereby all seed maize was size-graded. Basically this scheme, supervised by the Senior Seed Certification Officer, resulted in five uniform grades of seed being available to farmers who establish 84,000 acres with Queensland hybrids each season.

Approximately 20,000 bus. of grain sorghum seed was certified, and in addition 4,000 bus. of hybrid sorghum seed produced under supervision of Departmental officers was available for sale. During the year the Seed Certification Committee decided to provisionally include three grain sorghum hybrids in the certification scheme, the final decision to be dependent upon the results of certain official yield trials. Thus 850 acres of hybrid crossing plots comprising the varieties Texas 610, Texas 630 and Brolga have been grown under certification requirements. The availability of certified hybrid grain sorghum seed will ensure that farmers' crops will yield an average of at least 15 per cent. more grain than the better standard varieties, and furthermore the crops will equal the average of the better standard varieties in resistance to disease and insects.

Only 243 bus. of Italian and 178 bus. of Sugardrip sweet sorghum were certified, this seed mainly being purchased by non-certified seed producers who desire to maintain the genetic quality of commercial seed stocks offered for sale throughout the State.

Certified sweet sudan grass seed produced by two growers totalled 95,000 lb. Aerial application of a foliage desiccant was successfully undertaken on a portion of one crop. Desiccation allows direct harvesting to be undertaken, and indications are that germination and seed viability are not impaired.

Certified French bean seed amounting to 637 bus. was grown solely for use by commercial interests, who now produce approximately 16,000 bus. of approved bean seed in this State under Departmental supervision.

Certified tomato seed production increased, with sales of this seed meeting a steady demand. Certified tomato seed has had a tremendous influence on improving the quality of commercial tomato crops, and this influence is expected to continue.

Certified Biloela strain buffel grass produced during 1960-61 totalled 789 lb., with germination values ranging from 34 to 49 per cent. being well over the prescribed standard of 20 per cent.

Limited stocks of certified seed are being carried over in merchants' stores, and routine sampling is being undertaken to check seed viability. Viability of all seed lines is being maintained and thus regular sampling ensures that the highest quality certified seed is available to primary producers.

A summary of the production of certified seed is set out in Table 2.

TABLE 2

PRODUCTION OF CERTIFIED SEED

Crop	1959		1960		1961	
	Certified	Refused	Certified	Refused	Certified	Refused
Hybrid maize (bus.)	11,107	341	6,540	17½	16,333	114
Grain sorghum (bus.)	28,686	6,015	16,766	..	19,767	184
Sweet sorghum (bus.)	1,692	45	3	..	421	..
Sudan grass (lb.)	83,532	1,350	120,066	..	94,585	..
French beans (bus.)	371	28	504	6½	637½	36
Tomatoes (lb.)	466	..	109½	9½	218	3
Buffel grass (lb.)	..	640	25	..	789	..

REGISTRATION OF AGRICULTURAL REQUIREMENTS

Agricultural requirements such as pest destroyers, veterinary medicines, stock foods, fertilizers, lime, growth regulating substances, and marking preparations must be registered before being offered for sale in Queensland. Applications for the registration, re-registration or extension of registration of 3,762 agricultural requirements were received, compared with 3,528 in the previous year.

The Agricultural Requirements Board at 23 meetings reported on the efficacy of 1,163 preparations, of which 1,045 were pest destroyers and 118 veterinary medicines. On the recommendation of the Board, 9 pest destroyers and 1 veterinary medicine were refused registration.

New trends in agricultural chemicals include the marketing and registration of maneb (manganese ethylene bisdithiocarbamate) as a general-purpose fungicide for use as a dispersible powder, as a dust and in combination with insecticides, miticides and other fungicides. In the animal field, thiobenzole was registered for the control of roundworms in sheep, this particular chemical being marketed as a dispersible powder.

All applications for registration of stock food and fertilizer preparations are being reviewed this year. Soybean meal and fish meal are now being incorporated in a number of stock foods, while two high-urea licks for feeding to cattle were registered. Urea, which is of value to cattle in dry periods for utilising low-quality roughage, can be dangerous in excessive quantities, and certain warning paragraphs have been incorporated on labels to ensure that buyers are aware of the dangers.

