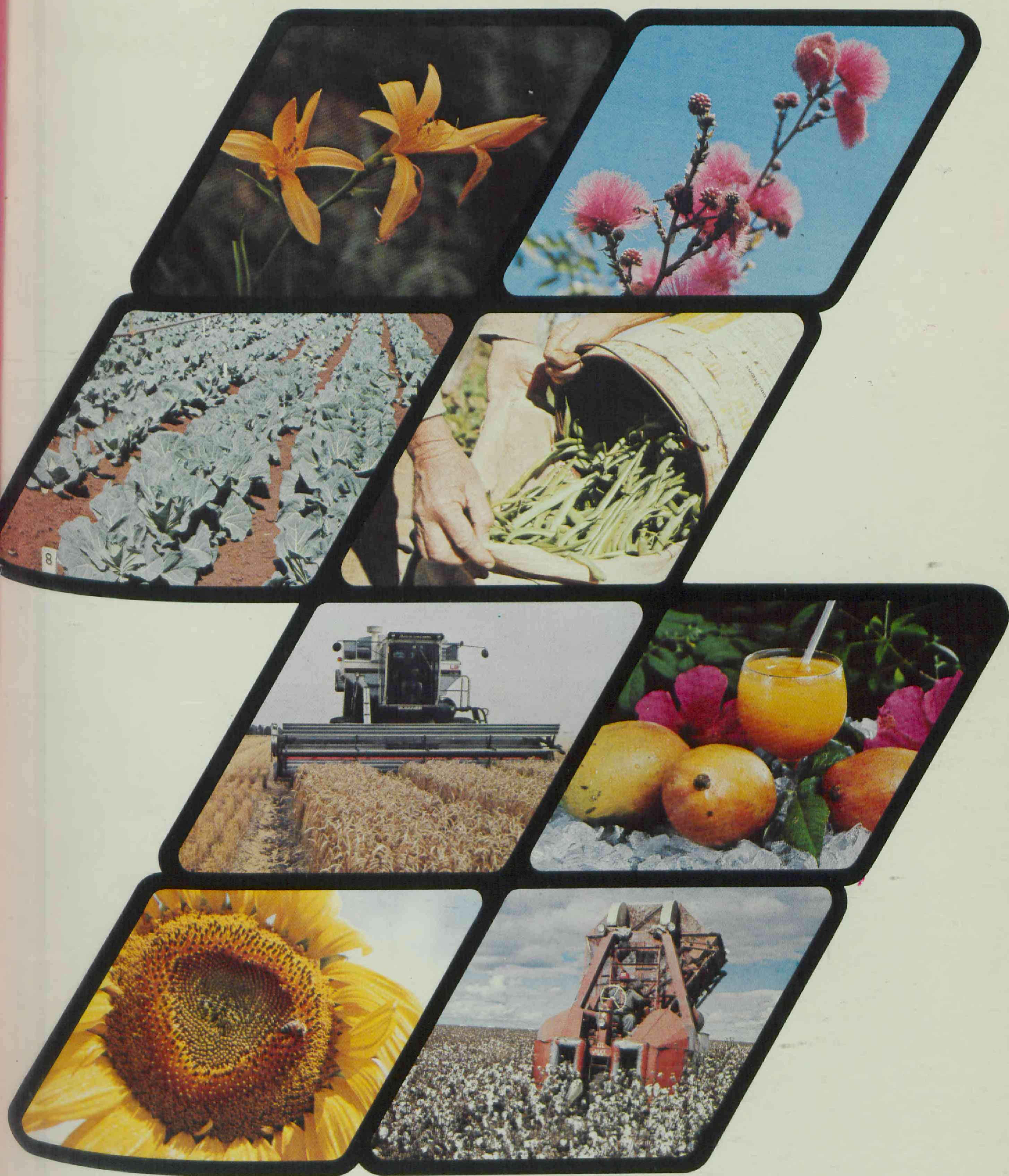


QUEENSLAND DEPARTMENT OF PRIMARY INDUSTRIES



Annual Report 1977-1978

Presented to Parliament by Command



An efficient quarantine service is one of Australia's vital barriers against the entry of new plant and animal pests and diseases. Animal quarantine officer Mr. G. L. Duffy displays some of the prohibited imports of animal origin seized in Brisbane.

Worker bees that gather Queensland's \$1.5m honey crop begin life as eggs in honeycomb cells. These pupae are about to emerge and take their place in the work-force.



This Giant African Snail, which managed to slip through the quarantine barrier, was found at Gordonvale in 1977. This pest could cause untold damage to pastures, crops and gardens. The eradication campaign by the D.P.I. and quarantine authorities promises to be successful.

QUEENSLAND DEPARTMENT OF PRIMARY INDUSTRIES

Annual Report 1977-78

Presented to Parliament by Command

By Authority: S. R. HAMPSON, Government Printer, Brisbane

65830—A. 33—1978

QUEENSLAND
PRIMARY

Organization of the Department as at 30 June 1978

Contents

General Comments	1
Division of Animal Industry	19
Division of Plant Industry	43
Division of Dairying	67
Division of Marketing	83
Division of Land Utilisation	91

Organization of the Department

as at 30 June 1978

MINISTER FOR PRIMARY INDUSTRIES .. Hon. V. B. Sullivan, M.L.A.

CENTRAL ADMINISTRATION AND CLERICAL AND GENERAL DIVISION—

Acting Director-General and Under Secretary E. O. Burns, B.Com., F.A.S.A.
 Deputy Director-General —
 Chief Advisory Officer (Administration) .. G. I. Alexander, B.V.Sc., M.S., Ph.D.
 Assistant Under Secretary H. J. Evans, A.A.U.Q., A.A.S.A.
 Assistant to the Director-General A. Winterton, B.Sc., Dip.Bus.Admin.,
 Q.D.H.
 Accountant J. D. Reardon, A.A.U.Q., A.A.S.A.
 Executive Officer, Research Stations Section G. H. Allen, Q.D.A.
 Executive Officer, Extension Services Section J. Gibb, B.V.Sc., Dip.Agric.Ext.
 General Manager, Agricultural Bank .. F. J. Strutton, A.A.S.A., A.C.I.V.
 Director, Information and Extension Training
 Branch J. L. Groom, B.Sc.Agr., Q.D.A.
 Chairman, Rural Reconstruction Board .. J. A. Barton

DIVISION OF ANIMAL INDUSTRY—

Director of the Division L. G. Newton, M.V.Sc.
 Deputy Directors J. W. Ryley, B.V.Sc., B. A. Woolcock,
 B.V.Sc.
Animal Research Institute
Biochemical Branch C. W. R. McCray, B.Sc., A.R.A.C.I.
 (Director)
Husbandry Research Branch L. Laws, M.V.Sc. (Director)
Pathology Branch W. T. K. Hall, M.V.Sc. (Director)
Beef Cattle Husbandry Branch M. R. E. Durand, M.R.C.V.S. (Director)
Veterinary Services Branch K. M. Grant, B.V.Sc. (Director)
Sheep and Wool Branch A. T. Bell, B.V.Sc. (Director)
Slaughtering and Meat Inspection Branch .. B. Parkinson, B.V.Sc. (Director)
Pig and Poultry Branch F. N. J. Milne, B.Sc. (Director)

DIVISION OF DAIRYING—

Director of Dairying V. R. Smythe, M.Agr.Sc.
 Deputy Director W. D. Mitchell, B.Agr.Sc., Dip.Agric.Ext.
Dairy Cattle Husbandry Branch I. H. Rayner, B.Econ. (Director)
Field Services Branch G. G. Crittall, Dip.Ind.Chem., A.R.A.C.I.
 (Director)
Research Branch Ailsa J. Gillies, M.Sc.App.(Med.)
 (Director)

DIVISION OF LAND UTILISATION—

Director A. Hegarty, B.Sc., Q.D.A.
 Deputy Director H. W. Pauli, B.Agr.Sc., B.E.(Civil)
Development Planning Branch W. F. Y. Mawson, B.Econ., H.D.A.
 (Director)
Soil Conservation Branch H. S. Pink, B.Econ., D.D.A. (Director)

DIVISION OF MARKETING—

Director of Marketing D. P. Lapidge, B.Com., A.A.U.Q.
 Deputy Director of Marketing —
Economic Services Branch R. B. Bygott, B.Econ., Dip.Agric.Ext.
 (Director)
Marketing Services Branch D. R. J. Densley, B.Agr.Sc., B.Econ.
 (Director)
Standards Branch W. V. Mungomery, B.Agr.Sc. (Director)

DIVISION OF PLANT INDUSTRY—

Director of the Division B. L. Oxenham, B.Agr.Sc.
 Deputy Director N. F. Fox, B.Agr.Sc.
Agriculture Branch J. K. Leslie, Ph.D., B.Agr.Sc. (Director)
Horticulture Branch H. M. Groszmann, B.Agr.Sc. (Director)
Agricultural Chemical Laboratory Branch .. T. J. Beckman, M.Sc., F.R.A.C.I.,
 F.C.S. (Director)
Botany Branch R. W. Johnson, M.Sc., Ph.D. (Director)
Entomology Branch T. Passlow, M.Agr.Sc. (Director)
Plant Pathology Branch G. S. Purss, M.Agr.Sc. (Director)

Organization of the Department

Introduction

The Department of [unclear] is organized into several divisions, each with its own set of responsibilities and functions. The following is a detailed description of the organizational structure and the roles of the various divisions.

The Department is headed by the [unclear], who is responsible for the overall management and coordination of the department's activities. The [unclear] reports to the [unclear] and is supported by a staff of [unclear] who assist in the day-to-day operations.

The Department is divided into the following divisions:

- Division of [unclear]:** This division is responsible for the [unclear] of the department's [unclear] and for the [unclear] of the [unclear]. It is headed by the [unclear] and consists of [unclear] staff members.
- Division of [unclear]:** This division is responsible for the [unclear] of the department's [unclear] and for the [unclear] of the [unclear]. It is headed by the [unclear] and consists of [unclear] staff members.
- Division of [unclear]:** This division is responsible for the [unclear] of the department's [unclear] and for the [unclear] of the [unclear]. It is headed by the [unclear] and consists of [unclear] staff members.
- Division of [unclear]:** This division is responsible for the [unclear] of the department's [unclear] and for the [unclear] of the [unclear]. It is headed by the [unclear] and consists of [unclear] staff members.

The Department also has a number of advisory committees and working groups that provide input and guidance on various issues. These include the [unclear] Committee, the [unclear] Committee, and the [unclear] Committee. Each of these committees is headed by a member of the Department and consists of representatives from various divisions.

The Department is committed to providing high-quality [unclear] and to maintaining the highest standards of [unclear]. We are confident that our organizational structure and the expertise of our staff will enable us to meet these goals and to continue to make significant contributions to the [unclear].

Queensland Department of Primary Industries

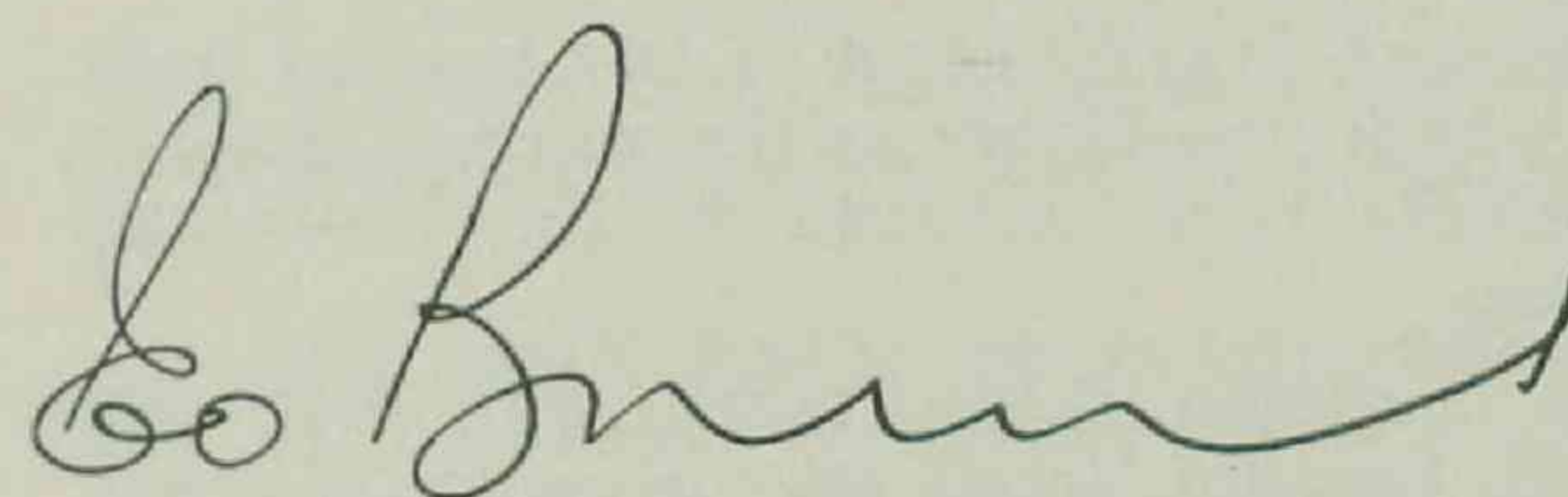
Annual Report 1977-78

To the Honourable the Minister for Primary Industries.

Sir,

I have the honour to submit the following report on the operations of the Department of Primary Industries for the year ended 30 June 1978.

Yours faithfully,



E. O. BURNS,
Acting Director-General.

General Comments

RURAL industries in Queensland experienced another difficult year in 1977-78. The impact of inflation on returns, which were about the same as in the previous year, has meant that the overall position has deteriorated in the last 12 months.

The gross value of rural production in Queensland in 1977-78 is provisionally estimated at \$1 418.5m, which represents virtually no increase on the equivalent figure for the previous year.

This, of course, is a graphic illustration of the general depressed situation in which the State's rural industries find themselves.

When the inflationary factor is also taken into account, a negative real growth situation is painfully obvious.

Fortunately, not all industries are depressed. Improved gross returns are expected for sugar, cotton, citrus and deciduous fruits, sheep and wool, cattle and the poultry industries.

Offsetting these are significant declines in the principal grain crops, potatoes, tobacco and peanuts.

Weather conditions

Although the State's grain growing areas received an excellent start to the 1977 winter crops in the middle of that year, the situation quickly turned sour and virtually no follow-up rain was received for about 5 months.

The result was that winter cereal crops did not yield as well as was expected and there was generally insufficient moisture for early plantings of summer grain and seed crops towards the end of calendar 1977. Pastures also began to dry off with the onset of warm spring and early summer weather.

By early September 1977, a number of Shires in the south-east corner of the State had been declared drought-affected. This sector was the worst-affected area and stock losses began to mount. Large areas of pastures were destroyed in bush and grass fires in the early summer period.

The number of Local Authority areas listed as drought-affected climbed steadily and reached a peak by the end of January 1978, when 54 Shires plus the City of Warwick were listed. Relief rainfall in eastern parts of the State early in the year enabled many Shires to be removed from the list and, by the beginning of June 1978, there were 33 Shires left on the list. At the same time, several Shires in the far south-west and northern inland had been declared. The general failure of the normal monsoonal rain influence in the far north was largely responsible for this. Little cyclonic activity was recorded during the cyclone 'season'.

By the end of May 1978, useful rain had again fallen across a wide part of the State and the prospects for winter cereal crops was promising. However, the central-west and north-western areas remained quite deficient in rainfall.

By-and-large, the drought situation was still not fully relieved in a large part of the State at the end of the financial year. Although stock condition at the beginning of winter was holding reasonably well, the availability of adequate pasture for the colder weather period was not assured.

Fodder crops and pastures

Infestations of aphids in lucerne crops caused concern early in the year, but control measures eventually proved effective. Unfortunately, losses were considerable and came at a time when market prices for lucerne were high.

The usual winter grazing crops of oats and ryegrass provided good feed and failed wheat and barley crops were also utilized.



An excellent stand of *Biloea buffel* grass growing in the Callide Valley is typical of buffel pasture in cleared brigalow country.

Throughout the western grazing areas, a fair-to-good body of dry feed presented a high fire danger as the warmer summer months arrived. Extensive fires occurred in the far-central and north-western areas.

Early in January, variable storm rains, with hot, dry periods between storms, brought about an 'on-again-off-again' drought situation in many of the grazing districts.

Further rain in the late summer and autumn months alleviated much of the severity of the drought situation but the pasture situation going into the winter of 1978 was not strong. A larger-than-usual area was expected to be planted to winter fodder crops.

Beef

Many areas of the State recorded below average rainfall during 1977-78 and at one stage 41 Shires were declared drought stricken. Drought was particularly bad in the South Burnett, Brisbane Valley and north-east Darling Downs areas. However, conditions had improved by April and cattle generally were in good condition towards the end of 1977-78.

Queensland's beef herd at 31 March was estimated to be 10 821 000 head, a 2% decrease on the number at 31 March 1977. The continuing high population, combined with insufficient overseas orders, meant supply was still greater than demand and returns to producers remained depressed.

Mr. Bruce Rouse, manager of 'Cloverdale', Brigalow, reads a 5 500 volt pulse on an existing fence which crosses a lagoon. The live wire is on hardwood posts without additional insulation. Field studies have established that up to 20 km of existing fences can be rejuvenated by energizing one existing wire.



Estimated average weekly prices for 200 to 250 kg ox ranged from 40c to 68c per kg, for 251 to 300 kg ox from 42c to 70c per kg, for 301 to 320 kg ox from 42c to 70c per kg and for 200 to 230 kg cows from 31c to 54c per kg. Lowest prices occurred during July and August and highest prices during February.

The gross value of all cattle marketed in Australia in 1976-77 was estimated to be \$1 006.2m, nearly \$300m more than the previous year. Queensland's share, estimated at \$247.3m in 1976-77, was well up on the 1975-76 estimate of \$184.93m.

Total Australian slaughterings of cattle and calves for 1976-77 were 11.6 million head, which was an increase of 9.6% on the previous season.

The total number of cattle and calves slaughtered in Queensland during 1976-77 at 2 821 000 head was 300 000 head more than in 1975-76.

Queensland beef and veal production for 1976-77 was nearly 530 600 tonnes, of which approximately 246 000 tonnes were exported.

The *Meat Industry Act Amendment Act 1977* was assented to by the Queensland Parliament on 3 October to set up a new Queensland Meat Industry Organisation and Marketing Authority. This Authority replaced the Queensland Meat Industry Authority and comprised an independent Chairman nominated by the Minister, a representative from the Department of Primary Industries, five producer representatives, two meat processors' and distributors' representatives and a person experienced in the field of commodity marketing.

Additional powers provided to the Authority were—

- (i) To co-operate and contract with the Australian Meat and Live-stock Corporation and meat industry authorities in other States and Territories as well as abattoirs, traders, meat and livestock producers and other organizations with a view to improving marketing arrangements in respect of stock, meat and by-products
- (ii) To develop, introduce and supervise systems of carcass classification
- (iii) To develop, introduce and supervise systems of consumer identification in respect of meat.
- (iv) To facilitate the availability of livestock producers of selling on a direct consignment and weight and classification basis
- (v) To prescribe bases of description of carcasses for the purpose of payment to livestock producers
- (vi) To direct owners of slaughterhouses and abattoirs when quoting killing charges to livestock producers to quote those charges in such a manner and detail as are prescribed
- (vii) To provide a market information service for producers
- (viii) To appoint such advisory committees as it considers necessary for its effective operation

- (ix) To co-operate with the Commonwealth Government, the Australian Meat and Live-stock Corporation and meat industry authorities in other States and Territories for the purpose of introducing and operating a uniform system of statutory minimum prices for the various classifications of cattle and carcass beef and administering any minimum pricing or stabilization scheme for livestock and meat agreed to
- (x) To co-operate with the Department of Primary Industries of this State, the Australian Meat and Live-stock Corporation and meat industry authorities in other States and Territories in implementing measures that are beneficial to consumers of meat and to the meat and livestock industry.

In each instance, prior approval of the Minister for Primary Industries is necessary.

Queensland exported a record 270 273 tonnes of beef and veal during the 1977 calendar year.

Australian beef and veal exports for 1977 were also a record 730 921 tonnes and were well above the previous record of 600 117 tonnes in 1973.

Estimated domestic disappearance of beef and veal (bone-in) for 1976-77 was around 65 kg per head of population. This was 5 kg less than for 1975-76.

The United States increased its Australian meat import quota by 1.6% to 300 962 tonnes for 1978. This amount was the highest since 1973 and is 51.3% of total U.S. beef imports.

Production in the U.S. of the type of meat supplied by Australia has fallen considerably during the first part of 1978 and higher prices have been paid for the Australian product.

The United States Department of Agriculture reported the U.S. cattle population as of 1 January 1978 at 116.3m head. This was the lowest since the 1971 population of 114.6m head and was 15.5m head below the peak in 1975. This has led to a situation where demand was exceeding supply and beef prices were rising rapidly at the end of 1977-78.

The Japanese Government announced that Japan's beef import quota for the first half of the 1978 fiscal year would be 40 000 tonnes. Special quotas are expected to be announced in June. Consumer pressure still is not sufficient to cause a substantial increase in Japan's beef import quota.

Although contracts of 10 000 tonnes carcass weight of beef to Egypt and 8 000 tonnes of boneless beef to Iraq were signed in March, a feature of 1978 to the end of May was the lack of sizeable exports orders apart from United States and Japan. It was hoped these would be forthcoming shortly after May and/or the United States, in an effort to curtail rising domestic beef prices, would increase its import quotas during the latter part of 1978.

A green vegetable dye is now being used to identify meat from carcasses treated by tenderstretch or any other *bona fide* process to prevent cold-shortening and so improve tenderness. Purple markings are used to identify meat from animals which have been genuinely lot fed.

The Prices Justification Tribunal is to conduct an inquiry into price stability in the meat industry with particular reference to the economics of handling and marketing on both the domestic and export markets.

Surveys conducted within the Department indicated that, of all cattle sold for slaughter in Queensland during 1976-77, approximately 56% were sold by auction at saleyards and 35% were sold direct to meatworks on a weight-and-grade basis.

The possibilities of establishing a system of Meat and Live-stock Market Reporting were investigated early in 1978. Studies on the technicalities of such a system are continuing.

Due to the technical problems encountered, implementation of an automated system of carcass classification has been postponed indefinitely. Because of this, Australian Agricultural Council at a meeting in April agreed to the introduction of manual objective carcass classification. This system is to be automated progressively as reliable methods are developed by the Australian Meat and Live-stock Corporation. Implementation of classification should now occur much sooner than would have been possible for a fully automated system.

A scheme to pay graziers a \$10 a head subsidy to slaughter their starving cattle came into effect on 12 December and is to remain in force in drought declared areas until 30 June 1978.

Such cattle had to be drought affected, over 5 months of age, in the present ownership for a minimum of the preceding 3 months before slaughter, and virtually unsaleable.

Owners had to give prior notification of intention to slaughter to designated officers of the Department of Primary Industries who were required to certify the subsidy claims.

Problems associated with marketing cattle have been blamed for many of the industry's problems. One study looked at selling systems and price reporting. Liveweight selling facilities are being installed at many major selling centres in the State. These cattle are leaving the scales at Cannon Hill saleyards.



Sheep

Sheep producing areas in Queensland generally suffered from dry conditions. Although some rain had fallen by the end of the period, most areas still required good rainfall to replenish water supplies as winter approached.

Preliminary figures released by the Australian Bureau of Statistics show that the number of sheep and lambs in Queensland at 31 March 1978 increased by 2% on the number recorded 12 months previously.

Although the number of sheep (1 year and over) decreased from 11 217 000 to 11 197 000 the number of lambs increased from 2 087 000 to 2 381 000 during the period.

Prices for lamb dressed weight 13 kg to 16 kg ranged from 75c per kg to 114c per kg and wethers dressed weight less than 23 kg from 29c per kg to 54c per kg.

The Australian Meat and Live-stock Corporation began trial shipments of fresh refrigerated lamb carcasses to the United States to test the market there. The move, in conjunction with a U.S. airline and importer, followed a big drop in frozen lamb imports from Australia.

The United Graziers' Association announced that it would press again for the introduction of a statutory marketing organization for Queensland's sheep and cattle producers.

Wool

The Australian Wool Corporation increased the floor prices for carding type wools by between 3.3 and 4.6% or 6 to 7c per kg and reduced support levels for fine wools by 2 to 2.5% or 7 to 9c per kg for the 1977-78 season.

The overall floor level of 284c per kg clean, remained for the 1977-78 selling season.

Wool production in Australia for the 1977-78 season was estimated at 668 400 tonnes (greasy), a fall of 4.9% on the 702 000 tonnes produced in 1976-77.

The estimated number of sheep and lambs shorn at 140.3 m was 3.8% below the previous season.

Queensland wool production of 64 395 tonnes during 1976-77 was 3% less than the 66 316 tonnes produced in 1975-76 and 56% less than the peak production of 115 841 tonnes in 1963-64.

Mr. A. T. Bell, Director of Sheep Husbandry (left) and Mr. R. J. Anson, District Adviser, inspecting mohair at the first Queensland mohair sale held in Brisbane on 20 June 1978. A total of 2 000 kg of mohair was sold at an average price of \$8.02 per kg with a top price of \$15.



Nine auction sales were held in Brisbane during 1976-77. A total of 373 612 bales was sold for \$100.6m. The average price obtained was 174.73c per kg compared with 139.91c per kg in 1975-76.

Although the number of sheep and lambs shorn in 1976-77, at 13 041 000, was nearly 700 000 below the number shorn in 1975-76, the average fleece weight of 4.54 kg for 1976-77 year ended 31 March was the heaviest recorded since 1972-73.

During the wool sales in May, 19 micron wool reached a new seasonal high of 355c per kg clean. The Market Indicator—which is a weighted average across 11 categories, each comprising 11 representative types—also rose to a new seasonal high of 310c per kg clean at the end of May.

Overall average price for the 1977-78 season to the end of May was 187.87c per kg greasy.

Brisbane's first wool auction for the 1977-78 season saw the Australian Wool Corporation purchasing more than one-third of the offering. At the end of May, the Corporation was purchasing less than 3%.

The International Wool Secretariat believes wool will increase its share of textile production in developed countries in 1978 because—

- (a) Retail sales are slowly rising in the U.S. and Western Europe
- (b) Moves to rationalize overproduction in the indebted European synthetics industry should have the effect of increasing prices of man-made fibres and reducing the gap between them and wool, which is currently around 300% in value terms
- (c) the E.E.C. has imposed heavy textile import quotas to protect its own stricken industries and, to get the best out of them, exporting countries have to sell a higher proportion of top quality garments, which should favour wool.

Keen trademand in 1978 led to high trade clearances and, by April, the Corporation stocks had been reduced from 1.12m bales at the end of March to 1.07m bales.

Australian wool production for the current 1977-78 season is estimated at 668 000 tonnes greasy which was 34 000 tonnes down on last season.

The Limited Offer to Purchase Scheme is to start in Queensland on 3 July 1978. Under this Scheme, the Corporation buys wool of any type or volume from any grower for an agreed price based on the Corporation's assessment of the current market. The Corporation provides payment within 15 working days of receipt into stores and rebates on savings in handling costs average \$2 to \$3 a bale.

Growers not satisfied with the price quotation can have their wool sold by the Corporation at the next available auction.

The Japanese Government's Fair Trade Commission granted another 3-month extension to the Worsted Spinners' anti-recession cartel from 21 April 1978. The spinners involved will cut worsted yarn production by 35% from the December 1976 level and seal 30% of their spinning machines. The cartel has been in operation since April 1977.

Pigs

Queensland's pig population, estimated at 458 000 at 31 March 1978, increased 4% on the 441 000 recorded at 31 March 1977.

The number of pigs slaughtered in Queensland during 1976-77 was 4.6% above the 1975-76 level of 698 200. Pigmeat yield, at 39 110 tonnes, was about 5.5% higher than the previous year.

Average dressed weight prices for pigs 60 kg to 73 kg ranged from 106c per kg to 124c per kg.

Although feed became expensive in the early part of the period, increased prices in hot dressed weights for prime grade pigs on consignment encouraged producers to maintain production.

All major bacon factories changed to payment on a hot dressed weight basis in 1977 instead of the previous hot dressed weight less an allowance for shrinkage on chilling.

Executive Council approved the establishment of a statutory organization for commercial pig producers in Queensland, which is known as the Queensland Commercial Pig Producers' State Council.

Objects of the Council include—

- (a) To organize all commercial pig producers into a comprehensive body and give each commercial pig producer an opportunity to voice an opinion in all matters affecting the industry
- (b) To take such action as may be necessary to ensure that the views of commercial pig producers are adequately represented to all bodies, the operations of which affect the industry



Introducing housewives to a range of new cheese varieties during a conducted tour of the Dairy Research Laboratory, Hamilton.

- (c) To do everything possible to ensure for all commercial pig producers a fair return for their capital and labour
- (d) To co-operate with the Department of Primary Industries in the production of improved method and efficiency in piggeries by means of technical and scientific knowledge and with other primary producer organizations to improve the efficiency and welfare of the industry.

Dairying

Production of wholemilk for all purposes declined dramatically this year due, in the main, to the severe drought conditions. Butter experienced the greatest decline in production falling to an estimated 4 800 tonnes compared with 7 555 tonnes in 1976-77. Cheese production declined from 9 860 tonnes in 1976-77 to an estimated 7 500 tonnes. There has been a growing trend towards diversification away from butter production towards more profitable products.

Little improvement occurred in the depressed export markets for dairy products. There appears to be little likelihood of any firm recovery in the immediate future.

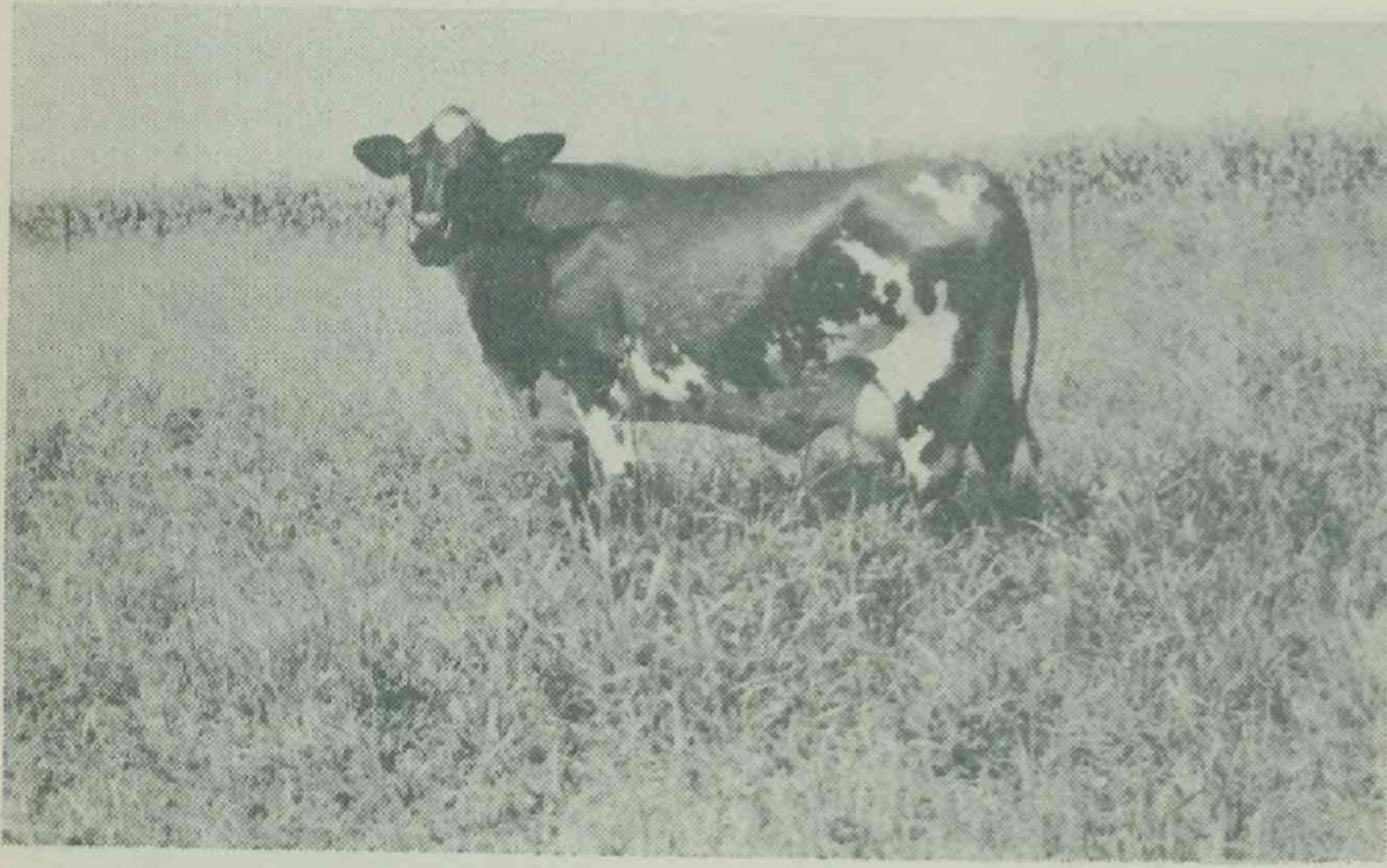
The low export returns for manufactured products have been a significant factor in negotiations for marketing arrangements for prescribed manufactured products. The so-called 'Stage I arrangements' operating this year provided for compulsory equalization of returns for prescribed manufactured products involving a levy/disbursement mechanism. The scheme was established under Commonwealth legislation.

In January 1978, the Australian Agricultural Council, by majority decision, agreed to the introduction of Stage II arrangements whereby each State would receive an entitlement to manufacture prescribed products with over-entitlement production being penalized.

The Commonwealth Government, however, has indicated its intention of introducing, as an alternative to Stage II, a system of selective underwriting of prescribed products whereby returns to a specified amount of factory production would be underwritten by the Commonwealth Government and participating State Governments. Finality in these arrangements has not yet been reached.



Characteristics of new cheese varieties being discussed with industry managers and factory directors at the Dairy Research Laboratory, Hamilton.



The type of Australian Friesian Sahiwal (A.F.S.) dairy cow being used in the breed evaluation program at the Kairi Research Station.

Under new legislation enacted by the Queensland Government, the Queensland Milk Board was established in June 1978 to replace the previous Brisbane Milk Board. The new Board has extended powers over the whole of the State in the areas of pricing, licensing provisions and the regulation of the supply and distribution of market milk.

A Milk Entitlements Committee has also been established which will determine the amount of milk which a factory or producer can provide for market milk purposes. The Committee will also operate a system for the controlled transferability of entitlements between co-operative or group organizations.

An Appeals Tribunal to hear appeals against decisions of the Board Committee has also been established under the Act.

Poultry

EGGS—Production controls in the egg industry continue to be the most important influence on the industry's outlook.

Despite the overall stabilizing effect of the hen quota scheme, improved farm management and investment in new technology have lifted production significantly.

In south Queensland alone, production increased by about 9% over 1976-77 levels. Egg sales by the South Queensland Board increased marginally over sales in the previous year. This improvement in sales, although small, is significant given the declining trend in sales in other States.

With the projected continued upward trend in production, the industry is foreshadowing a quota reduction of some 74 000 hens in south Queensland in the 1978-79 quota season.

During the year, the Hen Quotas Act was amended in certain particulars. The amendment changes the season from a financial year to a calendar year basis.

Among other things, the amendment also clears the way for more flexible procedures in transferability of quotas.

POULTRY MEAT INDUSTRY—The Chicken Meat Industry Committee completed its second year of operations during 1977-78. The Committee has proved to be a valuable forum at which the interests of both broiler growers and processors can be discussed.

The value of slaughterings during 1977-78 was estimated at \$31.5m compared with \$27.4m in 1976-77.

Grain crops

Following excellent planting conditions, expectations were high for record winter crops. However, lack of significant rain in all producing areas during the season resulted in reduced production and abandonment of 73 500 ha. On the credit side, these dry conditions contributed to 72% of wheat received by the State Wheat Board being of premium grade.

WHEAT—Wheat plantings in 1977-78 were estimated at 568 000 ha and production 560 000 tonnes. Although this was considerably less than last season, it exceeded earlier expectations. The dry seasonal conditions resulted in only a small amount of general purpose grain being harvested.

The distribution of receivals at State Wheat Board depots by grades was—

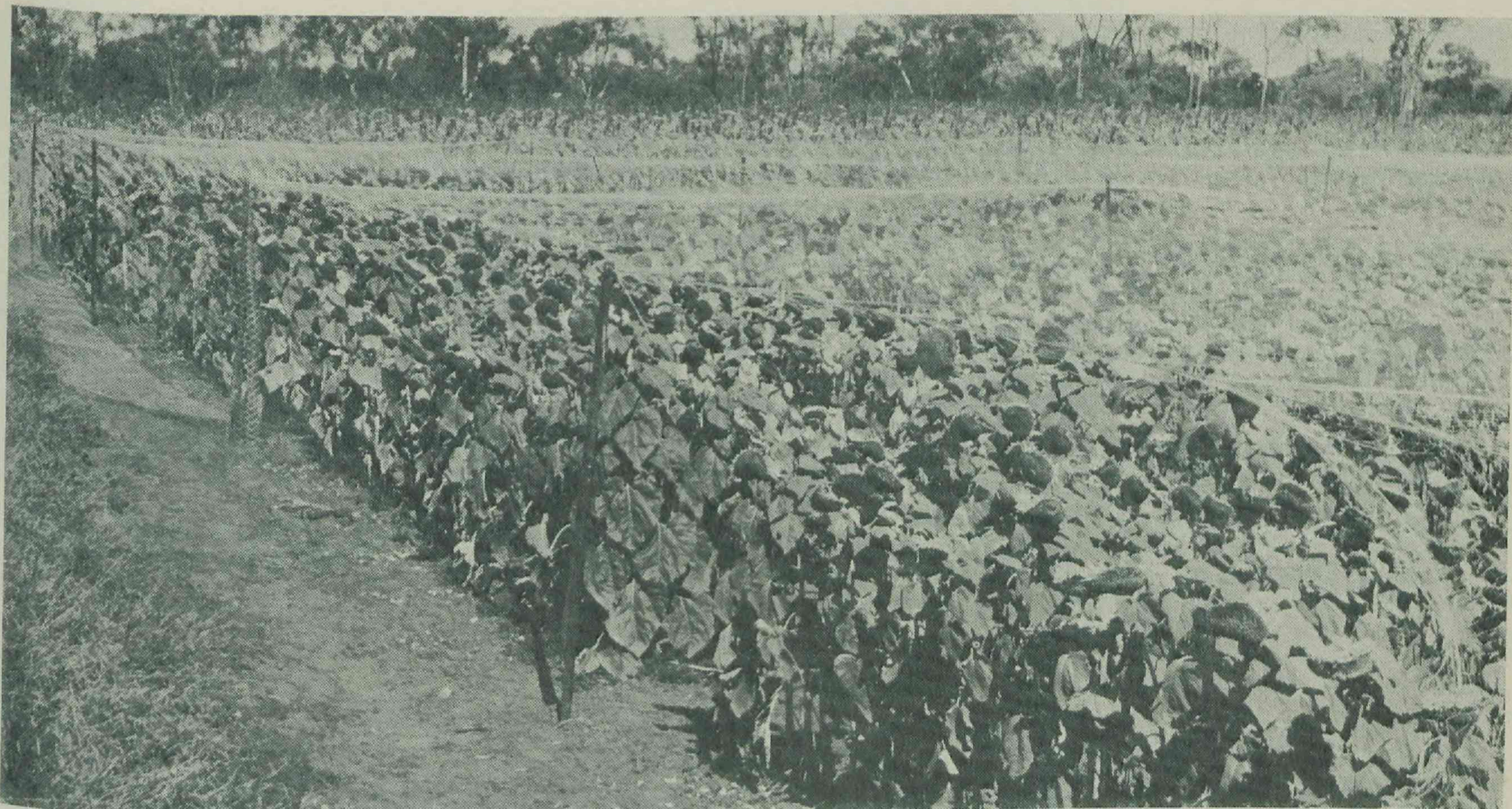
	Percentage
Prime Hard	48.4
No. 1 Hard	24.1
No. 2 Hard	0.5
Australian Standard White	20.8
General Purpose	4.3
Seed	1.9
	100.0

The export market early in the season was weak. Towards the end of the season, however, this market firmed and prices rose considerably due to increased demand, especially from China, and transport problems in North America. Growers' returns from the 1977-78 crop are expected to be above last season's estimated \$78 a tonne port basis.

BARLEY—Production from the 1977-78 barley crop was forecast at 200 000 tonnes from a sowing of 245 000 ha, of which 24 000 ha were abandoned. A similar growing season prevailed as for wheat resulting in reduced yields.

Brigalow Research Station combines land development for pasture and cropping with beef cattle raising. Undeveloped scrub is in the background.





Sunflower is an important crop in central Queensland. These plot trials on the Brigalow Research Station are protected from bird damage.

Lower receipts by the Barley Marketing Board reduced export availability to 92 000 tonnes compared with some 320 000 tonnes in 1976-77. The following table shows Barley Board receipts by grade for the 1977-78 season.

	Percentage
Malting	34.3
Manufacturing	40.1
Feed	22.7
Seed	2.9
	100.0

Because of reduced production, a larger percentage of grain was sold on the domestic market and returns overall will show a decline on last season.

GRAIN SORGHUM—Adverse weather conditions early in the season resulted in reduced plantings of grain sorghum estimated at 280 000 ha. Early dryland sowings recovered after the January rains and production is forecast at 420 000 tonnes. This is a considerable reduction on the 1976-77 crop of 605 000 tonnes from 377 000 ha.

The Queensland Graingrowers' Association, because of its current intake, has the potential to export about 50 000 tonnes compared with 212 000 tonnes in 1976-77.

The Central Queensland Grain Sorghum Marketing Board estimates receipts in 1977-78 to reach 170 000 tonnes, of which 150 000 tonnes will be exported. Last season, 208 000 tonnes were exported from receipts of 212 000 tonnes.

Because of reduced production, domestic prices were high relative to export prices. However, as the season progressed the export market showed an unexpected upsurge due to shipping delays in Argentina and the U.S.A., planting delays and implementation of the set aside program. The f.o.b. price reached \$95 per tonne.

MAIZE—Dry conditions in the latter part of 1977 delayed land preparation and the planting of maize. However, rain at the end of January and early February improved crop prospects. From estimated sowings of 31 000 ha production was forecast at 60 000 tonnes compared to 77 000 tonnes last season. Atherton Tableland yields are expected to be down because of the failure of the traditional 'wet'.

Returns to growers this season should be comparable with those of last year due to reduced production and the maintenance of firm export markets.