Movements in the fertilizer field include the use of aqua-ammonia and anhydrous ammonia as sources of nitrogen in the sugar industry, and the registration of complex fertilizers from Continental sources in competition with locally formulated complete fertilizers.

INSPECTION—AGRICULTURAL STANDARDS

In order to ensure that the provisions of *The Agricultural Standards Act of* 1952 are complied with, Agricultural Standards Inspectors maintain regular inspection services throughout the State. Intensification of activities in the main production areas of south-eastern Queensland was a feature this year, whereby inspectors visited 150 towns and carried out 1,526 inspections.

Inspection of crop and pasture seeds offered for sale in the main agricultural districts was confined to selective sampling rather than to complete sampling. An important innovation resulted in a visit by the Senior Inspector to guinea grass seed production areas on the wet tropical coast. A large percentage of the guinea grass seed being offered for sale can only be regarded as sub-standard, and joint efforts by officers of both Standards Branch and Agriculture Branch to improve seed quality are expected to result in material benefits to farmers and graziers concerned with the establishment of tropical pastures.

Details of action taken with respect to unsatisfactory seed are set out in Table 3.

TABLE 3

ACTION TAKEN ON UNSATISFACTORY SEEDS

—	1960–61	1961–62
Agricultural crop seeds cleaned under supervision or by instruction ..	3,177 bags	2,131 bags
Destroyed or otherwise rendered unsuitable as seed—		
(i) Agricultural crop seeds ..	501 bags	164 bags
(ii) Vegetable seeds	1,432 lb.	625 lb.
(iii) Packeted seeds	242 pkts.	526 pkts.
Processed for stock foods—		
(i) Agricultural crop seeds ..	625 bags	521 bags
(ii) Vegetable seeds	510 lb.	..

Intensification of effort was focussed on the inspection of agricultural chemicals, this action resulting in the detention of a greater number of unregistered preparations than in the previous year. Similarly, routine inspections of prepared stock foods were maintained, with samples being analysed by the Agricultural Chemical Laboratory.

During the year, 5,834 consignments of farm produce were inspected at either the Roma Street railhead or the interstate railway yards at South Brisbane and Clapham Junction. These consignments comprised 140,544 bags of chaff, 301,339 trusses of hay, 63,853 bags of grain and 24,674 packages of sundry materials. In all, 46 consignments were detained, and wherever possible the produce was released when the particular deficiency was remedied. The scheme to divert detained sub-standard hay and chaff to holding yards at the Brisbane Abattoir continued to operate satisfactorily and 254 bags of chaff and 1,270 trusses of hay were 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

—	1961–62					
	Fertilizers	Lime	Pest Destroyers	Veterinary Medicines	Stock Foods	Total
Samples received from—						
Inspectors	65	21	127	17	529	759
Buyers	2				10	12
Seized	91 (*b*)	422 (*b*)	1,685 (*b*)	13 (*b*)	510 (*a*) 1,270 (*c*) 3,208 (*d*)	
Reconditioned, relabelled or deficiency rectified ..	91 (*b*)		1,517 (*b*)	13 (*b*)	254 (*e*) 419 (*a*) 3,208 (*d*)	
Destroyed		422 (*b*)	164 (*b*)		— (*e*) 91 (*a*)	
Diverted to Abattoir					1,270 (*c*) 254 (*e*)	
Withdrawn from sale			4 (*b*)			

(*a*) Bags of prepared stock foods ; (*b*) Packages, tins or bottles ; (*c*) Trusses of hay ; (*d*) Bags of grain ; (*e*) Bags of chaff.

The Senior Inspector visited the Rosevale-Mt. Walker branch of the Queensland Dairymen's Organisation to discuss handling procedures for farm produce consigned to the Roma Street produce auctions.

INSPECTION—FRUIT AND VEGETABLES

All fruit and vegetables marketed in Queensland are required to meet minimum standards as defined in the Fruit and Vegetable Grading and Packing Regulations. Inspection services are provided to protect consumers, and indirectly producers, and these inspections ensure that unsound, diseased or undersized fruit and vegetables do not interfere with orderly marketing.