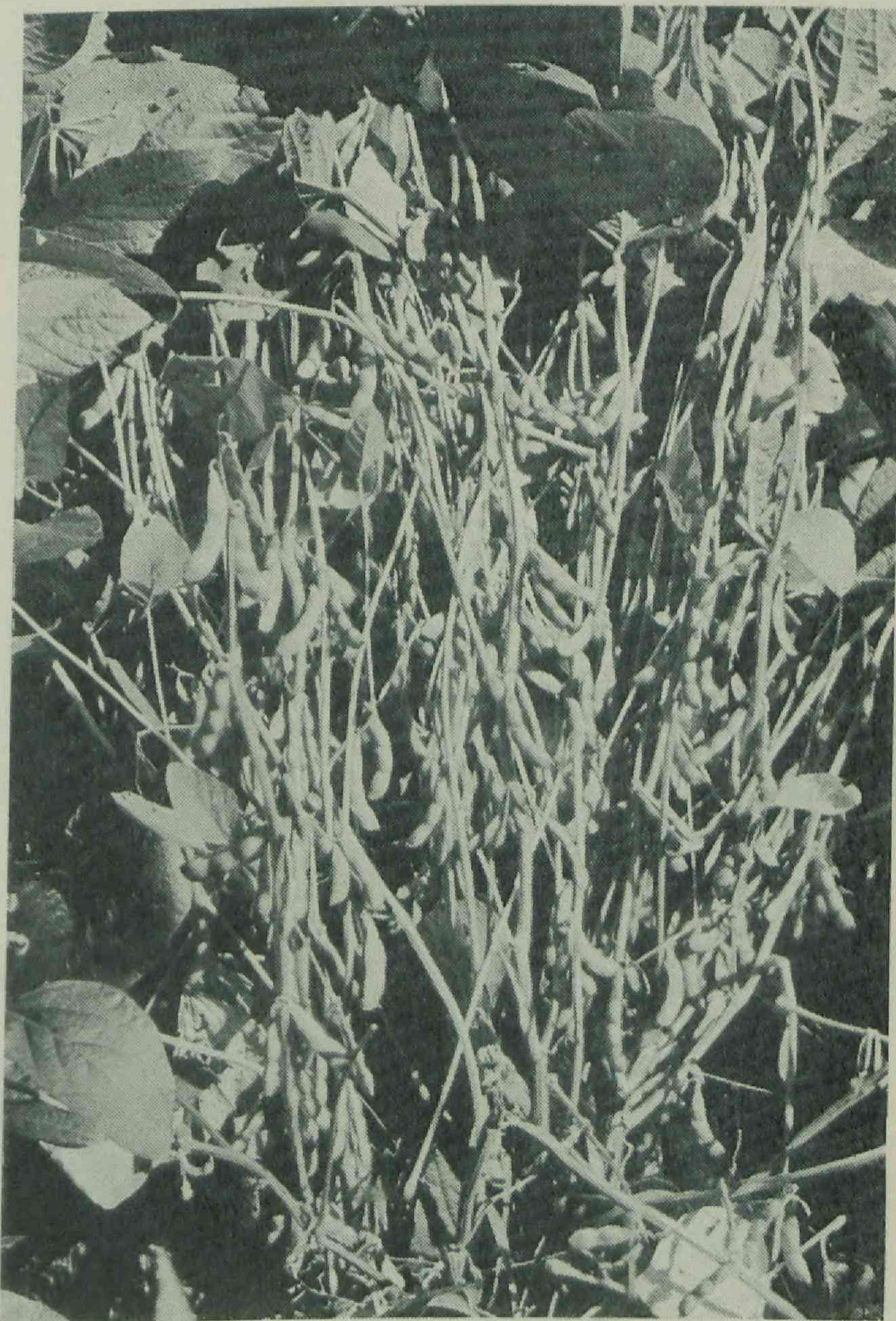
OILSEEDS—Due to improved seasonal conditions, production of safflower in 1977-78 was estimated at 18 000 tonnes from 21 000 ha. This was a vast improvement on the 1976-77 crop which produced only 2 202 tonnes from 4 205 ha.

Returns to growers in 1977-78 are expected to approximate \$190 per tonne delivered processors' plant, compared with \$210 per tonne in 1976-77.

Production of linseed in 1977-78 is estimated at 10 000 tonnes compared with 2 338 tonnes in 1976-77. Returns to growers are expected to exceed \$210 per tonne delivered processors' plants, compared with \$220 per tonne in 1976-77.

Because of the switch from grain sorghum, especially in central Queensland, the area planted to sunflower is estimated at 120 000 ha compared with 77 798 ha in 1977. Production is estimated to reach 72 000 tonnes compared with 40 271 tonnes in 1977. Returns to growers are expected to approximate last season's level of \$240 per tonne delivered processors' plants.

An example of good pod setting in a well-grown crop of soybeans in the South Burnett.



The area planted to soybeans in 1978 is estimated at 26 000 ha compared with 26 026 ha in 1977. Production reached an estimated 39 000 tonnes compared with 40 746 tonnes in 1977. Returns to growers in 1978 are expected to average \$220 per tonne delivered processors' plants, compared with \$240 per tonne in 1977.

Sugar

While in the north there were crop losses from flooding early in the year, many areas, especially those south of Ingham, were constantly dependent upon irrigation for maintaining growth, and some rivers dried up under this tremendous impact.

There were three comparatively mild cyclones during 1977. Cane was submerged at Ingham causing losses and the rainfall received at Babinda and Ingham from all three cyclones was above average.

However, there were few delays due to weather, industrial or technical problems and crushing had almost ceased by the end of November. Central and southern areas in particular, however, suffered severely from prolonged moisture stress leading to short, drought-stricken crops, which created some milling problems.

In Queensland during 1977, a record 22.331m tonnes of cane were harvested and a record 3.209m tonnes of 94 net titre sugar produced. This compared with the previous records in 1976 of 22.269m tonnes of cane and 3.163m tonnes of 94 net titre sugar.

The productivity values were 79.63 tonnes of cane and 11.44 tonnes 94 net titre sugar per ha. The corresponding values in 1976 were 80.52 tonnes of cane and 11.43 tonnes 94 net titre sugar.

The Queensland 1977 c.c.s. of 14.33 was 0.1 units more than in 1976 and was the highest figure recorded since 1972 when the c.c.s. was 14.90.

The Australian harvest in 1977 also reached record levels of 23.493m tonnes of cane and 3.208m tonnes 94 net titre sugar.

Queensland's gross industry income in 1977 could total \$465.5m compared with \$455.4m in 1976. The No. 1 Pool Price is estimated at \$188 to \$198 per tonne and the excess sugar price \$125 to \$135 per tonne. The corresponding figures for the 1976 season were \$214 and \$244 per tonne. The reduced returns reflected the lower free market price which rose to a high of £ (stg.) 151 in April, declined thereafter to a low of £ (stg.) 85 in November before improving to close the year at £ (stg.) 107 per tonne.

Exports during 1977 were a record 2.97m tonnes raw sugar. This was about 350 000 tonnes greater than in 1976 and meant that Australia maintained its position as the leading exporter to the free market.

Some 1.27m tonnes were shipped under long-term contracts and 1.7m tonnes were sold to the industry's traditional export customers at prices relative to world market values.

A new International Sugar Agreement was eventually negotiated in late 1977. However, the deadline for signature of the new Agreement was extended to the end of June 1978. By March 1978, 55 countries had signed the Agreement. These include the major importers U.S.A., Japan and Canada. Major exporters who have signed are Cuba, Australia, Brazil, Philippines and Thailand.

The Agreement is designed to keep the price of sugar in the range of \$A212 to \$A405 per tonne. When the price is below \$A212 per tonne quotas can be reduced to below 100% of basic export tonnages. As the price rises, quotas are suspended at \$A289 per tonne and stocks which are accumulated or replenished while quotas are operative are released in three equal portions at \$A366, \$A385 and \$A404. As prices fall quotas are re-introduced at \$A270.

The Agreement also requires exporters to hold stocks totalling 2.5m tonnes of which Australia's share would be 395 500 tonnes. But, if all exporters do not join, there is a provision for up to 7% additional stocks to be held by members. Australia, therefore, could be required to hold a maximum of about 423 000 tonnes.

To assist in the finance to hold these stocks, a levy of \$A5.60 per tonne will be imposed on all imports by members and all exports by members to non-members. From this levy fund, interest-free loans of \$30 per tonne per year will be made.

Peanuts

The area planted to peanuts for the 1978 season was estimated at 28 000 ha, a drop of about 2 700 ha from the actual area planted in 1977. A number of factors contributed to this decline.

Primarily, a very difficult year in 1977 produced a peanut crop which was one of the poorest quality crops in recent years. This helped to reduce grower confidence in the industry to some extent. However, the major factor was probably the weather. A long, dry summer delayed planting in many areas and some growers either elected to plant smaller areas or turned to alternative crops.

Despite the early setbacks, the quality of the crop was much better than the previous year's, but overall yields will be below the recent industry average. Total production should be about 32 000 tonnes, only marginally above the 31 627 tonnes produced in 1977.

Peanut production continues to expand in north Queensland with the prospect of a 6 000-tonne crop mainly on the Atherton Tableland. If achieved, this would represent almost 20% of the State's total, and reflects the continued popularity of peanuts in the area.

At a production level of 32 000 tonnes, some peanut imports would be required to meet domestic requirements for some specialized purposes. At the same time, however, the Peanut Marketing Board is trying to keep in touch with good export outlets in Japan and New Zealand by committing small tonnages of peanuts in the higher quality grades to these markets.

World market prospects for peanuts remain attractive and Queensland would have no problems in exporting significantly larger quantities when they become available.

Net returns to growers from the 1978 crop should improve considerably from the previous year which was plagued by quality problems and high costs in grading.

Navy beans

Production of navy beans for the 1977 season is placed at 5 591 tonnes from a planting of 6 283 ha. For the 1978 season, interest in navy beans has been very keen and plantings are estimated at 10 500 ha. Although seasonal conditions have been very dry, production is expected to reach 7 500 tonnes, well in excess of Australian requirements. Thus, the Navy Bean Marketing Board is actively pursuing export markets for the surplus.

Returns to growers for the 1977 season are currently estimated at 41c per kg, 3c down on the 1976 season's pool. This decrease in returns to growers has resulted from the increased grading costs.

Rice

The 1977 winter rice harvest produced 3 012 tonnes of paddy from a planted area of 1 212 ha to give a yield of 2.48 tonnes per ha. This compared favourably with the previous winter crop of 1 963 tonnes of paddy. This improvement was due to favourable growing and harvesting conditions for the 1977 crop. Payments to growers are estimated at \$138 per tonne of paddy.

Harvesting of the 1977-78 summer crop commenced in mid December and a total of 6 727 tonnes of paddy was produced from an area of 1 370 ha. The previous summer harvest produced 6 303 tonnes of paddy from 1 254 ha. The expected final payment to growers from the 1977-78 summer harvest is \$155 per tonne compared with \$110 per tonne from the previous summer harvest.

The 1978 winter harvest is expected to yield 6 000 tonnes of paddy from a planted area of 1 382 ha. The significant improvement in this winter crop is due to the dramatic expansion in production from the Mareeba area. It is expected that Mareeba will contribute approximately 40% of the estimated total production.

Tobacco

Sales of tobacco leaf during the 1977 Queensland selling season amounted to 7 870 884 kg at an average price of 353.4c per kg and a gross value of \$27.8m.

The minimum average reserve price for 1977 was 353c per kg and this has been raised to 362c per kg for the 1978 selling season.

The Australian marketing quota for 1978 is to be shortsold by 1 325 000 kg and Queensland's share of this to be 713 473 kg or 8.6% of the Queensland quota. With this shortsell, and ones of the previous two seasons, it is expected that the surplus leaf stock position which arose from a decline in the consumption of tobacco products, will be corrected.

The current Tobacco Industry Stabilisation Plan expires in December 1978 and a new Plan has been agreed to for the period January 1979 to December 1983. The Plan is similar to previous arrangements which have operated since 1965. The level of the quota will be reviewed each year taking into consideration movements in consumption, stock-holdings and deliveries by growers.

The Australian marketing quota for 1979 will be 15.3m kg, which represents an increase of 1.2m kg on the 1978 quota. Queensland's quota will be 8 238 000 kg.

The minimum average reserve price will be reviewed each year after considering movements in the cost of production.

Cotton

Production of cotton in Queensland set a new record in 1976-77, reaching 31 196 bales, each of 225 kg of raw cotton—and more than 11 000 bales above that of the 1975-76 season and nearly 2 000 bales more than the previous record in 1973-74.

The Emerald and St. George irrigation areas accounted for more than half of the increase in production but significant expansions also occurred in all other producing districts.

The average yield from irrigated crops in Queensland during 1976-77 was 773.4 kg per ha, slightly higher than the 1975-76 average of 752.5 kg per ha but considerably less than the 1973-74/1974-75 average of 930.0 kg per ha.

In southern Queensland, however, yields recovered from the low 1975-76 levels, averaging from 868.5 kg per ha in the St. George irrigation area up to 952.4 kg per ha in the Lockyer Valley district. This compares with 747.4 kg per ha and 917.7 kg per ha respectively in 1975-76.

Yields in central Queensland, on the other hand, declined marginally because of adverse weather conditions and high incidence of boll rot in the Dawson-Callide district. Late planting was also detrimental to yields in the Emerald irrigation area and the average was only 516.2 kg per ha, compared with 786.6 kg per ha at Biloela and 899.4 kg per ha at Theodore.

The mill use of raw cotton in the Australian cotton textile industry during 1976-77 totalled 96 400 bales, or around 18 000 bales below the 1975-76 level and nearly 48 000 bales less than the 1973-74 record. Australia imported 22 200 bales of high grade, strong long staple cotton of over $1\frac{1}{8}$ inch during 1976-77 because of the need to replenish stocks which had been run down over the previous two seasons.

Australia produced 110 600 bales of raw cotton in 1976-77 compared with 146 670 bales in 1975-76. The decline in production affected exports of raw cotton which fell from 71 100 bales in 1975-76 to 24 400 bales in 1976-77. Queensland exported 4 199 bales for a gross value of \$932 707.

World cotton prices for much of 1976-77 remained significantly higher than those of the previous season owing mainly to the tight cotton supply position. This was reflected in the Liverpool C.I.F. Index for Strict Middling 11/16 inch cotton which rose from the 1975-76 average of U.S. 62.18c per lb to U.S. 83.68c per lb for 1976-77, the highest seasonal average in many decades.

After fluctuating within relatively narrow limits during the latter half of 1976, the Index suddenly fell to U.S. 75.40c per lb on 14 January 1977. The decline was caused mainly by the slowdown in textile activity, reflecting the condition of the world economy, and increased competition from man-made fibres.

World cotton prices rose again late in January, averaging U.S. 81.15c per lb during the last week of the month. The recovery in the market was attributed to the basic tightness in the supply position.

After showing further increases in February and March, world cotton prices fell throughout April, with most of the decline occurring in the second half of the month. At the end of April, the Index for Strict Middling 11/16 inch cotton was U.S. 83.25c per lb, about 4c below the price in March.

The downtrend in cotton prices extended into the 1977-78 season and continued almost continuously until mid November, when the Index was U.S. 58.05c per lb, about 23c below the price in January.

Since then, cotton prices have strengthened in world markets, advancing steadily but generally slowly from U.S. 58.05c per lb in November to U.S. 70.85c per lb on 2 June 1978.

Cotton prices on the Australian market have increased from Aust. 121.94c per kg in November to Aust. 148.00c per kg on 2 June 1978.

The average return to Queensland growers during 1976-77 was 100.00c per kg, including 13.33c per kg from oil milling proceeds.

In Queensland, growing and harvesting conditions have been favourable in most producing areas, giving rise to optimism regarding production prospects for 1977-78. The crop this season is estimated at a record 41 000 bales.

The increase in production is attributed to a marked improvement in average yields since the planted area is estimated at 9 225 ha, nearly 400 ha less than that of 1976-77. Most of the increase will probably occur on the Darling Downs, where both yield and area planted are expected to increase substantially.

Ginger

Production of ginger from the 1977 crops totalled 4 151 tonnes from 115 ha. This compares with 4 365 tonnes from 119 ha the previous season.

Exports for 1977 to the end of December were up 68% over the previous year and already orders have been received from Europe for more than 50% of the expected 1978 crop. The 1978 ginger crop is expected to yield 5 000 tonnes from an estimated planting of 125 ha.

The Buderim Ginger Growers' Co-operative Association has experienced a record of profitability for several years which reflects the strong growth in both domestic and export sales that has occurred. This trend is expected to continue to such an extent that demand will not be satisfied by local production.

Fruit and vegetables

In October 1977, the Department submitted evidence to the Industries Assistance Commission inquiry into the Australian citrus industry. This inquiry followed on from previous submissions made to the Temporary Assistance Authority and the I.A.C. concerning imports of orange juice.

The latest inquiry embraced all activities concerned with the growing, distribution and marketing of citrus products. The Department requested a rate of tariff which would afford a realistic level of assistance to the local industry.

Recently-introduced vegetable varieties are tested for performance under Queensland conditions.





A horticulturist inspects the fruit set on a young persimmon plant.

A draft report of the findings of the inquiry was released towards the end of March 1973 and, following further public hearings, a final report will be issued early in the new financial year.

Special relief measures were provided for fruitgrowers hit by hail storms which inflicted severe crop damage in the Granite Belt region in late October and early November 1977. Assistance was provided in the form of low interest loans administered by the Agricultural Bank of Queensland. More than 300 growers were affected by the storms with 190 growers reporting a loss of 50% or more of their crops. Loss of revenue from these storms is estimated at over \$3m.

Apple prices continued at a satisfactory level throughout most of the year and values should remain firm in the coming months since 1978 is an 'off crop' year. Apple production from this year's crop is estimated at 1.7m cases compared with a pick of 2.0m cases last year. Apple prices are again expected to be high on the U.K.-Europe market during the 1978 export season but, with local supplies more limited this season, exporters may not be able to take advantage of this lucrative market to the same extent as last year.

The Commonwealth Minister for Primary Industry announced in November 1977 that a national reporting and forecasting system for potatoes would soon be introduced in Australia on a trial basis. Although the Department is already committed to a well-established system of market intelligence, the concept of a national system is supported. At this preliminary stage, Departmental staff and resources are being utilized to examine the way in which this scheme can be introduced in the near future.

Following an approach from representatives of the potato industry, officers of the Department investigated the possibility of establishing a statutory body to represent potato growers in Queensland. The report on this matter will be finalized by the end of the financial year.

The severely dry conditions experienced in the early months of 1978 adversely affected banana plantations in southern Queensland and northern New South Wales and this is likely to result in a reduction in consignments from this area. However, banana supplies are expected to increase significantly in the later months of 1978.



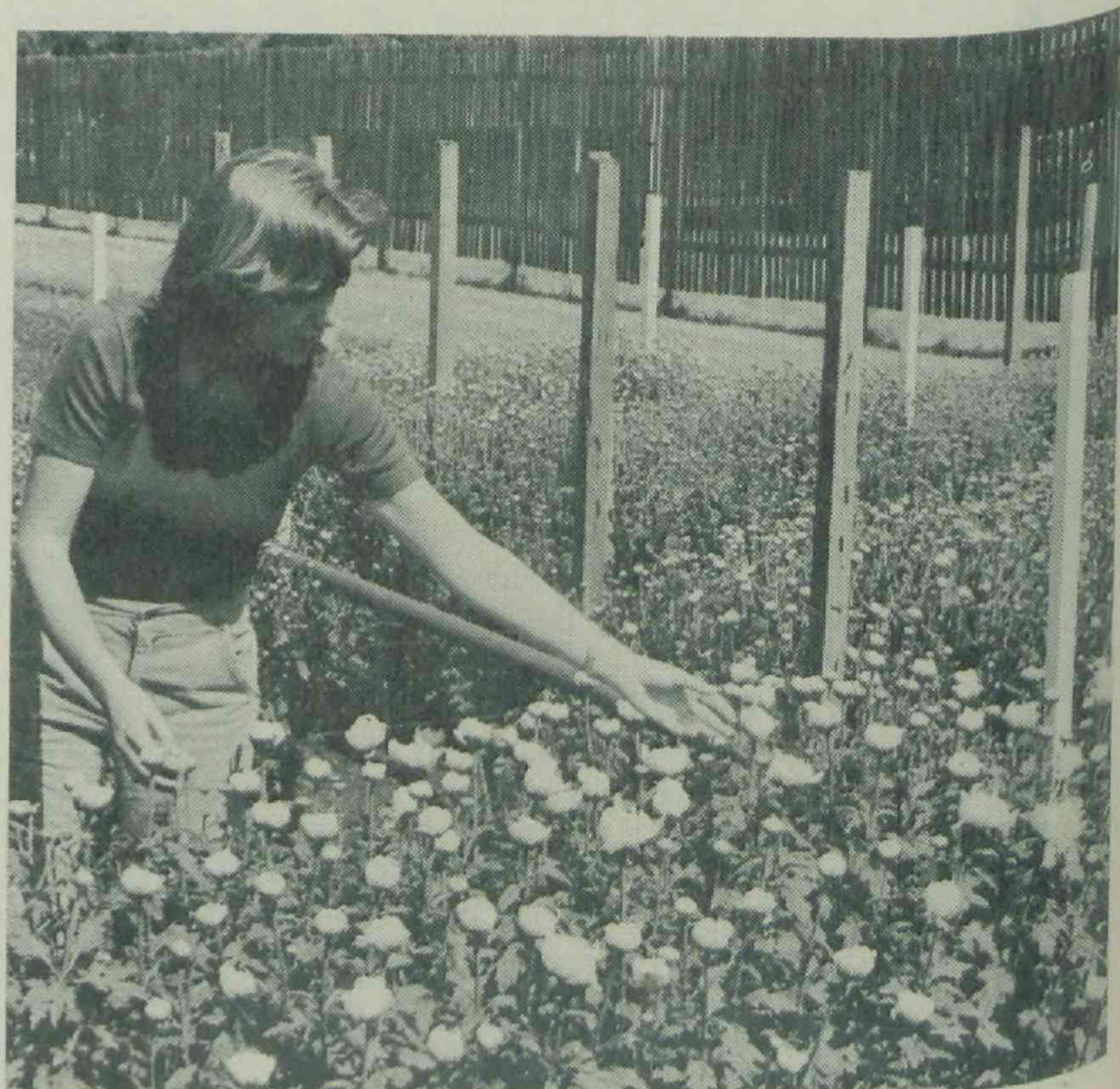
Management techniques have been developed to give concentrated cropping of guavas. This facilitates pest control and harvesting.

The intake of pineapples for processing during 1977 totalled 81 735 tonnes compared with an intake of 109 203 tonnes in the previous year. Intake was well below expectations due to the reduced winter crop harvest. Cannery sales during 1977 amounted to the equivalent of nearly 95 000 tonnes of pineapples on the Australian and export markets. The sales in excess of production were made up of stock carried over from 1976.

Intake of pineapples during 1978 totalled 35 649 tonnes up to the end of March compared with 41 886 tonnes in the same period of the previous year. The reduced intake from the summer crop is expected to be more than made up by a larger winter crop this year and the total 1978 intake is likely to exceed the unusually low level of 1977.

Officers of the Department attended a national Bean Improvement Workshop held in Sydney during April 1978. The primary aims of the workshop were to examine ways of overcoming seed quality problems and to provide a means of information exchange. Until recently, Queensland has been the major supplier of French bean seed to the Australian bean growing industry. However, recent seed quality problems have resulted in a serious decline in the quantity of seed produced and a corresponding increase in the amount of seed imported.

Production of cut flowers is an important industry.



General and Clerical

TOTAL clerical staff at 30 June 1978 was 571 officers, 382 in Brisbane and 189 in country centres.

Public Service Board approval was obtained for an additional 13 positions during the year, eight in Brisbane and five in country centres.

A total of 84 officers, 50 in Brisbane and 34 in country centres, resigned or were transferred to other Departments during the year. All have been replaced or will be replaced in the near future.

The Department has continued its policy of transferring clerical staff to gain further experience, and 45 officers were either transferred or promoted to different positions during the year.

Study Assistance Scheme

During the 1977 academic year, 328 officers were undertaking approved courses ranging from Senior to Doctor of Philosophy. Of these, 110 officers completed or discontinued their course. During the financial year 1977-78, reimbursement of fees totalling \$5 736 was made to 133 officers. A total of 84 officers amended their previously approved course.

An additional 56 officers submitted applications for course approval commencing in the 1978 academic year.

Accommodation

The Brucellosis and Tuberculosis Laboratory at Rockhampton was completed and occupied in 1977, and construction of the new Resources and Hydrology Building at Indooroopilly for the Division of Land Utilisation was finalized and the building occupied in January 1978.

Major projects under construction include the Biochemistry Building at Yeerongpilly, stage 1 of the Office-Laboratory Complex at Mareeba, and a Conference and Training Centre at Toowoomba. All of these projects will be completed and ready for occupation early in 1979.

The Department has been allocated five floors of the new building at 41-49 George Street, Brisbane. This area, when completed in March 1979, will provide modern office accommodation for the officers of the Department presently housed in the old William Street Building. Unfortunately it was not possible to accommodate the Departmental Library in this new building, and the library, together with Photography Section, the Carpenter, and the Department's Duplication Room and stores, will remain in the old premises.

Finance

Departmental expenditure from the Consolidated Revenue Fund during 1977-78 as compared with the previous year is summarized in the following table—

Service	1976-77	1977-78
	\$	\$
Payments authorized by Special Acts—		
Grant in aid of Stock Fund ..	3 406 133	445 536
Grant in aid of Banana Industry Fund	41 730	36 452
Department of Primary Industries—		
Salaries	18 591 839	20 170 339
Contingencies	13 238 232	18 072 257
	\$ 35 277 934	38 724 584

There was a minor increase in the staff establishment during the year on account of Bluetongue Control. The increased salaries expenditure of \$1 578 500 was mainly due to award increases.

The increase of \$4 834 025 in Contingencies expenditure can be attributed to the payment of \$8 415 377 as a Supplementary Grant to the Stock Fund, which represented an additional \$4 127 220 above the 1976-77 Supplementary Grant. This increased expenditure was necessary following the decision of the High Court of Australia declaring the payment of Stock Assessments, the main source of industry revenue of the Stock Fund, as invalid as from 1 February 1977.

The acaricide subsidy scheme, whereby 25% rebate of the wholesale price was granted to assist the cattle industry during depressed conditions, was continued during the year and the amount expended was \$1 066 857 as compared with \$1 172 621 during the previous year.

New areas of financial activity during the year included the reimbursement of the administration expenses of the Rural Reconstruction Board, the responsibility for which had been transferred from the Department of Lands following a change in Ministerial responsibility. Expenditure of this nature amounted to \$464 196. A grant of \$40 000 was made to the Queensland Meat Industry Organisation and Marketing Authority following a Cabinet decision on 28 February 1978 to assist the Authority to meet its requirements for the remainder of 1977-78. On 3 April 1978, Cabinet approved the implementation of a program for investigation, control and eradication of bluetongue. Costs of the program to 30 June 1978 totalled \$64 171.

Trust and Special Funds

The following table summarizes expenditure from Trust Funds in 1977-78 as compared with 1976-77—

	1976-77	1977-78
	\$	\$
Primary Industries Department		
Special Standing Fund	5 343 445	8 570 988
Banana Industry Fund	92 183	90 642
Commonwealth Agricultural Services Extension Fund	2 040 006	2 255 357
Commonwealth Poultry Industry Assistance Fund	705 833	1 125 897
Commonwealth Soil Conservation Fund	64 299	14 186
Dairy Pasture Subsidy Fund	185 495	69 161
Meat Inspection Account	1 695 994	1 907 375
Meat Research Trust Fund	395 926	421 567
Poultry Industry Fund	400 223	456 459
Stock Diseases Compensation and Stock Improvement Fund	12 549	11 493
Stock Fund	8 564 455	9 399 021
Sugar Cane Prices Fund	1 151 040	1 101 057
Swine Compensation Fund	87 541	26 496
Tobacco Research Fund	538 990	546 819
	\$ 21 277 979	25 996 518

Items showing significant increases in expenditure in the Department of Primary Industries Special Standing Fund were Disaster Assistance Schemes 1977-78 \$483 209 (1976-77 \$3 906), Livestock Account \$448 326 (\$235 366), National Campaign for Eradication of Bovine Brucellosis and Tuberculosis including Compensation Payments \$5 300 311 (\$3 019 133).

Receipts credited to Trust Funds in 1977-78 amounted to \$25 792 419 as against \$22 292 214 in 1976-77.

Resignations

During the year, 19 officers retired on reaching 65 years of age. Late in the year, 12 officers took advantage of alterations to the superannuation provisions and resigned before age 65.

A notable retirement during the year was that of Mr A. A. Ross, who had held the position of Director-General for 2 years. Mr Ross, in his 39 years with the Department, made significant contributions both as a field scientist and as an administrator.

He joined the Department in 1939 after completing his degree and, as a member of Horticulture Branch, served in Nambour, Stanthorpe, Gayndah and Maryborough until he moved to Standards Branch, Brisbane, in 1956. He became Director of Marketing in 1962 and was Deputy Director-General from 1965 until his appointment as Director-General in 1976.

In his official capacity Mr Ross served on many committees to advise the Government on rural matters and represented the Department on many organizations related to agriculture. He was a member of the Board of Advanced Education for some time and Chairman of the former Brisbane Milk Board for a lengthy period.

Mr J. E. Ladewig, director of the Division of Land Utilisation since 1965, retired during the year. Mr Ladewig joined the Department in 1933. He organized the Departmental soil conservation service and developed associated studies in land use.

Other senior officers who retired included Messrs. A. C. Peel (Deputy Director of Marketing), W. C. T. Major (Director, Dairy Research Branch), O. H. Brooks (Assistant Director, Veterinary Services Branch) and J. P. T. Mackay (Administration Officer).

Twenty-five officers who had given many years of service to the Department also retired.

They were: Miss P. M. Bremner (Standards Branch) and Messrs J. E. D. McDowell (Standards Branch), H. Woodings and J. H. Saint-Smith (Agriculture Branch), L. R. Payton, J. T. O'Rourke and N. H. Meissner (Horticulture Branch), C. E. Rose and W. Micola von Furstenrecht

(Agricultural Chemistry Branch), N. D. Irwin (Division of Plant Industry), T. Abell and R. L. Smith (Pig and Poultry Branch), F. G. Brown, S. T. F. Ozanne and V. Sewell (Veterinary Services Branch), D. M. Allison (Sheep and Wool Branch), R. Nieper (Beef Cattle Husbandry Branch), G. Mills (Animal Research Institute), C. Borthwick (Brands Section), V. J. Jacobsen (Dairy Field Services Branch), M. B. Ferricks (Dairy Research Branch), N. T. Reid (Accounts), T. J. Stevenson (Administration), E. W. Rogers (Information Branch) and W. B. Lew (Cane Prices Board).

There were 115 other resignations during the year.

Information and Extension Training Branch

THE principal functions of Information and Extension Training Branch are: (i) to disseminate agricultural information to the community, with special emphasis on the rural sector; and (ii) to undertake training activities for the development of Departmental staff. Added to this is a commitment to provide library, art, photographic and duplicating services.

In the Information Section of the Branch, the major effort was directed towards increasing the mass media coverage of agricultural information for both the rural and urban sectors. In the Training Section, emphasis was directed towards management development.

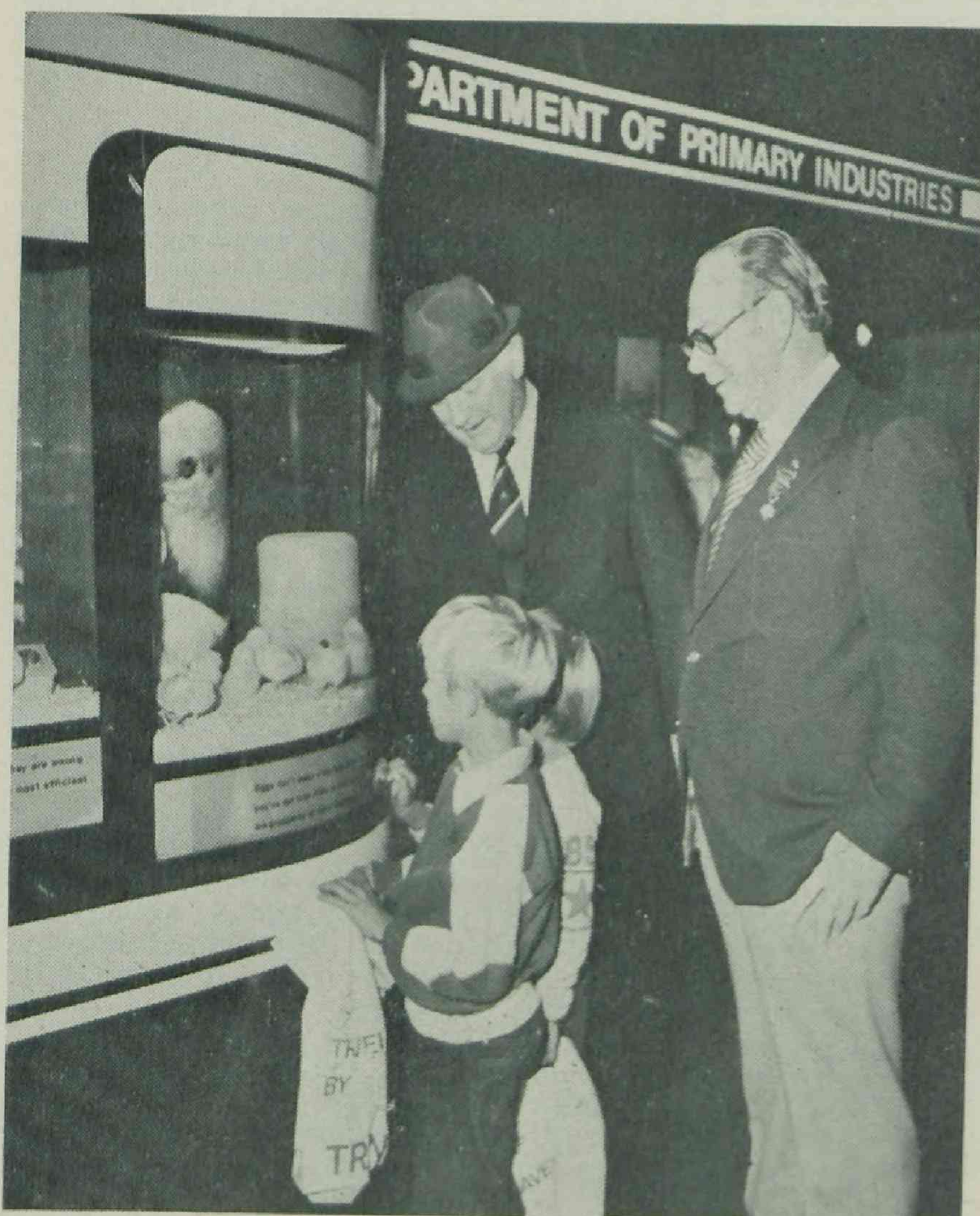
Publications

EDITORIAL. The *Queensland Agricultural Journal* remains the Department's principal extension publication. Six issues were published in 1977-78.

The articles prepared by Departmental officers are circulated to more than 10 000 subscribers who are made up of primary producers, private and public companies, libraries, educational institutions and the public.

In the last 12 months, 112 articles were published. Major articles covered such diverse topics as permanent electric fencing, tick control, registered fertilizers, peach and nectarine growing, buffel grass, and frost and minimum temperature probabilities.

The universal appeal of baby chicks . . . The Minister for Primary Industries (Hon. V. B. Sullivan, M.L.A.), left, and the Director-General of the Department (Mr E. O. Burns) join two boys in admiring the chicken segment of the Department's R.N.A. exhibit.



The *Queensland Journal of Agricultural and Animal Sciences* was issued on a 6-monthly basis.

The editorial staff co-operated with Branches in editing books for use by farmers. *Wildflowers of South-eastern Queensland*, Volume 1, was printed during the year. Two others, a *Handbook of Plant Diseases*, and *The Weeds of Queensland* are at an advanced stage of preparation and will be released next year.

This section also had commitments in the publication of the Department's Annual Report to Parliament and in providing background notes and speech notes for the Treasurer and the Governor.

PRESS. The weekly press items service was restored last July. This service is filling a valuable need for the metropolitan and provincial newspapers, radio and television stations. This bulletin of agricultural items is sent to 96 press outlets each week.

RADIO. The production of the 15-minute weekly radio program was maintained during the year. The program consists of four topical interviews and is distributed to 15 country A.B.C. and commercial radio stations as well as the National Macquarie News Service. In addition, a weekly item on marketing, supplied by Marketing Services Branch, is recorded for the A.B.C. Country Hour program. During the year, 300 items were recorded for radio.

REGIONAL INFORMATION. Regional Information Officers at Toowoomba and Rockhampton continued to publicize the work of the Department through local media outlets. A daily flow of either press, radio or television news items was released in central Queensland and on the Darling Downs.

ART. In 1977-78, the Art Section produced 287 pieces of art work for printing in the Department's Duplicating Room or the Government Printing Office. This compares with 231 in the previous year. Resignations have left only a single Commercial Art Assistant to handle the art work requirements of the whole Department.

IN-PLANT PRINTING. The in-plant printing operation continues to be one of the major undertakings of Information and Extension Training Branch.

The printing operation was reorganized in May 1977 as a subsection of the Government Printing Office and a Supervisor from the Government Printing Office was appointed. This restricted the range of work done but increased efficiency.

Since the reorganization the output has more than doubled. In 1977-78, production from the sub-section amounted to 5.2 million printed pages compared with 2.4 million pages in the previous year. Most of this work is handled as a same-day service.

The present output must be regarded as close to the peak production from the present staff and machinery.

PHOTOGRAPHY. Officers of Photography Section assisted country officers on request with photographic displays, publication requirements and scientific photography.

Still photography output for other Branches exceeded 10 000 enlargements, 170 murals, and 630 contact proofs. A total of 4 200 black and white and 6 500 colour exposures was made during the year. In addition, 5 400 slides and 120 prints were mounted, and 189 line negatives were made.

The Photography Section played a major part in producing the Department's exhibit at the Royal National Association Exhibition. A growing commitment for the Section is producing photographs and murals for an increasing number of displays. Arranging displays with a high photographic content is emerging as a major activity of some Regional Extension Leaders, and servicing this throws a heavy burden on Photography Section.

Both black and white and colour pictures were supplied to metropolitan and provincial newspapers and to specialist and national magazines.

The Photographic Section completed six 16 mm documentary films on agricultural topics during the year. These six had a total viewing time of 100 minutes.

Two others are in an advanced stage of production. The demand from Branches for film work is increasing and, if it is to be met, consideration must be given to setting up a cine team.

Television news stories were filmed at irregular intervals when staff could be spared from other duties. The demand for these stories is almost unlimited and, as mentioned in last year's report, television news coverage could readily be exploited by a television news team.

Library

Demands made on the library service continued at about the same level as in the previous year.

In an effort to encourage officers, especially those in the regions, to make more use of the library's facilities and resources, a publicity campaign has begun.

The organization and indexing of the collection of D.P.I. publications has been a major project undertaken by the Cataloguing staff.

During the year, 1 533 books were accessioned, 10 465 loans made and 4 529 items catalogued. A total of 1 973 items was lent to other libraries and 4 950 borrowed. Photocopying amounted to 251 500 sheets. In addition, the library handled 2 981 reference requests and compiled 62 bibliographies.

Training

MANAGEMENT DEVELOPMENT. A major initiative in Departmental training this year has been a program of Management Development for staff with supervisory responsibilities. The program has been developed by the trainers in consultation with senior management in Central Administration and Divisions.

The first two seminars, each of 1½ days, were conducted to gain the involvement and support of senior management in the program. Then followed the Management Development Courses, which comprised 2½ weeks of training, mostly residential. In these courses, senior Branch and Divisional officers reviewed their management roles and practised skills to assist them in implementing their roles.

Seventy officers have so far been involved in the program, and courses for a similar number are planned for next year.

EXTENSION PLANNING. The final phase was completed of a prototype course designed to improve the skills of selected extension officers in all aspects of program planning and evaluation. The training medium was the planning and execution of six extension projects chosen for this purpose.

Biometry Branch

THE purpose of Biometry Branch is to provide biometrical and data processing services to the Department.

Biometrical services involve consultation between biometricians and officers on choice of experimental designs, statistical analyses and interpretation of data in preparation for publication. These services also include development and maintenance of computer programs for repetitive statistical analyses, training of Departmental officers in use of statistical techniques and collaborative research into bio-economic systems.

Data processing services are oriented towards use of computers as aids to Departmental activity, both technical and administrative.

General comments

Further decentralization of biometrical services and consolidation of data processing services highlighted activity of Biometry Branch in the past year. Work loads of biometricians showed signs of easing but new areas of application began to emerge.

Following installation of a regional unit of Biometry in Toowoomba, a second unit was opened at Townsville in January 1978. Two biometricians and a technical assistant were equipped with a computer terminal, a card punch and a vehicle, and accommodated in premises renovated at the Oonoonba Animal Health Station. Equipment was purchased and accommodation was organized for a proposed third unit at Rockhampton.

Staff establishment was increased by four to provide the nucleus of Systems Analysts and Programmers needed to develop the Department's accounting system. Main emphasis of work so far has been training in preparation for the main task which should start during 1978-79.

Data preparation services maintained a high flow-through of work during the year although it was necessary to reduce staff numbers by one. Increasing data preparation activity by officers outside Biometry has helped offset this staff reduction. At the same time, the Branch has gained a much needed typing service which is essential for preparation of documents relating to new computer systems, for training documents, and for normal administrative communication.

Decentralization of services

The objective of providing closer contact between biometricians and research/extension officers by decentralizing Biometry Branch commenced in 1976.

Benefits to be gained from decentralization are not easy to assess. On the one hand, fewer intractable data sets are being submitted for analysis and more research officers appear willing to undertake analysis of their own data on computers with guidance from the biometricians. On the other hand, advice and assistance are being sought on the design and subsequent analysis of more complex types of problems which will require biometricians to spend more time on collaborative research. While giving greater work satisfaction to the biometricians, no reduction in work load seems likely in the foreseeable future.

Consulting services

Main objectives of consulting services provided by biometricians are to advise Departmental officers on experimental designs, to statistically analyse data and to interpret statistical analyses for research and extension projects within the Department. Limited assistance is also given to other Departments and organizations. This consulting activity accounts for more than 60% of the total work effort by the 17 graduate biometricians and their three technical support staff.

During 1977-78, a total of 461 new research projects was submitted to Biometry for comment on the experimental designs. This represented a reduction of one-quarter on the number of projects considered in the previous year. Officers from north Queensland submitted 28% of the total, 20% emanated from the Darling Downs, 10% from central Queensland and the remaining 42% were initiated in the Burnett-Moreton region and metropolitan Brisbane.

Limited assistance on experimental designs was given to organizations outside the Department during 1977-78. Advice was given to the Lands Department on field and laboratory investigations into herbicidal toxicity in undesirable plant species. The Egg Marketing Board was advised on sampling procedures for testing egg quality which forms one component of prices paid to producers. Nitrogen and phosphorus fertilizing of *Casuarina* spp. over 3 years in single and split applications were incorporated into an experimental design for the Beach Protection Authority.

Data analysis

The number of data sets submitted to Biometry for analysis increased by 5% during 1977-78 to a total of 619. The number of analyses completed also rose to 591.

Alternative sampling and measurement procedures used in quality control testing of milk samples were assessed to determine an alternative to counting contaminant colonies on incubated media plates over weekends.

Climatic data, soil characteristics and pasture management practices were related to soil phosphorous levels in a series of multiple regression analyses arising from a program of monitoring commercial applications of fertilizer in three districts of north Queensland.

Three dimensional graphs produced by computer are being used to analyse preliminary soil loss measurements at six caneland sites in the Pioneer Valley.

Investigation of the density effect of plant populations of leucaena at Brian Pastures attempted to isolate the influence of plant density on subsequent yields.

Chemical treatment and fruit temperature control of blemishes and rot infection in Ellendale mandarins during cold storage were assessed for the Sandy Trout Food Preservation Laboratory.

During 1977-78, biometricians were joint authors of seven articles contributed to scientific journals. Acknowledged assistance in publications by officers in other branches normally indicates that Biometricians have analysed the research data and also contributed interpretation of the statistical results. Increasing attention is being given to this component of consultative activity to ensure high standards of statistical methodology are maintained.

Development of statistical programs

Development of computer programs for repetitive types of statistical analyses is an objective of a small group of officers within the Branch.

The major effort of this group during 1977-78 was further development of program HARVEY. This program analyses non-orthogonal data which is frequently encountered with livestock experiments. A manual for HARVEY has been written and a computer version is available on the C.S.I.R.O. network for remote users.

Selection indexes of genetic data have been facilitated by program SELIND which was adapted for use on the C.S.I.R.O. network by the Branch during 1977-78.

A set of subroutines called PIGIT was developed to calculate growth rates, feed intake, feed intake per day and feed efficiencies for pig trials at the Animal Research Institute.

Several smaller programs were also developed as adjuncts to the major packages.

Systems design and programming for a computer recording scheme associated with the Bluetongue Virus Testing Scheme by biometricians was commenced in the second half of the year. This system aims at providing up-to-date information on test results to veterinary officers, and to permit geographical and time patterns to be examined. Summary data will be transferred to computer files. Computer drawn incidence maps will be made available as required.

Development of the Bluetongue system lies outside the normal scope of the biometricians. However, the urgency of the work and the unavailability of any other officers experienced in programming on the C.S.I.R.O. network necessitated the diversion of two biometricians to the task. This problem highlights a need for experienced programming capability within the Department for handling emergent technical systems apart from the biometricians who are fully committed to solving statistical problems.

Training in biometrical methods

Inservice training in biometrical methods has the objective of providing Departmental officers with a knowledge of mathematical techniques necessary for drawing inferences from Departmental research.

The last in a series of 11 Biometrics and Research Design Workshops completed introductory training for 300 Departmental officers with research responsibilities at the beginning of the year. This workshop ended a 3-year training program conducted by the Branch.

A second series of workshops during 1977-78 demonstrated the use of a number of statistical programs available on the C.S.I.R.O. computer network. Almost 90 officers have been given practical experience in using programs suitable for the more common types of statistical analyses of research data.

Extension officers and research support staff among branches responsible for livestock industries were given introductory training in experimental methods at Ayr and Toowoomba.

Biometry Branch is responsible for developing skills in computer programming and systems analysis among all Departmental officers.

Priority was given to training for development of commercial computer systems rather than for technical computing activity. Ten officers were enrolled for a systems analysis and design course offered at Q.I.T. during first semester.

Systems research

Participation in bio-economic systems research and development of capability in this field among technical officers in the Department are the objectives of another small group within Biometry.

Alternative mathematical models of apple bruising in dropped apple cartons were developed during 1977-78. A new type of container is being designed to help reduce apple damage due to dropping during transit from orchards to markets.

Within a computer simulation of a sheep breeding flock in north-west Queensland, a revised water run-off model was developed incorporating a surface layer for moisture storage. Energy and nitrogen balances between pasture growth and animal intakes are being modelled with an extension to include the effect of lactating ewes.

At the request of the Research Stations Board, an initial collation of all systems research projects in the Department was compiled. A Systems Research Manual is being drafted by Biometry Branch.

System development

Development of a computer system for processing the Department's accounts and inventory is the objective of a newly formed group within the Branch. Three officers are being trained as Programmers through participation in courses at the State Government Computer Centre, at Q.I.T. and short courses offered by commercial organizations which specialise in EDP training. Two new appointees who already have experience will continue training activity with on-job experience for the three existing officers.

A small system for processing requests for publications received by the Central Library has been developed.

A proposal for a computer based registration system for butchers' shops, meat delivery vehicles, kangaroo depots and pet food shops was prepared.

For the Wacol A.I. Centre, semen inventories, stock control and account invoicing are being developed as a major activity.

Associated with development of a computer system for processing the Department's accounting operations, a Departmental Working Party examined the feasibility of introducing a computer-based management information system similar to one in the Victorian Department of Agriculture. Preliminary investigations indicate that all Departmental activity could be re-organized into a program structure comparable with the Victorian system.

Computer hardware facilities

The activity of acquiring and locating data preparation and computer equipment concentrated on Townsville and Rockhampton. Both Biometry units have been equipped with card punching machines and remote interactive computer terminals which give direct access to the C.S.I.R.O. Cyber 7600 computer located in Canberra. C.S.I.R.O. facilities at both Rockhampton and Townsville are used to enter data on cards and to print the resultant output.

Increased computing activity and reduced Telecom charges made feasible consideration of linking a terminal at the Charleville Pastoral Laboratory with computing equipment at Toowoomba.

The first of five terminals connected to the new State Government Computer Centre was installed in the Department's William Street Building in May 1978. Terminals will also be located at the Otto Madsen Dairy Research Laboratory, the Animal Research Institute and at the Head Office in Comalco House.

Research Stations Section

RESEARCH Stations Section is responsible for the management and operation of 12 major research stations and for the co-ordination of multi-disciplinary research programs based on these centres.

Emphasis is placed on applied research under controlled field and laboratory conditions and includes integrated studies of soils, plants, animals, natural resources, climate and environmental factors.

Formal industry involvement in the planning and evaluation of research programs is achieved at the stations by regular meetings with primary producers and representatives of their rural organizations. Continuing contact between research and production interests is achieved by the inclusion of extension and economic services personnel on station co-ordinating Committees.

The Station Committees operate under a charter determined by the Research Stations Board, which is responsible for the overall determination of research policy and priorities. The Board consisting of a Chairman nominated by the Director-General, the Director of each Division and the Executive Officer meets regularly to consider programs and policies. The Board has been represented at all industry consultative meetings held at the Stations.

In a year of some economic difficulties, it has been necessary to reduce a number of investigations so that resources could be directed to problems of higher current priority. Total projects were reduced from 408 to 394. The total section staff remained constant at 148, and 130 scientist and technical grade staff were based at the research stations. Special and short-term services involved 95 visiting or part time staff.



High-yielding Starbonnet rice on the 'Fort Site' Burdekin test farm.

Peanut production is rapidly expanding in north Queensland. These nuts are from a Red Spanish crop on the Atherton Tableland.





Small-seeded amaranthus grown at the Hermitage Research Station. This crop has potential use in poultry feed because of its special protein form.



Seed increase of new guar (cluster bean) selections in a glasshouse.

Co-operative studies

The Research Stations provided facilities for co-operative studies with National Parks and Wildlife Service, Fisheries Services, University of Queensland, C.S.I.R.O., Irrigation and Water Supply Commission, and commercial firms, especially those supplying seed, chemicals or fertilizers to primary industry.

Progress and technical results of the research programs are presented under the industry or Divisional headings in this report, and during the year significant progress was made in many areas of primary production.

Fenugreek, an old world crop with new potential, is under study at Hermitage and Gatton Research Stations.



A peanut breeding program was implemented in the South Burnett and the area and production of peanuts on the Atherton Tableland has been doubled over the past 2 years. On the Tablelands, the peanut area increased from 2 500 ha to 5 000 ha largely at the expense of maize, where the area declined from 7 500 ha to 6 500 ha in the same period.

Continued success in the maize breeding scheme centred on Kairi Research Station resulted in the commercial release of two hybrids and two outstanding experimental hybrids are being multiplied for release in 1978-79. The sweet corn breeding work has resulted in increased commercial production extending to southern Queensland.

In dairying, the research stations at Ayr and Kairi have given priority to further development of the tick resistant tropical dairy animal based on Friesian and Sahiwal breeding. Thirty-six tested cows have been incorporated in producers' herds and wider distribution of selected animals is projected.

The area available for long grained rice production in the Burdekin region has declined due to demand for sugar-cane lands, but the development of rice production in the northern area served by the Walkamin Research Station provided 600 ha yielding 5 tonnes per ha. The area could expand to 1 000 ha in future seasons.

In the central Queensland area, considerable interest resulted from the successful biological control of heliothis in sorghum at Biloela Research Station through the use of an Elcar virus preparation. Considerable progress was made in the evaluation of sorghum lines with some resistance to midge.

Land development procedures and crop farming were emphasized at the Brigalow Research Station to furnish data on costs and returns of these alternatives for livestock producers adversely affected by the slump in the beef cattle industry.

Research programs were fully maintained in southern areas at Hermitage near Warwick with respect to cereals, and at Gatton Research Station in the further development of the vegetable and fruit crop areas which supply city and southern markets. A project for production of seed potatoes in south-east Queensland has confirmed that local material comparable with Victorian Certified Seed and superior in yield to certified seed from N.S.W. can be produced.

During the year, special projects have been conducted in the development of new crops or evaluation of potential crops, including guar, chickpeas, grams, amaranthus, fenugreek, niger, lupins, processing beans and guayule. There was revived industry interest in the wider production of tea, sweet potatoes, avocados, soybeans, and mung beans due to the results achieved in research and improved markets.

The role of agricultural crops for liquid fuels and industrial purposes has been recognized by current studies especially with cassava as a source for starch, high energy feeds and ethanol.

The research stations are now soundly established, with facilities and well trained staff to ensure continued security in our recognized industries while also exploring and developing new forms of production.

Financial assistance and contributions to research facilities are acknowledged individually but the continued support by the Commonwealth Extension Services Grant, various Marketing Boards, Co-operatives and Companies is recognized with appreciation.



Test digging equipment for the recovery of cassava (tapioca) tubers at the Coolum Research Station.

Extension Services Section

EXTENSION Services Section staff are responsible for maintaining close contact with the State's agricultural industries on a regional basis and for focusing the activities of the Department's specialist extension officers on the more significant production problems being encountered by producers.

The overall concept being pursued by staff in the Section is to have officers regard themselves as members of a multi-disciplinary team wherein the team members collaborate to provide overall management advice to producers which will allow them to use their resources efficiently. Each team member, besides acting in his professional capacity as an individual, acts in a management capacity helping to set firm objectives and to organize and implement work activities to achieve these objectives.

A State-wide system of District Extension Committees has been established and functioning for 5 years. Through this system, all extension staff exchange information regularly on a district basis and keep a close, continuing watch on the local agricultural situations.

Some of the highlights of this work during the past year are discussed briefly.

Graziers in the Far South West were involved in discussing local survey information on low-lambing problems, in deciding their future actions and in co-ordinating these activities with those of relevant local authority officers. The net result has been some spectacular lifts in lamb-marking percentage on selected properties.

Horticultural seminars were conducted in the Near North Coast Region. The overall program was aimed at a fast growing sector of the farming population in the area, which covers a significant group of novice producers. Some 3 300 people attended these events and a formal evaluation conducted by local staff soon afterwards indicated that 50% of the people attending were novice producers, which the program deliberately aimed at reaching. Evaluation also showed that more than 50% of producers attending the last seminar indicated that the program had influenced them to change their practices in some way.

Departmental officers assisted in conducting many Rural Expositions during the year. Overall attendance at the three largest Expositions exceeded 90 000.

At the 'North Queensland Field Days', the major thrust of the Departmental displays was the cost reducing innovations that cattlemen could adopt as a means of offsetting the economic effects of low beef prices. The two innovations given emphasis were electric fencing and the versatility of helicopters in cattle mustering. There is ample evidence to demonstrate that properly organized mustering by helicopter in association with strategically placed station staff is more economic in time, effort and cash outlay than conventional mustering systems.

At the 'Expo V' Horticultural Field Days at Gatton, the Department organized no fewer than 16 separate displays ranging from new crop varieties and the major pests and diseases currently affecting crops, through to new produce packaging systems and the handling and forced-air cooling of farm produce.

Of the eight Departmental exhibits at 'Farm Fest', the State's major Exposition of equipment for the grain industry, the display on electric fencing attracted wide interest as did the demonstrations using a rainfall simulator to show the impact of stubble cover on soil protection and water conservation.

While the sheep and cattle producers were interested in electric fencing because of its low cost, easy maintenance and effectiveness in controlling stock, the grain producers saw it as a means of protecting their crops, waterways, and grassed soil conservation structures from the effects of marsupials and feral pigs.

Undertakings similar to these Expositions have increased in popularity with agri-business firms and with rural people over the past 5 years. Some are now being organized on a more or less regular basis by separate organizations (often for particular industries) in many widely scattered areas of the State. They have proved to be an excellent opportunity for Departmental officers to bring relevant information and simple demonstrations to the attention of a large number of producers in a short time and it is expected that they will receive continued support in the future.

Land degradation and underground water quality in the Lockyer Valley was another commitment for Departmental officers. A local Water Conservation Committee, made up



Helicopter mustering at north Queensland field days. (Queensland Country Life picture).

of representatives from a wide range of Government, Local Government and Community-interest Groups, was formed late in the year as the dry summer months brought home to many producers the seriousness of the situation. A pilot water conservation and management scheme has been developed by the committee as a possible model for the area.

This involvement of all interested groups at a district level to overcome a local problem affecting a significant proportion of the district is but one example of the many co-operative self-help action groups which are developing in many areas of the State.

Training

The officers who participated in the Special Extension Planning Workshop mentioned in last year's report, met again in March this year to consider what had been achieved by their six individual extension programs and by the procedures used in the planning operations.

This evaluation indicated that all projects had achieved their objectives and all officers involved had benefited from their participation in the inter-disciplinary activities developed to overcome the problems on which they were working. It is proposed to develop a second Extension Planning Program in the near future.

Division of Animal Industry

THE complexity of the Division of Animal Industry's functions and responsibilities is revealed in the detailed objectives and functions of the eight Branches which comprise the Division.

VETERINARY SERVICES BRANCH

1. To investigate and control serious disease outbreaks affecting commercial animals and birds.
2. To eradicate bovine tuberculosis and bovine brucellosis in Queensland, and to develop other disease eradication programs as these become necessary and practicable.
3. In co-operation with Commonwealth Government, to maintain animal quarantine services to prevent the introduction of exotic animal disease, and to assist in the exportation of animals and animal products.
4. To effect control over stock movements as a disease control measure.
5. To promote field projects aimed at elucidating disease problems affecting the livestock industries.
6. To promote extension activities in the disease control field with a view to increasing farmer awareness concerning animal disease matters, and acceptance of Departmental programs and policies.
7. To facilitate in-service staff training.

SLAUGHTERING AND MEAT INSPECTION BRANCH

1. To inspect stock and poultry for the presence of disease and to ensure that a high hygiene standard is maintained during processing and handling from the time of slaughter until the meat is delivered to the consumer.
2. To attain standards specified in the Meat Industry Act and Regulations applicable to all premises licensed by the Queensland Meat Industry Organization and Marketing Authority and registered by the Department.
3. To inspect and supervise all activities associated with the slaughter of prohibited animals and stock intended for use as petfood and to inspect all premises where flesh or meat is processed and offered for sale as petfood.
4. To collect information concerning disease detectable at slaughter and to trace back affected stock to the property of origin.
5. To promote quality and to facilitate trade by classifying and grading meat and by promoting tenderstretch and other methods of improving meat quality.
6. To avoid waste and to lower processing costs, for example, by bruising studies.

BEEF CATTLE HUSBANDRY BRANCH

This Branch is responsible for extension of research findings in beef cattle husbandry and management, and for carrying out applied research in these fields. It conducts the 'Swan's Lagoon' Cattle Field Research Station and has research functions at Brigalow, 'Brian Pastures' and Coolum Research Stations.

SHEEP AND WOOL BRANCH

This Branch similarly is responsible for the provision of extension and advisory services to the sheep and wool industry. It aims at developing programs which will assist producers to overcome their current production problems. The Branch conducts the Wool Biology Laboratory which provides a fleece testing service at a nominal charge.

PIG AND POULTRY BRANCH

1. To provide an advisory service to the commercial pig and poultry industries, to offer a least-cost ration formulation service, to conduct surveys in order to define industry problem areas and to develop appropriate extension programs.
2. To take an active interest in product acceptance in the market place, to advise the respective industries of consumer attitudes, and to ensure that quality products reach the consumer.
3. To improve pig carcass quality and growth efficiency by on-farm performance testing using growth rate and back fat measurement as the main criteria for selection.
4. To work closely with highly intensive producers to improve the environment, health and general husbandry and to develop an awareness of the environmental implications of highly intensive systems.

HUSBANDRY RESEARCH BRANCH

1. To collate relevant information from the sheep, cattle, pig and poultry industries and elsewhere with the objective of defining problems and to investigate these problems.
2. To test technical solutions at the Animal Husbandry Research Farm, Rocklea, or at regional stations.
3. To report all results in the scientific literature and transmit the practical application of scientific findings to extension staff and/or directly to industry, and to provide a reference source of specialized knowledge to extension staff and industry.

PATHOLOGY BRANCH

This Branch provides a diagnostic service for the animal industries and undertakes applied research into animal disease problems of significance. It plays a major watchdog role in respect to exotic diseases and assists with laboratory services to disease eradication programs.

At its Tick Fever Research Centre at Wacol, the Branch prepares and distributes vaccines against tick fevers and anaplasmosis and conducts research into these diseases.

The Branch is increasingly involved in monitoring animal products and in testing animals and animal products involved in export and interstate trade.

It conducts diagnostic laboratories at Yeerongpilly, Oonoonba and the Brucellosis and Tuberculosis Laboratory at Rockhampton.

BIOCHEMISTRY BRANCH

Biochemistry Branch is integrated functionally into the advisory, regulatory and research activities of Division of Animal Industry. It does this by the application of the discipline of chemistry to the wider objectives of the Division.

It serves also as a reservoir of resource personnel in specialist aspects of nutrition, metabolic disorders, toxicants and the regulation of agricultural chemicals in feeds, animal products and the environment.

Notable events

Mr. K. M. Grant retired after 40 years in the Veterinary Services Branch, the last 10 as Director of Veterinary Services. Mr. Grant served on many committees including the Agricultural Requirements Board, the Technical Committee on Veterinary Drugs, the Cattle Tick Commission and the Poisonous Plants Committee.

Mr. O. H. Brooks, Assistant Director of Veterinary Services, also retired on 16 June after 37 years' service. He served in various capacities at Murgon, Atherton and Rockhampton before moving to Brisbane in 1961 as Assistant to the Director, Division of Animal Industry. Mr. Brooks was appointed Assistant Director of Veterinary Services in 1968 and in recent years played a major role in the administration of the brucellosis and tuberculosis eradication campaign.

This year was the year of exotic disease incidents: identification of a virus of the bluetongue group in cattle, illegal importations of cockatoos carrying a Newcastle disease virus, illegal importations of eggs, a suspect case of rabies at the Lytton Quarantine Station and the diagnosis of contagious equine metritis in southern States all occurred during the year. Details appear in appropriate sections later in this report.

Progress in brucellosis eradication must be considered a notable event for the year. The scheme is at present ahead of schedule. During the year, the protected areas were enlarged substantially, a voluntary eradication program was commenced in the dairy industry and the stud herd accreditation scheme reached a peak of testing.

An 'outbreak' of foot and mouth disease was simulated at Emerald in November 1977. An operational headquarters, complete with a communications adviser from the State Emergency Service, was established and six teams of a veterinary officer and a stock inspector investigated the 'outbreak'. The exercise concluded with the destruction and burial of 100 'infected' and 'in contact' cattle which were, in fact, brucellosis reactors.

Mr. A. Brown, Chief Veterinary Officer of the Ministry of Agriculture, Fisheries and Food for England and Wales, observed the exercise and commented that under the conditions he expected aerosol transmission of the virus to be far less important than was the case in Europe. Our strategy for control was largely based on European experience.

The introduction of the *Meat Industry Act Amendment Act 1977* during 1977-78 provided for the reconstitution of the Queensland Meat Industry Authority as the Queensland Meat Industry Organization and Marketing Authority. A new chairman was appointed, the livestock producer representation was increased and one member who is experienced in commodity marketing has been appointed. The powers and duties of the new Authority have been considerably widened by the addition of responsibilities which include the development of a system of carcass classification and the provision of a market information service for producers.

Trials of the Australian Meat and Live-stock Corporation's automated carcass classification system continued at the Metropolitan Public Abattoir, Cannon Hill during 1977-78 but unfortunately numerous technical problems have been experienced. The term of secondment of an inspector to the Australian Meat and Live-stock Corporation has been extended to the end of 1978. Large scale trials of a manual objective beef classification system were instituted at the M.P.A.B., Cannon Hill; Kilcoy Pastoral Company, Kilcoy; and the South Burnett Meatworks, Murgon. These trials have proved that manual carcass classification is practical, accurate and reasonable in cost.

The Australian Agricultural Council has agreed that manual carcass classification be immediately implemented throughout Australia on a voluntary basis. It is accepted that the manual system has a continuing role in small abattoirs and in training classifiers.

A roller ribbon brand to identify tenderstretch and electrically stimulated carcasses was introduced during 1977-78. Both these processes act by preventing or reducing cold shortening and thus toughening of meat. A green colour is used to identify these carcasses and to distinguish them from blue ribbon branded carcasses. In addition, a ribbon brand using a purple colour was introduced to identify lot-fed beef. Identification of meat in this fashion should ensure that consumers obtain the genuine article when requested.

With the co-operation of a leading bacon factory, a slide film series depicting the break-up of a superporker was produced. This series has been shown to butcher and consumer groups. Some retail butchers have shown interest in this new method of marketing pork.

Several years of investigation into the various causes of bruising culminated in the production of a 20-minute film, financed by the Australian Meat and Live-stock Corporation.

In the Roma district, Beef Cattle Husbandry Branch staff played a major part in the conduct of a well attended symposium on the 'Future of the Family Farm' and in follow up activities arising from the symposium.

A vigorous extension program, designed to reduce reliance on chemicals for tick control, was pursued with evidence of some success, and an on-going program to monitor the level of pesticide residues in slaughter cattle has been initiated by the Veterinary Services, Biochemistry and Slaughtering and Meat Inspection Branches, with financial assistance from the Australian Meat Research Committee.

Liveweight selling became an important issue at many saleyards, but with opposition from many meat exporters.

Development of facilities

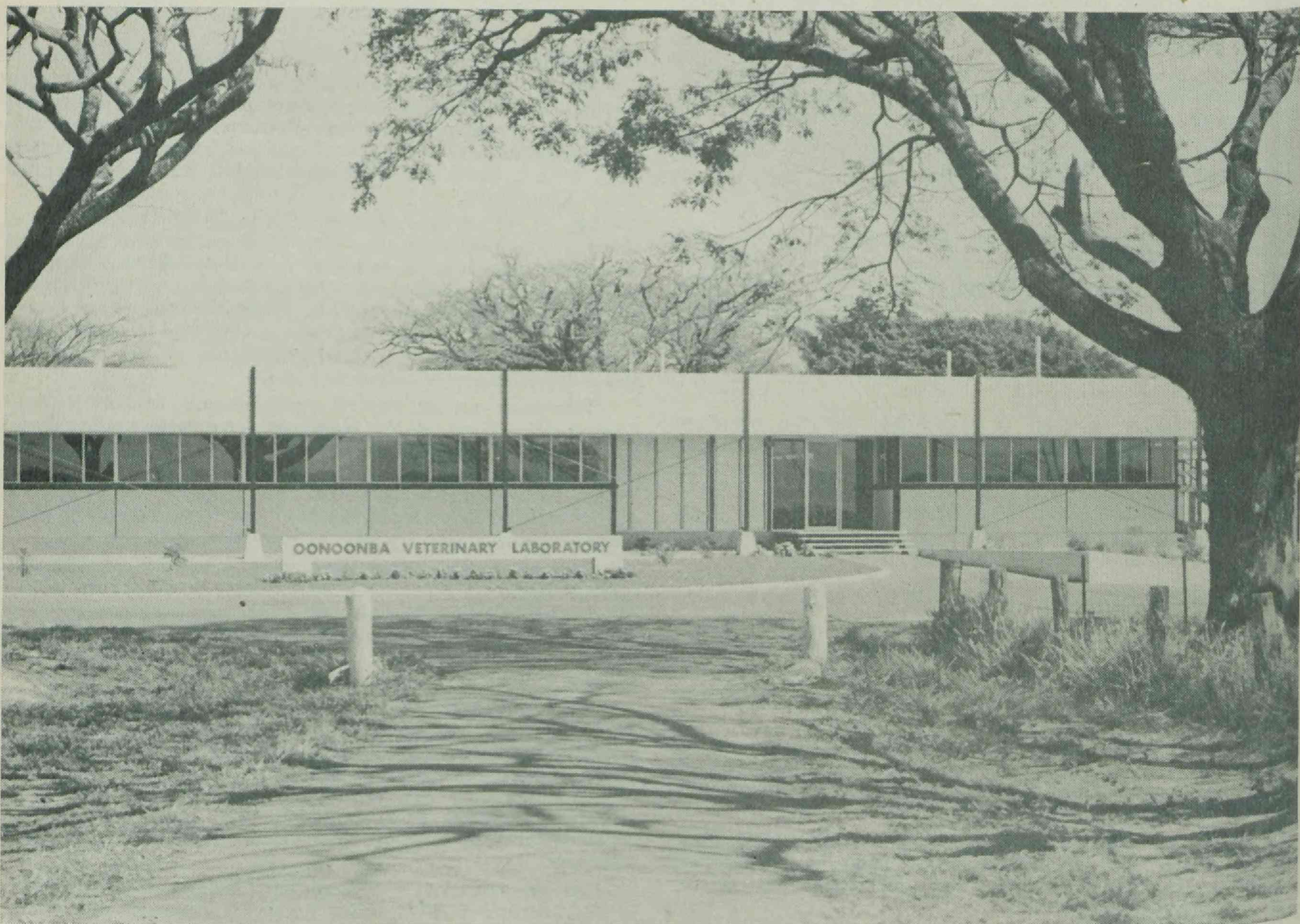
The new veterinary laboratory at the Animal Health Station, Oonoonba, which was constructed to replace the main building destroyed by fire in July 1972, was occupied in May 1977 and officially opened by the Honourable V. B. Sullivan, Minister for Primary Industries, on 18 October 1977. The facilities at this laboratory provide a diagnostic service and associated research for north Queensland and have played a major role this year in giving laboratory support to the Brucellosis and Tuberculosis Campaign and serological testing for bluetongue.

The new laboratory constructed at Rockhampton to provide support to the Brucellosis and Tuberculosis Campaign was completed in January 1978. It commenced testing of blood samples on 1 March 1978 and by the end of May was testing at the rate of almost 4000 tests a day which is near the planned capacity.

Two caravans were fitted out to undertake Rose Bengal testing. One commenced testing at Toowoomba in January and the other at Roma in April.

Considerable progress has been made in construction of the Stage II of the Biochemistry Laboratory at the Animal Research Institute, Yeerongpilly. It is anticipated that this major laboratory will be completed during the forthcoming year.

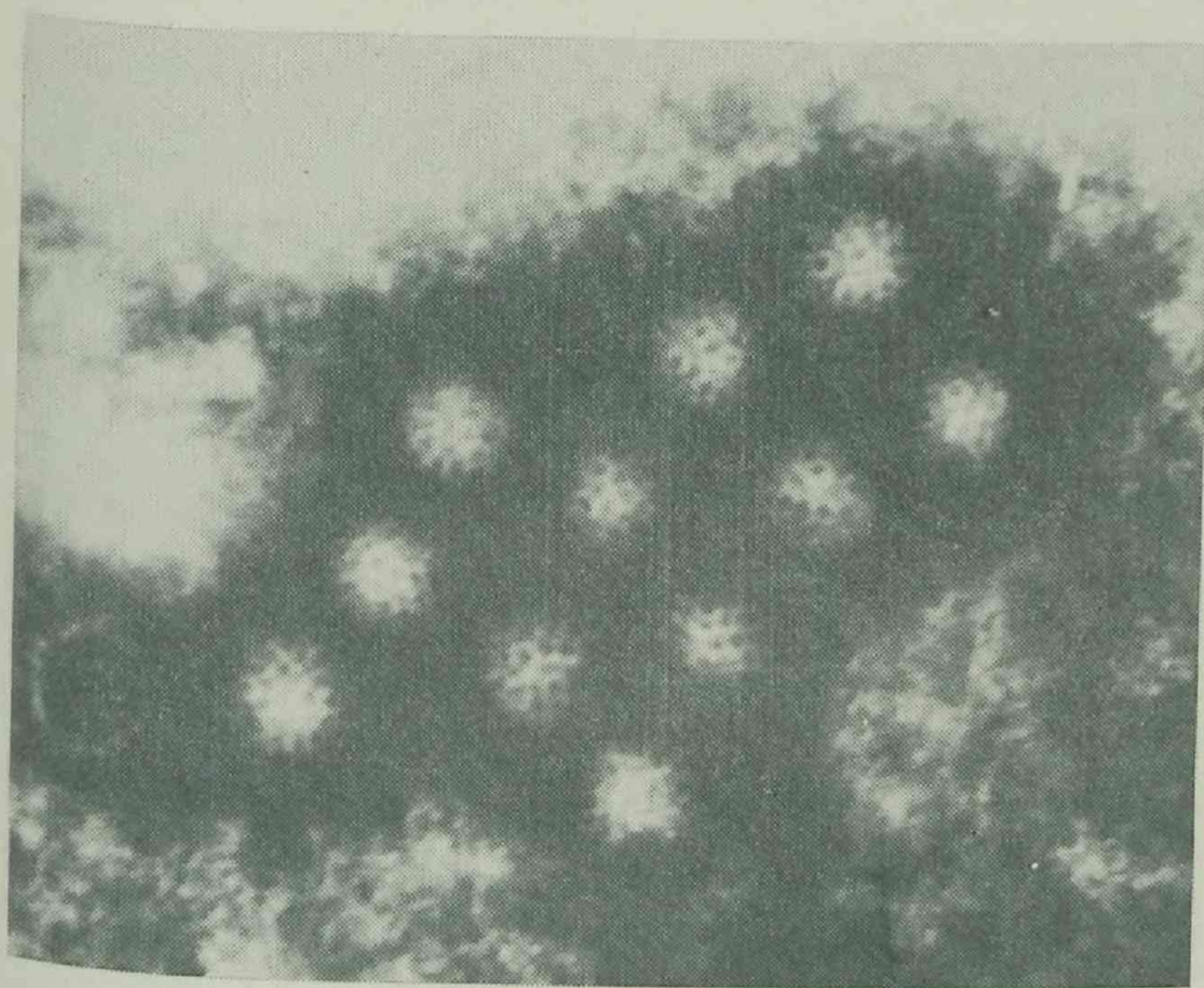
A substantial area of grazing land adjacent to 'Swan's Lagoon' Cattle Field Research Station, Millaroo, was purchased during the year. This land was obtained to enable verification of trial results under conditions simulating those of commercial producers.



Oonoonba Veterinary Laboratory. The veterinary laboratory at Oonoonba was opened by the Minister for Primary Industries (Hon. V. B. Sullivan, M.L.A.) on 18 October 1977. It replaces the old buildings destroyed by fire in July 1972 and provides a modern facility servicing the animal industries of north Queensland.

Finance

The Division has had considerable difficulty in maintaining its services to the animal industries due to involvement with three exotic disease episodes and the resulting demands on field and laboratory services. Special Treasury Grants were obtained to maintain routine services following the loss of stock assessment revenue, and to cope with the demands caused by the detection of serological evidence of exposure of cattle in Cape York Peninsula to a strain of bluetongue virus. While most of the Division's activities are financed under the Stock Fund, this Fund is now entirely supported from Consolidated Revenue.



An electron microscope picture of the bluetongue virus magnified 250 000 times. The electron microscope installed at the Animal Research Institute, Yeerongpilly, at the end of 1977-78 from Commonwealth Extension Services Grant funds allows the morphology of viruses to be studied.

Certain fees charged for services were increased towards the close of the year, including charges for inspection and testing of livestock exported from the State. The position of the Meat Industry Fund deteriorated due to increasing costs.

Support for special extension projects and research continued at approximately the same level as in the previous year. A sharp rise in funds available enabled a substantial increase in activity in the brucellosis and tuberculosis eradication program.

Animal quarantine

In Queensland, the Commonwealth Quarantine Act is administered by Veterinary Services Branch, under the supervision of the Director of the Division, who is the Chief Quarantine Officer (Animals).

Officers in the Far North of the State were involved in the destruction of a number of cockatoos illegally introduced to the area from Ambon in Indonesia. An exotic Newcastle disease virus was isolated from one of these birds. Following on the isolation four premises were depopulated of poultry and aviary birds including those on the premises of a tourist attraction, the Australian Bird Park.

All commercial poultry flocks and backyard poultry considered to be at risk were tested, as were native birds captured on the premises of the Australian Bird Park, and all dying and dead birds reported by the public. The results in all instances were negative, as has been the subsequent monitoring done in the area, which indicates that the virus had not escaped into the native bird population or commercial flocks.

Three persons were subsequently convicted and fined on charges relating to the Customs and Quarantine Acts in relation to the illegal importation.

In the Brisbane Division, one large aviary and two small ones were depopulated, cleansed and disinfected during March following the introduction into an aviary at Park Ridge of illegally imported eggs from the Philippines for hatching. All three aviaries were recleansed and reinfected a week later and a 6-week quarantine period was imposed. There was no evidence of disease before the birds on the three properties were destroyed.

In March 1978, a dog died at Lytton Quarantine Station with lesions suggesting death was due to heartworm (*D. immitis*) infestation. However, routine examination of the brain by C.S.L. Parkville suggested death was due to rabies and all animals (15 dogs and one cat) that had been released from the Station following the arrival of the suspect rabid dog were recalled. Approximately 1 month later the 'all clear' was given and the animals were again released.

The diagnosis of a new contagious venereal disease of horses in the United Kingdom in May 1977 precipitated the establishment of a survey in a number of studs in Australia. Officers collected samples from recently imported horses and those that had had coital contact with imports. No cases were discovered in Queensland and very little spread within Australia appears to have occurred.

Initially, all importation of horses from the United Kingdom and Ireland was suspended but, in early November, importation was resumed. Horses must now undergo a period of isolation in the United Kingdom, with concurrent swabbing and medication. A further swabbing and period of isolation is undertaken upon entry into Australia.

During the year, approximately 700 kilograms of meat and meat products, 200 kg of dairy products including cheese and butter, and more than 100 eggs were seized from incoming passengers at the Brisbane International Air Terminal. Two people were convicted and fined for illegally introducing meat and meat products. Two cases of dog smuggling were investigated.

IMPORTS. Since 1973, all accommodation at the Lytton Quarantine Station has been reserved for dogs and cats introduced from Papua New Guinea, Hawaii, Fiji and Norfolk Island. This year, a section of the Station was made available for dogs imported from the United Kingdom.

During 1977-78, 118 dogs and 14 cats were quarantined at Lytton including 68 dogs from the United Kingdom. During the same period, 213 dogs and 133 cats were introduced from New Zealand. Dogs arriving by air from the United Kingdom in approved containers undergo 90 days' quarantine while dogs and cats from the Pacific region (excluding New Zealand) are quarantined for 9 months. Dogs and cats from New Zealand are not required to be quarantined.

Meat imports (both fresh and tinned) to Queensland totalled 56 676 kg during the year. Supplying countries include United Kingdom (45 467 kg), China (2 300 kg), Canada (8 100 kg), Germany (505 kg) and Switzerland (304 kg).

EXPORTS. Live cattle exports during the year totalled 15 111. Importing countries include Fiji (117), Hong Kong (7 025), Malaysia (2 057), Philippines (1 989), Papua New Guinea (48), Indonesia (3 851), Vietnam (18), and Pakistan (6).

Exports of other animals included 435 dogs, 120 cats, 25 497 queen bees, 131 827 day-old chickens, 269 other birds, 144 horses, 1 599 toads, five rabbits, five guinea pigs, two kangaroos, 269 pigs, three goats, three bats, 110 fish and 129 970 fertile eggs. One thousand seven hundred and fifty cattle ticks were also exported to research workers overseas.

Amendments to legislation

The Regulations under the *Brands Act* 1915-1975 were amended to delete certain designs of cattle and sheep earmarks that were withdrawn from registration many years ago, to define the term 'code' as it applies to earmarks and to insert the various letters and designs used in relevant brand series. At the same time, all brand and earmark application forms and certificates were amended to make them easier to process, with a view to computerization of records at some later date.

The risk of introduction of Newcastle disease of poultry with birds smuggled into Cairns, and the recovery of a strain of bluetongue disease virus in the Northern Territory and serological evidence of its presence in Gulf areas of Queensland led to amendments of the Regulations under the *Foot and Mouth Disease Expenses and Compensation Fund Act* 1958-1969 to up-date valuation fees and to Orders in Council declaring birds, buffaloes, camels, cats, dogs and horses to be animals under the Act.

Orders in Council were also promulgated to declare birds and buffaloes to be stock under the *Stock Act* 1915-1976; to declare an Infected Area in the Cairns district in relation to Newcastle disease, to declare a Bluetongue Infected Area of Cape York Peninsula and to control the introduction of buffaloes, camels, cattle, goats and sheep from the Northern Territory. The Cairns Infected Area was subsequently revoked on completion of control measures and conditions of entry from the Northern Territory were amended in the light of information on the local incidence and spread of bluetongue virus.

Other amendments under the Stock Act and Regulations included extension of the Brucellosis Protected Area to include a further 40 shires, and amended conditions of entry into or movement within the Protected Area. The boundaries of the Brucellosis Infected Area were amended accordingly. Provisions were also introduced to control movements within the declared Tuberculosis Infected Area.

The regulations relating to artificial insemination of stock were amended to revise the price per dose of semen sold within Australia, and the accommodation and processing charges at the Wacol and Redlands Centres. The stock permit form was also revised to enable ready extraction of information for computerization of records.

By Orders-in-Council, chemical residues and equine contagious metritis were declared to be diseases and equine contagious metritis and equine rhinopneumonitis (abortion form) to be notifiable diseases.

The *Meat Industry Act Amendment Act 1977* came into operation on 1 March 1978. This legislation provided for the reconstitution of the Queensland Meat Industry Authority as the Queensland Meat Industry Organization and Marketing Authority with widened powers and responsibilities. The meat Industry Regulations 1973 were amended to provide for appointment of members of the revised Authority.

The Gympie and Mackay District Abattoir Boards and relevant areas were abolished by Order-in-Council and replaced by Regional Meat Areas under the control of the Authority.

Further amendments to the Regulations provided additional powers in regard to notices of intention to slaughter stock, eased certain conditions pertaining to carriage of meats in registered meat delivery vehicles and placed an onus of proof on a respondent to produce evidence where it was claimed approval had been granted for certain usages or activities.

Training programs

In-service training is an important aspect of the activities of a technical organization and the Division participated in staff training programs to the limit of resources available for this purpose.

Technical in-service training was maintained near previous levels but, in common with other Divisions, there was a greater emphasis on management development training. Most senior Divisional and Branch staff have now had exposure to modern management concepts, practices and skills.

Four extension officers completed Post-Graduate/Diploma training in extension and three officers commenced studies in this field in 1978. Miss J. K. Elder, Pathology Branch, completed post-graduate studies in veterinary epidemiology and Mr. C. R. Hass, Veterinary Services Branch officer, commenced a Masters degree in this area at the University of Melbourne. Dr. B. M. O'Sullivan is presently on post-doctoral study leave at the School of Veterinary Medicine, Cambridge. Dr. T. McEwan and Mr. G. Murphy, of Biochemistry Branch, undertook consultancies to developing countries on behalf of the Australian Development Assistance Bureau and the Food and Agriculture Organisation respectively.

Mr. S. G. Knott, Veterinary Services Branch, attended an Exotic Diseases course at Grosse Ile in Canada in May 1977 and visited the U.S.A., U.K. and Europe to study diseases exotic to Australia. Mr. R. T. F. Armstrong, Sheep and Wool Branch, visited several African and Asian countries to study breeds of sheep adapted to semi-arid, tropical and sub-tropical conditions which might be imported through the Cocos Island Quarantine Station for use in Northern Australia. Mr. P. B. Hodge, Supervising Husbandry Officer, Beef Cattle Husbandry Branch, undertook an overseas tour of North America and Europe to study advances in beef cattle husbandry. Mr. A. J. Ernst, Husbandry Officer, Beef Cattle Husbandry Branch, attended the Third International Farm Management Congress in Hamburg.

Branch or regional workshops were conducted by six Branches. The majority were essentially of a technical nature, but with emphasis on definition of industry problems and establishment of work priorities. The first Animal Quarantine Officers Workshop was held in May 1978. This proved very successful and fulfilled a long felt need.

Slaughtering and Meat Inspection Branch embarked on an ambitious staff training program. The basic aims were to enhance technical proficiency and to develop managerial effectiveness at all Branch levels. The needs had been established in a survey of staff and following exploratory workshops of Branch supervisors held in 1977. Workshops have been held for supervisors in supervision training and counselling. Training skills checklists and role specification have been introduced. The training program is managed by a Branch Development Steering Committee which has representatives from all Branch levels. The program is considered to be a model for other Branches of the Division.

Beef Cattle Husbandry Branch has developed programmed learning courses for field staff and a current awareness program based on recorded tapes. Both are relevant to a Branch whose officers are widely scattered throughout the State.

A number of officers completed interstate study tours and short courses on technical subjects such as electron microscopy, immunology and animal breeding. Several officers presented papers at scientific meetings and conferences during the year. These included the Twelfth Biennial Conference of the Australian Society of Animal Production, the Australian Veterinary Association Annual Conference, the Second Australasian Poultry and Stock Feed Conference, the Fourth Australian Symposium on Analytical Chemistry, and the Sixth Australian Conference of Residue Chemists.

Cattle industry

Both cattle industries continued in a depressed economic state which was aggravated by poor seasonal conditions. While there were intermittent rises in cattle values, these were off-set by similar down-turns and overall, average values for most descriptions of slaughter cattle were similar to that of the previous year and with further cost increases the industry in effect lost ground. Cow values, however, improved slightly with boner types strengthening most. Well-finished young cattle suitable for the domestic trade were in lighter than normal supply and average values over the year showed a marginal improvement, largely due to higher prices in the immediate post-drought period. At the close of the year there were indications for some optimism in the future of the beef market.

Cattle slaughterings at 3.03 million in the year from May to April established an all time record and exceeded the previous year by almost 9%. There was an increase in slaughter of all descriptions and females represented about 39% of the total kill. This compares with 37% for the same period last year in a total kill of 2.8 million. Calf slaughterings increased by 5% over the previous year.

Despite this record kill, the total numbers of beef cattle, according to the 1978 census showed only a 2% decrease on the previous year. During most of the year, it appeared that meatworks were unwilling to accept all cattle on offer. The excess of supply over demand no doubt affected prices paid.

The store cattle market has remained in the depressed state which has prevailed since 1974. Low slaughter cattle values coupled with poor seasonal conditions have kept values down at unit price significantly below slaughter values. Greatest demand has been for older steers for short term fattening with little demand for females. As the year closed, store prices firmed following good rains in southern States and improved prospects for the beef market.

Paddock selling of store cattle has continued to replace the auction system. This reflects the attempt by store producers to reduce selling costs and to avoid the risk of low market values when transport costs have already been incurred.

Fatteners have been able to take advantage of low store values, and there has been a slight resumption of interest in feedlot finishing.