Regular daily inspections were carried out at the wholesale markets, together with 2,941 inspections of retail establishments at Brisbane, Ipswich and Redcliffe. Implementation of uniform inspection procedures throughout the State followed a visit by the Senior Inspector to country centres such as Toowoomba, Bundaberg, Rockhampton, Mackay, Townsville, Innisfail and Cairns.

Inspections on deliveries by road and rail to produce merchants totalled 358,344 bags of potatoes, 72,461 bags of pumpkins and 238,646 bags of onions. Of these totals, 7 per cent. of the potatoes, 6 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.

Regrading and reconditioning of fruit and vegetables constituted an important activity during the year. Careful supervision in the re-treatment of 88,352 packages resulted in the release for sale of all sound produce. Maturity testing of grape and citrus fruits was continued and when necessary immature fruit was withheld from sale.

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.
Fruit—					*Vegetables*—				
Tropical fruits	1,220	..	..	..	Cucumbers and salad vegetables	992	..	4	..
Citrus fruits	3,820	..	..	..	Potatoes	25,876	..	..	..
Apples and pears ..	10,921	..	..	..	Onions	29,110	..	..	..
Stone fruits	3,800	..	..	..	Pumpkins	4,453	..	..	..
Tomatoes	4,687	..	..	..	Root vegetables	630	..	..	..
Rockmelons	639	..	..	..	Other vegetables	1,248	..	354	66
Other fruits	956	1,456	..	..					
Totals	26,043	1,456	..	..	Totals	62,309	..	358	66

TABLE 6

MARKET CONDEMNATIONS—FRUIT AND VEGETABLES

	Pkgs.	Lb.	Doz.	Bun.		Pkgs.	Lb.	Doz.	Bun.
Fruit—					*Vegetables*—				
Tropical fruits	2,461	639	270	232	Cucumbers and salad vegetables	6,210	..	626	1,080
Citrus fruits	3,665	..	..	..	Cabbages, cauliflowers	1,164	..	3,294	..
Apples and pears	12,079	..	..	..	Beans	6,772	1,219	..	..
Stone fruits	8,917	..	..	..	Potatoes	4,325	..	..	..
Tomatoes	12,349	..	..	..	Onions	4,931	..	..	..
Rockmelons	3,472	..	..	..	Pumpkins	1,265	..	..	..
Other fruits	2,056	21,615	134	..	Root vegetables	3,356	165	..	877
					Other vegetables	4,004	206	..	1,460
Totals	44,999	22,254	404	232	Totals	32,027	1,590	3,920	3,417

The drive to acquaint producers with fruit and vegetable standards continued, by officers attending growers' meetings and certain industry advisory committee meetings. Active participation by the Senior Inspector in New South Wales Departmental potato field days in New England has resulted in improved quality and packaging of potatoes from this important interstate source.

IMPORTS AND EXPORTS

Imports of seed for sowing (Table 7) were highlighted by the entry of 11,691 bags of velvet beans from South Africa and the entry of 195 bags of centro seed from Indonesia and Malayan sources. Seeds from these sources frequently contain prohibited seeds and soil, and to meet Commonwealth plant quarantine requirements, cleaning under the supervision of Standards Branch inspectors is invoked before releasing the seed for sale. Added risks from new plant diseases are ever present and it is advisable that all crop and pasture seed imported into this State be cleaned and effectively treated with a fungicide before being released for sale.

TABLE 7

IMPORTS—SEED FOR SOWING

Agricultural Seeds—	Bags
Centrosema	195
Pueraria javanica	2
Stylosanthes gracilis	4
Mangel	10
Clover	161
Rape	92
	464
Grass Seeds—	Bags
Molasses grass	22
Guinea grass	120
	142
Velvet Beans	11,691 bags
Vegetable Seeds—	Lb.
Beet	214
Cabbage	30
Carrot	90
Cauliflower	7
Celery	6
Cucumber	70
Lettuce	51
Marrow	11
Melon	43
Onion	10
Pumpkin	7
Radish	9
Turnip—kohl rabi	36
Miscellaneous vegetables	39
	623
Peas	407 bags
Herbs for culinary purposes	1,170 lb.
Miscellaneous parcels	172 bags

Grain and crop seed exports (Table 8) continue to be a valuable source of income for farmers and merchants. Important exports include 221,000 bags of bird seed grain, 473 tons Poona cowpea grain and approximately 50 tons paspalum seed from northern New South Wales.