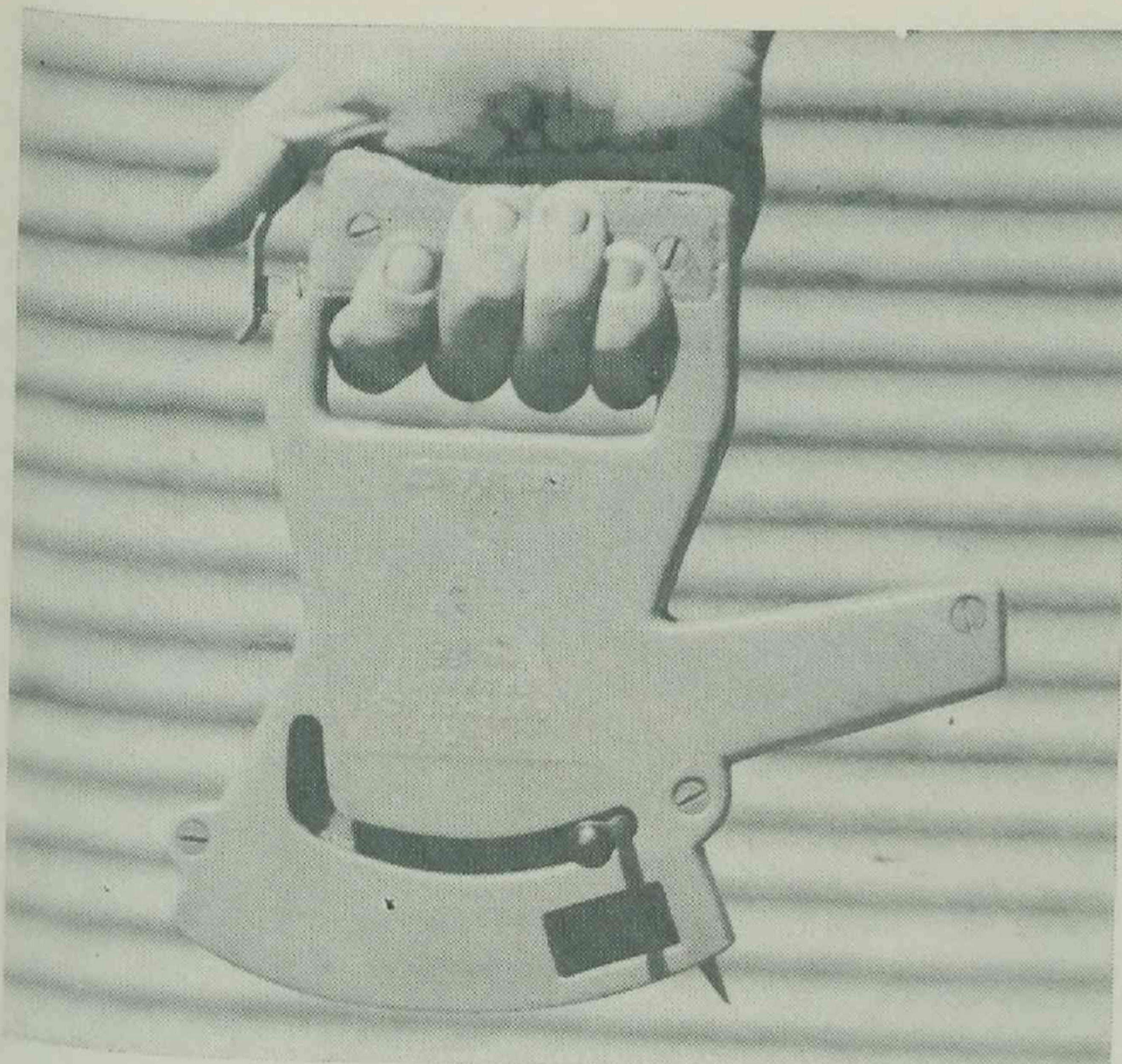
The trend continues towards reducing breeder numbers and carrying steers over for later sale either as older stores or for fattening. Where possible, producers have significantly reduced their scale of operation placing more emphasis on diversification.

The interest in liveweight selling has continued. Scales have been installed and are operating or ready for operation at Miles, Roma, Toowoomba, Warwick, Oakey and Gympie, in addition to Cannon Hill. Scales are being installed at Murgon, Longreach, Wandoan and Rockhampton. At present, they are seen as being used almost exclusively for fat cattle. However, it is considered that direct consignment to meatworks, either from a paddock sale or for payment by weight and grade is preferable and less costly. It is envisaged that liveweight selling will be used more and more for store sales in the future. In this way, the high capital cost can be serviced even if a greater percentage of slaughter cattle go direct to meatworks.

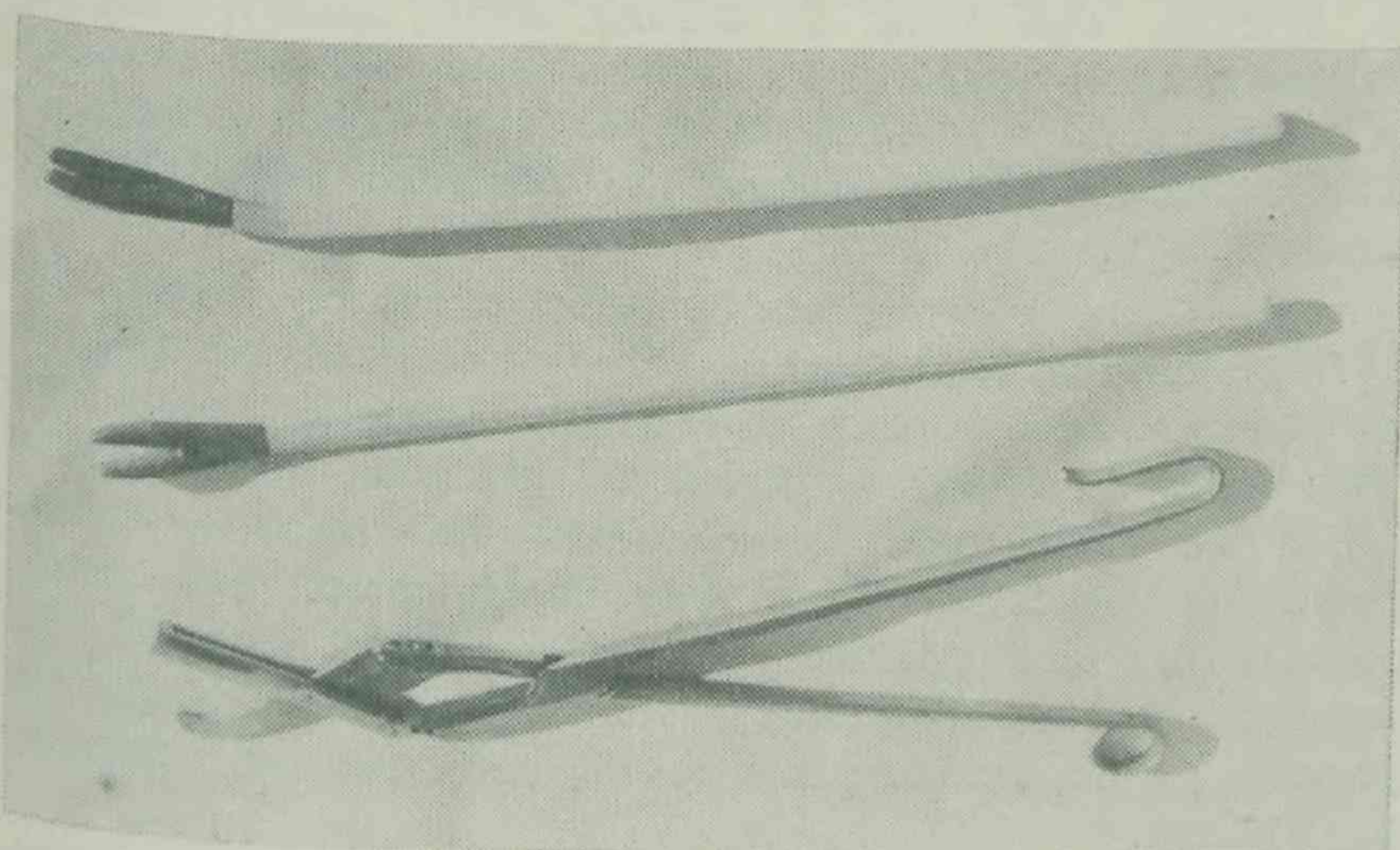
Although classification has not yet been introduced, except on a trial basis, interest among producers is still keen. Competitions for assessing carcass 'class' in live animals have continued. The measurement of backfat, and the display of this information on neck cards, has continued to attract interest among RNA exhibitors.

At Roma a symposium on 'The Future of the Family Farm' attracted 195 participants. The objective was to stimulate property owners (mostly beef and wool producers) to assess realistically their future in the face of continuing unfavourable 'terms of trade'. This was followed up by an invitation to those who took part to indicate what aspects of the symposium they would like to pursue further. Extension officers will seek to help them investigate and possibly implement further action.

Detailed statistics of meat cattle breeds were first collected in 1973. Statistics were obtained for the second time in March 1977. These showed that over the 4-year period straight tropical breed cattle numbers increased by 109% and represented 15% of the total beef cattle numbers as against 9% in 1973. Over the same period, the overall increase in numbers of straight British and European breeds was only 2% and these represented 37% of the total beef cattle population in Queensland compared with 43% four years earlier. The Shorthorn, Angus and Red Poll breeds decreased in numbers while the Murray Grey increased by 157% and Hereford by 8%. The Hereford (included Poll Hereford) still retains the distinction of the straight breed with the largest number of cattle. Of the cross breeds, which represented 48% of the total beef cattle, Brahman-British cross numbers increased by 38%. They represent 27% of all beef cattle in Queensland compared with 24% in 1973.



The automatic flank knife used in spaying cattle. The knife, which quickly and accurately incises the flank, was developed by Mr. J. C. Biggers, an officer of Veterinary Services Branch.



The ovary extractor used in spaying cattle. This instrument is safer, cheaper and more efficient than spaying scissors shown at the bottom of the picture. It also was developed by Mr Biggers. Considerable interest has been shown by producers where it and the automatic flank knife have been demonstrated.

A new technique for spaying cattle was developed by Mr J. Biggers, Stock Inspector, Toogoolawah, with the co-operation of a local steel fabricator and a local grazier. The technique uses—(i) an automatic flank knife that quickly and accurately incises the flank of the beast; (ii) an ovary extractor that is safer, cheaper and more efficient than spaying scissors; and (iii) a squeeze crush without a head bail that minimizes struggling but provides good access to the flank and good protection for the operators.

A small team can spay at a rate of 25 to 35 per hour using the technique. It has been demonstrated at more than 30 field days. The technique is easy to learn, little tuition is needed, and is being widely adopted by graziers. Enquiries have been received from U.S.A., Canada, West Germany and from all over Australia.

Spaying continues to be widely adopted throughout the industry and it is estimated that the number spayed, about 0.5 million, is approximately the same as the previous year. Officers have continued to conduct spaying schools throughout the State and there is still considerable producer interest in these schools.

Producers have continued to defer property development and to drop management practices which are labour intensive. In many cases, property maintenance has suffered.

Brucellosis-Tuberculosis Eradication Program

Further significant progress was made in the national campaign to eradicate tuberculosis and brucellosis from Queensland herds. The problem is reaching towards a peak of activity which should level out over the next 3 years and then begin to decrease as the State moves towards its objective of provisionally free status by 1983-84. The program in this State has well defined objectives and detailed forward plans. With the continued high levels of co-operation from industry and of dedication from staff, the goal is achievable.

While the tuberculosis program has not made significant progress due to the economic state of the beef industry, the second phase of the brucellosis program was commenced ahead of schedule and encompassed a larger area than originally planned.

BRUCELLOSIS. Major development of the program occurred during the year. The declared protected areas were enlarged substantially and eradication was begun in these new areas. A voluntary eradication program was commenced within the dairy industry, the stud herd accreditation scheme reached a peak in testing activity, and a new laboratory was established at Rockhampton.

The scheme is at present running ahead of schedule. Although this has imposed some minor strains, particularly in terms of laboratory resources, the simultaneous declaration of a large contiguous area appears to have softened the impact of movement restrictions. The overall results are most encouraging.

Eradication proceeded smoothly in the North Queensland Bovine Brucellosis Eradication Area (NQBBEA) and its southern equivalent (SQBBEA), and few infected herds remain in those areas. The change in the Milk Ring Test (MRT) results for the north Queensland dairy industry illustrate this point.

MALANDA SUPPLIERS

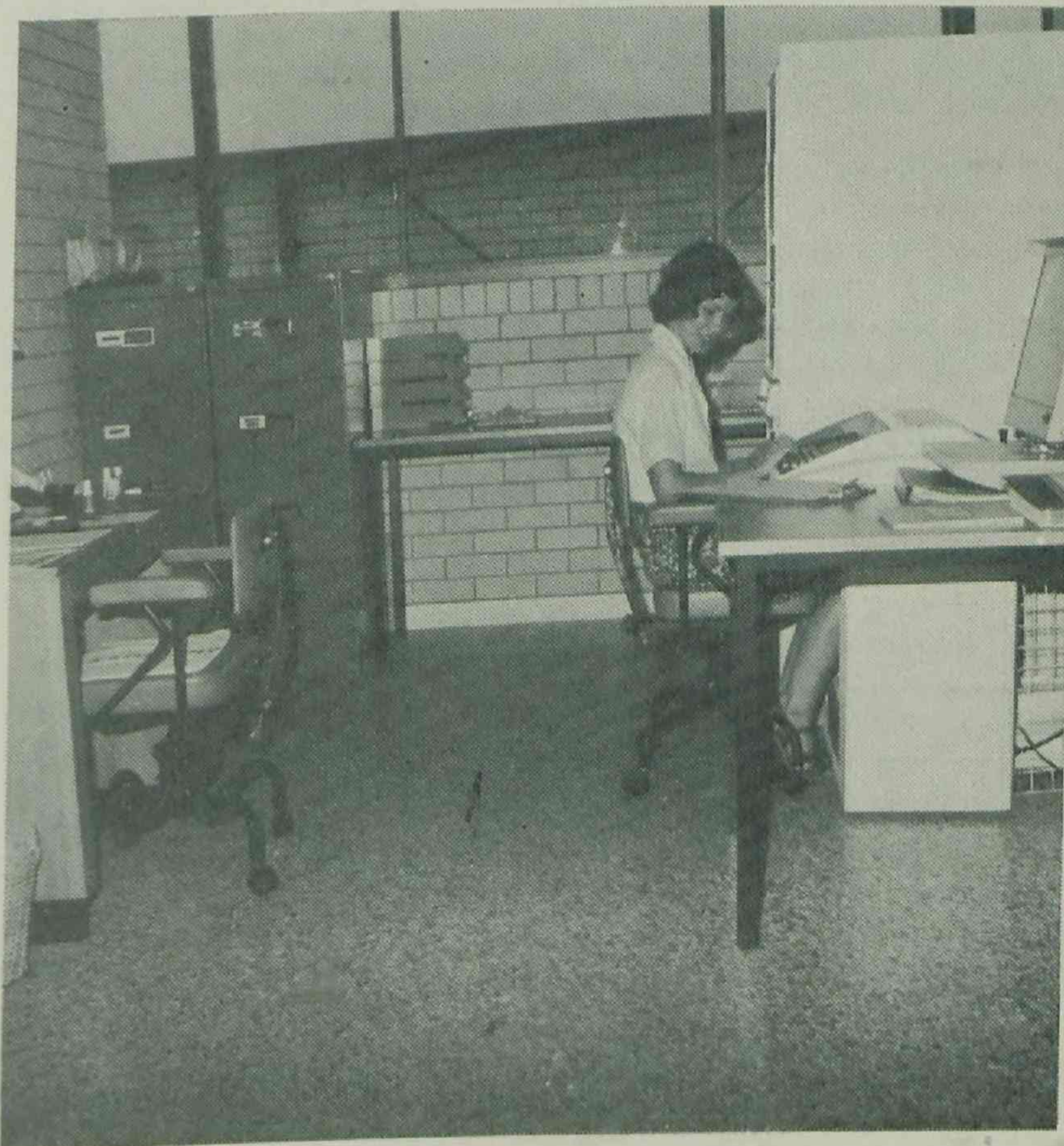
MRT Score	April 1974	December 1977
—	58.4%	96.61%
+	10.7%	0.34%
++	9.8%	0.68%
+++	11.0%	1.35%
++++	10.1%	1.02%

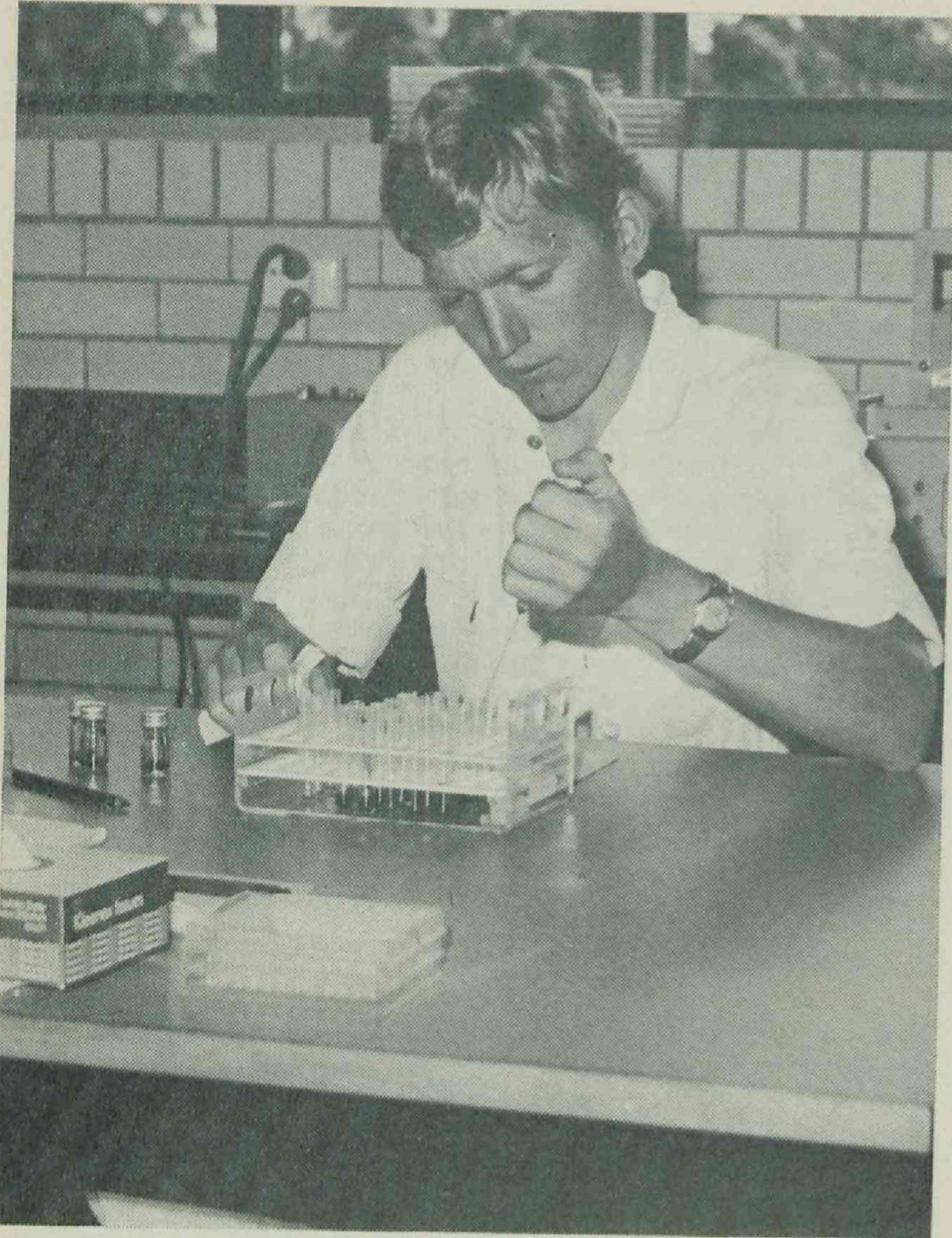
Some 20 formerly infected herds remain under test in the Townsville Division—most have returned at least one clean test. In addition, some 30 herds in the Flinders Shire have yet to be fully tested, although meatworks results suggest that few will prove to be infected.

As progress in the SQBBEA was equally satisfactory, it was decided to enlarge the eradication area from 1 May 1978. The whole State is now under eradication conditions except for the far-west and the immediate Mackay, Rockhampton and Brisbane hinterlands. The expanded eradication area contains more than 4 million breeders, leaving some 1.6 million breeders in the infected areas.

Difficulties arose in the marketing of export dairy produce early in the year when two traditional markets required that produce originate from a brucellosis-free source. In response, a voluntary dairy eradication scheme was introduced progressively into various factory supply areas, in which free test and compensation for reactors is available to herds with positive Milk Ring Test results. By the end of the year, only Beaudesert and a section of Booval and Q.U.F. suppliers were not involved in the scheme. These will be incorporated as

Mini computers have been installed at the three veterinary laboratories undertaking serological testing for brucellosis as part of the national eradication scheme. Testing results and other details are entered directly into the computer which forms part of the Australian National Disease Information System.





An officer undertaking the complement fixation test at the new Rockhampton Veterinary Laboratories. All blood samples are initially screened using the Rose Bengal test and those positive to the screening test are subject to the definitive complement fixation test.

funds become available, probably during the next 12 months. The response among the suppliers to the participating factories has been very good. A number of heavily infected town supply herds has been confirmed; one by traceback from a human brucellosis patient. In these herds, where further intensive herd vaccination programs were likely to be unrewarding, eradication was undertaken—in many cases by phasing reactors out of the herd over a period of up to 12 months. In this way, drastic effects on daily milk production have been minimized.

Almost 300 stud herds were accredited free from brucellosis by the end of the year, and a similar number was progressing towards accreditation.

Blood sampling was undertaken by Departmental officers, both by permanent regional staff, and by the specialized brucellosis field teams. By the end of the year, the latter comprised a total of 28 officers, of whom 11 were temporary appointees. Part-time lay assistants were also employed on a contract basis to assist stock inspectors when necessary.

Veterinary practitioners played an increasing and significant role in both the intensive areas and the remote pastoral areas in formulating herd eradication programs and integrating them with management, as well as in sampling and interpreting test results. Their involvement is illustrated in the following table:—

HERD TESTS AND ANIMALS SAMPLED BY PRACTITIONERS

	Herd			Stock		
	Beef	Dairy	Total	Beef	Dairy	Total
April-June 77	449	214	663	51 264	14 795	66 059
July-Sept. 77	1 115	361	1 476	122 030	27 170	149 200
Oct.-Dec. 77	769	747	1 516	90 542	65 332	155 874
Jan.-Mar. 78	740	707	1 447	93 386	61 128	154 514
Total (July 77 to March 78)	2 624	1 815	4 439	305 958	153 630	459 588

Not only has this arrangement provided the Department with an economic alternative to employing large numbers of temporary staff, but it has undoubtedly maintained many practices in rural areas.

Overall testing figures for the year are not yet to hand, but there are indications that the samples tested will total 2.5 million. The overall reactor rate remained constant at 1.2%. Of these nearly 1.5 million samples were tested at the three central laboratories, the balance being screening tests performed by field staff or at field laboratories.

A total of 531 893 blood samples was collected between July 1977 and March 1978, at meatworks by disease control and meat inspection staff. This total represents a significant 55% increase on the total 1976-77 figure and an increase of 342 032 samples from the same period last year. The increase can be attributed to the fact that all 34 meatworks are now serviced for brucellosis blood collection, to the high rate of slaughter of females, and to tail tag identification.

Rose Bengal testing by meatworks staff continues at six works. The need for testing to continue in meatworks has now become apparent due to the inability of the laboratories to handle all meatworks samples because of the heavy influx of field samples. Rose Bengal testing in meatworks is likely to increase if the present situation continues.

Vaccination programs are continuing, although on a reduced scale. Just over 100 000 calves were vaccinated with Strain 19 during the year, less than half the number vaccinated in 1975-76. This trend is causing some concern, and an extension effort aimed at the 'at risk' herds is being mounted. A similar number of doses of 45/20 K.A. vaccine were used. The demand for this vaccine has remained fairly constant since 1975-76.

Movement controls are working effectively. The May 1978 declaration embodied modified movement controls for a 'phase-in' period, with concurrent eradication conditions. This allowed owners a period of grace in which testing could be done with compensation for reactors, before movement restrictions were fully implemented. The system appears to have operated very successfully, although the demand for testing services has been very high during the phase-in period, straining field testing and laboratory resources to the limit.

Monitoring systems continued to operate successfully. Sufficient negative information has been accumulated from the testing of tail tagged cattle at meatworks to allow some properties to be classified as free for movement purposes without any on-property testing. More importantly, the continuing flow of negative information has removed the need for check retesting of herds classified during the earlier days of the scheme, and has identified hitherto unknown infected herds for immediate attention. It is now clear that tail tagging is the greatest single advance made in the control of livestock disease in Australia. The Milk Ring Test monitoring system for dairy herds also operated successfully and enabled infected herds to be selected for field testing in the same way as meatworks monitoring operates in beef herds.

The new brucellosis serology laboratory built at Rockhampton was completed on 11 January 1978 and began operating in early March 1978. It is testing blood samples from the Rockhampton and Maryborough Divisions. Semi-ambulatory laboratories equipped for the screening Rose Bengal test were established in caravans at Roma and Toowoomba, and provide rapid interim results for owners unable to remuster to remove reactors. The reactors to the screening test are held pending confirmation from the central laboratories. Although Departmental field testing teams are also equipped and trained to perform the screening test, additional field laboratory testing facilities at centres such as Wandoan, Emerald and Goondiwindi are deemed necessary.

Research was undertaken during the year into the suitability of Strain 19 vaccine for use in adult animals, in both extensive and intensive herds, in relation to the serological tests in current use. Results have been encouraging, and Strain 19 is now being used routinely for whole herd vaccination in some circumstances. Trials have also been conducted to compare the Rose Bengal and Complement Fixation techniques in the anamnestic test, in an attempt to simplify the anamnestic procedure. However, the immunology of the anamnestic response proved too complex to allow a simple screening test to be sufficiently accurate.



Two mobile laboratories have been equipped to undertake the Rose Bengal screening test for brucellosis at strategic centres in order to improve the service to producers. The laboratories are located at Toowoomba and Roma but will be relocated at other centres as the eradication campaign progresses.

The eradication program is expected to peak during the 1978-79 and 1979-80 financial years. Provided that sufficient funds continue to flow from Commonwealth and State sources, it is planned to bring the remainder of the State (except for the far south-west) into eradication during the 1979-80 financial year. At the same time it will be possible to declare the original NQBBEA and SQBBEA 'Provisionally Free'—in fact, the former area already meets the requirements for this action. Combined brucellosis and tuberculosis programs will be stepped up in the southern channel area as the ability of the industry to sustain these programs improves.

The Data General Nova computers are operating reasonably well. However, the amount of labour required for input and associated clerical work has been under-estimated. Programs, particularly those concerned with laboratory statistics, are still being developed and are urgently needed.



The milk ring test is done on a vat sample from each dairy herd quarterly. One infected cow in the herd is sufficient to produce a positive result.

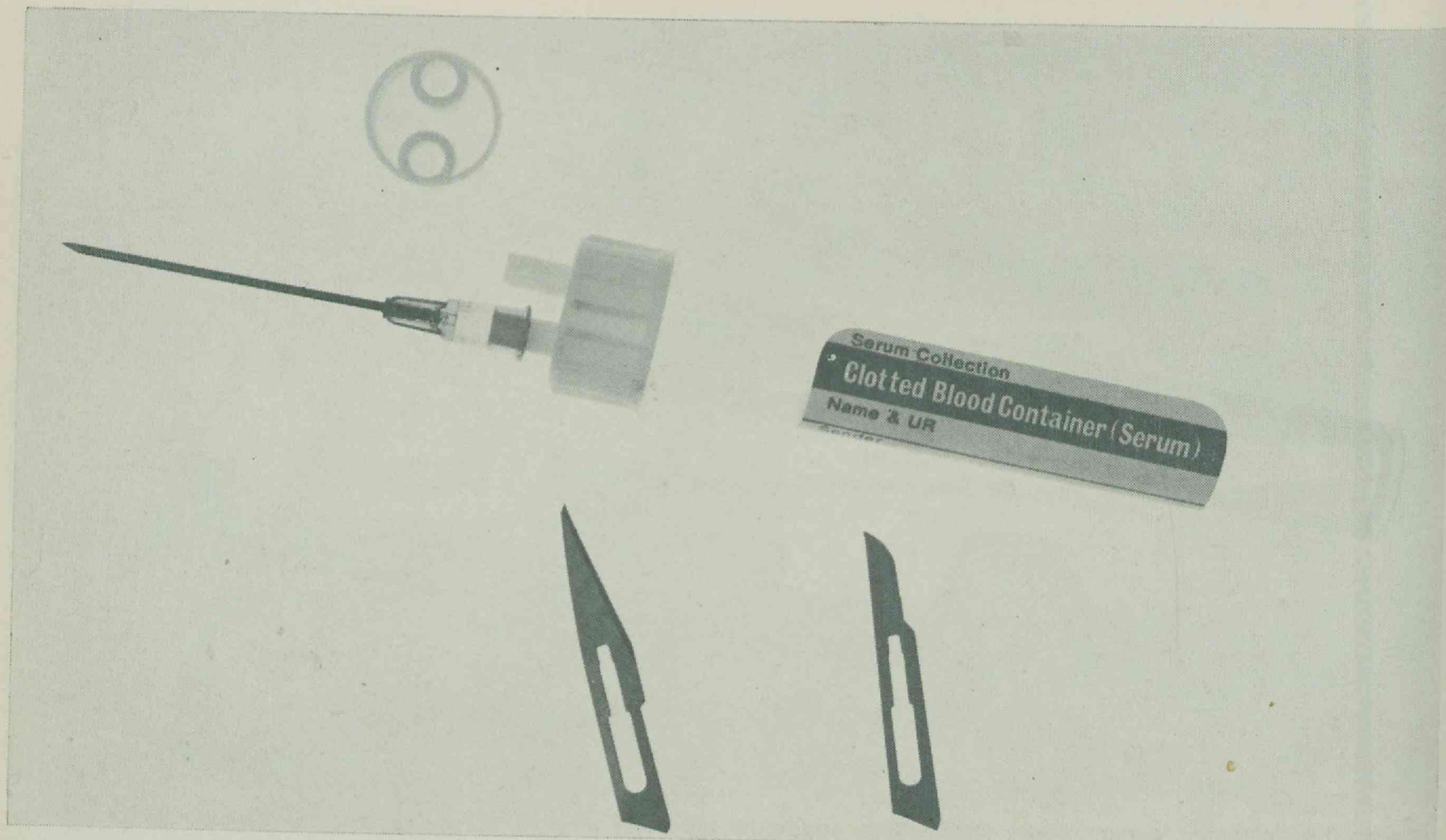
TUBERCULOSIS—The overall situation as outlined in the previous annual report remains relatively unaltered. The static situation is due to the effects of the depressed state of the beef industry and the reluctance of owners of infected properties to commit themselves to additional costs of presenting cattle for testing at short intervals. There is also a reluctance to outlay capital, engage extra staff and to interrupt normal station routine. This applies especially to the infected area, which embraces the Channel Country in the far south-west.

The following is a Divisional summary of T.B. infected properties and the number of herds under test. The figures for the corresponding period last year are shown in brackets.

Division	Infected Herds No. (1976-77)	Under Test (Approved Program)	
		No.	%
Protected area			
Roma	31 (51)	29 (34)	94 (67)
Brisbane	1 (12)	1 (12)	100 (100)
Toowoomba	2 (9)	2 (9)	100 (100)
Maryborough	4 (3)	4 (3)	100 (100)
Rockhampton	47 (45)	45 (36)	96 (80)
Townsville	49 (43)	24 (26)	49 (52)
Cairns	14 (16)	10 (10)	71 (63)
Mount Isa	52 (58)	46 (52)	88 (88)
TOTAL	200 (226)	161 (182)	81 (81)
Infected area			
Roma	35 (35)	8 (8)	23 (23)
Rockhampton	8 (14)	3 (10)	37.5 (70)
Mount Isa	15 (19)	12 (12)	80 (60)
TOTAL	58 (68)	23 (30)	40 (45)
GRAND TOTAL	258 (294)	184 (212)	71 (72)

It will be noted that there has been very little change in the number of infected properties and those under test. Some of the changes cannot be demonstrated by these statistics, because of the dynamic nature of the changes during the year. The statistics do not reveal the number of herds which have been classified as clean and those which have been found infected during the year.

The reduction of T.B. infected herds from 294 in 1976-77 to 258 in 1977-78 represents a net reduction of 36 or 12.2%. The proportion of T.B. infected herds under test remains unaltered. There has been very little change on a regional basis, except for a significant improvement in the Protected Area of the Roma Division.



Blood samples are collected from dairy cattle by needle into a closed container. Most beef cattle are sampled from a stab incision made in the tail with a small scalpel blade. Two examples of the blades used are shown in the lower section of the picture.

The following summary is a comparison of testing on a Divisional basis between 1976-77 and 1977-78, for the periods from June to May.

Division	Herds Tested		Cattle Tested		Reactors	
	1976-77	1977-78	1976-77	1977-78	1976-77	1977-78
Brisbane	462	91	61 523	14 097	152	20
Toowoomba	227	87	24 793	14 248	65	58
Roma	135	156	81 993	98 617	1 441	212
Maryborough	360	198	44 033	22 076	126	80
Rockhampton	305	285	100 373	137 405	180	402
Townsville	177	243	92 861	103 076	511	373
Cairns	31	59	8 961	45 797	3	121
Mount Isa	379	340	335 805	254 039	1 660	1 071
STATE	2 076	1 459	750 342	689 355	4 138	2 258

There has been very little significant change in the volume of testing. There has, however, been a drop of 45% in the number of reactors. This is the result of lower prevalence of reactors in the herds undergoing eradication, the emphasis on the testing of younger cattle in part-herd programs, and a decline in testing of high prevalence herds in the more remote areas due to the industry situation.

On a Divisional basis, there has been a significant decline in the volume of testing in the Brisbane (77%), Toowoomba (43%) and Maryborough (50%) Divisions as the disease is eliminated. In the Mount Isa Division, the volume of testing has decreased by 24% due mainly to the depressed state of the industry and a change from whole to part-herd testing. This decline has been partially offset by increases in the Roma (20%), Rockhampton (37%), Townsville (11%)* and Cairns (44.1%) Divisions. The dramatic increase in the Cairns Division was due to more favourable weather conditions and the improved economic circumstances of the pastoral companies in that area.

The declaration of the Provisionally-free Area as predicted in the last annual report did not materialize owing to an unacceptable number of infected herds which had not begun approved testing programs, particularly in the Protected Area of the Roma Division. This position has now improved and it is hoped to achieve this status for a large area of the State during the coming year.

For the 9-month period to March 1978, a total of 1 701 863 (903 557 male, 798 306 female) cattle was slaughtered at Queensland meatworks. Of this 1979 were affected and 1 459 condemned for tuberculosis.

Cattle tick

The extension program on cattle tick control has been vigorously pursued, particularly in the tick areas of south-east Queensland. The principal objective has been to make producers aware of the long term danger in relying on chemical control and to consider reliance, instead, on tick resistant cattle. In association with officers from C.S.I.R.O., Rockhampton, meetings were held at Taroom, Eidsvold, Monto, Gympie, Mundubbera and Kilcoy. These were well attended and produced lively and interested discussion. These activities have naturally attracted the opposition from the Breed Societies of *Bos taurus* cattle. However, talks with the societies have ironed out some of the misunderstandings in relation to this program.

Special emphasis was given to the problem of persuading owners of crossbred herds that frequent dipping of growing cattle was not necessary, and certainly not economically justified.

A joint C.S.I.R.O.-Queensland Department of Primary Industries meeting in Rockhampton was held in April to discuss research priorities and extension policy in relation to tick control. Demonstration trials on selection for tick resistance have commenced on two north Queensland properties.

Organo-phosphorus acaricide resistance is continuing to spread. To date, there has been no evidence of Promicide (O.P.) or amidine resistance despite extensive testing, so that adequate acaricides are still available to control multi-resistant ticks.

A total of 151 tick samples was tested for resistance at the Animal Research Institute, Yeerongpilly. The relative incidence of resistance in these samples was: Mt. Alford 20.5%, Biarra 49%, Mackay 1.3%, Ridglands 15.2%, Tully nil and 'no resistance' 14%.

Conditions during 1977-78 were less favourable for the propagation of cattle ticks in the normally free areas of portion 'T' (Eastern Downs and Southern Burnett). The rate of increase of properties under quarantine has slowed with an increase of only eight properties this year compared with 109 additional properties in 1976-77.

The numbers of properties under quarantine for the various stock sub-districts for 1977-78 with figures for the previous year in brackets are: Toowoomba 199 (182); Dalby 1 (1); Warwick 43 (38); Kingaroy 129 (145); Roma 3 (3) and Wandoan 17 (15).

During the past year, tick extension officers in Veterinary Services Branch carried out an extensive survey throughout the tick infested area of Queensland in collaboration with the Animal Research Institute, Yeerongpilly, and the University of Melbourne Veterinary School. The survey involved 400 graziers and 100 dairy farmers. The purpose of the survey was to obtain basic information concerning control practices presently in use and also to determine the attitude of producers towards tick control. The survey is being processed at present.

Tick fever

Numerous field outbreaks of tick fever were investigated during the year. The Tick Fever Research Centre, Wacol, confirmed 66 cases due to *Babesia bovis*, nine cases of *B. bigemina* and six cases of *Anaplasma marginale*.

A total of 633 639 doses of vaccine was supplied from the Tick Fever Research Centre during the 12 months from 1 July 1977 to 30 June 1978.

The Tick Fever Research Centre at Wacol and, to a lesser extent, the Animal Health Station, Oonoonba, continue with financial support from the Australian Meat Research Committee, to carry out an extensive research program into babesiosis and anaplasmosis of cattle. The Tick Fever Research Centre has established a reputation throughout those countries of the world where these diseases occur, and has supplied vaccine and advice to those countries on many occasions. Dr Callow, Principal Protozoologist of that laboratory, attended the Second Expert Consultation on Tick Borne Diseases in December 1977 convened by FAO in Rome. En route he also visited India, Pakistan and Malaysia to advise on various aspects of cattle tick and tick fever control. Mr Dalglish visited Costa Rica as FAO consultant in December 1977 and January 1978 to advise on control of babesiosis.

Increasing quantities of the now safe *B. bigemina* vaccine are being used, particularly in cattle being exported from Australia. A group of 100 fully susceptible dairy cows and heifers, in calf, were vaccinated with attenuated *B. bigemina*, *B. bovis* and *Anaplasma centrale* immediately before their departure for Pakistan. Despite the absence of close surveillance at their destination all survived their concurrent babesial reactions.

Buffalo fly

Buffalo fly infestations were the worst ever recorded in the south of the State. Large numbers of flies overwintered in the Maryborough Division and there they had assumed serious proportions by midsummer. By late summer, infestations had spread to the New South Wales border and they were in plague proportions in the Brisbane Division.

Buffalo flies have caused concern to cattlemen, and have lingered on into winter longer than is considered normal. However, research by C.S.I.R.O. at the National Cattle Breeding Station (Rockhampton), and at the 'Swan's Lagoon' Cattle Field Research Station suggest that these parasites may have little effect on production.

The effect of buffalo fly on liveweight gain is being studied in a trial at 'Swan's Lagoon'. Buffalo flies were present throughout the winter period, increasing during November and December 1977 but decreasing again in February 1978. Treatment with one of the new synthetic pyrethroids, AF 1117, every 21 days kept the majority of cattle free of buffalo fly, except in wet weather when cattle remained free for only 10 to 14 days. Treated Brahman crossbred steers gained only 2 kg more than untreated steers between July 1977 and May 1978. For bullocks, the difference was 4 kg. Bullocks tend to carry more flies although this is probably due to a body size effect.

Internal parasites

The joint C.S.I.R.O.-D.P.I. drenching and dipping trial at Peak Crossing continued. There was a substantial response to drenching until steers reached 2 years of age, after which drenched and undrenched steers grew at the same rate. The combination of dipping and drenching further improved performance. As mentioned last year, these results are contrary to most previous field research. Further investigations are planned.

In a cobalt treatment trial near Bundaberg, cattle given cobalt bullets have become very heavily infested with helminth parasites. Despite this infestation they grew faster and attained better condition in an apparent response to cobalt therapy.

Bluetongue

A strain of virus (known as CSIRO 19) isolated from insects collected near Darwin was identified in October 1977 as belonging to the bluetongue group. Although no signs of clinical bluetongue disease were present, the Veterinary Consultative Committee took the decision to place controls on movement of stock from affected areas as a precautionary measure until the distribution and pathogenicity of the virus were ascertained. Subsequently, the virus was serotyped as a new strain-bluetongue type 20.

Pathogenicity experiments have been carried out with the virus. Early work showed cattle and sheep could be infected readily by inoculation of tissue culture virus and blood from febrile animals. Further work has been carried out on sheep with virus of insect origin. No signs of disease were detected in cattle but sheep developed febrile reactions and varying degrees of inflammation and ulceration of the mouth.

Preliminary insect vector studies have implicated at least three species of biting midges, *Culicoides brevitarsis*, *C. actoni* and *C. schultzei*, as potential vectors of bluetongue type 20. *C. brevitarsis* has a wide distribution over northern and eastern Australia while *C. actoni* is known to be distributed throughout the wetter areas of northern and eastern Australia. The known distribution of *C. schultzei* is the tropical region of the Top End of the Northern Territory.

Both the group specific test (complement fixation and gel diffusion) and type specific test (BT20 serum neutralization) have been utilized in serological studies of animal populations throughout Australia. The type specific test for BT20 indicates that transmission of this virus is confined to the northern area of Western Australia, Northern Territory and Queensland. Group specific tests have detected reactors across a much broader area of Australia including the more central areas of the Northern Territory, the eastern area of Queensland, much of New South Wales especially east of the Great Divide and the Kimberley and Pilbara regions of Western Australia.

Odd reactors were detected in the south-east of South Australia while Tasmania and Victoria appear free. This does suggest that there could be more than one strain of bluetongue present in Australia. In fact, in late May 1978, Pirbright Laboratory, United Kingdom, advised that a new bluetongue serotype was detected serologically in sera from cattle in New South Wales.

Of 26 samples submitted to Pirbright for testing against serotypes 1 to 17 and serotype 20, some 7 sera from three herds were shown to be positive for serotype 1 or a variant of serotype 1. In view of this information, attempts to isolate further strains of bluetongue virus will be increased.

Immediately after notification of the presence of a bluetongue virus in Australia, animal health authorities instigated precautionary control measures in an endeavour to prevent the spread of virus into Australia's sheep raising areas and protect the nation's live animal and semen export industries. Initially, movement restrictions were imposed on ruminant stock on properties within an 80 km radius of an infected herd. Also, controls were placed on those properties with recent introductions from infected properties.

Subsequently, areas were defined to delineate infected areas from non-infected areas to prevent the spread from one area to another and to allow freer movement within the infected areas.

Federal and State Governments are giving active consideration to compensation for producers who have been financially disadvantaged by testing for bluetongue. This is likely to take the form of payments for mustering and testing on a per head basis.

A series of sentinel herds is being established throughout the State as a means of monitoring the status of the Infected Area and areas immediately contiguous to the Infected Area.

Other diseases

Isolated cases of ephemeral fever were reported early in the year. During the early and midsummer, outbreaks were widespread in south-eastern Queensland with some cases north of Mount Isa. The prevalence was much reduced by March. Mainly young stock and bulls were affected.

Tissues were examined from two acute fatal cases in bulls. Mild liver lesions and quite severe lung lesions of interstitial emphysema were present in both animals together with purulent bronchiolitis in one of the bulls. Two animals that had been down for 9 days with ephemeral fever had severe Wallerian degeneration of the white matter of the spinal cord.

The number of blackleg outbreaks during the year was disturbing. Seventeen yearling bulls died at Jandowae with the typical blackleg lesion and *Clostridium chauvoei* was isolated from specimens. All of these bulls had previously been vaccinated. Likewise, 10 yearlings died at Bowen, five head died at Nebo, eight at Georgetown, 12 at Charleville and one at Bell. All had been previously vaccinated and *Clostridium chauvoei* was cultured from all these outbreaks. Four head died at Maleny that had been vaccinated twice.

The Animal Research Institute, Yeerongpilly isolated a variant strain of *Cl. chauvoei* from an outbreak at Nanango, involving a loss of seven 10-month-old cattle which had been vaccinated once previously. As part of the investigations, several sub-cultures from isolates derived from blackleg lesions were forwarded to I.C.I. Tasman Vaccine Laboratory at Upper Hutt, New Zealand, for immunological study. It was found that a strain isolated at the Animal Research Institute was not covered by vaccine but was antigenically suitable for inclusion in a vaccine. Vaccine prepared from this antigen gave complete protection, withstanding challenge with all the official strains of *Cl. chauvoei* issued by laboratories.

Abortions were associated with *Campylobacter fetus* bio-type *venerealis*, with *Leptospira pomona* infection and on two occasions with Sarcocystis/Toxoplasma-type organisms. In the last named, 3 to 6-month fetuses had severe interstitial myocarditis. The brain of one had scattered foci of necrosis with glial proliferation. Rare cysts were found in one case.

Bruising

Bruising continues to be a significant source of loss. However, there is still no direct cash incentive to encourage producers and cattle handlers to reduce bruising. Following a seminar at Injune, a project is being conducted at A. W. Anderson's meatworks, Roma, over a period of approximately 6 months to ascertain the extent of bruising occurring in cattle slaughtered at the Roma meatworks. A new bruise assessment form has been designed and two meatworks employees were trained in its use. To date the project has progressed extremely well.

Losses due to bruising of cattle are substantial but research has shown that tail tagging does not increase the amount of bruise trim.

Producers are being sent information on bruise assessment for their cattle following slaughter. The trial is being conducted by Slaughtering and Meat Inspection and Beef Cattle Husbandry Branches and its success could lead to better prices being paid for non-bruised stock.

A 20-minute film on bruising was produced by the Department, with part of the costs met by the Australian Meat and Live-stock Corporation. It will be shown in all States and incorporates some of the results of several years of trials and investigations. These are continuing, though on a reduced scale.

A saleyard survey in 1977-78 suggested that 44% of Queensland's cattle were horned with 48% of these having tipped horns. However, research shows that tipping has no effect on bruising. Tipped and untipped cattle had similar bruising, whether sent for slaughter as separate groups or together. Hornless cattle had significantly less bruising than horned cattle when consigned as separate groups, but not when sent as a mixed group. Direct consignment to the abattoir is the only way producers can guarantee hornless animals will avoid horned cattle. At saleyards, hornless lots encounter horned cattle after sale in the buyer's yards.

Many graziers and organizations strongly criticized the introduction of tail tagging (as part of the National Tuberculosis and Brucellosis Eradication Program), because they considered it would increase the incidence of bruising. However, nine trials in various parts of the State showed conclusively this is not true. Average bruising for the 248 tail tagged cattle was 1.1 kg bruising tissue and 1.0 kg for the 246 untagged cattle. Handling associated with the running of bruising trials also did not affect bruising.

In August 1977, a trial compared the bruising of hornless steers, suitable for the Metropolitan trade, when they were sold by three different methods. Steers consigned direct to slaughter had the same level of bruising as those sent through the saleyard either on liveweight or by pen sale auction. At several southern Queensland abattoirs, officers of the Australian Meat and Live-stock Corporation have monitored bruising in an attempt to examine the effects of different selling systems. These results are not yet available. Aspects of transport in relation to bruising are still under investigation. The importance of breed and temperament are also being studied.

At 'Swan's Lagoon' Cattle Field Research Station the effect on weight gain of dehorning steers at weaning, at yearling age or as adults (30 months of age) is being studied. Animals dehorned at weaning or as yearlings suffered a 7 to 10 kg setback, but differences disappeared by the time animals were 30 months of age. For the first draft of cattle, dehorning as adults had a negligible effect on their performance. This result is in contrast with earlier research, when dehorning bullocks 6 months prior to slaughter reduced gains by 10 to 14 kg.



Reproduction

More efficient reproduction, with increased turn-off for the same input continues to offer one of the few opportunities for the individual beef producer to beat the 'cost-price squeeze', even though, for the industry as a whole, a reduction in turn-off is highly desirable. The role of various management factors (weaning, controlled mating, culling, supplementing, and disease control) are firstly well understood and an explanation of these formed a major part of extension programs in most districts.

The performance of British breed and low grade Zebu cows is affected if they are lactating during the dry season in north Queensland. At 'Swan's Lagoon' Cattle Field Research Station, the effect of weaning in April, June and August is being studied with the Sahiwal herd. The earlier the weaning was carried out, the less weight the cows lost during the dry season, they remained in better condition and fewer cows needed to be survival fed. More early than late weaned cows became pregnant the following summer. On the other hand, calves weaned in April were lighter at 18 months of age than those weaned in June and August.

The study with Droughtmaster cows at 'Katandra', south west of Hughenden, has continued to provide useful information. The final pregnancy rate of 87% for the herd in 1977 was below that for the previous 3 years (92 to 94%), reflecting the more adverse season. At weaning in July, cows were in backward store body condition compared with forward store in previous years. Eighty percent of maiden heifers and 63% of mature cows conceived during the first month of the 3-month mating period (March-May). Mating of heifers as yearlings rather than as 2-year-olds depressed pregnancy rates at the subsequent mating (55.5% v 76.6%).

Nutrition

The year was exceptionally dry, with many shires declared drought stricken for extensive periods. High stock numbers and inadequate outlets have aggravated the situation and without any chance of agisting cattle or sending them for slaughter, many producers were faced with the alternatives of feeding cattle, destroying them or allowing them to die. While the potentially disastrous situation was averted by late rain, prospects are still bleak for many areas, where the chances of rain are now negligible.

Interest in supplementation has been widespread, but most producers have not, advisedly, taken any action until absolutely compelled to do so.

Even in normal years inadequate nutrition continues to be the major limitation to beef production in Queensland, because of the heavy reliance on native pastures. Various

methods of improving the nutritional status of animals, including the use of improved pastures and nitrogen and mineral supplements, are currently under investigation.

PASTURE IMPROVEMENT. Studies on improved pastures have ranged from the introduction of Townsville stylo into the existing native pasture to the complete replacement of the native pasture with pangola grass irrigated and fertilized with nitrogen.

With the high cost of development and the increasing cost-price squeeze, it is becoming increasingly important that efficient use is made of funds available for pasture improvement. A pasture management trial at 'Swan's Lagoon' which terminated this year aimed at determining the most effective distribution of Townsville stylo development over a property. During the 51 months of the study, native pasture produced 266 kg liveweight gain/ha while a comparable area oversown with Townsville stylo and fertilized with superphosphate produced 382 kg/ha. However, 60% of the increase in production was obtained when only 20% of the area was improved. This suggests that pasture development of this nature should be spread strategically over the property rather than in one block, and native and improved areas used in conjunction.

In an attempt to obtain information on the effect of different phosphorus levels in the diet on performance of breeders, Brahman cross heifers were run on fertilized and unfertilized Townsville stylo pastures. Animals on the fertilized pasture were heavier, survived the dry season better, gave birth to heavier calves and produced heavier weaners. Despite the low phosphorus intake on the unfertilized pasture, no obvious symptoms of phosphorus deficiency (for example, bone chewing and 'peg-leg') were observed.

Cattle grazing the mulga pastures of the Nebine area have poorer production than cattle on other mulga pastures in south-west Queensland. This poor production is highlighted by a rapid loss of weight in cows raising their first calf.

The major nutritional factors involved in this syndrome were investigated, with financial support from the Australian Meat Research Committee. Twelve Shorthorn heifers when 3 to 4 months pregnant were put into a paddock in May 1977 and withdrawn in March 1978. Pasture production, heifer and calf liveweights and the levels of elements in body fluids and faeces of the heifers were monitored regularly. The climatic conditions were normal throughout the trial with rainfall occurring in January and February 1978 only. The heifers calved in October and November 1977. Three calves did not gain in liveweight during the 1 to 2 months they were suckling and subsequently died. The nine surviving calves had a small liveweight gain until pastures responded to rain in January after which liveweight gain was rapid. Analyses showed that from June to December the heifers suffered a protein and phosphorus deficiency. It is reasonable to assume that sulphur and digestible energy were also below requirements. In the coming season, the trial will be repeated in the same paddock with a control group and a group supplemented with urea, phosphorus and sulphur.

During the recent drought in south-east Queensland the most economical form of supplementation of cattle was high levels of molasses. Here two types of molasses storage are shown: bulk tanks and 44-gallon drums.



Where irrigation water is available, intensive development of pure grass pastures fertilized with nitrogen offers scope for reducing age of turn off and increased production. In the coastal Burnett region, irrigated ryegrass returned capital invested plus 20% profit during the grazing season of 200 days.

With our present level of knowledge the only satisfactory method of determining the production potential of a pasture is to conduct expensive long-term grazing trials. A group of workers at Coolum Research Station is now examining the value of a range of pasture attributes as predictors of animal performance in an attempt to reduce this demand on resources. Animal measurements being made include time spent grazing, number of bites taken, size of bite, composition and digestibility of pasture eaten and liveweight change. Initial results are promising and further studies are planned to examine a range of pasture availabilities, pasture species and growing periods.

ENERGY SUPPLEMENTS. With the emphasis on low-cost beef production with depressed market prices, energy supplementation of grazing animals has received little attention. At Gatton Research Station, the last in a series of studies on the effect of grain feeding of young dairy-beef animals grazing irrigated temperate grass-legume pastures was carried out. As entire males are more efficient than castrates at converting dietary energy to beef, a comparison was made between bulls and steers. Liveweight performance was similar when the grain supplement was fed at 0.5 and 1.0 kg/100 kg liveweight/day indicating a substitution of grain for pasture at the higher level. Weight gains in bulls were 14% greater than those in steers.

As a follow-up to the *ad lib* molasses-urea feeding conducted previously at 'Swan's Lagoon', acceptance studies were commenced with molasses fortified with urea and true protein in the form of meat meal. Intakes up to 5 kg/head/day were obtained with 15% added meat meal or 3% urea but consumption was reduced to one quarter of this amount when 8% urea was included in the supplement.

NITROGEN SUPPLEMENTS. Nitrogen supplementation continues to offer one of the cheapest methods of improving the nutritional status of cattle grazing native pastures in many parts of the State. In a study with breeders at 'Swan's Lagoon', cows fed urea-based dry lick during the dry season lost less weight than unsupplemented cows. Six percent of animals from the unsupplemented group required survival feeding while no animals from the supplemented group reached this state. Conception rates at the subsequent mating are not yet available.

On a commercial property at Stanthorpe, a meat meal: molasses supplement (1:12 W/W) reduced the weight loss in a group of pregnant Hereford heifers during the winter period. Approximately 6.4 kg supplement (DM) were required to save 1 kg liveweight. By the end of the following summer, these liveweight differences had virtually disappeared. There was a trend for conception rates at the subsequent mating to be higher in supplemented animals, but larger numbers of animals are required to confirm this.

MINERAL SUPPLEMENTS. Phosphorus deficiency remains the principal mineral deficiency in many areas of Queensland. Despite many years of research, there is still a paucity of documented evidence of the benefits to be gained from supplementing various classes of stock. In two large field studies in north Queensland, individual intakes of phosphorus supplement plus reproductive and liveweight responses were measured in heifers. Mean supplement intake ranged from 0 to 33 g/head/day between animals. In one study, there were no liveweight responses to supplementation while, in the second study, supplement intake was positively related to liveweight change.

In a preliminary study with weaners grazing green panic-Siratro pastures on granitic sands near Bundaberg, cobalt supplementation produced spectacular liveweight responses. During the past year in a more detailed study, animals receiving a cobalt bullet at weaning gained more weight than unsupplemented animals (73 v 30 kg). Performance of animals receiving a cobalt bullet in spring was intermediate. There appeared to be an interaction between susceptibility to worm infestation and cobalt-treatment with treated animals carrying much higher worm burdens than untreated animals. Further studies are planned to elucidate this problem.

Copper deficiency has long been suspected of limiting animal performance in parts of the Taroom shire. A survey revealed that low copper status in cattle was widespread and seemed to be associated with improved brigalow-vine scrub areas. Injections of copper glycinate at 3-monthly intervals produced only 15 kg liveweight response in Hereford weaners over 12 months. Blood and liver copper levels in both treated and untreated groups were low despite a rise as a result of treatment. Further work is planned to attempt to elucidate the basic cause of the condition.

INTENSIVE FEEDING. High yielding feed grade rice is a possible crop in the Burdekin River delta. When used for finishing cattle the proportion of hulls (25%) may eliminate the need for roughage but the low protein content (7 to 9%)

will require the use of high levels of urea. Trials have begun to evaluate a diet of 100% rolled rough rice (plus minerals). The experiment is in the early stages but problems of regurgitation scours and loss of body condition and death of two steers from peritonitis resulting from perforation of the bowels by the hulls has necessitated the inclusion of another roughage (cotton seed hulls).

Development of liver abscesses in feedlot cattle is common and represents a significant financial loss through reduced feedlot performance and condemnation of livers. In a trial to compare the effect of three antibiotics on the incidence of abscesses, both tylosin and chlortetracycline significantly lowered the incidence of abscesses while bacitracin was ineffective.

SURVIVAL FEEDING. The first experiment on the use of molasses as the main source of energy for survival feeding of cattle during drought was reported last year. The results indicated that heifers of approximately 230 kg liveweight could survive for 6 months on 2.0 kg molasses/urea and 400 g of poor quality hay daily. During the 6 months' feeding, they lost 70 kg liveweight. The 2.0 kg molasses was equivalent to 1.4 kg of cracked sorghum grain per day in survival feeding value. There was apparently no detrimental effect of eliminating roughage from the sub-maintenance diet and weight loss was slightly less on twice weekly than weekly feeding.

During this year, an experiment with maiden heifers of initial liveweight of 250 kg was undertaken to examine the value of roughage and urea in survival feeding with molasses. Eliminating mixing to incorporate urea into the molasses and avoiding roughage feeding would simplify the logistics of feeding. The results clearly demonstrated that roughage is unnecessary in the survival feeding situation if molasses is used. Marked responses were obtained to an increase in molasses intake and the inclusion of urea. Heifers survived for 6 months when fed solely on 2.0 kg/day of molasses and those fed 3.2 kg/day plus 3.75% urea approximately maintained weight. Feed cost per head for survival for 6 months was \$10 and for maintenance \$19, assuming molasses at \$30/tonne and urea \$160/tonne. The work is continuing with pregnant and lactating cattle.

Genetic improvement and breed evaluation

The Beef Cattle Husbandry Branch extension program has continued to place emphasis on the use of objective measures in selecting breeding stock, but at this stage no special emphasis is being given to encouraging enrolment in the National Beef Recording Scheme (N.B.R.S.).

A technical bulletin on the principles and practice of beef cattle breeding has been published. A leaflet, to be used as a 'diary' of bull sales, has also been printed. This incorporates an explanation of the principles of animal selection.

On the Downs, four extension districts are combining to promote objective selection. An extension program is being developed that will involve both stud and commercial breeders.

The N.B.R.S. has actively enrolled breed societies for a pedigree performance recording package that should place it on a firm financial basis. The major event of the period was the installation of a new computer facility at the N.B.R.S. centre in Armidale. A.M.R.C., State and Federal Governments and A.B.R.I., Armidale contributed a total of \$300 000 to cover the costs of a new \$250 000 computer and a new building to house it. This new facility opens the way for a major expansion in performance recording.

The previous facilities were being used to capacity, and breed societies wishing to enrol in performance—pedigree systems could not be handled with the old equipment. With the new facility, the enrolment of breed societies in the performance-pedigree system continued. There are now 10 breed societies enrolled and discussions are continuing with other societies.

At the present time there are 3 000 herds performance recording with the N.B.R.S.. Most of these have entered through the performance-pedigree system. It is expected that there will be 10 000 herds on performance recording by the early 1980s. During the past year enrolments in this system in Queensland increased by 7% to a total of 77 herds.

A performance test of 31 Brahman bulls for the selection of superior sires to stand at the A.I. Centre at Wacol was completed at the Animal Husbandry Research Farm, Rocklea. Selection criteria were acceptability to the breed society, pre-weaning performance, growth rate from 300 kg to 450 kg, tick resistance, physical soundness, and back fat depth. Compared with an average growth rate of 0.85 kg/day, the best two bulls selected averaged 1.03 kg/day. Their tick resistance averaged 98.9% and their back fat 5.2 mm.

Research activities related to herd improvement continue to place high priority on the evaluation of breeds in different environments. The emphasis in this work is on the tropical breeds.

At 'Swan's Lagoon', development of the stabilized $\frac{1}{2}$ Brahman, $\frac{3}{4}$ Brahman and high grade Sahiwal herds continue. Conception rates during the period under review have generally been similar. Half Brahmans had the heaviest birth weights followed by $\frac{3}{4}$ Brahman, $\frac{3}{4}$ Sahiwal and $\frac{7}{8}$ Sahiwal. The progeny from Brahman cows had higher pre-weaning growth rates than progeny of Sahiwal cross cows. A $\frac{1}{2}$ Sahiwal herd is also being developed.

At Brigalow Research Station, the Simmental crossbreeding trial continues. In Phase 2 of the experiment, quarter-bred Simmental x Hereford progeny from Hereford dams had pre-weaning growth rates of 0.68 kg/hd/day while similar genotypes with halfbred Simmental x Hereford dams had pre-weaning growths of 0.86 kg/hd/day. Post-weaning growth rates of Hereford and halfbred Simmental x Herefords during a 22-month period averaged 0.29 and 0.34 kg/hd/day respectively.

In the Africander crossbreeding program at Brigalow Research Station, straight bred Herefords are being compared with Africander x Hereford crossbreds. In pre-weaning performance Africander x Herefords averaged 0.78 kg/hd/day while Herefords averaged 0.73 kg/hd/day. To date, the relative post-weaning performance averaged 0.31 and 0.19 kg/hd/day respectively for the Africander x Hereford and Herefords.

Many breed evaluation projects are carried out on private properties, and this work forms an important segment of the Beef Cattle Husbandry Branch's research program.

At 'Sunnyholt' in the Arcadia Valley, the growth of Hereford, Hereford x Brahman and Chianina crosses is being compared. Phase 1 steers were slaughtered at 28 months of age and gave fat-free carcasses of 242 kg for Chianina crosses, 226 kg for Brahman crosses, 217 kg for Hereford x Brahmans and 205 kg for Herefords. Under the A.B.C.A.S. scoring system, Chianina crosses scored 67.5 points, Hereford x Brahman scored 57.7, Herefords 55.0 and Brahman cross 52.8.

The first phase of a series of projects designed to test research results under commercial conditions has been completed at 'Lancefield', Dululu. During a 3-year period, Brahman, Belmont Red and Droughtmaster sires were mated to Brahman x Hereford dams. It was found that breed of bull had little effect on pregnancy rates, rates of conception or foetal/calf survival rates to 3 weeks. Breed of sire also had no effect on pre-weaning growth.

The evaluation of Africander, Brahman and Hereford bulls mated to Brahman cross cows at 'Kunapipi Springs', near Mackay, continues. Pre-weaning growth rates indicate little difference between the different groups with Hereford, Africander and Brahman sire progeny groups averaging 1.07, 1.05 and 1.02 kg/hd/day respectively.

The performances of Africander and Brahman crosses are being compared at 'Cubbaroo', north of Cloncurry. Over 3 years there is little difference in average pregnancy rates with Brahmans being 74% and Africanders 73%. The 1977 drop calves were weaned in October, with Africander crosses averaging 146 kg liveweight and Brahman crosses averaging 161 kg liveweight. This contrasts with the previous year's results when there was little difference between the two genotypes.

The growth of Africander cross, Sahiwal cross and Shorthorn steers is being compared at 'Rocklands', north of Camooweal. Weaning weights during July averaged 159, 156 and 142 kg respectively for the Africander, Sahiwal and Shorthorn genotypes. Growth from weaning to the end of the dry season in December averaged 0.15, 0.14 and 0.05 kg/hd/day for Africander, Sahiwal and Shorthorn groups. Wet season growth averaged 0.61, 0.55 and 0.37 kg/hd/day giving combined dry and wet season growth rates of 0.36, 0.32 and 0.19 kg/hd/day for the Africander, Sahiwal and Shorthorn groups.

At 'Havilah', near Collinsville, the performance of Brahman cross, Sahiwal cross and Santa Gertrudis cross steers is being compared from weaning to slaughter. In the first draft only Brahman cross and Santa Gertrudis cross groups were available and their respective growth from weaning to slaughter averaged 0.37 and 0.36 kg/hd/day respectively. In the second draft, Brahman cross, Santa Gertrudis cross and Sahiwal cross are being compared and for 8 months post-weaning have growth rates of 0.40, 0.37 and 0.37 kg/hd/day respectively.

The growth of tropical and Hereford breeds from weaning to slaughter is being assessed at Peak Crossing in the Brisbane Valley. During a 574 day period, Belmont Red x Brahman grew at 0.36 kg/hd/day, Belmont Red at 0.34 kg/hd/day, Braford's at 0.33 kg/hd/day and Herefords at 0.30 kg/hd/day.

Carcass composition studies

Work is continuing at the Animal Research Institute, Yeerongpilly, with funds from the Australian Meat Research Committee, to develop predictions of yield of saleable meat for use in beef classification schemes and carcass competitions. This year, the equation developed for yield of saleable meat (YSM) using cold carcass weight and fat depth over the

rib-eye muscle area was tested against two further sets of data. These were from 20 Brahman cross steers finished on pasture at 'Swan's Lagoon' and AIS x Hereford and Limousin x Hereford steers finished on high grain diets at the Institute.

There was a surprisingly good fit when this equation was used to predict the YSM of the 'Swan's Lagoon' cattle. While the AIS x Hereford comparison of measured YSM compared with predicted YSM was extremely good, the equation underestimated all the 21 Limousin x Hereford results. This is the only breed difference to show up using the equation. It can be attributed, in this case, to a lower fat and lower bone content in the Limousin cross relative to carcass weight compared with other breeds.

Economics and marketing

In 1976, beef cattle husbandry officers carried out a formal survey of industry problems involving personal interviews with 570 specialist beef producers. The second report from this study was completed and published this year. Original information on herd inventories, turn-off ratios, financial data, employment trends, stocking rates and management practices is now available on a regional basis.

The serious problems of some sections of the industry were particularly emphasized. For example, at the time of the survey, 66% of properties carried some debt. For these properties, the average debt per breeding female carried was \$68.90 for the State, ranging from a low of \$17.24 for the Peninsula-Gulf-North Coast region to a high of \$229.72 for the South East Coast region. For the same properties, equity in the property averaged 77%, ranging from 57% for the South Central Plains region to 89% for the Far North Coast.

It was also clear that specialist beef producers are seeking to expand their off-property interests. By 1976, 36% had taken some form of outside employment and 42.1% were obtaining significant off-farm income. Between 1973-74 and 1975-76, employed labour declined by 25%.

As a consequence of factors such as these, some Beef Cattle Husbandry Branch staff have placed an increasing emphasis on farm business management, on socio-economic problems and on the development of cost-cutting techniques. This philosophy has applied to both on farm production and the marketing chain to the point of slaughter. In particular, greater attention has been focused on the benefits and costs of the alternative selling systems.

An examination of the liveweight selling method has suggested that this innovation may not be as objective or as beneficial as has been anticipated. Considerable variations in pre-fasting times can occur and the buyers' skill in estimating dressing percentages is critical. Some sections of the industry are concerned that saleyard weighing increases the potential for bruising. On the other hand, the high capital cost of scales and ancillary equipment may encourage a greater concentration of saleyards which could benefit producers over the longer term. It is worth noting that, since the introduction of scales, Cannon Hill has increased its percentage share of Queensland's saleyard slaughter cattle from 11% to 14%. Over the same period, Gympie has increased its share from 1% to 2%. These are the only two of the 108 existing saleyards which provided continuous trading by liveweight in 1976-77.

Although the saleyard system would appear to cost more to maintain and operate than any direct to meatworks system, their relative importance in pricing efficiency is not clearly understood. Any change in the relative use of the two systems that might be stimulated by the introduction of carcass classification could alter the relative bargaining strength of market participants. This subject warrants further investigation.

In fact, even the determination of the percentage of slaughter cattle sold through the various systems is subject to a number of estimation errors. Beef Cattle Husbandry Branch investigations suggest that approximately 56% of Queensland's slaughter cattle are sold via saleyards and 35% are sold on a weight and grade basis. There has been no clear evidence of a general trend away from saleyards for slaughter cattle over the past 5 years. However, there are suggestions that saleyard usage declines at times of low prices and increases when higher prices prevail. Analysis of this study is continuing.

Some concern has been expressed about the quality and quantity of short-term marketing information available to producers. For example, there is no easily accessible or timely information available to producers on ruling weight and grade prices. On the other hand, prices for auction cattle are regularly reported in the media, although the quality of reporting is sometimes questioned. The Beef Cattle Husbandry Branch examined the possible errors in reporting that occurred at Cannon Hill over a 9-week period. The survey found that there was minimal variation between the Queensland Livestock, Property Brokers' report and the survey price for the majority of trade descriptions. Some divergence occurred in the boner group.

Following suggestions of buyer prejudice against particular breeds of cattle, the effect of various animal characteristics on price paid at auction was also examined at Cannon Hill. This study showed that for cattle of similar condition, age, sex and within the same liveweight range, low content Zebu breeds received approximately 1% more than British breeds and British breeds received approximately 1% more than medium and high content Zebu breeds. Dairy breeds were discounted by an average of 3.5%.

Pens of all horned cattle received 3.8% less than pens of all polled cattle. At most price levels this provides an attractive incentive for producers to dehorn all cattle.

Sheep and wool industry

The sheep industry continues to experience rising labour and material costs while wool prices remain more or less static with the reserve price indicator at 284c/kg clean.

During the year, two new options for marketing wool became available. The first is based on the use of Jumbo bales and the second on the Australian Wool Corporation's Limited Offer to Purchase Scheme. Both of these schemes offer early payment and a rebate on standard charges and have introduced more competition into the wool marketing system.

Sale by sample has been accepted by producers and in excess of 80% of all Queensland wool is tested before sale. Some producers continue to class by traditional methods and do not obtain the full benefits which are offered by the sale by sample system. Branch officers, in conjunction with the Australian Wool Corporation, continue to promote these techniques.

The Queensland industry had little participation in the live sheep export trade to the Middle East. This is due to a number of reasons including the availability of suitable sheep in other States, the lack of suitable sheep in Queensland, and the extra distance sheep have to be transported. Some companies conducted feasibility studies into the export of sheep from Queensland through Queensland ports, but no sheep were exported.

With the continued high lamb prices being received, producers have shown an increased interest in prime lamb production.

The Angora goat and mohair industry continues to grow. Much interest in this industry has been created by the continued high price of mohair and a number of segments on television depicting a very glamorous and rewarding future for mohair production. These factors, together with a shortage of quality Angora goats, have caused prices to increase to a point where the commercial viability of a mohair industry is doubtful.

An officer of Sheep and Wool Branch discussing the breeding of black sheep with a producer. There is a new interest in producing black wools which are bringing premium prices because of the demand for hand spinning and weaving and related cottage industries.



Interest has continued in the breeding of coloured sheep and Sheep and Wool Branch officers service the demand for information on this aspect of sheep husbandry.

The emphasis of sheep research was placed on the nutrition of weaner ewes, selection for adapted animals, ram breeding programs, pasture management to improve wool production, wool harvesting, blowfly control, the alleviation of low lambings, the development of a mini-care sheep, the productivity of Mitchell grassland and mulga grassland pastures and methods to improve the productivity of mulga.

Cost-saving devices and techniques

As labour costs escalate and it becomes more difficult to employ well-trained labour, producers will cease undertaking some husbandry techniques or will utilize mechanical devices to minimize the labour component. A range of these labour-saving devices is available for a number of operations. Sheep and Wool Branch officers undertake programs to discuss the advantages and disadvantages of the various implements and the management changes required to obtain maximum efficiency from the new systems.

With the increasing cost of fencing, the use of electric fences has been investigated. Trials in the Darling Downs region have shown that a four-wire (two live, two earth) permanent fence is very effective in controlling sheep and Angora goats, while being relatively inexpensive to erect and maintain. The fences are being tested in western areas and early results are equally promising.

Trials are being undertaken on the upgrading of low standard existing fences. Many old plain wire fences with wooden posts have been rejuvenated by straining up the wires and electrifying alternate wires. Old ringlock and steel post fences are being rejuvenated by adding an offset electrified wire 225 mm above ground, 225 mm offset from the fence. Temporary fences for strip grazing of crops by sheep are being tested and show good results to date. It is estimated that 50% of commercial Angora goat producers on the Downs are using electric fences to control their animals.

Parasites

Technology related to parasite control accounts for nearly 30% of the day-to-day enquiries received by Sheep and Wool Branch officers. Blowfly is the major external parasite. As high labour costs and shortages make all aspects of sheep husbandry difficult, advice concentrates on techniques which give maximum or permanent protection for minimal inputs of labour. Mulesing is one technique which gives good control of breech strike in sheep and continues to be actively promoted in all areas of the State.

Trials continued in various areas of the State and in other States testing the efficacy of formulations based on 40% phenol in producing discrete permanently defleeced areas of skin in sheep of different breeds and on different pastures. These trials indicate that the technique will have major application to 'ring' wethers and to eliminate wool blindness, but less application for mulesing.

Using an extract of the fungus *Paecilomyces varioti*, sheep were protected against larval implants of *Lucilia sericata* for 12 weeks in a further experiment to isolate fungal extracts capable of protecting against fly strike.

Nine field strains of blowflies from a wide area of sheep country showed resistance to diazinon up to a factor of 15 times. This still allows control with diazinon but points to potential problems. Trials have shown that the concentration of the insecticide in the fleece, and its persistence are equivalent when the insecticide is either 'jetted' or 'misted' into the fleece. While the concentration of the insecticide is double in the misting fluid, only one-third the amount of insecticide is used for misting compared with jetting.

The control of the body louse (*Damalinia ovis*) continues to be hindered by high labour costs and shortages. Off-shears treatments are being promoted.

Internal parasites continue to be a problem in all areas. The barber's pole worm (*Haemonchus contortus*) is the main one reported and, owing to a series of years with higher than normal rainfall, its incidence has been higher than normal. Infestations of black scour (*Trichostrongylus* spp.) and nodule worm (*Oesophagostomum columbianum*) have been reported. Routine control measures have contained infestations.

Breeding

WOOL BIOLOGY LABORATORY—The Sheep and Wool Branch promotes the use of fleece measurement as an aid to ram selection. The Wool Biology Laboratory has continued its modernization program with the purchase of additional equipment and further investigation and development of the use of the liquid scintillation techniques. A further three studs are making full use of the computer grading program introduced last year.

As part of the promotional and extension program, the Officer-in-Charge of the Wool Biology Laboratory has visited most of the major Merino sheep studs of the State to discuss the services and benefits available to the stud owner and his clients. Field officers attended a field day on one stud that uses the full program to discuss and become fully acquainted with the fleece measurement system. The Australian Broadcasting Commission made a film on the selection of sheep using the computerized grading program and screened it on the 'Countryman' session.

Field officers and the Wool Biology Laboratory assist in the running of objectively measured sheep production competitions. These competitions were initiated in Queensland and in recent years have been commenced in other States.

The Wool Biology Laboratory processed 7 829 fleece and 103 mohair samples, 129 dyeband samples and six skin sections in normal routine analysis. The Laboratory also services a number of experiments where measurements include skin, fleece and dyeband parameters. The chemical defleecing trials have included samples of hair and skin from rabbits and guinea pigs as well as from sheep.

NORTH-WEST GROUP RAM BREEDING SCHEME—A group breeding scheme, established at 'Toorak' in October 1976 now has 19 co-operator producers. The scheme aims at producing rams with adapted qualities for the semi-arid tropical environment. This has been promoted by the necessity to improve productivity of Merinos in an area known for low wool cuts, low lamb-marking percentages and relatively few commercial studs. Criteria which have been placed on flock sheep before inclusion in the scheme are above average wool production, proven fertility and traditional classing standards.

The first 250 rams from the scheme will become available to co-operators in September 1978. Continuing selection for ewes from co-operators' flocks will increase the numbers to 2 500. It is envisaged that sufficient rams can be bred from this flock to meet all requirements by 1980.

MERINOS IN NORTH-WEST QUEENSLAND.—It is desirable to increase the diversification of the sheep industry in the tropics in order to lessen dependence on wool. The development of a large-framed sheep with acceptable wool qualities would produce dual purpose qualities which would improve the viability of the industry. At present, the size of local tropical wethers is a factor affecting sheep export from north Queensland to the Middle East markets.

Six strains of Merino rams have been evaluated over the last 3 years in terms of progeny performance. Results suggest that larger-framed South Australian ram progeny are better survivors (10 to 20%) during the neo-natal period of life and subsequent wool production is greater (5 to 10%) than indigenous ram progeny. Improvement in the net productive rate of tropical flocks is an integral part of research at 'Toorak'. Any genetic advantage of improved lamb survival that different strains of Merinos may have would be of great economic benefit to the local industry.

EVALUATION OF WILTSHIRE HORN X MERINO SHEEP—The high fertility of the half-bred Wiltshire Horn (WH) x Merino (M) ewes reported previously continued with the 1977 lambing at the Hermitage Research Station. Virtually all ewes that were mated lambled, and approximately 50% of the WH x M ewes had twins, while 14% of the Merino ewes mated to similar rams produced twins.

All 1974 and 1975-drop WH x M sheep exhibited shedding from the head, neck, belly and breech regions. It has previously been reported that approximately 50% of the 1976 drop $\frac{1}{2}$ M $\frac{1}{2}$ WH lambs shed from the head, neck, belly and breech regions, while no $\frac{3}{4}$ M $\frac{1}{4}$ WH sheep showed shedding as lambs. As two-tooths, 90% of the $\frac{1}{2}$ M $\frac{1}{2}$ WH shed from the head, and 56%, 73% and 73% shed from the belly, neck and breech regions. The corresponding figures for the $\frac{3}{4}$ M $\frac{1}{4}$ WH sheep were 29%, 4%, 8% and 11% for the four regions respectively.

The 1977-drop lambs were substantially lighter at 4 months of age than the 1976-drop. None of the 1977-drop sheep exhibited shedding by February 1978. Ewes were mated in April 1978 to produce sheep for future evaluation.

Nutrition

UREA SUPPLEMENT FOR LAMBING EWES—The nutrition of the lambing ewe is often inadequate during the dry spring months of the semi-arid tropics. As a consequence milk yield is reduced, causing significant lamb mortality and low growth rate of lambs. Urea supplementation of ewes during lactation has significantly improved milk performance and consequent lamb growth and survival rates.

PREFERENTIAL WEANER MANAGEMENT—A preferential management system aimed at improving survival and growth rates of weaner ewes has been studied at Toorak Sheep Field Research Station. The system aims at adopting an early weaning strategy, and improving the nutritional status of the weaners.

Most lambs in north-west Queensland are born in the autumn and weaned at a time when adverse seasonal conditions prevail. The object of the work was to adopt the principle of shallow water storage for providing a forage sorghum crop for weaners during a 6-week period from June to August. A 4-ha area of the shallow water storage dam yielded 20 tonnes of forage sorghum. The crude protein content of the sorghum was 14% when immature, 12% when seeding and 8% after seeding. During a 6-week feeding period, weaner ewes fed Flinders grass hay *ad lib* lost 1.2 kg liveweight, while others fed Flinders grass *ad lib* and forage sorghum at 3.5 kg/head/week gained 0.5 kg.

The advantages of this system lie in the improved survival and growth rate of weaners, their subsequent productivity and the collateral benefits that arise from an early weaning strategy. Such benefits stem, not only from improved liveweight of the ewes so managed, but also include the likelihood that such ewes will be in better than usual body condition during the ensuing spring.

MITCHELL GRASS PASTURE STUDIES IN SOUTH-WEST QUEENSLAND. Liveweight and wool growth have been measured on wethers grazing continuously on Mitchell grass pastures at a range of grazing pressures. The liveweights of the wethers in the less intensively grazed paddocks have continued to be consistently better than those in the heavier grazed paddocks. During the period August to January, little or no rain occurred and the benefits of lighter stocking rates were evident in the liveweights. Following February rains, the sheep in the heavier stocked paddocks showed compensatory liveweight gains. There appears to be no benefit to lighter stocking rates as regards wool production.

SUPPLEMENTATION OF SHEEP CONSUMING FELLED MULGA. Previous work in pens had indicated that feed intake and productivity of sheep consuming mulga could be increased by the supplementation with sulphur-contained compounds. Sheep consuming felled mulga at the Charleville Pastoral Laboratory were supplemented for two months with commercially prepared blocks containing sulphur. While the unsupplemented group lost an average of 5.5 kg liveweight and two sheep in the group died, two of the supplemented groups virtually maintained liveweight and the third group increased liveweight by 3.5 kg. There was also some increase in wool production in the supplemented groups compared with the control group.

Previous experimental work involving sulphur supplementation of mulga fed sheep suggested that cobalt deficiency may be limiting the response of sulphur-supplemented sheep. A trial to test this hypothesis indicated that there was no benefit in supplementing sheep consuming mulga with cobalt.

Reproduction

Investigations continued into the low lambing percentages recorded in recent years. Results from central Queensland show that, in flocks monitored, the pregnancy rates were high, but lambings remained low. This indicates losses in late pregnancy and early lactation. Disease has not been detected as a cause and is discounted. Investigations to date indicate that the losses are caused by predation and undernutrition.

An officer of the Sheep and Wool Branch undertook a survey in the Blackall district to determine the practices which affect lambing percentages. The major finding was that the properties with lower stock rates have higher lambings. This result agrees with the finding of an earlier economic study undertaken by an officer in the south-west.

Trials in central and northern Queensland on supplementation by iodine or dosage with stilboestrol failed to increase lambing percentages.

Wool harvesting

Previous reports have described the production of a partial or complete break in the staple by the use of drugs administered parenterally. Considerable experimental work was done at 'Toorak' and the Animal Research Institute during the year to investigate factors controlling wool growth. The program was broadly divided into two main areas of research: biophysical and biological defleecing.

Biophysical studies included the production of a mini-break in the wool fibre with subsequent removal of wool by external application of hydrosulphide in a wet or dry form.

Investigations of the biological defleecing of sheep were conducted in three main areas—1. Factors controlling the synthesis of cystine which included studies of the amino acid metabolic pathway and the influence of enzymes, co-factors and indolamines 2. Physiological pathways of control of natural fibre shedding 3. Control of wool follicle mitotic rate.

Progress was made in all these areas of research providing additional information relating to the development of a safe process which will produce a predictable break in wool fibres for the practical and economical removal and handling of the fleece.

Diseases

As part of bluetongue investigations, members of a flock of sheep near Gatton that had oedema of the lips, but no erosions of the skin or mucous membranes, were examined. Paired sera from the flock were negative to both serum neutralization and complement fixation tests against CSIRO 19 virus.

Leucomyeloencephalitis was diagnosed in six goat kids 2 to 5 months old which were showing signs of fever, ataxia, circling hindlimb paresis and hyperaesthesia.

Serum copper levels suggestive of copper deficiency were found in sheep from a property at Cunnamulla. The property had poor lambing percentages and has some history of copper deficiency in 'big' years.

Following reports from the Central Highlands that the noxious weed *Parthenium hysterophorus* taints sheep meat, an experiment was conducted in association with officers from the Department of Lands to investigate the severity of tainting as ascertained by taste panel members. Due to the inability to use grazing animals, penned sheep were fed for 24 days on either a diet of grain and chaff or the same diet plus 30% air dried *Parthenium*. Results from the taste panel indicate that although the two diets were judged as having different flavours, the tests for aroma, meat flavour and acceptability were judged as not being significantly different. If the compound causing the tainting were a volatile compound, then the lack of tainting in the sheep meat could be due to the fact that the *Parthenium* was air dried before feeding.

Staphylococcus aureus was isolated from a case of caprine mastitis at Gunalda and *Clostridium welchii*, the cause of enterotoxaemia, was isolated from post mortem material taken from a goat which died at Yandina.

Pig industry

The Queensland pig population increased by 4% to reach an estimated 458 000 pigs by March 1978. Pig slaughterings and meat produced in Queensland for the 12 months to April 1978 showed increases of 4.7% and 5.5% respectively, compared with the same period ended April 1977. National figures reveal a similar trend.

Although the market for pigs remained fairly stable, producers faced rising production costs throughout the year. Grain supplies became scarce in some districts due to a reduced harvest of winter cereals grown under drought conditions. Planting intentions for the new season's sorghum were not fully realized for similar reasons. Protein meal supplies were reasonably adequate although fishmeals became scarce or unobtainable.

In July 1977, three major processors of pigmeat agreed on uniform conditions of sale of pigs by weight and grade. Included was a definition of a dressed carcass and provision for payment to producers based on hot dressed carcass weight.

Officers of the Pig Section handled numerous requests for information on specific and general pig raising topics and continued to be involved in the activities of Queensland Pig Industry Producers' Association (Q.P.I.P.A.) and producer discussion groups. This activity provided excellent opportunities for communication.

Pig Section staff also assisted Marketing Division officers in compiling and up-dating pig producer rolls in preparation for the election and appointment of producer representatives to the newly formed Commercial Pig Producers' Organisation. District Councils are now constituted and the first meeting of the State Council was held on 13 June in Brisbane.

Pig carcass competitions have declined in recent years and about 30 competitions were judged by Pig Section officers. Their involvement was on the condition that there were six or more entries.

Departmental officers played a major role in assisting the Australian Development Assistance Bureau in the conduct of the Second International Training Course in Pig Husbandry. A successful school on building materials was held at Biloela and officers discussed many aspects and problems in swine reproduction at a well attended producer school at Boonah.

Producers have been kept informed on current trends in manure treatment and disposal, particularly on the benefits of land disposal as a fertilizer. Officers have also assisted producers and Local Authorities on problems associated with manure disposal. There has been considerable interest in automatic flushing, shed insulation and ventilation in building designs.

Disease

A large number of stillbirths and high neo-natal mortality rates due to leptospirosis have been diagnosed on several properties. On one property, vaccination had never been adopted and the disease had apparently never occurred previously despite the fact that breeding animals were purchased at markets.

Parvovirus has been implicated in several herds where large numbers of piglets have been born mummified. Near Helidon, two large piggeries and a third much smaller piggery all had outbreaks of disease at the same time. On one of the large piggeries in a 35-day period, 26 sows averaged 1.5 piglets born alive and 5.5 born dead (this figure includes stillbirths and the large mummified foetuses—smaller mummies would have been missed). Sows of all ages produced affected litters. No pigs had been introduced to the herd in the previous 12 months and wild pigs had not been seen in the area. Piglets born alive had a normal survival rate and most sows appeared to hold to subsequent service, though this has to be confirmed at a later date. In another case, the disease occurred in gilts that had been isolated from older breeding stock until 5 days before mating.

Brucella suis was cultured from the spleens of two bacon pigs from a property in the Mount Larcom area. These are the first positive culture of *B. suis* from non-feral pigs in Queensland south of the Tropic for many years.

A haemorrhagic syndrome was investigated on two properties in the Biloela region. On the first affected property approximately 150 pigs died whereas an effective control routine had been established by the time clinical cases were seen on the second property and none of the 10 affected pigs died.

Affected pigs had massive subcutaneous and intramuscular bisecting haematomas in various parts of the body and some had bled from the nose. Tests at the Animal Research Institute indicated that there was a coagulation defect of vitamin K dependent factors (Factors II, VII, IX and X). A coumarin type toxin or fungal metabolite was suggested. There was no history of warfarin-type compounds being used on the property, and a feeding trial on laboratory rats using the feed fed to pigs on the property failed to induce any clinical signs of the disease.

The problem was controlled initially by injecting pigs with vitamin K, and latterly by the addition of 225 g of sugar-based menadione sodium bisulphate, a vitamin K analogue, per tonne of feed. There have been no further losses since the adoption of these control measures.

Swine dysentery has been confirmed on a number of occasions at the Animal Research Institute by the finding of large numbers of large spirochaetes in the bowels of affected pigs. Haemorrhagic bowel syndrome was also diagnosed more commonly during the year.

A tentative diagnosis of encephalomyocarditis has been made on the basis of clinical history and gross and histopathology on a property in an outer Brisbane suburb. Preliminary virological studies support the diagnosis but are not completed. A total of eight pigs was reported to have died aged between 4 to 10 weeks of age in a 17-sow unit. Most pigs died suddenly but some were sick for 24 to 48 hours.

A congenital condition of multiple cysts in the liver, accumulation of bile in the gall bladder and bile ducts and multiple cysts in the kidneys has now been seen in piglets from a total of five litters from a Caboolture piggery. The condition was originally seen in piglets from two litters approximately 1 year ago, and three further litters have been affected recently. The sows that had affected litters recently had previously produced apparently normal litters, and the two gilts that produced affected piglets 1 year ago have since given birth to normal litters.