TABLE 8

EXPORTS—GRAINS, SEEDS, &C.

Barley	130,383 bags
Beans	48 lb.
Buffel grass	162 lb.
Canary	80,209 bags
Cowpea	473¼ tons
Carpet grass	42,320 lb.
Centrosema	614 lb.
Clover	39 lb.
Green panic	7,811 lb.
Guinea	2,673 lb.
Japanese millet	1,190 bags
Lucerne	160 lb.
Lupin	30 lb.
Maize	84 bags
Mixed bird seed	70 bags
Molasses	1,256 lb.
Onion	13 lb.
Paspalum	106,626 lb.
Peas	29 lb.
Phasey bean	252 lb.
Pueraria	31 lb.
Rhodes	13,440 lb.
Ryegrass	20 lb.
Setaria	59,406 bags
Sorghum	35 bags
Sunflower	2,315 bags
Soybean	190 bags
Stylosanthes	625 lb.
White French millet	80,012 bags
Miscellaneous grasses	15 lb.
Lucerne hay	166 tons

Queensland fruit now commands a ready export market, and 199,258 bus. cases of apples, 11,344 cases of pears and 15,949 bus. cases of oranges were shipped during the season (Table 9). Packing-shed inspections of all export apples and pears were carried out by authorised markets inspectors at Stanthorpe, while orange and other fruit shipments were inspected at local ports prior to despatch.

TABLE 9

QUEENSLAND EXPORTS—FRUIT AND VEGETABLES

Apples	197,108 cases 86 bins (approx. 25 x 1 bus. cases each)
Apricots	101 cases
Avocadoes	48 cases
Cherries	150 cases
Custard apples	12 cases
Grapes	326 cases
Grapefruit	297 cases
Lemons	253 cases
Mandarins	390 cases
Rockmelons	38 cases
Nectarines	38 cases
Oranges	15,949 cases
Peaches	186 cases
Pears	11,344 cases
Plums	194 cases
Strawberries	2 boxes
Beans	499 bags
Beetroot	160 bags
Brussells sprouts	17 cases
Cabbages	311 cases 854 bags
Capsicums	236 cases
Cauliflowers	10 cases 201 bags
Carrots	415 cases 1,074 bags
Celery	364 cases
Cucumbers	575 cases

TABLE 9—*continued*

QUEENSLAND EXPORTS—FRUIT AND VEGETABLES—*continued*

Garlic	81 bags
Lettuce	1,112 cases
Mushrooms	45 boxes
Nuts	7 bags
Onions	730 cases
	7,032 bags
Parsnips	6 cases
	305 bags
Parsley	18 cases
Peas	22 bags
Potatoes	2,311 cases
	4,178 bags
Pumpkins	320 bags
Rhubarb	101 cases
Swede turnips	386 bags
Tomatoes	4,705 cases
Total number of packages	252,511
Total number of bins	86

The total includes 36,173 cases of Queensland apples exported ex Sydney

FARM PRODUCE AGENTS ACT

The Farm Produce Agents Acts, 1917 *to* 1952 places a statutory obligation on every farm produce agent to operate a special trust account, called a Farm Produce Account, in connection with all his trading activities as an agent. An agent is also duty bound by the Act to account for in this account all moneys due to, but remaining unpaid to, any principal who has consigned farm produce to him for sale on his behalf. Routine inspection of agents' books of account were again carried out throughout the year. Particular attention was given to the methods adopted by agents in operating the trust account and accounting for trust moneys.

During the year under review, a company trading at the Turbot Street Markets, Brisbane, defaulted in payment to its grower principals. The company was convicted and fined for two breaches of the Act. The Fidelity Bond was estreated and the moneys received were paid in making compensation to those persons who suffered damage by reason of the default in payment by this farm produce agent.

There are 112 licensed farm produce agents in Queensland and of these 71 are in the Brisbane area. Country agents are situated in 21 centres throughout the State.