The condition has apparently not been recorded previously in pigs. However, the lesions are very similar to a condition known as Human Infantile Polycystic Disease Potter Type 1, seen in human infants. In the human condition, cysts are also seen in the pancreas. Experimental models of the human condition have been induced by the administration to pregnant rats of a carbazole compound and an impurity of diphenylamine.

Scouring in young pigs is a major cause of economic loss to pig producers throughout the world. In Queensland, records of scouring in approximately 500 litters have been collected to establish some of the factors involved in the epidemiology of the disease and also to attempt to quantify the slowing of growth that occurs when piglets scour.

On one property, a vaccination procedure involving feeding to pregnant sows of cultures of *E. coli* isolated from a typical case of neo-natal scour on the same property was undertaken. Overall survival rates of piglets, death rates

due to scouring and weight at 14 days and 28 days of age were recorded. The performance of litters of vaccinated sows was not superior to litters of sows that received a placebo. These results were contrary to the finding of field trials using a similar technique in U.S.A. A second vaccination trial using an injectable vaccine on three properties is currently under way.

Breeding

PERFORMANCE TESTING OF STUD BOARS. The boar performance testing station at Rocklea evaluated the breeding worth of 232 Large White and Landrace boars. Use of the best station tested boars as sires has brought about an annual rate of improvement in the co-operating herds of six breeding index points. Screening for malignant hyperthermia syndrome resulted in the culling of eight boars. The calculations used in determining breeding values were reviewed and brought up to date. To enable a 60% increase in station throughput, the performance test range has been shortened so that the test now is carried out over the live-weight range of 50 kg to 90 kg.

ON-FARM PERFORMANCE TESTING. A research project supported by the Australian Pig Industry Research Committee showed that a significant genetic improvement could be obtained through objective selection of breeding stock. Additional and complementary improvements in management and feeding practices were also evident.

All Pig Section staff had access to ultrasonic equipment to demonstrate on-farm performance testing to interested farmers. It is encouraging to note that some producers are obtaining equipment to carry out their own selection programs. Many participants in testing schemes rely on these schemes for replacement stock selection, while some are selling breeding stock to other producers thus spreading the benefits over a wider area. In addition to genetic improvement, the work also provided a key to useful modifications in overall husbandry.

SELECTION FOR ECONOMIC GAIN IN A PIG HERD. A comparison of the performance of pigs in a herd selected for economic gain with those of pigs from a genetically stable control herd has shown that selection has resulted in a marked improvement in feed conversion efficiency and leanness of both *ad lib* and restricted feeding;

a reduction in appetite on *ad lib* feeding; an improvement in growth rate only on restricted feeding; a reduction in fat throughout the length of the carcass; and an increase in the length of the carcass without a decline in eye muscle area.

MALIGNANT HYPERTHERMIA SYNDROME AND MEAT QUALITY IN BOARS. Boars entering the Rocklea performance testing station are screened using halothane anaesthesia to detect the malignant hyperthermia syndrome (MHS). Of 140 boars tested in each breed, eight Landrace gave typical MHS reactions, while there were no reactors in Large White. The results indicate the presence of a deleterious recessive gene present in Landrace at a frequency of 0.24 but absent from Large White. Meat quality measurements, made on 56 Large White and 60 Landrace boars slaughtered after performance testing in the Station, showed that MHS reactors had significantly paler and more acid muscles than normal boars of both breeds. Normal Landrace had paler, more acid and less marbled muscles than Large White.

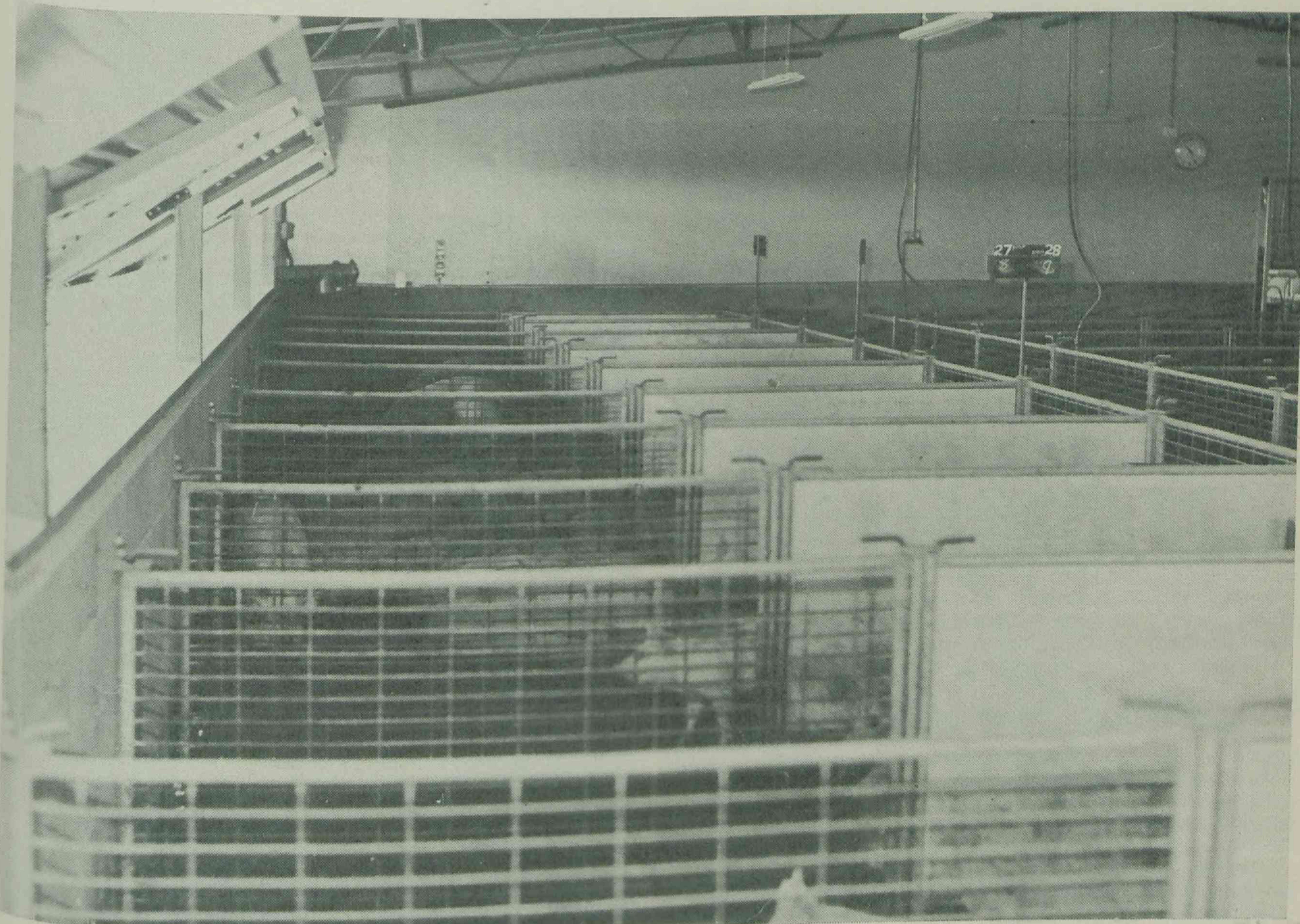
Nutrition and reproduction

ROUGH RICE AS A COMPONENT OF GROWER PIG DIETS. A series of trials assessing the value of feed grade rice (I.R.R.I. 224) is almost completed. Recommendations regarding its use, based on results obtained to date, are that rice can replace approximately 15% of the wheat or maize in a single grain diet and 40% of the sorghum without affecting growth rate. A major benefit found from incorporating rice in a whole maize diet has been a significant reduction in carcass fat depth.

EVALUATION OF PROTEIN CONCENTRATES. Comparisons were made of the effectiveness of isonitrogenous amounts of soybean meal, mung bean meal, meat and bone meal and maize gluten meal. A major investigation of sunflower meal was also undertaken.

Comparing the different protein concentrates, growth of pigs was always best with soybean meal and worst with gluten meal. The performance of the gluten-fed pigs was only 60% of those fed the soybean meal and only marginal improvement occurred with the addition of synthetic lysine. There was little difference between the growth promoting abilities of meat and bone meal and mung bean meal with these being only slightly poorer (about 10%) than soybean meal.

The grower pens at the Pig Research Centre at Wacol. Results of work at this Centre, which was completed last year, should soon start flowing to the industry.



The sunflower evaluation trials showed that, with the addition of small amounts of synthetic lysine, sunflower can be used to replace part or all of the soybean in a wheat based ration. No significant differences for growth rate and feed efficiency were observed in one trial and only small significant differences for growth rate were observed in a second experiment. In a third trial, where sunflower was replaced by meat and bone meal and lysine levels of all diets were equal, again no significant differences were observed for growth rate, feed conversion efficiency or carcass quality.

Management

Preliminary results of field experiments on spray cooling of pigs indicate that performance was improved during hot weather. Equipment for these experiments was purchased with funds provided by the Australian Pig Industry Research Committee.

Performance recording has been maintained for a number of years and continues to assist the producer in monitoring piggery performance and in achieving predetermined goals in production. Primarily record keeping helps to define areas of weakness in management and is of vital importance in identifying reproduction problems.

To be relevant and useful to the producer, the system of maintaining and evaluating records needs to be simple in concept. A system developed in the Burnett region is worthy of adoption in other districts.

In conjunction with physical performance recording, gross margins analysis affords the producer a valuable insight into the strengths and weaknesses of his operation. The system is useful in monitoring progress in the establishment phase of production or in solving a problem. Unfortunately, the work is time consuming and once the producer feels reassured that normal production targets are achieved he often sees no need to continue the work.

A voluntary scheme for registration of pig tattoo brands was introduced in November 1977. To date, registrations amount to about 4% of 3 700 holdings with pigs in this State. Most of those registered represent larger piggeries marketing pigs by weight and grade. An orderly means of tattoo branding is a necessary pre-requisite for the eventual introduction of pig carcass classification.

Staff of the Veterinary Services Branch and the Pig Section have provided assistance and advice on treatment of food wastes or on a change of feeding methods and diets to comply with the legislation enacted in October 1976 to prohibit the feeding of untreated animal matter to pigs as an exotic disease control measure.

Poultry industry

During the period under review there has been a trend for companies and other organizations involved in the poultry industry to seek more technical advice from Departmental officers serving the industry than previously. This has been due mainly to two factors: a greater recognition among these bodies that the specialist expertise available can be of considerable assistance in overcoming complex production problems, and a decrease of technical services provided by some private firms.

During the year, the Poultry Section's specialist service was further expanded by the appointment of a veterinary officer to an existing vacancy. Responsibility for poultry disease control including supervision of the pullorum testing program has been transferred from Veterinary Services Branch to the Poultry Section.

The veterinarian has made a complete review of the extension literature on poultry disease, and has revised and re-written a number of disease pamphlets which have been printed in Farmnote form.

During the year, she has been assessing the current situation in the industry regarding misuse of drugs, farmers' awareness of the principles of disease control and the role that management plays in prevention and control of disease. It now seems clear that many farmers do not understand these principles and tend to rely on drugs alone to treat disease rather than taking steps to prevent it. An extension project aimed at correcting this situation has been planned.

Thirty people representing all sections of the Queensland poultry industry attended, by invitation, a meeting to discuss importation of poultry genetic material. The overwhelming view expressed was against any change in the quarantine laws which would permit importation of poultry genetic material. This opposition was based mainly on the grounds of the possible adverse economic effect on established Australian breeders and the risk of introducing exotic poultry disease agents.

Mr G. D. Stewart Husbandry Officer, Division I, Toowoomba was invited by the New Zealand Dairy Board to be guest speaker at the annual Poultry Farmers' Conference,

South Island at the University of Canterbury during November 1977. Mr Stewart was able to spend 3 weeks studying the New Zealand poultry industry.

Significant matters which were examined by the Poultry Advisory Board included: importation of poultry genetic material; exercises in exotic disease control; Local Authority regulations governing poultry shedding and poultry farming; conditions for egg handling and storage on farms; need for assured supplies of certain poultry vaccines; controls on interstate eggs sold in Queensland; sample testing of breeding flocks for pullorum disease; streamlining procedures for interstate movement of day-old chickens and hatching eggs; egg quality surveys at retail outlets; feather sexing and the future of licensed chicken sexers and layer replacement surveys.

Egg industry

The main feature of the egg industry in 1977-78 has been the continued prosperity which is the direct result of reduction of egg surpluses through production controls. Net return to producers for eggs sold under Egg Marketing Board control was 70.37c/dozen for the 10-month period to the end of April 1978. This is 5c/dozen more than the corresponding period for the previous year and is some 20c/dozen above that of 2 years ago.

The improved morale of egg producers has been maintained and many producers are making firm plans for replacement or upgrading of their existing production facilities. In contrast to the situation before the introduction of Hen Quotas, very few poultry farms are now for sale, and any for sale are finding ready buyers.

Egg production in south-east Queensland for 1977-78 is estimated to be almost 8% higher than that for the previous year and this has prompted the Hen Quota Committee to apply a further reduction in south-east Queensland producers' hen quotas of 72 700. This reduction is to take effect from 4 September 1978.

Poultry Section officers who are also inspectors under the Poultry Industry Act have important responsibilities in ensuring that eggs offered for sale to the public are of high quality and correctly graded for weight. Routine checks of quality and grading are made in retail stores.



The increase in egg production which has occurred in south-east Queensland in spite of stationary hen quota numbers in the last year has been mainly due to two factors: more effective use by growers of their hen quotas (90% occupancy rate of laying accommodation compared with approximately 84% on introduction of quotas) and possibly a higher rate of lay because of the lower average age of laying flocks and genetic improvement of laying potential.

Re-allocation of some unused hen quotas in north and central Queensland has resulted in these areas moving closer to being self-sufficient in eggs. This is also a factor contributing to the current surplus of eggs in south-east Queensland.

With the advent of controlled production, egg producers are now in a position to seek prices for their eggs which are more closely related to cost of production than previously. With this aim, the Egg Marketing Board Suppliers' Association (E.M.B.S.O.) has established a Committee to keep the Egg Board informed on a regular basis on the costs of producing eggs. A cost of production model has been developed for eggs by officers of Economic Services Branch and Poultry Section. Cost inputs to the model are updated on a quarterly basis.

It is of interest to note that in the period under review egg production costs have risen by an estimated 2.5c per dozen. The most significant cost increases have been in feed and labour.

The egg quality incentive program adopted by the Egg Marketing Board in 1976 has been successful in improving the quality of eggs delivered by producers. In April 1976, 54% of consignments reached the minimum standard of 67 Haugh Units whereas in April 1978, 85% satisfied this standard. More than 98% of eggs received by the Board in April 1978 met the standard.

Late in 1977 the Board increased the incentive payment for eggs meeting the 67 Haugh Units standard from 1 to 3c. This has applied greater pressure on the small percentage of growers who still do not meet the standard.

Poultry meat industry

There has been considerable expansion in the broiler industry in 1977-78 in the traditional broiler growing area of south-east Queensland, the bulk of this expansion being attributable to one major processor. It is estimated that 22 million meat chickens will be processed in Queensland in 1977-78 with approximately 20 million being processed in an area within 100 km of Brisbane. This represents a 4% increase over 1976-77.

There are 88 broiler growers in south-east Queensland and eight others in the remainder of the State. In addition, processor-owned farms contribute in a minor way to the overall production. Expansion has occurred steadily since July, 1974 when 82 growers had 232 257 m² of shedding under contract, in July 1977 there were 87 growers with 289 857 m² of shedding and in June 1978 there were 88 growers with 295 431 m² of shedding under contract. The anticipated cessation on 30 June 1978 of the 40% investment allowance has resulted in many growers ordering plant and equipment for shedding to be constructed late in 1978.

Market requirements determine age at which birds are processed. One processor with a large take-away food market is processing at 49 days in winter to 53 days in summer while another is processing at 53 days in winter to 58 days in summer allowing for seasonal variations in performance.

At 58 days, a broiler chicken can currently be expected to weigh 1.9 kg for a feed conversion efficiency of 2.15 and an average flock mortality of 3.5%. Stocking density varies from 0.060 m² to 0.069 m² per bird. Currently batch throughputs vary from 4.2 to 4.7 batches per year.

Steady enquiries are made regarding commercial development of ducks, turkeys, geese, pheasant and quail, but opportunities for such development are very limited. In the case of ducks and turkeys competition with processed birds from interstate makes it virtually impossible to establish commercial units for production of these species in Queensland.

Disease

Outbreaks of infectious bronchitis occurred during winter 1977 in a number of broiler and pullet flocks which had been vaccinated by various methods against infectious bronchitis (IB). Outbreaks occurred in flocks 14 to 21 days after vaccination with a commercial vaccine containing A-strain IB virus.

A Newcastle disease virus (NDV) was isolated from salmon crested cockatoos illegally introduced into Australia. Tests indicated that the isolate was a strain more pathogenic than other NDV previously isolated in Australia. The virus caused a severe respiratory disease in chickens exposed oronasally at 1 day of age and in chickens housed as day olds with infected chickens. To prevent the possible

spread of this virus to Australian birds, an aviary in which the birds had been held and some small poultry premises were depopulated, disinfected and quarantined. Serological surveys and virus-isolation studies on flocks within a wide radius of the illegal introduction indicate that the NDV has not spread to Australian birds.

These cockatoos also had a number of parasites including *Cardiofilaria* spp in their peritoneal cavities and *Mocrofilaria* spp and *Haemoproteus/Plasmodium* spp in their blood.

The haemorrhagic form of infectious laryngotracheitis (ILT) was confirmed in a flock of 60 000 broilers, 7 weeks of age, at Narangba. Two consecutive batches were affected. A strict clean out and hygiene program was carried out to eradicate the disease. The source of the virus could not be traced. Two outbreaks of a milder form of ILT were also recorded in the East Moreton district.

Two of the major integrators reported isolation of an adenovirus from an infectious condition in 3 to 4-week-old broilers. A mild cough was the only clinical sign, and no measurable effect on performance has been observed from the disease. At least 30% of flocks were affected over the summer period.

Avian encephalomyelitis was diagnosed in three 'back-yard' flocks. During the latter part of 1977, commercial avian encephalomyelitis vaccine was in short supply because of production problems experienced by the only Australian manufacturer of this product.

Salmonella pullorum reactors were found in breeding flock at a Bundaberg hatchery with a long history of infected breeding flocks. As this flock was the only hen breeder flock detected in Queensland this year, every effort is being made to eliminate the infection by repeated testing and preventive management. The most recent testing has not revealed any further reactors.

Omphalitis due to *E. coli* caused 5 to 10% mortality in four batches of 3 to 4-day-old chicks in south-east Queensland. Multiple outbreaks of omphalitis in chickens from one Brisbane hatchery were caused by *Pseudomonas* sp. This bacterium was found to be resistant to a wide range of antibiotics.

Aspergillosis due to *A. fumigatus* was associated with a loss of 240 out of a flock of 6 000 chickens at 2 weeks of age at Edmonton. The same organism caused sickness with low mortality in 4-week-old chickens at Gumdale.

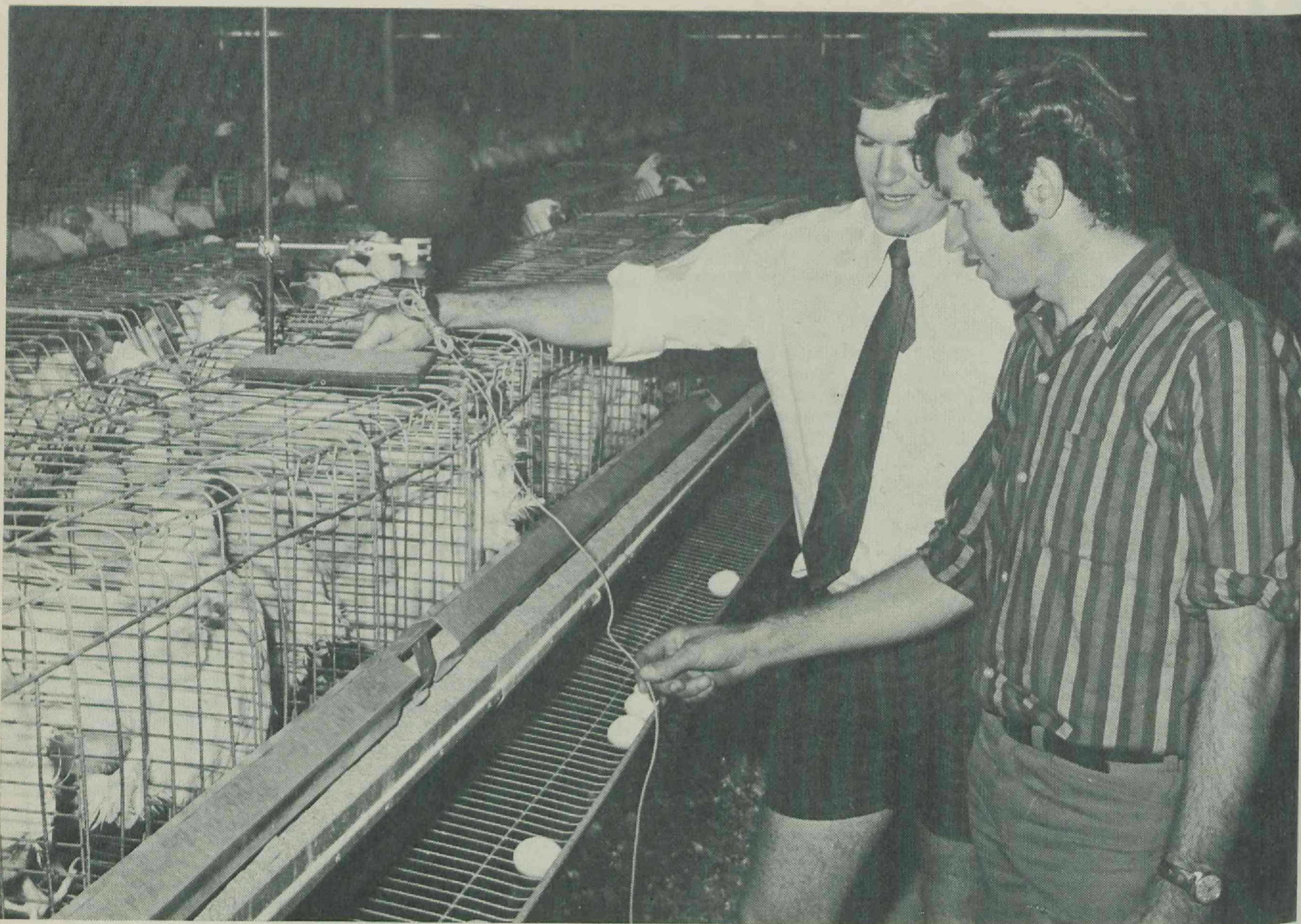
LOSSES IN LAYER FLOCKS. An investigation was conducted to determine the causes of sickness and death in three flocks each of 1 800 caged layers. Each flock was of a different commercial layer strain but the three flocks were fed the same ration. Total losses during a 6-month period were 8.3%, 5.4% and 5.8% in the three flocks. Lymphoid tumours were the greatest single cause of loss in two of the flocks and the second greatest cause of loss in the third flock (15% of total losses). Prolapse/cannibalism was the greatest cause of loss in the third flock (30% of total losses). High losses due to that cause have also been experienced on other farms using the strain of hen in the third flock.

Nutrition

RESTRICTED FEEDING OF LAYERS AND BROILER BREEDERS. Investigations continued in this field at the Poultry Section, Animal Husbandry Research Farm, Rocklea. The propensity of the layers used commercially in Queensland to deposit excessive amounts of depot fats represents a major inefficiency in our egg industry. Restricting the feed intake of both the replacement pullet and the mature laying hen is an effective means of controlling fat deposition and, consequently, of improving the efficiency of egg production. The emphasis has been on the development of practical programs, easily applicable on commercial farms, that are based on limiting the birds' time of access to feed.

A program developed in earlier work has been extended to the industry and has been widely adopted. This program involved denying the birds access to feed for 40 in 72 hours during the growing period. Typical benefits obtained are a reduction in feed required to produce 1 kg of eggs from 2.71 kg for full-fed birds to 2.54 kg. The main difficulty found has been excessive delay in maturity of some controlled-fed flocks. A number of instances of flocks not laying until 26 to 28 weeks of age have been reported. Management, diet and equipment faults have been identified as possible causes of this problem. The main extension emphasis of the program now is to identify and solve the problems encountered. An evaluation of the extension program is planned for next year.

Other programs, including ones which require no labour or management decisions on week-ends, when farm staff is often limited, have been shown to be equally effective. The density of housing layers and/or the cage population has no effect on the response of birds to restriction. Restricted birds have been shown to have the ability not only to respond to higher intakes of the essential amino acid, lysine, than full fed birds but also to use the lysine ingested more efficiently.



Records of environmental conditions in poultry houses provide valuable information about factors affecting performance of poultry flocks. Here a poultry adviser discusses the advantages of painting roofs to reduce radiant heat levels in laying sheds with the farm manager. A globe thermometer supplied by the Poultry Section was used to check radiant heat levels.

The greater persistence of lay of restricted birds as they age was demonstrated in an experiment which extended into the second year of egg production. Results from this experiment will be used in the construction of models for the planning of pullet replacement programs.

The poor reproductive performance of the broiler breeder represents the most inefficient link in the chain of production of chicken meat. Many of the failings of this bird, such as low peak and poor persistence of lay, weak eggshells, low fertility and high embryonic mortality could be related to obesity. For the first time at Rocklea, time of access restriction programs were applied to this class of stock. A week-end denial program proved as effective in improving performance as the rigid allocated allowance procedure at present used in the industry. However, neither program reduced the costs of production of the day-old broiler chicken to a reasonable level. Much more work on the management of this type of bird needs to be done.

METABOLIZABLE ENERGY (M.E.) ASSAYS USING AUSTRALORP CHICKENS. Sixteen mixed diets were assayed for M.E. by chick-bioassay by Husbandry Research and Biochemistry Branch officers and by the University of New England using a trained cockerel method. Correlations between chick assay and expected values, between the U.N.E. assay and expected values, between chick assay and the U.N.E. assay, and between chick assay and prediction values developed by the Biochemistry Branch were all highly significant.

Breeding

SELECTION TO IMPROVE EFFICIENCY IN LAYING HENS. Selection, based on liver fat content, has continued for high and low fat lines of Australorp hens. After four generations of selection, the liver fat of the high line birds is approximately twice that of the low fat lines. This has been associated with a difference of approximately 30% in carcass fat for the high and low fat lines, and a difference of 7% in body weight.

Feed consumption from 17 to 41 weeks was 18.12 kg per bird for the high fat line and 17.31 kg per bird for the low fat line. Egg production was similar for the two lines, resulting in a marked improvement in feed efficiency for the low fat line relative to the high fat line.

Miscellaneous

EGG QUALITY. The extension program begun by the Poultry Section in 1976-77 continued during the current year. Main activities were the staging of egg quality workshops for producers in Brisbane and Rockhampton, the presentation of an egg quality seminar for retailers at Surfers Paradise, and the conduct of surveys to determine egg quality at retail outlets in Brisbane and Rockhampton.

During 1977, the Egg Marketing Board increased the differential payment to producers who deliver eggs which meet the 67 Haugh Units standard set by the Board from 1c to 3c per dozen. This has stimulated greater interest among producers in methods of maintaining and improving the quality of eggs supplied to the Board. As a result of this, there has been a high rate of adoption of the improved methods for handling, transport and storage of eggs which have been discussed at egg quality workshops.

The results of the surveys of egg quality at retail outlets will be used to assess the impact of the egg quality improvement program on the quality of eggs reaching consumers.

WET DROPPINGS IN LAYERS. This is an intermittent field problem in caged layers which is more common in summer months than at other times of the year. There is now good evidence that certain strains are more prone to the problem than others and that the condition is due to 'overconsumption' of water.

FARM RECORDS. Activity in this area has been aimed at development of computerized recording systems for pullet rearing, egg production and broiler production. The overall aim of the program, which is supported by CESG funds, is to increase producers' awareness of the value of farm records as an aid in management.

As a result of a review of the existing pullet rearing recording system, it was decided that producers should be given progress reports at strategic intervals throughout the growing period for each batch of pullets. Previously reports were produced at the end of the rearing period only and were of historical rather than of immediate value in identifying problems. A computer program is being developed to analyse recorded data, which will assist in preparing these reports.

Three feed metering units have been installed for demonstration purposes on a co-operators' egg farm near Toowoomba. The aim of the demonstration is to show the value of accurate records of daily feed consumption in assessing laying flock performance. It has been necessary to modify the equipment to simplify calibration and to improve accuracy. Feed consumption and temperature recording has commenced on the farm. Data are also being obtained on laying performance and this will be related to feed consumption, temperature and age of the flock. By the end of the 1978-79 year, it should be possible to determine whether the main problem of the layer recording system, that is, recording feed consumption in mixed age flocks, can be successfully overcome.

Horses

The diagnosis of a new contagious venereal disease of horses, equine contagious metritis, in the United Kingdom in May 1977 resulted in a survey in a number of studs in Australia. The University of Melbourne Veterinary School isolated a gram-negative coccobacillus with characteristics closely resembling those reported in the United Kingdom isolate. The identity of the isolate was confirmed at the Central Veterinary Laboratory, Weybridge, United Kingdom.

Staff collected samples from recently imported horses and those that had had coital contact with imports. No cases were discovered in Queensland and very little spread within Australia appears to have occurred.

Initially, all importation of horses from the United Kingdom and Ireland was suspended but, in early November, imports were resumed. Horses must now undergo a period of isolation in the United Kingdom, with concurrent swabbing and medication. A further swabbing and period of quarantine is undertaken upon entry into Australia.

The quarantines that had been imposed last year following the finding of *Babesia equi* in Australia were lifted in October 1977 following a decision taken by the Veterinary Consultative Committee. The quarantines were lifted because there was evidence that the disease had been present since the 1960s, evidence of active or past infection had been found on properties in Western Australia, New South Wales and Queensland, there was no evidence of tick-borne transmission in Australia and where clinical symptoms had occurred they had been mild. Most infections were in imported horses and where transmission had occurred there was circumstantial evidence that careless use of hypodermic needles was involved.

Osteodystrophia fibrosa appears to have declined as a problem. However, the condition occurred in the Arcadia Valley in horses which were being supplemented with ground limestone and molasses.

Research on this condition continued, with financial support from the Queensland Equine Research Foundation, to test the hypothesis that the high oxalate content of some introduced tropical pastures interferes with calcium metabolism and is responsible for the condition. Several balance studies were undertaken during the year as a joint project between the Pathology, Husbandry Research and Biochemistry Branches at the Animal Research Institute. Two balance trials using an oaten, lucerne chaff mixture with potassium oxalate added at 2.7 and 4.0% respectively demonstrated significantly negative calcium balances in the six horses used. Two further balance trials using buffel grass hay (1.5% total oxalate) demonstrated negative calcium balances of similar magnitude to those in the first two studies. Ten horses were fed continuously on an oaten, lucerne chaff mixture with 2% potassium oxalate added for 9 months without producing significant clinical signs. This trial is continuing as the balance studies indicated that symptoms are not likely to appear before 12 months. Balance and grazing studies to investigate other pasture species and calcium supplementation are planned.

Meat inspection services

Considerable progress was made during the year with the provision of separate amenities for State inspectors at export meatworks. The decision to request meatworks management to provide separate amenities resulted from the demand by the Commonwealth Meat Inspectors' Association that State disease control officers be not permitted to share Commonwealth amenities.

The Commonwealth Meat Inspectors' Association decided as a matter of policy that, at all new export meatworks, State officers would not be permitted to undertake routine meat inspection duties, whether stock for domestic consumption were to be killed at these works or not. This policy has serious implications in Queensland as a new export meatworks is nearing completion at Mt. Isa. The intention is to kill stock there both for export and domestic consumption, and the new works would replace an old slaughterhouse at which a State inspector undertook meat inspection duties.

The State's attitude is that if stock are to be killed there for domestic consumption a State inspector should be present to undertake meat inspection. Top level discussions between senior Commonwealth and State officers have been held in an attempt to resolve the issue.

Abattoirs killing solely for domestic consumption were staffed by State inspectors, who also undertook inspections as far as was practicable at country slaughterhouses. In areas where no Slaughtering and Meat Inspection Branch staff were available, the latter services were undertaken by Veterinary Services Branch officers.

Inspection of meat in premises registered as butchers' shops was regularly undertaken for the purpose of policing franchise provisions of the Meat Industry Act in relation to Public and District Abattoir and Regional Meat Areas.

Slaughtering facilities

A changeover from cradle dressing to gravity rail dressing on the beef slaughter floor at the Ipswich Public Abattoir was accomplished during the year. A moving viscera table and downwards hide puller was also installed. To date the new system is operating satisfactorily.

Extensions to the beef slaughter chain at Bromelton were completed during the year. Renovations to the small stock chain were also made. This was done to ensure compliance with Swedish and E.E.C. requirements and also to make it possible to work the small stock chain to capacity by killing lightweight cattle when there are insufficient calves or sheep. Work continued on the construction of new chillers.

New abattoirs at Innisfail and Tolga were completed and became operational during the year.

During the year, continuing advice and assistance has been given by officers to licensees of country slaughterhouses to ensure compliance with legislative requirements. From the structural standpoint the position now is reasonably satisfactory.

Pressure is now being applied by the Queensland Meat Industry Organization and Marketing Authority to persuade slaughterhouse licensees who intend feeding swill containing animal matter to pigs to bring their boiling down pots and piggeries to full compliance with the requirements of the Meat Industry Regulations 1973.

Poultry

Regular inspection of poultry slaughterhouses was carried out during the year. Weight gain tests were undertaken during the year at the large poultry slaughtering establishments using spin-chilling equipment. One result over 8% was recorded but a repeat test was satisfactory.

Butchers' shops and smallgoods' establishments

The insistence on high standards of construction and appliances in new premises has been maintained during the year. Excellent co-operation has been forthcoming and some very high standard premises have been constructed, mainly associated with supermarkets. Reasonable standards in older premises are being maintained. Good progress has been made in the provision of concrete graded and drained floors at the expense of wooden floors.

More specialised and regular inspection is now being given to Class 2 butchers' shops (smallgoods factories) because of their high volume of throughput. A high hygiene standard of these premises is essential.

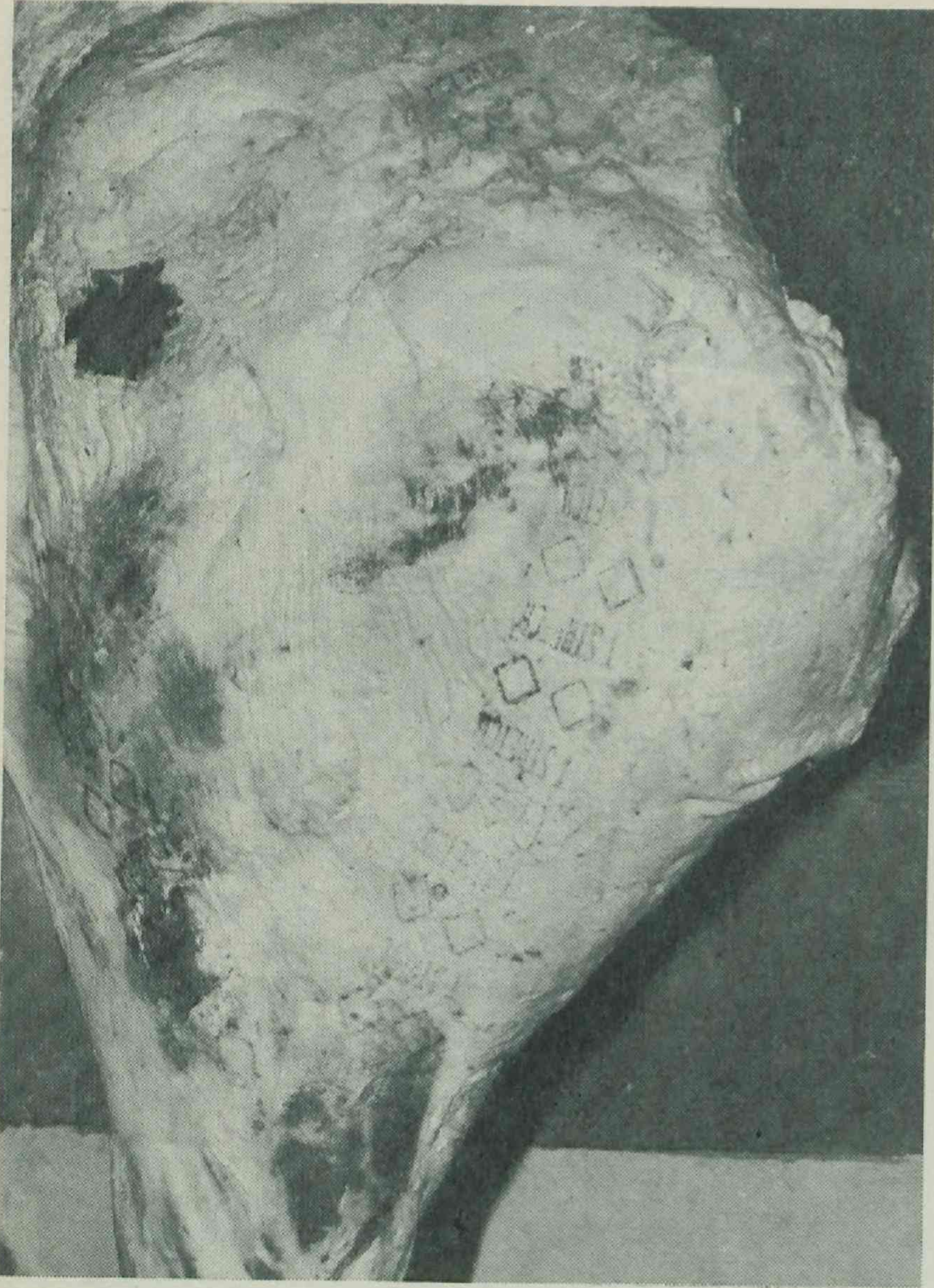
Meat quality

Tenderstretch usage remained static during the year largely because of lack of public interest and confidence in the product.

During the year, approval was granted to institute a voluntary system of identifying meat which has been specially treated to enhance quality. This will include the tenderstretch and electrical stimulation processes and lot-fed beef. Generally the system will be an extension of the blue ribbon system with different colours being used to identify different treatments applied to beef meeting the blue ribbon standards. The assistance of the industry wing of C.S.I.R.O. Meat Research Laboratory in formulating inks suitable for this purpose is gratefully acknowledged.

Both tenderstretch and electrical stimulation are processes aimed at preventing cold shortening in beef. At our request, C.S.I.R.O. conducted experiments comparing the two processes. Results indicate basic similarity, with tenderstretch marginally better. With this in mind, it was decided to identify both processes with a green colour for simplicity.

Agreement was reached on an acceptable definition of 'lot feed' in terms of time on feed and quality of ration. The onus is on the owner to identify each group of 'lot-fed' cattle. The identification of each lot is to be supported with a statutory declaration that the cattle meet the definition of lot-fed. In this case such beef is identified with purple ink.



A new branding system of identifying beef carcasses which have been treated to improve meat quality was introduced during the year. The main purpose is to protect the consumer from misrepresentation. This photograph shows the green ribbon brand for tenderstretch and electrically stimulated carcasses. A purple brand is used to identify lot fed beef.

Promotion material relating to tenderstretch and electrical stimulation was prepared.

Some serious problems are being encountered at the Metropolitan Public Abattoir Board in getting a clear and attractive brand for tenderstretch. This is related to the wet nature of the carcass at the branding point. No such problems are being encountered at Toowoomba and Townsville where carcasses are branded after drying. For this reason, promotion of the system has been kept low key although acceptance by the trade to date has been good despite the problems.

Since identification and enhancement of beef quality seem to be the responsibility of the new Queensland Meat Industry Organization and Marketing Authority an approach was made for assistance in negotiations with management in overcoming these branding problems.

During the year, staff made arrangements for officers of C.S.I.R.O. Meat Research Laboratory to study cold shortening in several abattoirs. In all instances, cold shortening was demonstrated in beef. In some of the abattoirs, design of an electrical stimulation system for the works was discussed. It is hoped that there will soon be a works routinely using on line electrical stimulation in Queensland, a first in Australia.

During the year, a Branch officer in collaboration with K.R. Darling Downs Pty. Ltd., Brisbane produced a series of slides and a taped commentary on superporker type carcasses. This has been well received at butcher and consumer talks. The series has been shown to other organizations with favourable comment. Requests for copies are anticipated. Branch officers have given talks, slide and film showings on meat to various organizations including each intake of apprentice butchers at the School of Food, Coorparoo.

The use of vacuum packaged cuts of meat continues to grow. There is some concern at lack of trade and consumer education in this process. The need to set a reasonable standard for this product in terms of time of ageing and temperature during this procedure has been considered along with the need for methods of identification. While the parameters for a reasonable standard of ageing are known, no way of satisfactorily identifying such meat is evident to date.

Carcass classification

An officer is on secondment to the Australian Meat and Live-stock Corporation (A.M.L.C.). Three temporary inspectors have been appointed to assist in the trials with the automated system of carcass classification at M.P.A.B., Cannon Hill. They jointly man the system with Commonwealth inspectors. These trials are under the control of the A.M.L.C.

Continued difficulties have occurred with the system. These include software problems, hardware unreliability, malfunction of the automatic scales and ticket printer and managerial problems. There have also been serious problems associated with reliability of the C.S.I.R.O. fat probe and reliability and accuracy of the Danish probe.

As a result of this, Slaughtering and Meat Inspection Branch was asked to test the manual system proposed 2 years ago. Objectives were to determine its feasibility under meatworks conditions and accuracy of the hot fat cut, and to assess the technique and the costs involved. Funds were provided through the A.M.L.C. With the co-operation of management, trials were conducted at M.P.A.B., Kilcoy Pastoral Company and Murgon Co-operative Meatworks. Great credit is due to the staff for the effort they made in successfully and rapidly completing these trials under difficult conditions.

The trials showed that the manual system is practical, accurate, objective and reasonable in cost compared with projected costs of the automated system. An interim report giving details was prepared and circulated to key personnel in all States.

As a result of this, the Australian Agricultural Council accepted that manual classification is an acceptable alternative to the semi-automated system of A.M.L.C. and could be adopted on a voluntary basis. Other States are using the system with favourable results.

Feedback of pig carcass data to producers at M.P.A.B. reported last year had to be abandoned because operators who owned the carcasses refused to co-operate further. The reason for this was that buyers of pig carcasses were taking the classification into account. This clearly indicates that pig carcass classification has immediate commercial meaning and impact.

The manual trials referred to earlier also indicated a significant degree of damage to fat in the area where fat is proposed to be measured. This is most severe with, but not confined to, downward pulling hide pullers. The significance of this damage is quite great in relation to classification, and the only acceptable solution is to measure fat at an alternative site.

Since no information was available on the relationships between measurements at various sites, a significant amount of data was collected from eight sites considered most practical. This data has been analysed and the results clearly indicate highly significant differences between sites. This means alternative sites cannot be used directly in classification, and care must be taken in routine classification to measure at the correct site.

An officer demonstrated the hot fat 'cut and measure' technique to New South Wales Department of Agriculture, and A.M.L.C. staff in Sydney. Officers have addressed field days and seminars on classification on several occasions.

Grading

The modified blue ribbon grading scheme continues to meet most of the trade requirements in the Brisbane area. An average of 87% of carcasses was offered for grading, a slight increase over last year. The modified scheme has only recently been introduced in the Ipswich and Toowoomba areas. No difficulty is envisaged in adopting the blue ribbon grading scheme to classification when adopted.

Poisonings and mycotoxicoses

Poisonous plants

LOSSES IN STOCK. Prussic acid (HCN) poisoning occurred at Wilksdale when cattle were accidentally shut in a paddock of sorghum stubble with regrowth and no access to water. When this was discovered five were already dead and the survivors were given water. Subsequently 30 more adults died of HCN poisoning and several cows aborted. Losses would have been even higher if affected animals had not been given sodium hyposulphite.

Dwarf Darling pea (*Swainsona luteola*) poisoning occurred in a mob of 250 breeding cattle between Roma and Taroom. The owner was absent for 2 weeks and when he returned he found 7 to 10 head dead. Severe nervous signs were evident; some of the worst affected were dragging their hindquarters. The survivors were moved from the paddock

but 3 weeks later 13 had died and 15 were missing. The owner reported a high abortion rate and expects a lower calving percentage. Almost all animals were affected to some extent.

As with most plant intoxications, ecological considerations were of prime importance. The paddock was stick raked and burnt last summer. Late rains came in May (20 cm), followed by a dry period. Enormous quantities of dwarf pea germinated and grew to 1 to 2 metres. The paddock grass was dry while the pea was lush and its semi-prostrate climbing nature made it very attractive for grazing. Once stock started eating it, they actively sought it out.

Pea poisoning also occurred on properties adjacent to the one on which the above incident occurred and in both cattle and sheep south of Mitchell.

Zamia poisoning was diagnosed as the cause of posterior inco-ordination in cattle that had been observed eating zamia palms in the Ingham area. On another property in the same area cattle were affected with both zamia staggers and botulism. Seven deaths occurred.

Nicotiana megalosiphon was suspected on field evidence of causing 33 mortalities in cattle at Wallumbilla and 32 at Surat. The plant was abundant in drought affected paddocks.

A severe mortality due to ingestion of bracken fern occurred on a farm at Malanda in the latter half of 1977. Some 40 heifers died during the outbreak.

MINERAL POISONINGS. Arsenic poisoning caused the death of cattle on properties at Moogerah, Malanda and Kerry. The sources in two cases were an old rubbish dump and a dip. In the other case, cattle were weaned into yards adjoining a dip that contained arsenic 20 years ago. Lead poisoning was responsible for death of cattle on six properties. Car batteries were the source of lead in the two cases where it was possible to ascertain the source.

MYCOTOXINS. Collaborative work between the Biochemistry and Pathology Branches has shown that a toxin isolated from the fungus *Paecilomyces varioti* is toxic to blowfly larvae. Processing of further fungal material has given a crystalline extract that allowed elucidation of its structure. Measurement of its proton magnetic resonance spectrum and comparison with data obtained on known fungal metabolites has established its identity as viriditoxin, a known mycotoxin.

Efforts to assist the marketing of crops using skills in mycotoxin analyses developed by the Biochemistry Branch for animal industries have involved the assay for aflatoxin of 112 samples of peanuts, 40 of corn, 12 of macadamia nuts, three of navy beans and two of mung beans.

Environmental studies

Chemical residues in animal products

With financial assistance from the Australian Meat Research Committee, a program has been established to monitor slaughter cattle for residues of DDT, DDD, BHC, HCB, dieldrin, bromophos ethyl, chlorpyrifos and ethion, representing the more persistent chemicals to which animals might be accidentally or intentionally exposed.

The program began in March 1978 with an expected volume of 8 000 samples per annum. Difficulties in obtaining samples due to industrial sanctions on Commonwealth collaboration has kept the program at about half anticipated capacity. Some technical difficulties have occurred in the use of automated analytical procedures, chosen to restrict manpower requirements of the program.

Significant residues from dipping are more frequent than was anticipated from other data and 'follow up' visits to determine the sources of the residues and to advise on management practices to minimize residues are proceeding.

A separate trial in collaboration with Shell (Australia) to evaluate the residue status of the synthetic pyrethroid 'Fenvalerate' as a treatment for buffalo fly was completed. This has promoted the acceptance of this chemical for registration. The need for such an insecticide was pressing due to the non-effect on buffalo fly of several acaricides used to control multi-resistant ticks and also the urgent need to replace conventional dipping for movement to sale of cattle from the Gulf and Peninsula.

A survey of cannery waste, pineapple, beet and carrot waste has indicated that such products currently offer no organochloride residue hazard to livestock industries.

Manure disposal

The project to determine the beneficial and pollutant effect of the disposal of beef cattle manure on pasture continued with financial support from the Environmental Control Council. There has been no significant difference in pasture yield or pasture species between treated with manure and control paddocks. Bacterial pollution of ground and run-off waters with coliforms and *Salmonella* spp. is usually at a significant level. Pollution of the run-off and ground water with organic and inorganic elements remained low but with a gradual increase.

Because the manure deposited has often been fresher than that usually used from a beef feedlot and a high percentage of samples contained *Salmonella* spp., feedlot manure was composted and its bacterial count monitored. Within 24 hours of composting, the temperature of the manure at 30, 60 and 90 cm depth was 53.3, 57 and 53.3°C. The air temperature was 26.6°C. The maximum temperature recorded was 65.5°C at 60 cm on the fourth day. Temperatures above 50°C were maintained for 67 days. Before the manure was heaped it contained 91 *Salmonella* spp. per 100 g. No salmonella organisms were recovered from 1 kg samples of manure 56 days after piling. By 98 days, total bacteria and coliform counts had decreased but were still high. *Escherichia coli* type 1 had decreased considerably. This work demonstrates the sterilizing effect of manure composting and the decrease in pollutant potential of this type of manure.

Laboratory services

Specimens examined

A major part of the Division's resources is devoted to the examination of specimens by the laboratories to support the extension and research officers servicing the livestock industries.

The total batches of specimens examined by the Pathology Branch, excluding those received in connection with the Brucellosis and Tuberculosis Campaign, were 7 173 at the Yeerongpilly Laboratory and 1 877 at the Animal Health Station, Oonoonba. While the amount of material from cattle received for examination remains high, less than 30% of those specimens are from abnormal, diseased or dead animals. The decline in this type of material is believed to be associated with the depressed state of the industry rather than a reduction in disease problems.

In addition to the serological tests for bluetongue and brucellosis outlined elsewhere in the report, 107 416 serological tests were undertaken against a number of organisms at the two laboratories for the 12 months ending 31 March 1978.

Most of these tests were on cattle sera and 33 590 of the total were tests to meet export requirements for the expanding live animal export trade to overseas countries. When the bluetongue tests undertaken to meet the requirements of importing countries are added, the high level of resource needed to meet these requirements is apparent. In addition to the volume of testing required, the need to adhere to strict deadlines when considered in relation to the vagaries of some biological tests places considerable strain on laboratory resources.

Demands on the dip analytical service of the Biochemistry Branch have again declined slightly from 2 722 samples in 1976-77 to 2 621 samples in 1977-78. Analyses of a range of 11 separate acaricides were undertaken at the laboratory.

In addition to the economic animal species, which form the major component of the laboratory services, animals from zoos and some wildlife species are examined partly to monitor conditions present in these specimens in order to ensure that they do not constitute a risk to domestic animals. During the year, specimens were examined from kangaroos, wallabies, koalas, a wallaroo, a potaroo, harbour seal, southern elephant seal, dolphin, sea lion, two crocodiles and numerous snakes in addition to a number of species of free living and captive birds.

Method development

BLUETONGUE TESTING PROCEDURES. The isolation by C.S.I.R.O. of a virus from midges that was subsequently identified as belonging to the bluetongue group produced a major need to quickly organize testing to detect animals that may have been exposed to the virus. Serologists at the laboratory played a major part in developing the complement fixation test and more than 10 000 sera were tested. Subsequently the serum neutralization test was used to test sera from cattle to determine the spread of the CSIRO 19 virus and to test for export purposes.

Both of these tests produced a major strain on laboratory facilities and staff. These tests require a very high and continuous standard of performance and the transition from a small number of experimental tests to large scale testing creates

enormous difficulties given the staffing and old buildings presently in use at Yeerongpilly. Officers were sent to the Veterinary Research Station, Glenfield, N.S.W., to obtain details of the gel diffusion test, and considerable assistance was given by C.S.I.R.O. in setting up the serum neutralization (SN) tests at the Yeerongpilly and Oonoonba laboratories.

While the situation is not yet clear, it seems likely that the discovery of these viruses will continue to increase the routine burden of the virology and serology sections of the Department's veterinary laboratories.

The S.N. test is a type specific test used to detect antibodies to one of the 20 types of bluetongue virus whereas the complement fixation and gel diffusion tests will detect antibodies to any of the bluetongue group of viruses. The extent to which reactions will occur with the latter two tests in the presence of antibodies to any other insect-borne virus is not known, so it was decided to change to the more specific S.N. test. During the year, 15 400 serum samples were tested by the S.N. test and except for a small number of low level reactions detected in central and southern Queensland all positive herds have been confined to northern areas.

The use of the S.N. test to examine sera from cattle for export has not been without difficulties. The test takes about six days to complete after receipt of sera and any positive or doubtful reactions in the screening test have to be validated by a more extensive titration test. Under these circumstances, meeting exporters' requirements is extremely difficult.

DIAGNOSTIC PROCEDURES. Microbiology, like all fields of science, is being engulfed in a wave of new technology and sophistication. The Animal Research Institute, Yeerongpilly, has adopted some of these new techniques and methods to improve the diagnostic service.

A major field of development has been in the rapid identification of bacteria. The Institute is now using routinely a commercially available, semi-micro system that enables identification of a wide range of bacteria in 18 hours. This contrasts with the traditional methods which require a minimum of two days.

Further new technology has been adopted in the identification of *Streptococcus equi*, the cause of strangles in horses. A test kit is now in use that enables both rapid and reliable serological grouping of streptococci, an important step in the identification of these organisms.

The test kit replaces the traditional Lancefield precipitin test which is both laborious and time consuming.

ELECTRON MICROSCOPY. The Siemens Elmiskop 102 electron microscope which was installed in May 1977 has performed well during the year with only minor malfunctions. The control room has been air-conditioned thus overcoming problems of overheating resulting in shut down of the microscope. A Dynovar vacuum coating unit has been installed and is operating satisfactorily.

Staff have acquired skills in the preparation and processing of specimens for examination. The microscope has proved of great value to both virologists and pathologists. The rapid visualization of viruses possible with the electron microscope has been particularly useful and a good example is the identification of Newcastle disease virus in illegally imported parrots. Another example of its usefulness during the year was that study of the ultrastructure of organisms previously thought to be *Protothera* spp. revealed that they are, in fact, green algae.

An atlas of the ultrastructure of normal animal tissues is being prepared.

Miscellaneous

SEROTYPING OF BACTERIA. A better understanding of the spread of disease is possible if a particular strain of micro-organism can be traced with a high degree of accuracy. For many bacteria, the antigenic structures that produce antibodies may be suitable markers. However, for many groups of bacteria this characteristic has not been studied and it is necessary to develop the system by research. In contrast, a genus such as *Salmonella* has been described in detail and a typing centre specializing in the group is available to examine isolates.

During the year, information was obtained on the antigenic structures of five groups of bacteria.

MICRO-ORGANISMS FOR VACCINES. Newly discovered diseases as well as those that have been around for some time are often controlled by vaccines. The strain of bacterium or virus used must be the best available to produce immunity in the animal vaccinated. Quite often, the source of these valuable strains is routine examination of specimens sent to the laboratories for diagnostic purposes, as the following examples show.

In 1976-77, blackleg caused by the bacterium *Clostridium chauvoei* occurred in circumstances that led to suspicions that the existing vaccines may not adequately protect against this disease of cattle. From one of the specimens examined, bacteriologists at the Animal Research Institute isolated a strain of the organism that was subsequently chosen for incorporation into one of the vaccines.

In the viral field, a strain of Newcastle disease virus isolated at Yeerongpilly in 1966 has been developed by a vaccine manufacturer and the vaccine prepared from this strain has been used in Asian countries.

It is interesting to note also that another avian virus isolated by the virology section at Yeerongpilly has been shown by workers at the National Biological Standards Laboratory to be a new subtype of infectious bronchitis virus. The discovery of this strain while investigating breakdowns in vaccination leads to a better understanding of immunity in infectious bronchitis of chickens.



An extension program has been directed at making cattlemen aware of the value of tick resistant cattle. In the 4 years from 1973 to 1977, the percentage of tropical breeds and their crosses in the Queensland beef herd increased from 43 to 54%.

Division of Plant Industry

THE objectives of the Division of Plant Industry are to improve and stabilize the productivity of the agricultural pastoral and horticultural industries of Queensland and to conserve its soil and plant resources for the benefit of the entire community.

This requires broad ranging programs of research and extension or advisory services which extend from improving the native pastures of our arid regions to ensuring superior quality of wholesome fruit and vegetables on the consumer's table.

The Division's functions are developed by two major production branches: Agriculture Branch, which is responsible for native and sown pastures, field crops and heavy vegetables; and Horticulture Branch, which undertakes research and extension in the fruit, vegetable and ornamental plants industries. The work of these Branches is co-ordinated with the specialist research Branches of Entomology, Plant Pathology, Agricultural Chemistry and Botany.

The Director of Horticulture administers Plant Quarantine in this State as agent for the Commonwealth Department of Health and the Division is also involved in the administration of regulations concerned with plant and crop protection.

Officers of the Division provide a service to other State Departments, to graziers, farmers, orchardists and home gardeners, to the private sector servicing agriculture, and to users and marketing authorities of agricultural products.

Three research units supported by industry or joint Commonwealth-industry funds are administered by the Division.

'BRIAN PASTURES' PASTURE RESEARCH STATION, near Gayndah, is an Australian Meat and Live-stock Corporation research centre. Its objective is improved beef production through the development of improved nutrition and husbandry practices.

The Australian Meat and Live-stock Corporation contributes an agreed sum each year, and staff salaries and running costs are met by the State Government.

QUEENSLAND WHEAT RESEARCH INSTITUTE. This is the centre for the State's wheat breeding program, and undertakes important research into plant protection, soil fertility and fertilizer use, wheat quality, winter weed control, pasture relations and surface management of arable soils.

The Institute is financed by the Australian Wheat Research Council and the Queensland Wheat Industry Research Committee. The State Government pays the majority of staff salaries.

SOUTHEDGE TOBACCO RESEARCH STATION, Mareeba, and the small BEERWAH FIELD STATION provide facilities for development of disease-resistant tobacco varieties, and for plant protection and crop management research. These facilities and associated research and extension programs are financed largely by the Tobacco Industry Trust Account with some salaries being met by the State Government.

1977-78 has been a year of real achievement. Commercial releases of improved crop varieties have continued in many industries, and evaluation of new pasture legumes in the dry tropics reveals real prospects for substantial productivity gains in these extensive cattle producing regions of the north. Prospects for further releases are good, particularly for barley where substantial yield gains in malting varieties are in view.

Control of *Heliothis* in grain sorghum with a nuclear polyhedrosis virus, of pink wax scale by an introduced parasite *Anicetus*, and the evidence of effective genetic resistance to sorghum midge are exciting advances in the fight against insect pests through biological pathways.

Research with new tropical fruit crops is opening up possibilities for valuable industries, and redesign of fruit packaging and pelletizing systems has achieved significant economics in the producer to consumer chain.

Agriculture Branch

IN broad terms, Agriculture Branch seeks to improve the productivity and stability of field crop, forage crop and pasture production in the State through a combined research and extension program.

The extraordinary diversity of Queensland's agricultural environment necessitates major plant breeding efforts in wheat, barley, sorghum, maize, sunflower, soybeans, tobacco, peanuts and cotton to seek superior local adaptation and disease resistance.

Significant selection programs are also applied to varietal improvement in forage oats, linseed, safflower, rice, navy and mung beans, potatoes, sweet potatoes and onions. Exploratory work is assessing the potential for such new crops as chick pea, sesame, lupins and cassava.

Soil fertility and weed problems are also diverse and irrigation developments require specialized technical servicing.

The pasture research program seeks principles to guide balanced use of our natural grazing lands with emphasis on the mulga, Mitchell grass, blue grass and bunch spear grass communities. Forage crops and sown pastures are researched for intensively developed areas.

Branch research relies heavily on support and collaboration from other branches of the Department, and particular effort is directed at linking the Branch's practically-oriented research with the important but more basic studies undertaken by C.S.I.R.O. and Universities.

To provide a continuum in the service to industries, communities and farmers, the Branch maintains a widely deployed extension staff skilled in promoting the application of crop and pasture technology to commercial enterprises. This is a particularly demanding activity which has to blend profit motives with a conservative treatment of natural resources.

Pasture research

Seed production studies

Seed production studies have continued at Walkamin and Gympie. At Walkamin, it has been shown that 25% of available useful seed of Gatton panic was not even collected by the header and a further 25% of that collected was lost undetached from the heads. In Gatton panic, the header is unselective in the seed it collects but, for the larger seeded *Brachiaria decumbens*, it is highly selective of mature seed. This knowledge is being used to improve harvesting efficiency.

Dry tropics pastures

Among the legumes showing promise is *Clitoria ternatea* on heavy clay soils in the Collinsville district and on the Balbarini Land System in the Gulf Country. It has persisted and spread over a number of years on the Balbarini and is readily eaten by stock in the dry season.

At Collinsville, *Vigna putigera*, *Canavalia* sp. and *Phaseolus trilobus* also showed promise, as did *Stylosanthes scabra*, the latter having performed well throughout the Ayr hinterland. New lines of *S. scabra* including CPI 55868 and 55818 have also performed well at Southedge in the lower Peninsula region.

Of the grasses *Andropogon gayanus*, *Bothriochloa insculpta* cv Hatch, *Brachiaria decumbens* cv Basilisk, *B. dictyoneura*, Q 16707 and *Hyparrhenia rufa* continue to show promise at Southedge, Kalinga and Merluna, so that there are possibilities of selecting grasses that will combine with the promising legumes for the dry tropics.

Sulphur deficiency has been confirmed as a major nutrient limitation to animal production from sown pastures on the red basaltic soils at Meadowbank. Residual effects of sulphur fertilizer applications have been variable.

On the red earths of Cape York Peninsula, phosphorus is the major limiting nutrient and, although strong responses to fertilizer are obtained, it has been possible to establish a range of *Stylosanthes* without P applications at many sites. This characteristic renders these legumes most practicable for low cost pasture improvement on extensive cattle enterprises. The implications to animal production of low P contents in this high protein forage are to be determined.

Pasture studies in central Queensland

The evaluation of *Stylosanthes* species has also continued in central Queensland, with *S. scabra* CPI 40205 continuing to show considerable promise there. It is earlier flowering than Seca (the only cultivar released at this time) and is agronomically a preferable plant which is not affected by Anthracnose in this environment. *S. guianensis* CPI 40255, an early flowering free seeding form, is also performing well in the region.

S. viscosa and *S. fruticosa* have been generally unaffected by fertilizer application and *S. viscosa* lines are performing well and showing considerable frost tolerance. Anthracnose has severely affected *S. fruticosa*.

On the wet solodic soils of the Mackay coastal area, the legumes *Aeschynomene*, *Centrosema*, *Teramnus* and *Vigna* continue to show some promise but few exceed Dalrymple verna which is proving most useful in these situations. On degenerated Siratro pastures on these soils, ripping has given substantial increases in seedling numbers and, provided soil seed stocks are adequate, resowing extra seed is unnecessary.

A study of *Parthenium* weed has indicated that it is most likely to invade sites on developed scrubs where perennial grasses have not established or have been lost by overgrazing or drought. It is evident that, with pasture spelling, the perennial grasses can rehabilitate infested areas.

Lucerne studies

The clarification of factors affecting lucerne persistence has continued with both disease and hot wet soils being associated with plant mortalities. *Colletotrichum* crown rot becomes particularly serious as lucerne stands age. *Phytophthora* is mainly a problem in irrigated situations and mainly at lower temperatures when soil is saturated. *Rhizoctonia solani* has also been shown to be a problem at Brigalow Research Station following heavy summer rains. This knowledge evidences the importance of joint C.S.I.R.O.-D.P.I. efforts to breed lucerne varieties resistant to these diseases as well as resistant to the lucerne aphids.

Aphid damage, while serious, has been reduced by dry weather and ladybird predators in grazing stands. Hay production has been maintained by insecticide treatment. Evaluation of introduced lines with resistance to spotted and blue green aphids has found useful substitutes for Hunter River. These lines may not, however, give long-lived stands under subtropical conditions and the long term solution is believed to be in breeding resistant lines from a Hunter River base.

Pasture studies in the wet tropics

At Ingham and Kennedy on the drier end of the wet belt, common centro and puero remained the most productive legumes, while a search for better seeding, stoloniferous *Desmodiums* to replace Johnstone hetero also failed to reveal any within a range of *D. adscendens* lines.

At King Ranch, a stocking rate of 2.5 to 3.7 beast/ha is being consistently achieved on the trial area. This is more than double the accepted productivity.

In a semi commercial demonstration at Utchee Creek, degraded pasture is being rehabilitated under the progressive scrutiny of local graziers. Marked increases in productivity have already been achieved with significant gains in cash flow.

Management studies on semi-arid pastures

The run of wetter years has caused an improvement of the condition of Mitchell grass pastures in the Blackall district.

At 'Burenda', Augathella, there is a detectable trend on Mitchell grass towards lower carrying capacities after 3 years at high levels of utilization. There is still, however, little difference in wool cut and body-weight of the sheep between treatments but basal area and composition of all pastures are changing.

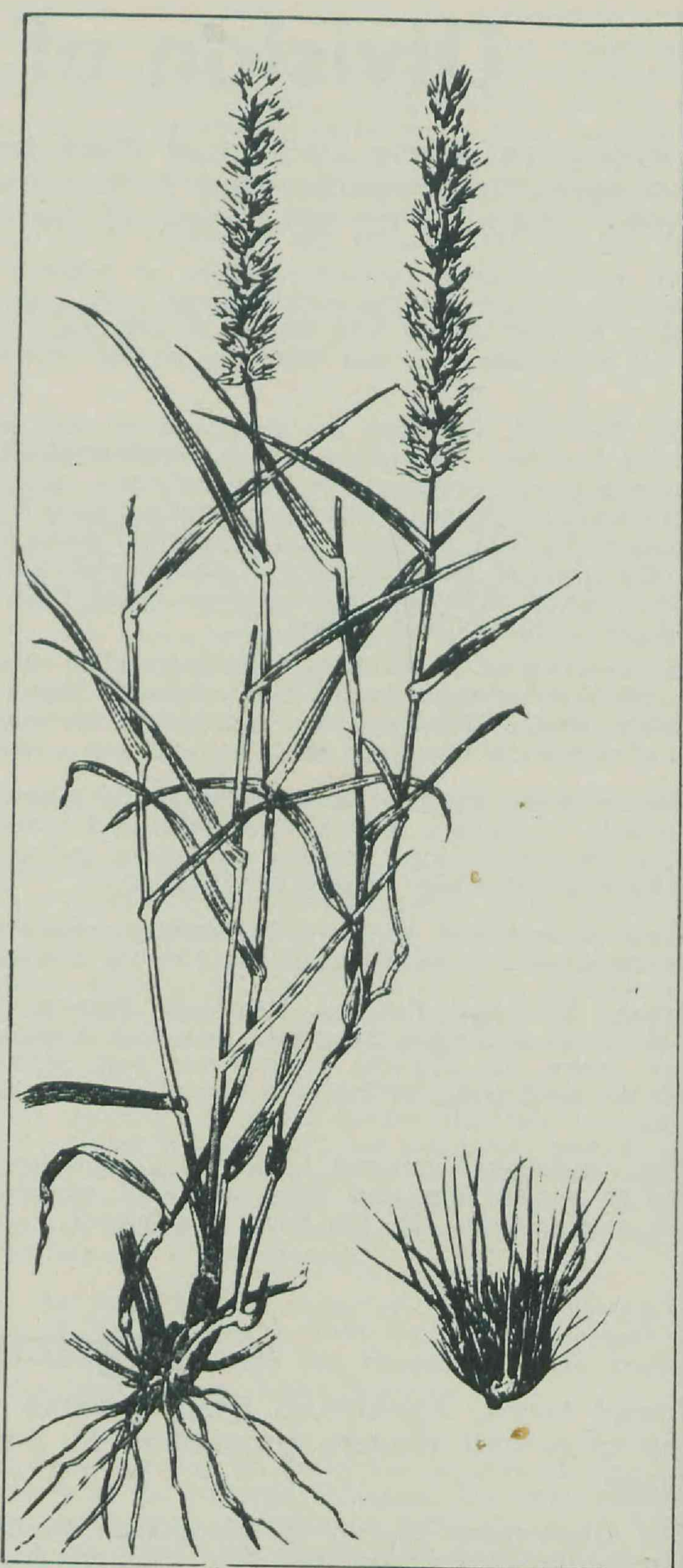
In one year at Toorak, short-term intensive stocking did not affect Mitchell grass seedling numbers. Basal area of Mitchell grass actually increased on the intensive area whereas it decreased during the same period on the area from which sheep were excluded.

Studies of Mitchell grass communities in the north-west following wild fires suggest that an increased number of smaller tillers is produced by Mitchell grass after a fire. Flinders grass had more plants but fewer tillers per plant in the burnt areas. Dry matter yield was not affected but both *Astrebla lappacea* and *A. pectinata* seeded more heavily on the burnt areas.

Studies on annual medics

The wide ranging study of annual medics based on Warwick has also covered sites at Biloela, Gayndah and Roma. The project seeks to predict growth, flowering and seed production behaviour. At Warwick in 1977, snail medic planted in late March flowered in 47 days while *M. rugosa* took 158 days. From a May planting, the difference in span of flowering was half that of the March planting.

At Toowoomba, woolly burr medic on a site with a history of differential sulphur fertilization required S fertilizer to increase yield, but grass and other species required both S and N with a strong positive interaction to treatment with both nutrients.



Illustrations and descriptions of important crop and pasture species are regularly included in the Queensland Agricultural Journal. This illustration appeared in a recent article on buffel grass in Queensland.

On the traprock areas, surface sown Jemalong barrel medic responded to S alone and not to P alone but gave the greatest yield with combined treatment with P and S.

At Biloela and Brigalow Research Stations, there are medic trials which were sown in 1973. Some lines have been grown successfully each winter since without further seeding. At Biloela *M. minima*, *M. rugosa*, *M. polymorpha* and *M. scutellata* were relatively resistant to blue green aphids but other species were susceptible. Similar results are being obtained at Brigalow Research Station.

Temperate species

Temperate species make up a substantial area of total pasturage especially in southern areas because of their ability to take advantage of winter rainfalls.

On the eastern Darling Downs, Demeter fescue has been the outstanding grass at a range of sites. Annual medics have made little contribution to soil or forage nitrogen whereas white clover and lucerne have made significant contributions.

Before the advent of the blue green aphid, *Astragalus hamosus* cv. Iomin was showing considerable promise. Unfortunately, it has proved to be completely aphid susceptible.

At Coolum Research Station, white clover and ryegrasses are proving the best winter species under rain-grown conditions. Under irrigation at Gatton, Sirocco phalaris was the highest yielder over 40 months but Narok setaria has also performed well. Haifa was the best white clover over the same period.

In another study of phalaris lines, Siro 1146 and PX 19 significantly outyielded others including Sirocco. Siro 1146 also maintained its yield best over the 3-year period of evaluation.

Plant nutrition

At Gympie, potassium levels in soil samples are showing little increase with potassium fertilization. On forest soils of the West Moreton area, responses to phosphorus by Siratro-based pastures can be obtained only when the soil phosphate level is below 10 p.p.m. Where P levels approximate 20 p.p.m. maintenance phosphorus fertilization may not be required for as long as 5 years.

Grass establishment on black soils

Setaria porphyrantha continues to show considerable promise both for establishment and subsequent production on the self mulching black soils of the Darling Downs. *Bothriochloa insculpta* also continues to perform well. The native *Dichanthium sericeum* is also highly productive.

The livestock performance on *B. insculpta* with a major *Dichanthium aristatum* contaminant was substantially less than *Panicum coloratum* in the first year of grazing at Gowrie Junction.

Irrigated pastures—Burdekin

No perennial grass species has been found to outyield pangola grass at Millaroo despite attacks on pangola from rust, lema beetles and aphids, although *Setaria splendida* and *Digitaria* spp. Q 10249 and Q 10250 and Callide Rhodes grass have produced well.

While pangola grass responds markedly to nitrogen on the heavy solodic soil at Millaroo, dry matter responses to phosphorus and potassium fertilization are erratic, although concentration of these elements in the forage increases with their application. Harrowing of plots following fertilizer application has given consistent, small increases in dry matter yield. Routine discing has reduced yields.

Agronomy research

Wheat

The mid season variety Oxley has increased in popularity among growers. For the 1976-77 season, State Wheat Board statistics estimated the State wide yield for Oxley at 1.81 t/ha grown on 25.4% of the total area. This may be compared with the average yield for all varieties including Oxley of 1.55 t/ha.

There is, however, a threat that existing field races of rust virulent on Oxley could multiply, and work is therefore progressing on a replacement variety. The crossbred QT 4144 was tested in the regional mid season trials for the first time in 1977 and has good resistance to stem and leaf rusts.

The quick maturing variety Cook, which was released last year, was grown by some 50 farmers in 1977. Favourable reports were received, with special comment on its

good yield and rooting ability under drought stress, its outstanding test weight and good grain appearance, together with some resistance to weathering.

In the regional quick maturing varietal testing program, trials were grown at 10 sites in southern Queensland and six sites in central Queensland. Two quick maturing crossbreds, QT4081 and QT4083, were included in the program for the first time. They were developed primarily for improved rust resistance but one of the most exciting results in 1977 was their high grain yields.

They were of similar maturity to Cook but consistently yielded more grain at 16 sites. QT 4081 and QT 4083 produced the highest mean yields in both the southern and central Queensland sections of the program. Their mean yields were QT 4081—1.649 t/ha (southern) and 1.816 t/ha (central); QT 4083—1.623 t/ha (southern) and 1.886 t/ha (central). The highest yielding commercial variety in both regions was Gatcher with 1.485 t/ha (southern) and 1.581 t/ha (central).

The effects of seeding rate and variety on the response of wheat to phosphate fertilizer in the dry western region have been studied. The yield response of Oxley to phosphate was reduced as the seeding rate was increased from 15 kg/ha to 45 kg/ha. Seeding rate had no effect on the yield response of Spica to phosphate fertilizer.

In a study of the influence of nodal root production on wheat yields under conditions of limited soil water and phosphorus supply, it was found that varieties of high tillering capacity had greater instability in fertile tiller number under conditions which gave low nodal root production. This tillering instability should discourage the use of such varieties (for example, Timgalen) in regions where there are few and variable periods of significant rainfall, especially when the soil P status is marginal.

Late applications of nitrogen, as foliar sprays or as side-dressings to irrigated wheat, substantially increased the protein content of the grain. Side-dressings gave the greater increases at the boot stage; spray applications were better at the post flowering stage while either method produced similar increases at flowering. Applications made after the boot stage contributed little towards yield of grain.

Barley

The barley breeding program has as its primary objective the development of locally adapted high yielding varieties with similar malting quality characteristics to the current commercial variety, Clipper.

In the last 2 years, 20 crosses have been evaluated. The potential for yield improvement in Queensland is evidenced because almost all the lines tested gave higher yields than Clipper although random selections from these crosses were used.

Seven crosses have been selected for high yield and large genetic variance. Approximately 100 selections from each of these crosses will undergo more extensive testing in breeding selection trials. One hundred and fifty of the

An excellent stand of wide-row sorghum in the Miles district.



most advanced selections have been tested in seven breeding selection trials. All these lines gave higher mean yields than Clipper over the seven sites. Some selections from the Bussell x Zephyr cross appear to combine high yield with reasonable malting quality and seed size.

A long term population breeding program has been commenced. Seventeen parents of diverse origins and including most of the desirable traits of barley have been selected as the foundation stock. These have been recombined in a diallel crossing system. Recombination by pairwise crossing will continue for three more generations to develop a base population in which cycles of selection and recombination will be continued.

The regional variety testing program was continued in 1977 with trials at five sites in southern Queensland and five sites in central Queensland. Three advanced selections from the breeding program were included. The mean yields of two selections HB 1 and HB 3 exceeded the mean yield of Clipper by 27 per cent in southern Queensland and by 22 per cent in central Queensland.

Sorghum

The sugarcane mosaic virus resistance breeding program is now nearing completion. It has been most successful and during the year 11 male parent lines were released to the seed industry.

The released lines all have resistance to sugarcane mosaic virus and, in addition, some have resistance to other diseases such as rust, leaf blight, grey leaf spot and sorghum downy mildew. A limited amount of testing indicates that these lines produce hybrids with higher grain yields than those of their recurrent parents.

In forage sorghum breeding, a late Greenleaf Sudan grass variety has been selected for possible release. The proportion of leaf/stem dry matter is higher than in ordinary Greenleaf. In the same program late, photo-period sensitive A and B Combine Kafir type lines are being produced. A problem in imparting total male sterility in the A lines appears to have been overcome.

In the regional variety testing program, trials were planted at 21 sites in the 1976-77 season but due to very dry conditions only 12 sites could be planted in the 1977-78 season. In the past, few early maturing lines have been able to match the yielding ability of Texas 610SR but some promising lines are now coming forward from a number of seed companies.

In a series of sorghum emergence studies carried out on a black clay soil at Emerald where emergence decreases as the surface soil dries, emergence was improved by increasing the depth of planting and by the use of presswheels. Water injection at the rate of 4 litres per 100 m of row improved emergence by 160% when the soil moisture level in the surface 10 cm was below wilting point.

Wide-row and twin-row cropping in grain sorghum has been investigated in central and southern Queensland for three consecutive seasons. Provided weed control is maintained, there is no evidence of higher yields from wide-row husbandry compared with conventional row cropping; and under high yielding conditions wide-row crops can produce lower yields. In commercial practice, wide-row systems tend to achieve better weed control and this appears to explain their apparent benefits.

Maize

Two new hybrids were released from the breeding program during the year. QK394 was released for use in Papua New Guinea where it outyielded QK217 by nearly 30 per cent in field trials. A smut-resistant hybrid, QK413, was released for use on the Atherton Tableland where in trials it produced 20% more grain than QK487, the standard smut-resistant hybrid.

Two experimental hybrids, employing a white-grained parent derived from tropical germplasm, have produced 40% higher yields than QK217 in trials on the Atherton Tableland over the past three seasons. The experimental hybrids have been re-constituted as QK690 and QK694 and are undergoing seed multiplication.

The regional variety testing program was continued at five sites in the 1976-77 season. In southern Queensland, XL81 produced the best average yield in the early maturing series (5.836 t/ha) but two experimental hybrids, MH698 (2.68 t/ha) and MH699 (2.636 t/ha), produced the highest yields at Kingaroy in the only trial in which they occurred. The mean yield for that trial was 1.595 t/ha. In the mid season and late maturing trial series, GH5004, a new hybrid from the New South Wales Department of Agriculture, performed extremely well providing the highest yields (mean 5.163 t/ha) in three of the four southern trials, the appropriate trial mean being 4.085 t/ha. GH5004 also performed very well (3.552 t/ha) in northern Queensland where only QK413 produced a higher yield (3.755 t/ha).

A heavy crop of Bragg soybeans in the South Burnett.



Soybean

Several lines from the soybean breeding program are showing promise in the strain trials. These high yielding lines derive mainly from the crosses Semstar x Hill and Davis x Bragg. Strain trials are conducted at five sites in southern Queensland, two sites in central Queensland and two sites in northern Queensland.

Lines from the University of Queensland's breeding program are also included in these strain trials. SH1274 from the Semstar x Hill cross and Hutton, a late maturing introduction from the U.S.A., are being advanced to the regional variety testing program.

Regional varietal testing was continued and 17 trials were successfully harvested in 1977.

The varieties P25 and Cannapolis together with UFV-72-1, are eminently suited to central and northern Queensland and could lead to an expansion of the area planted to commercial soybeans in these regions.

Soybean nutrition studies have been continued on soils in the South Burnett. Additional data on phosphorus responses have been collected and these will enable calibration of soil tests with plant responses to P fertilizer. In early work with potassium, consistent yield responses were obtained where soil test values were 40 p.p.m. potassium or less. Current work aims at determining response patterns in soils with soil test values in the range 40 to 95 p.p.m. potassium.

Sunflower

Breeding of rust-resistant, open-pollinated sunflower varieties was continued at Hermitage Research Station. Rust resistance has been effectively back-crossed into the oilseed variety Peredovik. The material produced in this program has been selected for homozygosity of the resistance gene but it needs further evaluation for uniformity of height, flowering and oil content.

The birdseed variety Polestar, which has been grown for many years in Queensland, is very susceptible to rust. During the screening of the world sunflower collection for sources of rust resistance, a line was selected as a possible replacement for Polestar.

This line, Q12356, originated in Canada and produces similar yields to Polestar in the absence of rust, but under conditions of high rust incidence Q12356 outyields Polestar by as much as 190%. The line shows considerable genetic variation. Selection to date has reduced the variability in flowering but further selection for reduced plant height is required.

There is a need to develop germplasm adapted to local conditions to allow expression of optimum yield potential. Population breeding can increase the frequency of desirable genes with the likelihood of improved inbreds being derived from such selected populations. One disadvantage of this breeding technique is its long term nature. Considerable advantage, however, has derived from using this technique in other crops particularly maize, and two projects are now in progress with sunflower.

New hybrids from seed companies continue to show promise in regional varietal tests. In trials in central Queensland, these new hybrids have outyielded the standard, open-pollinated variety Sunfola 68-2 by 20 to 64%.

Processing of data from the sunflower time of planting studies was continued and a model has been constructed. This model, when applied to climatic data, suggests that autumn plantings may be suitable for sunflowers in central Queensland and this area of research is now being pursued.

The winter planting trial was repeated on the Darling Downs in 1977 with sowings in July and August. Despite drought conditions, yields of up to 1.4 t/ha were harvested due to high water use efficiency and high frost tolerance.

Peanuts

The recent appointment of a plant breeder has enabled the commencement of a peanut breeding program. In addition to the large number of lines already available in Queensland, germplasm has been obtained from C.S.I.R.O. and the Departments of Agriculture in Western Australia and the Northern Territory. Introductions have also been obtained from India and U.S.A.

All available lines are being screened for selection as parents to be used in a crossing program. As this is a long-term project an attempt is being made to obtain a short-term yield advance by reselection within existing commercial varieties.

Fertilizer trials in the South Burnett have established that an adequate soil phosphorus level for peanuts (10 to 15 p.p.m. BSES method) is much lower than that required for other crops (for example 30 to 40 p.p.m. P for navy beans).

Seeding rate trials in north Queensland have shown a significant linear relationship between plant population and yield at two sites at Walkamin Research Station and Lakeland

Downs. At a third site in the Endeavour River Valley, no yield responses to varying plant populations occurred. In the Lakeland Downs/Endeavour River area, no yield responses were obtained to phosphorous applications on krasnozem soils but there was a response to phosphorus and to calcium on a sandy loam soil.

Tobacco

Research on tobacco is based primarily in the Mareeba-Dimbulah area and is centred on Southedge Tobacco Research Station. It involves plant breeding and agronomic studies into plant nutrition, crop development and crop management.

Concurrent studies conducted at the field station near Beerwah form an integral part of the tobacco plant breeding project in which emphasis is given to breeding for resistance to blue mould and black shank, with some selection for tolerance to bacterial wilt and nematodes.

A potential line ZZ 100 derived from a cross between C.S.I.R.O. 40T and Speight G 28 incorporates tolerance to bacterial wilt and resistance to blue mould APT I. This line is to be extensively evaluated in north Queensland in bulk farm tests during the 1978-79 season.

In tobacco agronomy, studies are in progress to evaluate the potential of cultivars for early season plantings. Climatic conditions in north Queensland enable an extended growing season but early-planted crops (May) yield a third less than mid season (August) or late season (October) plantings. Leaf type and quality also are adversely affected with early plantings. If these disadvantages can be overcome, then split plantings would allow greater utilization of farm resources.

A study began in 1972 to reassess the Departmental recommendation for land usage associated with tobacco production. This involves a comparison between continuous tobacco cropping and the incorporation of a grass ley and leguminous crops into the system. Results to date have shown that erosion problems were accentuated where row crops of peanuts and soybeans were used. This had necessitated a change from row cropping to complete ground cover using leguminous crops.

It has also been shown that incidence of the soil-borne disease black shank was greater following the legume cover crop. The grass used in these studies, green panic, is recommended for non-tobacco periods but has continued to be difficult to establish and maintain without fertilization. Alternative grasses are being evaluated for ease of establishment and for providing better coverage particularly during the first year after sowing.

Cotton

Insect control represents a major cost of production in cotton and the development of cultivars resistant to insects, particularly *Heliothis* spp., would present an opportunity for growers to reduce this cost. Early indications of a significant detrimental effect of bud gossypol levels in excess of 1.2% on *Heliothis* larval weight were confirmed.

Field tests on the relative yields of high and low gossypol lines under unsprayed conditions showed a consistent advantage for high gossypol lines. No field test of the relative yielding ability of high and low gossypol lines has been successfully completed to date.

Variety trials were conducted at four sites as part of the Australian Cotton Cultivar Trial series and the Deltapine Smoothleaf types again produced the best yields. Deltapine 61, the latest introduction, gave the best mean yield of lint with 1 260 kg/ha.

Rice

In the last 2 years, 85 lines of rice have been imported from U.S.A., Philippines and Colombia. More than half of these have cleared quarantine procedures and are undergoing seed increase. Observations on the growth of the American varieties during seed increase suggest that they will not be suited to conditions in the Queensland rice growing areas. Bonnet 73 yielded well but its growing season is too long.

The variety Bluebonnet 50 is being phased out of commercial production in the Burdekin region and is being replaced by Starbonnet. There is little difference in yield between the two varieties, but Starbonnet is more resistant to lodging, and in lodging situations gives considerably higher yields than Bluebonnet 50 which tends to lodge when high levels of nitrogen fertilizer are applied. Optimum nitrogen fertilizer levels for the Starbonnet variety are being investigated.

Bluebonnet 50 is grown under rain-grown conditions in the Ingham area, and experiments have shown that lodging results when more than 80 kg nitrogen/ha are applied.

Navy bean

Many navy bean lines have been generated in the last few years in crossing programs in the South Burnett and on the Darling Downs. A special project was instituted in 1977 to test these lines and 177 lines, comprising early, mid season, late and large-seeded types received preliminary testing. Some promising, high yielding lines were selected from each type for further evaluation and these selections are now being screened for resistance to peanut mottle virus and bean common mosaic virus.

In regional variety tests the recent releases Actolac and Actosan continued to perform well. One line, Selection 46, bred at Kingaroy, gave the best overall average yield (2 340 kg/ha) and showed good adaptation in the Burnett and Darling Downs regions where trials were carried out.

In zinc nutrition experiments on the Darling Downs, it was shown that the ability of navy beans to extract zinc from the soil varies with the soil type. In a creek alluvial soil at Emu Vale, yield increases were obtained from applied zinc. Zinc sulphate was superior to Nuzinc. In a red-brown clay loam at Nobby, there were no responses to applied zinc though the soil test value for zinc was lower than at the Emu Vale site.

In phosphate fertilizer experiments in the South Burnett, higher yields were obtained by placing the fertilizer at seed level and 4 to 8 cm to the side. Placing fertilizer closer than 4 cm to the seed caused excessive soil disturbance and resulted in reduced plant emergence due to increased soil moisture loss.

A joint project with Agricultural Chemistry Branch was conducted to relate soil phosphorus test levels to recommendations for the use of phosphorus fertilizers on krasnozems in the South Burnett. Good correlations were obtained between the soil phosphorus test and relative yield or best rate of phosphorus fertilizer.

Safflower

The safflower is assuming considerable importance commercially in central Queensland where more than 27 000 ha were sown to the crop in 1977. The comparatively low average yield of 655 kg/ha was due largely to the severe incidence of *Alternaria* blight. The main research effort has been directed towards alleviating the effects of this disease.

A study was conducted to determine the effects of *Alternaria carthami* on yield by comparing yields of diseased and fungicide-treated, disease-free plots. The disease-free plants yielded 56% more grain than diseased plants. It was shown that the manganese in the fungicide increased yield by 15% and that the yield increase from eliminating the disease would, therefore, be about 40%.