CLERICAL AND GENERAL DIVISION

There was a total staff of 1,520 officers attached to the Department at June 30, 1962. Of this number, 296 were Clerks, Clerk-Typists, Male Assistants and Female Assistants located as shown in the following table:—

——	Brisbane	Country	Total
Clerks	103	4	107
Clerk-Typists	89	80	169
Male Assistants	10	1	11
Female Assistants	8	1	9
	210	86	296

There has long been a need for the appointment of male clerks to the more important country branches of the Department to relieve technical officers of routine clerical work and enable them to devote the maximum amount of time to their primary duties. It is pleasing to report that during the year the Public Service Commissioner approved of such appointments being made and three newly appointed youths are presently undergoing preliminary training at Head Office prior to being posted to branch offices in their home towns. More such appointments are expected in the next financial year.

RECORDS

Correspondence passing through the Records Branch continues to grow in volume annually. The following table comparing the last three years illustrates the position:—

Mail Registered

Year	Inward Letters	Outward Letters	Intramural Correspondence	Total
1959–60	90,326	55,930	12,492	158,748
1960–61	98,126	59,631	14,863	172,620
1961–62	104,537	61,496	12,268	178,301

Additional to these are many thousands of returns and forms of various kinds which are received and sorted and delivered to appropriate Branches for attention.

A photo-copying machine installed in the Records Branch has done much to speed up the copying of correspondence, technical articles, etc. It is used extensively within the Department and work has also been performed on behalf of other Departments.

TRANSPORT

A fleet of 346 official motor vehicles is now in operation. During the year 69 new vehicles were purchased, comprising 45 replacements for vehicles which were reported on by the Chief Inspector of Machinery as having reached the end of their economical lives and 24 additions to the fleet. Fifteen of the new purchases were made from funds provided by the Commonwealth, viz. the Commonwealth Extension Services Grant, the Commonwealth Pleuro-pneumonia Fund and the Tobacco Research Fund. Disposals of old vehicles totalled 57 and 11 are awaiting sale.

HOUSING

The Government's housing programme for public servants is doing much to alleviate the difficulty of finding homes for rental by officers in country centres. In the past 12 months, residences for this Department's officers were either erected or commenced at Blackall, Winton, Ingham, Ayr, Clermont, Barcaldine, Goombungee, Kingaroy, Miles and Mitchell. For the 1962-63 financial year, approval has been given for the construction of 10 more homes at Charleville, Gympie, Longreach, Mareeba, Jandowae, Miles, Millaroo, Murgon, Gatton and Winton. The Housing Commission has also assisted by making three homes available at Biggenden, Roma and Cooroy.

OFFICE ACCOMMODATION

The problem of providing accommodation for the expanding needs of the Department in Brisbane still persists and becomes increasingly difficult each year. However, in the country centres the accommodation position is showing rapid improvement. Good offices have been provided in many instances and improvements are being made or are planned for other towns.

A new Entomology laboratory and glasshouse at Indooroopilly has been occupied as also has a new Pineapple Plant Physiology Research Unit and Glasshouse at the Maroochy Horticultural Research Station. Extensions to the Horticultural Research Station buildings at Redlands have been completed, a new hay shed has been erected at the Animal Husbandry Research Farm, Rocklea, and good progress has been made with the Artificial Breeding Centre at Wacol, the establishment of the Cattle Field Stations in the Burdekin, extensions to the Departmental office and laboratory at Nambour, and seed stores at Indooroopilly and the Hermitage Research Station. At Cooroy new Departmental offices are being built, and at Mareeba extensions to the Court House building provide adequate accommodation for offices and laboratories for officers engaged primarily in the development of the Mareeba–Dimbulah area.

ACCOUNTS

The total expenditure and receipts of the Department for the year 1961-62, compared with 1960-61, are as follows:—

	Expenditure		Receipts	
	1960–61	1961–62	1960–61	1961–62
	£	£	£	£
Consolidated Revenue	1,633,329	1,737,361	252,110	274,275
Trust and Special Funds (includes Sugar Bulk Handling Facilities—Expenditure £1,077,587 and £355,157—Receipts £1,075,466 and £310,155)	2,371,922	1,792,392	2,351,915	1,753,878
Schedule B—				
Salary of Minister	3,739	3,852	..	..
Schedule C—				
Stock Fund	201,056	316,273	..	..
Banana Industry Fund	7,654	6,847	..	..
Total £	4,217,700	3,856'725	2,604,025	2·028,153

Further statistical figures are detailed below:—

	1960-61	1961-62
Receipts issued	24,430	27,841
Vouchers paid	40,291	41,442
Cheques issued	58,754	60,730
Income-earning certificates issued	2,076	2,184

EXTENSION SERVICES

Two 12-day in-service schools in extension methods were conducted, the total enrolment being 64 Departmental officers and two Colombo Plan trainees. Fifteen such schools have been conducted and the bulk of the Departmental officers concerned in extension have now received this form of training. Some 40 new appointees were given short courses of instruction in extension techniques, and short courses were also provided at technical conferences of extension officers.

Consultation on extension matters was provided to many Branches during the year. These covered such matters as programme planning, use of extension aids, field and mail surveys, assistance at field days and schools, and work method studies.

A weekly tape service was provided in digest form to commercial and national radio stations in Queensland. A questionnaire revealed that most stations were using the tapes, many at preferred broadcasting time.

During the year, an extension research officer was stationed at Toowoomba to conduct an experiment in the group approach to agricultural extension. An organised soil conservation group in the Pittsworth district is co-operating in this project, which is designed essentially to guide and assist a group of farmers in determining and resolving its needs for better production and satisfying living.

LIBRARY AND ABSTRACTING SERVICE

Both the Central Library and the separate scientific abstracting service continued to provide satisfactory services to Departmental officers. The Central Library, which is staffed by the Public Library of Queensland, further assisted in the organising and servicing of sectional libraries.

Over 300 periodicals, and numerous other publications (annual reports, serials and occasional publications) are seen by the Science Abstractor. Short abstracts of all material of interest to the Department are made, and lists in the subject fields covered by the various Branches are compiled.

The Branches are responsible for distributing duplicated copies of these to officers, who can then obtain the original papers in which they are interested from the Central Library or other source in the Department. These lists enable all officers to keep in touch with subject literature without having to peruse a great number of periodicals, many of which contain only a few papers in their particular subject field; they can also be used as the basis for subject indexes.

PHOTOGRAPHY SECTION

Good use was made of new equipment and improved techniques in handling a large volume of work for numerous Branches.

Claims on the time and services of the staff of the Section continue to grow in number and diversity. Regular visits are made to the Toowoomba area, and frequent visits to Redlands, Nambour, Yeerongpilly, the A.I. centre at Rocklea, and the Food Preservation Research Laboratory at Hamilton. During the year the Section's output included 22,780 prints, over 1,200 colour transparencies, nearly 2,000 negatives, and a miscellany of other jobs.

There was a heavy demand on the Central Film Library by field officers conducting film evenings for extension purposes. It is expected that this activity will be reduced to some extent as television extends into country areas in the next few years. A considerable footage of film was shot for various purposes.

PUBLICATIONS

The year 1961-62 saw the publication of new, enlarged editions of both Vol. I (Farm Crops and Pastures) and Vol. II (Fruit and Vegetables) of the *Queensland Agricultural and Pastoral Handbook*. Both books are in strong demand at prices of 27s. 6d. for Vol. I and 32s. 6d. for Vol. II, and sales to June 30, 1962, were 1,000 and 1,200 respectively.

The Monthly *Queensland Agricultural Journal* maintained its circulation despite some reduction in the rate of subscription renewal. A stream of publicity has been initiated, from which a rise in the level of renewals is anticipated.

Extracts from the *Queensland Agricultural Journal* continue to be used by country newspapers and radio stations, and many articles have been reprinted for issue in the form of advisory leaflets. The total number of leaflets issued was 115, made up as follows:—Division of Plant Industry 58, Division of Animal Industry 45, Division of Dairying 11, and Division of Marketing 1.

The Department's Press Release was circulated to more than 100 newspapers and radio stations each week, and a 150-word precis of each item was prepared and forwarded to selected A.B.C. stations. News reports covering current activities of the Department were prepared regularly and released to newspapers, news agencies and radio stations.

Feature articles on special aspects of the Department's work were prepared and supplied to selected newspapers and farm periodicals. Provincial newspapers and farm periodicals have given prominent display treatment to these articles.

By Authority: S. G. Reid, Government Printer, Brisbane

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