Resistant varieties offer the best means of combating this disease. All available lines including those from a breeding program conducted by C.S.I.R.O. at Griffith are being screened for resistance. No line with complete resistance has yet been found, but some are exhibiting considerable tolerance. Lines produced in India from an interspecific cross between *Carthamus oxycantha* and *Carthamus tinctorius* are reputed to have total resistance to the disease. These lines were introduced and testing will commence in the 1978 season.

Potatoes

Over a period of 6 years, 235 varieties of potato from breeding programs in other States have been tested in the main potato growing areas of the West Moreton and Atherton Tableland. None of these varieties has been superior to the standard variety Sebago.

The pilot scheme to produce seed potatoes in Queensland will be completed this year. The scheme is showing that good quality seed can be grown in Queensland and could be available for early winter planting at a time when seed from southern States is in short supply. It would also be possible to ensure that the seed is relatively free from diseases which are important in Queensland but rarely show symptoms in the southern States.

The leaf roll virus and purple top wilt are the most devastating problems facing the potato industry. Experiments indicate that boron has no effect on either disease. Caging of potato plants in jassid-proof cages seems to prevent purple top wilt incidence. A study of the relationship between meteorological data and incidence of purple top wilt over the past 30 years indicated the possibility of low rainfall and higher temperatures being associated with greater incidence of the disease.

Onion

Irrigated trials indicate that, in a crop that is growing well at bulbing, the frequency of irrigation after bulbing can be greatly reduced if the onions are to be harvested at an early stage of maturity. It was also found that, by allowing onions to grow from the 5% tops fallen stage (early harvest)

to complete senescence of foliage, total yield was increased by 135% in a March planting and by 52% in an April planting. It is, therefore, necessary for a grower to obtain improved prices, when harvesting early, to compensate for the loss in yield.

In a seeding rate trial, it was found that, by increasing the seeding rate from 2.25 kg/ha to 4.5 and 6.75 kg/ha, the total yield of onions was increased by 26 and 40% in a March planting and by 13 and 17% in a May planting. The percentage of the desirable No. 1 grade onions was also increased by the increased seeding rates. Plant arrangement had no significant effect on total yield, but closer row spacing did improve bulb shape by reducing intra-row density.

Lupin

Preliminary evaluation of lupins showed the crop could perform well in southern and central Queensland under fairly good moisture conditions. The program was expanded in 1977 and variety trials were grown at 21 sites on the Darling Downs, in the Maranoa, South Burnett, South-east coastal, Callide and Central Highlands areas. Eight of these trials on the Darling Downs failed because of severe moisture stress and frost damage.

Good yields were obtained from the four irrigated trials—two on the Darling Downs and one each at Biloela and Emerald. Varieties Ultra, Hamburg and Kiev, belonging to the *Lupinus albus* species, were the best yielding varieties.

A study on the Darling Downs has shown lupins to have a substantial effect on a following wheat crop. Wheat following lupins yielded 1 686 kg/ha while wheat following wheat yielded only 977 kg/ha.

Chick pea

In a season when rainfall was negligible in all districts, extensive testing of chick peas showed that the crop has reasonable adaptation to both rain-grown and irrigated situations. Most strains appear to be frost tolerant.

Trials were conducted at 23 sites in 1977. The crop performed extremely well under irrigation, with yields up to 5 884 kg/ha at Walkamin and 5 491 kg/ha at Emerald. The best rain-grown yield was 1 420 kg/ha at Hermitage Research Station.

Irrigation

Another season of bulk cropping trials was completed at the Fort Site in the Lower Burdekin area on Koberinga and Dalrymple soil associations. This program continues the assessment of the performance of various crops for any expansion of irrigated agriculture likely to occur should major new water storages be constructed in the Burdekin River Basin.

No solution has yet been found to the crop emergence problems on the Koberinga soil. Rice is the only crop that has proved totally satisfactory, but maize and soybeans would also be suitable provided this emergence problem is overcome.

Maize, soybean, French bean, and navy bean crops have produced satisfactory yields on the Dalrymple soil association, and peanuts, cassava, mung bean and culinary beans also show promise.

Weed control

In north Queensland, weeds in peanuts and soybeans can be successfully controlled with herbicides. Early cultivation in peanuts has been shown to increase the percentage of edible kernel in the yield indicating that cultivation still has a part to play in peanut culture.

For grass control, trifluralin, used pre-plant incorporated, is the most effective chemical in both peanuts and soybeans though improper application in peanuts and the growing of a susceptible soybean variety can cause yield reductions.

Dinoseb in peanuts and bentazone in soybeans are effective post-emergence chemicals for broad-leaved weed control. In soybeans, the use of a close row spacing (60 cm) and a tall variety assists chemical weed control particularly when linuron, a chemical with a limited life in hot weather, is used.

A State-wide survey of off-type sorghums is in hand following the discovery of shattering off-type sorghums last season. The survey aims at assessing the distribution and nature of off-type sorghums in Queensland. It is hoped that the survey will also establish the magnitude of the off-type sorghum problem and identify areas which may no longer be suitable for the production of hybrid sorghum seed. Last season, a survey of some crops grown from seed produced in the Lower Burdekin area detected shattering off-types at levels of 1 plant to 10 to 20 ha in some crops.

The tolerance of four barley cultivars (Clipper, Lara, Corvette and 6671) to four herbicides (barban, difenzoquat, dichlofop and WL43425) was evaluated. Barban did not damage any cultivar at the normal rate, but caused severe damage to all but Corvette at three times the normal rate. Difenzoquat did not cause any injury or yield reduction. Dichlofop caused some injury at the normal rate and severe damage at three times the normal rate. WL43425 caused no damage except when applied at the high rate at the first node stage of growth.

Glyphosate (Roundup*) has been evaluated for eradication of small patches of Johnson grass in cultivation. It was demonstrated that three repeated applications of glyphosate applied to flowering regrowth, at 0.09% a.e. solution, provide rhizome eradication. Single applications failed to provide complete rhizome eradication.

Herbicide tolerance investigations in navy beans have shown that applications of dinoseb at rates between 1.12 and 2.25 kg a.i./ha are likely to cause severe leaf scorching and yield reduction when the maximum temperature on the day of application exceeds 26°C.

Agricultural extension

Farmers, primary producer organizations and local authorities require technical information and managerial advice on crop and pasture production, soil and farm management. Agribusiness firms and their representatives are also making increasing demands for such assistance. The extension service exists to meet these needs.

The extension officer's role is to link industry with developing technology and to temper this with consideration and concern for the stability of our soil and water resources. Within this role, extension officers undertake specific projects emphasizing new problems or techniques, they engage in routine dissemination of information and they are frequently involved themselves in technical training.

Branch extension in the State

Recommendations on the most appropriate crop varieties to plant in each district have been continued. This service, which covers wheat, oats, barley, grain sorghum, maize and soybeans, is an on-going service and provides growers with information enabling them to choose top-performing varieties for the farm.

The depressed state of the beef industry has again been a major factor influencing extension operations during the year. Many beef producers have diversified into summer crops such as grain sorghum and sunflowers. This expanded the limits of cultivated agriculture and many useful crops have been grown despite the restrictions of limited plant, equipment and capital.

These properties will probably remain diversified after beef returns to more profitable levels, as the experience of the last 5 years has highlighted the precariousness of single enterprise properties.

In extension on the control of insect pests of stored grain, farmers are being encouraged to design and construct new farm buildings that can be readily cleaned. New grain protectants became available for on-farm use during the 1977 winter cereal harvest, thereby offering graingrowers additional tools with which to combat these insect pests.

Extension programs to inform grain growers of these new protectants were mounted. Recent research by agricultural engineers and entomologists is providing information on which significant future extension activities will be based. Techniques have been developed to clean farm machinery (grain harvesters in particular) and entomological research is pinpointing the significant on-farm sources of insect infestation.

The major inservice training activity during the year was a grain sorghum workshop. This workshop, which recognized the recent expansion and the increasing significance of grain sorghum in Queensland's agriculture, reviewed the advances in grain sorghum agronomy over the last decade. Officers from C.S.I.R.O. Division of Tropical Crops and Pastures, the University of Queensland and the Queensland Agricultural College also participated in this workshop.

A workshop on management of pastures in south-east coastal Queensland was also a significant training activity during the year. This workshop reviewed the considerable pasture research in this region over the last 20 years and related pasture management to both dairy and beef production.

The role of extension officers continues to expand as farming becomes more complex, more technically based and more management-oriented. One trend which has developed significantly in the past few years is the increasing demand for advice on farm machinery. This demand has been created by both increasing machinery costs and decreasing farm labour.

Most Branch extension programs are planned and implemented at district and regional levels, so that they are relevant to local farmer needs and quickly responsive to changing conditions.

North Queensland

Peanuts are an expanding crop in north Queensland and are now a permanent part of the agricultural scene at Mt. Garnet, Mareeba, Dimbulah and Lakeland Downs as well as in the traditional areas on the Atherton and Evelyn Tablelands. Extension programs on plant populations, disease control and post harvest artificial drying have been specifically directed at peanut growers in these districts.

The large number of growers new to peanut growing has necessitated a lot of individual attention and extension officers at both Atherton and Mareeba have been heavily involved. A one-day school for these new growers held in Atherton in December, which was attended by some 65 growers, discussed seeding rates, disease control, weed control, harvesting and drying as well as the economics of peanut growing.

Rice has expanded at Mareeba from 25 ha in 1975-76 to 570 ha in 1977-78 and could reach 1 500 ha within the next 3 years. The crop in the Burdekin has stabilized at around 2 000 ha—about 1 200 to 1 400 ha of winter crop and 700 to 750 ha of summer crop.

In contrast to the expansion in rice and peanut crops, the area and production of tobacco has retracted somewhat. Nevertheless, tobacco worth \$22 300 000 was produced in 1977-78. A significant extension program on the use of maleic hydrazide in sucker control was successful. This systemic suckercide is attractive to growers because of lower application costs.

Activities in mechanization of the tobacco crop have ceased until the economic climate of the tobacco industry improves. Other extension activities in the tobacco districts have concentrated on improved seedbed management, nut grass control and control of diseases and insect pests.

The management of sown pastures for beef production has been the main activity on the wet tropic coast. The trial at Utchee Creek, demonstrating the profitability of beef production in this environment, has been a great stimulus to the maintenance of sown pasture based beef production systems. The management strategies in this demonstration are gaining wider acceptance.

In the dairying areas of Malanda and Millaa Millaa, extension activities have been aimed at feed year planning and fertilizer budgeting. One interesting development has been the use of maize silage in the feed year program as an alternative to grain, which is traditionally fed in these dairying areas.

In the beef producing districts of the dry tropics, the newly released legumes Seca and Verano stylo continue to excite interest among graziers despite the depressed beef prices. Extension programs based on demonstrating the value of these legumes in beef production systems of the dry tropics have been planned for a number of districts from Collinsville and Bowen to Cape York Peninsula.

Capricornia

Extension staff in this region maintained their efforts to restrict the spread of Parthenium weed. On-site advice on pasture management strategies to control the weed has been a heavy commitment. A film on the weed was produced in conjunction with the Australian Broadcasting Commission. The film has been shown to hundreds of primary producers following its release through the A.B.C. 'Countryman' program.

Locust control commitments were also heavy. Field officers at Emerald, in particular, and at Biloela were involved in crop damage and locust population assessment, the organization of chemicals and other administrative duties as well as in offering advice on management strategies designed to minimize the effect of the locust plague. Activities to control locust plagues have become an annual feature of extension commitments in the Central Highlands and prevent full development of other extension activities.

Grain growing continued its expansion in the region and is assuming increased importance. Landholders in Area III of the Brigalow Land Development Scheme are rapidly increasing their areas under grain sorghum and sunflowers along with similar developments in other areas of the Scheme. However, winter cropping is more significant in the more southern Areas I and II.

This property development offers exciting challenges to extension officers in ensuring that balanced development of these brigalow lands is achieved together with stability of the natural resources.

* Registered trade name.

Burnett and South Burnett

Extension activities assisting farmers to diversify their cash cropping enterprises are significant in all districts. In the South Burnett, where cash cropping is already quite diversified, the crop husbandry factors of lupin growing have been elucidated so that the crop can be included in cropping systems. Lupins are particularly attractive as a cheap source of protein for pig producers.

In the Gayndah and Monto districts, soybeans have become well established in cropping systems while sunflower plantings are increasing.

On the coast at Bundaberg and Maryborough, cane growers have requested assistance in their diversification attempts which have been triggered by the current recession in the sugar industry. Soybeans, sunflowers and lupins are promising crops for these coastal areas while cassava is a crop with distinct possibilities.

In the dairying areas, the use of high density fertilized ryegrass for winter and spring production is now an established practice on farms where irrigation is available. This extension program has been operating for 4 years and has gained almost complete acceptance in the coastal dairying areas.

In the peanut growing areas, a significant extension effort was directed at early harvest and subsequent artificial drying of peanuts to overcome the aflatoxin problem. The effort has had some success as there has been a steady increase in the number of driers installed on farms in the region.

Peanut growing is also expanding in this region particularly at Mundubbera and Eidsvold and these new growers have required additional personal attention.

Lucerne aphids became a major production restraint during the year and required constant surveillance and immediate attention. Much of the extension effort in this area was directed at identification and chemical control methods.

Agriculture Branch extension officers are heavily involved with officers of Soil Conservation Branch in extending the area of cultivation protected by soil conservation measures. These include crop stubble retention and mulching, reduced tillage and modifications to existing farm machinery.

Near North Coast and Moreton

In the dairying areas, emphasis has been placed on dairy farm diversification, pasture management and cow nutrition. These extension activities have necessitated the integration of the extension activities of officers from Dairy Field Services and Soil Conservation Branches with those of Agriculture Branch officers.

As costs rise, dairy production based on sown pastures has been given greater emphasis. Dairy farmers are also diversifying into grain cropping to augment farm incomes. Grain sorghum and soybeans are the preferred crops particularly in the Moreton region.

The new orange-fleshed sweet potato varieties have obtained a premium in the market. Grower interest is high, particularly in the coastal areas, and a field day in April attracted an attendance of 200.

Lucerne aphids were a major production restraint in this region also and related extension activities were numerous.

Chemical usage in crop protection in the region is sophisticated and widespread. A West Moreton Chemical Liaison Committee has been established to encourage proper and safe use of agricultural chemicals and this Committee has received favourable support from farmers and chemical companies. The Committee has held seminars on various crops throughout the year and this program will continue.

A project on tobacco beetle control has been extremely successful in the Caboolture-Berwah-Glasshouse tobacco district. Only one instance of live tobacco beetles present in tobacco offered on the sales floor was recorded despite a large amount, some 250 tonnes, of overquota leaf stored on tobacco farms in 1977-78.

Darling Downs and Near South West

One of the features of the extension activities in these regions has been the increasing demand for assistance from part-time and hobby farmers whose properties are usually close to centres of population. In many instances, the landholders have little or no previous farming experience and property size is such that the farm is non-viable commercially. Extension activities aimed at the needs of these landholders have been implemented, but they are very time consuming and compete for extension resources with service for the commercially viable farmer.

The extension project to minimize spray drift on the central Darling Downs was expanded. Whereas previously emphasis was on minimizing herbicide spray drift, the project now aims at reducing spray drift from all agricultural chemicals during application.

The area of crop suspected of being damaged by spray drift and reported during the year was less than 100 ha and none of the crops were broadleaf crops such as cotton, soybeans or sunflowers.

The extension project fostering the development of farming systems in the Crow's Nest-Haden areas was continued. This project involves the integration of sown pastures and forage crops into new feeding systems. The development of these systems is having an impact on the dairy farms of the district and those of adjacent areas.

Activities planned to foster control of Johnson grass in the Jondaryan Shire were continued. The chemical, glyphosate, became readily available and some 5 000 litres were applied in the Shire. Emphasis was also given to the value of slashing roadside infestations and a 10% increase in areas slashed was recorded.

Evidence of the new interest in sweet potato growing in Queensland is shown by this large attendance at a field day at Deception Bay where new varieties from the U.S.A. are being evaluated by the Department.



Weeds continue to be a major production restraint on the Darling Downs and activities aimed at achieving control through a balance of cultural practices and chemical application received considerable support from the farming community.

The tobacco growers in the Inglewood Shire have almost completely re-built their industry in the last decade. Extension activities emphasizing the agronomic desirability of producing the crop on sandy soils and the benefits of mechanization including solid set irrigation, bulk curing and taxi harvesters have been significant in putting the tobacco industry in this Shire on a sound economic base.

In the grazing areas of the traprock and granite country south and west of Warwick, an extension project promoting the introduction of *Vicia dasycarpa*—woolly pod vetch—into pastures has obtained wide grazer support.

At Goondiwindi, a major extension project on all aspects of rural labour in property management has involved officers from a number of Branches of the Department. This project is studying the various options for keeping labour

in rural areas as well as strategies enabling less labour to be needed on properties. It has relevance to properties throughout the grain-grazing areas of the State.

Irrigation is expanding significantly wherever possible along the Condamine, Balonne, Macintyre and Barwon Rivers. Cotton, navy beans, and soybeans are the major summer crops receiving attention, while appreciable areas of wheat are irrigated during the winter months. This trend is expected to continue.

In the dryland cropping areas of the western districts, extension activities have been directed at strategies which increase the reliability of summer crop production. Varietal selection, weed control and planting time are critical in this environment, and the strategies are gaining acceptance among the graingrowers.

The use of phosphatic fertilizers in wheat production on brigalow soils is also increasing on the Western Downs, the Maranoa and Border areas of the region. As agriculture on the Darling Downs becomes more diversified, the centre of wheat production in the State is shifting to the west and extension programs such as these significantly increase both productivity and the reliability of that production.

Horticulture Branch

HORTICULTURE Branch is concerned with the production, post harvest handling and processing of fruits and vegetables. Its activities cover also the field of ornamentals including commercial production of cut flowers and nursery stock, and the requirements of landscaping and the home garden.

It aims at improving the efficiency and stability of commercial horticulture from the point of production right through to the consumer.

Cultural research is centred at five horticultural research stations at Applethorpe (Granite Belt), Ormiston (Redlands), Nambour (Maroochy), Cairns (Kamerunga) and Bowen (Delta), supplemented by field trials in the main producing districts. Post harvest and processing research is carried out at the Sandy Trout Food Preservation Research Laboratory.

The Branch provides extension services in all fruit and vegetable growing districts. Liaison with industry is maintained through six horticultural advisory committees, composed of grower and Departmental members and covering six major crops or groups of crops.

The Branch plays a major part in administering the Diseases in Plants Act, which aims at controlling the incidence and limiting the spread of pests and diseases of plants within the State, and preventing their entry from other States.

As an agent of the Commonwealth, it also administers, within the State, the Commonwealth Quarantine Act (Plants) designed to prevent the entry into Australia of any pests or diseases of plants, or any weeds which might constitute a hazard to primary production.

A further function of the Branch is the supervision of the gardens at Government House, the Museum Gardens, Queen's Park and the State Migration Office.

Research

The horticultural research program is designed to service all levels of the industry. The major aim is to improve the quality of horticultural products at the consumer level while containing production costs by the development of cost and labour saving techniques.

It includes the search for improved varieties by plant introduction and breeding, improving cultural techniques, development and integration of mechanized production systems, and improvement in methods of transport and storage. Some emphasis is also given to the development of new industries.

Vegetables for processing

Queensland is a major producer of vegetable crops for processing, and research has been aimed at overcoming some of the industry problems.

Excessive top growth is often a problem in the production of baby carrots. It causes a higher humidity within the plant canopy which favours the development of diseases, and also causes problems in machine harvesting. Overseas reports have suggested that Alar (a growth regulator) could overcome this problem. Trials have shown that applications at the 10-leaf stage will reduce top growth to some extent, but further reductions will be necessary to overcome the problem.

Most of the processing pea crops in the Lockyer and Fassifern districts are grown in the late winter-spring period. Attempts are being made to extend this production by autumn cropping, but observations have shown that, in autumn, plants continue to produce leaves and flowers after the main crop is set. This causes a wide spread of maturity and reduced yields as the crop is harvested by machine in a once-over operation.

A range of growth regulators is being tested to limit growth after the major crop is set, and preliminary results show that this can be economically achieved.

Serious failures often occur in spring bean crops and a major factor appears to be a severe deficiency of zinc under cold soil conditions. Trials have shown that soil and foliar applications of zinc do not correct the problem, and it has been found that, under cold conditions, root growth is reduced and roots are also restricted to the shallow layers of the soil. The conclusion from this work to date is that beans should not be planted when minimum night temperatures are below 10°C. Beans planted under these conditions will not produce economic yields.

Despite the fact that Queensland is a major producer of most processed vegetables, the production of tomatoes for processing is very small. Attempts to grow the crop in south-east Queensland have not generally met with success and a research program is aimed at determining the causative factors. A major problem is that the crop must grow for a part of its cycle through the hot, wet months of January and February. This places stresses on the disease resistance of the tomato plant, and it has been established that, in heavy soils, the plants collapse under hot, wet conditions due to root failure.

Lighter soil types overcome this problem but, if the soil is too light, maintaining adequate moisture in hot dry weather is difficult and blossom-end rot may become a serious problem. Because the crop is grown on the ground, relatively dry weather during the fruit maturation period is essential. The most promising area for production of this crop appears to be the lighter alluvial soils along the inland river systems west of Toowoomba.



A young papaw plantation is checked for disease.

Fruit maturity

A series of investigations has been continuing with a view to developing criteria to identify stages of maturity when fruit is generally acceptable to consumers.

Avocado maturity investigations have been completed and the results show that a high oil or dry matter content is necessary for fruit to be palatable early in the season, but that fruit becomes palatable at lower oil contents as the season progresses. A compromise recommendation of a minimum of 12% oil has been made. Total solids have been studied, and would be quite satisfactory as an alternative to oil content.

Following a survey of the maturation characteristics of mangoes over two seasons, 13% total solids is being recommended as a minimum concentration for marketable quality.

The proposed standard for all varieties will be superior to the present standard as it will be independent of the degree of ripeness.

The application of the growth regulator Ethrel* has been demonstrated to promote maturation of Wilson and Santa Rosa plums. This results in a better quality fruit as well as savings in labour costs by reducing the number of harvests. It will also overcome the problem of poor plum quality of recent years that has resulted from the marketing of immature fruit that have been given some colour development by treatment with ethylene.



The first mechanical harvester in Australia for fresh market tomatoes has been introduced by a Bowen grower.

Mechanization

The first mechanical harvester in Australia for fresh market tomatoes was introduced late in the season by a Bowen grower. The success of this innovation will require the integration of varietal and cultural aspects of tomato production with the requirements of the machine.

Previous trial work has identified varieties with suitable fruit attachment characteristics for mechanical harvesting and which perform well under Queensland conditions. Investigations have also been made of requirements for crop establishment, plant density, irrigation and growth regulation. Co-operative work will be extended to assist in making mechanical harvesting an accepted procedure in the fresh market tomato industry.

The plug-mix planter that was imported from the United States has undergone some modifications and further field testing. This unit allows seed to be planted in a small amount of favourable soil mixture. The technique has application where there are particular problems such as soil crusting, damping-off or poor uneven establishment. An enterprising Queensland grower has developed a machine to do a similar job and the technique is now creating considerable interest.

Improved vegetable varieties

The program to develop improved vegetable varieties for use in Queensland is continuing. Varieties are obtained from throughout the world and tested for adaptability, improved disease resistance, yield, flavour and quality characteristics. The crops under test include tomatoes, beans, lettuce, cabbage, cauliflower, broccoli, sweet corn, capsicum, cucumber, watermelon, rockmelon, zucchini, beetroot, and carrot.

Some of the recent results of this program have included the dissemination of improved cucumber and rockmelon varieties, the importation of bean varieties suitable for the fresh and processing markets and testing a considerable number of lettuce varieties and demonstrating their potential for the spring and summer months in south-east Queensland.

In addition to the variety importation program, there are major breeding and testing programs being carried out in tomatoes, beans, capsicums and sweet corn, and smaller breeding programs being conducted in cucumbers and broccoli. Some commercial bean seed of Redlands New Pioneer will be available to the industry this season.

A plant breeder makes a cross between two bean varieties.



* Registered trade name.

A mildew tolerant, semi-elongated, white cucumber which is similar in flavour to Crystal Apple is presently being prepared for release to the industry.

There is considerable potential for a sweet corn industry in south-east Queensland, especially during the summer months. This is limited by the susceptibility of current cultivars to sugarcane mosaic virus, leaf blight and rust during hot weather. Four of the 12 cultivars examined performed well under spring conditions. The most promising one, KSC 467, is being recommended for release as an interim measure pending the development of further improved varieties.

The tomato variety Flora-Dade, imported from Florida a few years ago, has again shown its superiority in field trials. It is now being readily accepted by growers and seed collected from select plants has been included in the Tomato Seed Certification Scheme.

Trials have been carried out in association with the C.S.I.R.O. to test the potential of a hybrid tomato with a mutant character that results in fruit ripening more slowly. This would increase the shelf-life of fruit and allow it to be marketed at a riper red stage. It has been found that hybrid fruit remained firm for 2 to 3 weeks compared with only 1 week for coloured fruit of standard varieties. Fruit quality of the hybrid requires further development, but the slow ripening characteristic shows considerable potential.

Potential new fruit crops

Trial plantings of Kiwifruit have been made at a number of localities. It has been found that the vines will not crop in the coastal lowland areas such as Nambour due to lack of winter chilling. A block at Imbil progressed well until the vines quickly lost vigour due to heavy infestation with nematodes. Two of four blocks in the South Burnett area have grown particularly well, while another trial block has been established on Mt. Tamborine where a small planting of vines has performed exceptionally well this year. It is apparent that the fruit is susceptible to fruit fly and an efficient protective program is needed.

The evaluation of guavas as a potential commercial crop is continuing. Fruit yields have been very good with 3-year-old plants producing 45 kg fruit. Under the conditions of concentrated cropping that have been developed for the crop, fruit fly is a minor problem and can be readily controlled. The fruit has been evaluated for its processing potential, and canned and frozen pieces, juice products and jams of high acceptability have been produced.

A persimmon variety trial is now well established and some varieties fruited this year. Some local selections with high quality and low astringent fruit have been collected, and five more non-astringent varieties have been introduced from Japan. At this stage, the crop appears to be relatively easy to produce.

A long-term project to investigate the potential of a range of exotic fruit for tropical areas has commenced. Rambutan, pulasan, sapodilla, durian, langsat and mangosteen clones have been introduced. Plants are being established in the field and further introductions will be made to ensure that a range of material is available for selection.

Refrigerated storage and transport

There has been rapid expansion in the use of refrigeration in post harvest handling of fruit and vegetables. This is a most important factor in maintaining high quality of fresh fruit and vegetables through the marketing chain to the consumer.

One aspect in which particular interest has developed is that of forced-air cooling. This allows a great reduction in cooling time by forcing cool air through vents in the packages. An experimental 18-litre carton has been developed for palletized forced-air cooling and has been widely tested. While the carton is ideal for rapid cooling, some problems of self heating as a result of respiratory activity have occurred when the cartons are packed in a block stow during transport.

Cassette data recorders have been developed to monitor temperature and air flow on interstate loads of fruit. Data are being accumulated to determine the basic characteristics of refrigerated and non-refrigerated loads in road and rail vehicles. A system to allow both forced-air cooling after packing and temperature control during transport is under development.

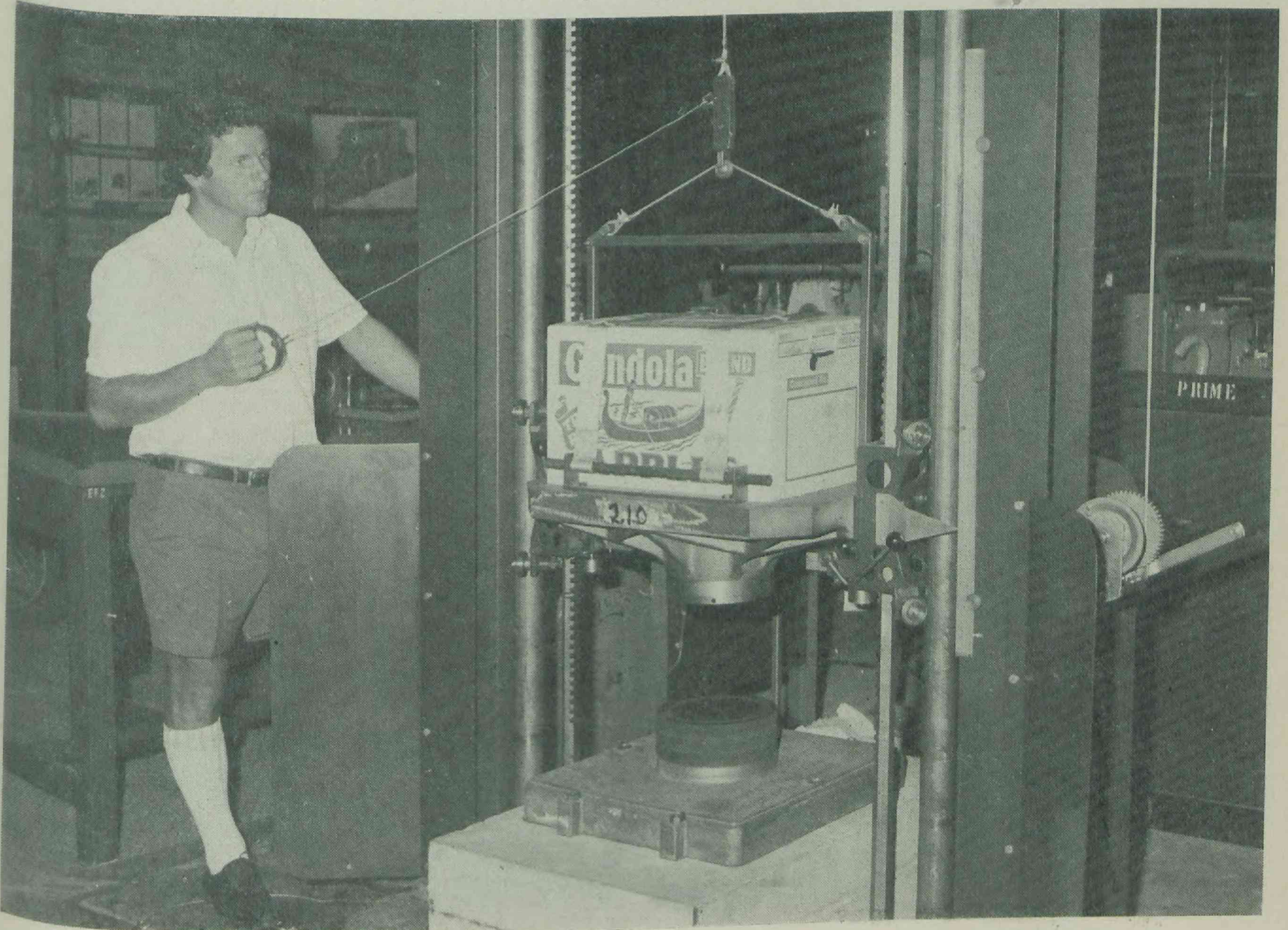
A series of trials was conducted to determine the cause of a rind burn which developed on Ellendale mandarins during storage and transport to overseas markets last season. The trials showed that the main cause of the burn was the diphenyl pads which are included in cartons to control green and blue mould. The burn was found to be worst where warm fruit were packed with diphenyl pads and placed straight into a cool room at 3°C.

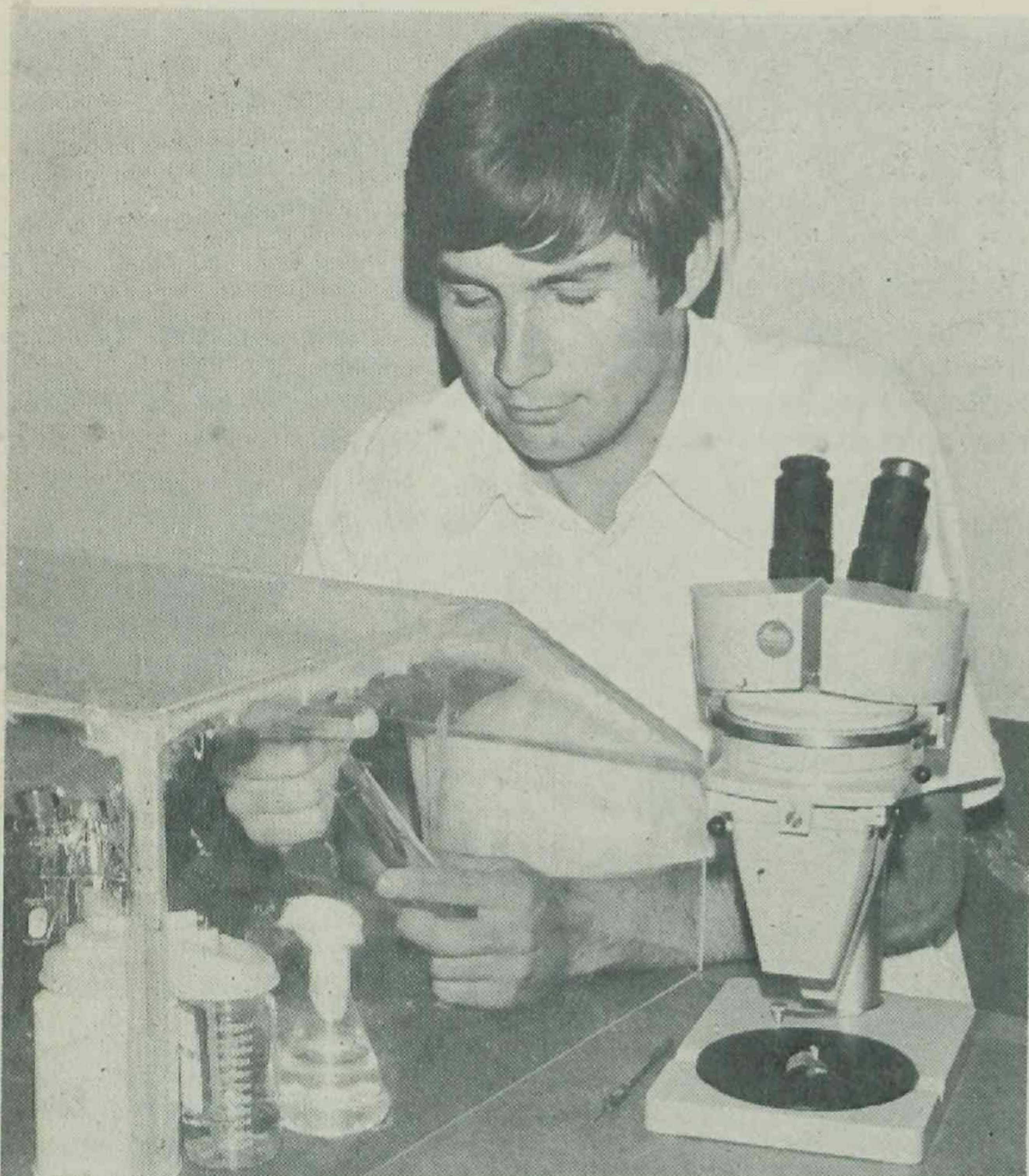
These problems were more serious last season because most of the exporting growers had installed cool rooms on their farms and cooled fruit immediately after packing, rather than sending the fruit to Brisbane for cooling as was done in previous years. Recommendations have been made to growers on the basis of these results to help avoid rind burn problems in the future.

Packaging and handling

Considerable savings in packing and handling costs for fruit and vegetables could be made if the number and type of packages were rationalized. There are currently more than 60 different sized cartons approved for use throughout Australia. A range of five packages with sizes ranging from

Dropped packages are a major cause of fruit bruising. Dropping is simulated in studies to develop improved packages.





The growth of plants by meristem culture is done under sterile conditions.

9 litres to 54 litres has been developed and is now under test. These are of modular dimensions such that they are compatible with one another when palletized for forced-air cooling or general storage and transport.

The number of 36-litre plastic returnable crates in use in Queensland has continued to rise indicating the increasing acceptance of this package. A second manufacturer has entered the field with an improved crate which can be fully integrated with the first, and whose suitability for forced air cooling has been demonstrated. An 18-litre plastic returnable crate, with base and top dimensions similar to the 36-litre crate and compatible with it, is now under test.

To cope with palletized bulk handling, collapsible bulk bins of modular height and using a standard base of 1 165 mm square are being designed.

A detailed study has been made of fruit bruising in apple packages in relation to the properties of the fruit, package characteristics and handling hazards as defined by the number and height of drops. A theoretical model has been developed to describe these relationships. The use of these

results will now allow packages to be designed to give the optimum relationship between the cost of a package and the amount of protection that it gives to the fruit.

Ornamentals

The production of gladiolus in winter is limited by poor yields and reduced flower quality. Flowers apparently compete with corms and cormlets for plant reserves and lower temperature conditions favour corm and cormlet production.

It has been found that this trend can be reversed by the use of artificial light. By using incandescent lights in the field during the night, flower yields have been almost doubled without loss in quality. Investigations are continuing to determine the most economical levels of lighting that will give the responses.

Investigations of some problems associated with the production of potted plants have also been made. The cost of peat in potting mixes is a major problem and a series of tests has been made to determine methods of overcoming problems associated with the use of a range of by-products as peat substitutes.

Extension

As in previous years, there has been a very high demand for the services of horticultural extension officers in all districts. An appreciable number of properties has been changing hands, and as the new owners are often unfamiliar with the growing of horticultural crops, the demand for advice has been accentuated. An additional problem is being created because many of these inexperienced people are taking up small holdings on a part-time basis.

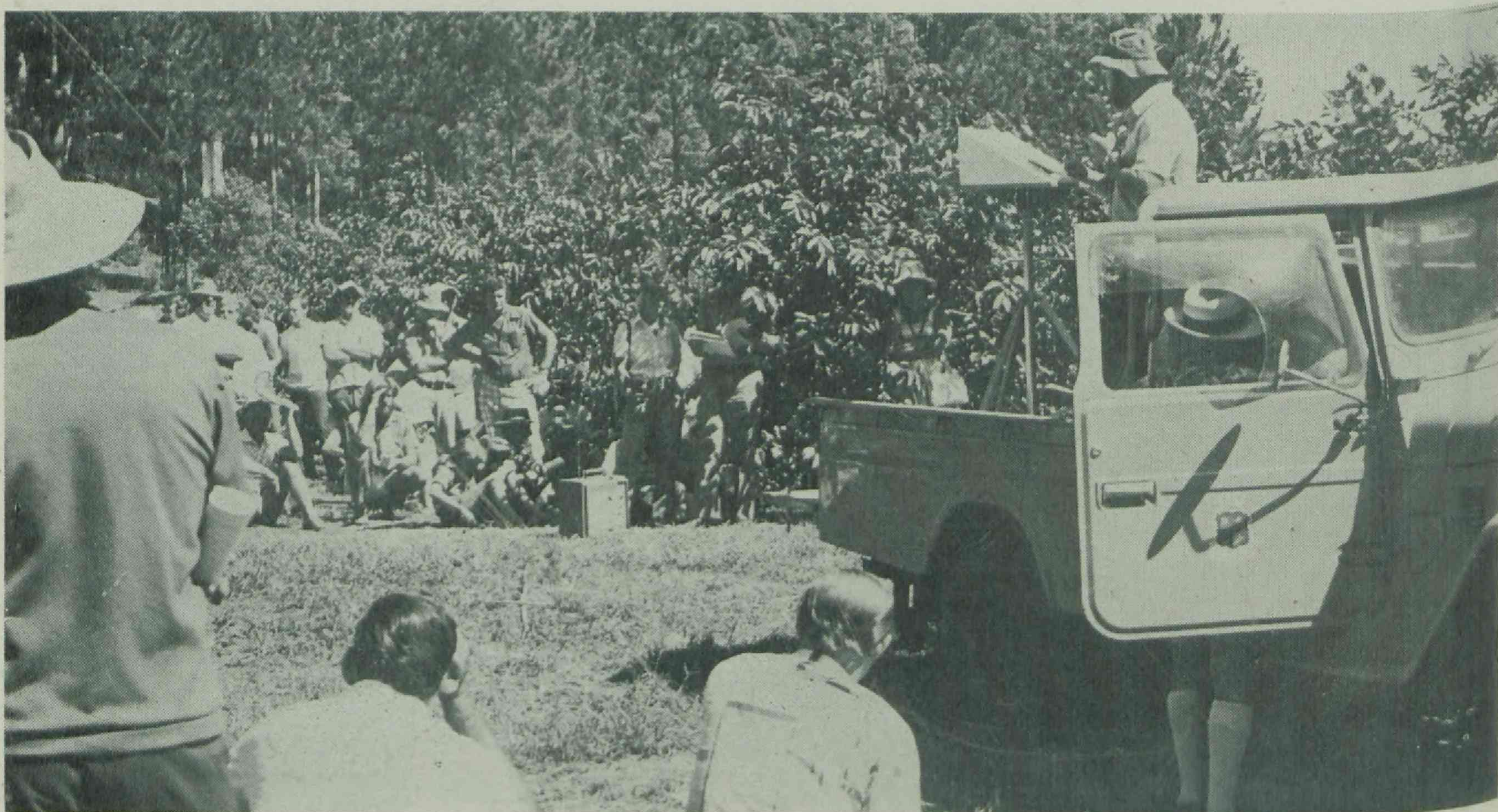
The ever increasing sub-division and real estate development of farms and land, particularly in the coastal areas, is a major cause for concern. Overall production is being adversely affected by the sub-division of better quality land suitable for fruit and vegetable growing into small non-viable holdings.

In the Granite Belt, major attention has been focused on an Apple Industry viability study. One of the many aspects which has been examined was the distribution chain, and this has led to a new cost saving arrangement for unloading, sorting and stacking of palletized consignments.

The unitizing of pallet loads has resulted in a saving of 7c on each case for the grower, and a minimum of bruising because of the reduced handling. There has also been a saving for the transport operator since his time of arrival at the Brisbane Market is critical. As a result of this saving, at least one large transport operator has not increased freight charges for the 1977-78 season.

Extension officers have been involved with the Granite Belt Controlled Atmosphere Cool Stores Association in the determination of harvest dates and times of removal of produce from storage. Officers from the Sandy Trout Food Preservation Research Laboratory have also collaborated by testing the efficiency of the cool stores.

An interested group listens to a talk at a field day.



The Deciduous Fruit Handbook, Part 2, which covers all aspects of crop protection and weed control in deciduous crops, was again published this year, and as usual it met with a very enthusiastic reception by all growers. This publication provides the latest recommendations for the control of pests, diseases and weeds based on the most recent research findings. A comprehensive pest and disease control spraying schedule is included for each of the major crops. Since its initial publication some years ago this handbook has become the most important horticultural extension publication in the Granite Belt.

The compilation and distribution of the *South Moreton Horticultural Digest* has continued on a regular basis and this publication is welcomed by growers as a means of keeping them informed on latest developments in the fruit and vegetable industry.

Expansion of the cut flower and nursery industries in the North Moreton District is continuing, and there is now an appreciable export of flowers to other States as well as New Zealand. This development is resulting in the commitment of an increasing amount of the time of extension officers.

The planned extension program for the year in the South Moreton District has included improvement of banana planting material, chemical weed control in crops, crop establishment in vegetables, strawberry ratooning and runner production, potato fertilizer prediction and vegetable variety improvement. The extension project aimed at phasing out the use of chlorinated hydrocarbons has been highly successful, but it will be continued next year to consolidate the results.

Investigations are continuing within the North Moreton District aimed at finding alternative horticultural crops. Guava and Chinese gooseberries are under investigation and demonstration plots have been established. Some fruit from trial plantings in the Nambour district was marketed during the year but yield and quality were inferior to that of the New Zealand product.

Following the successful demonstration of the recently developed banana dehanding machine last year, this equipment is now available commercially. There are indications that it will have a greater impact in the larger banana growing areas.

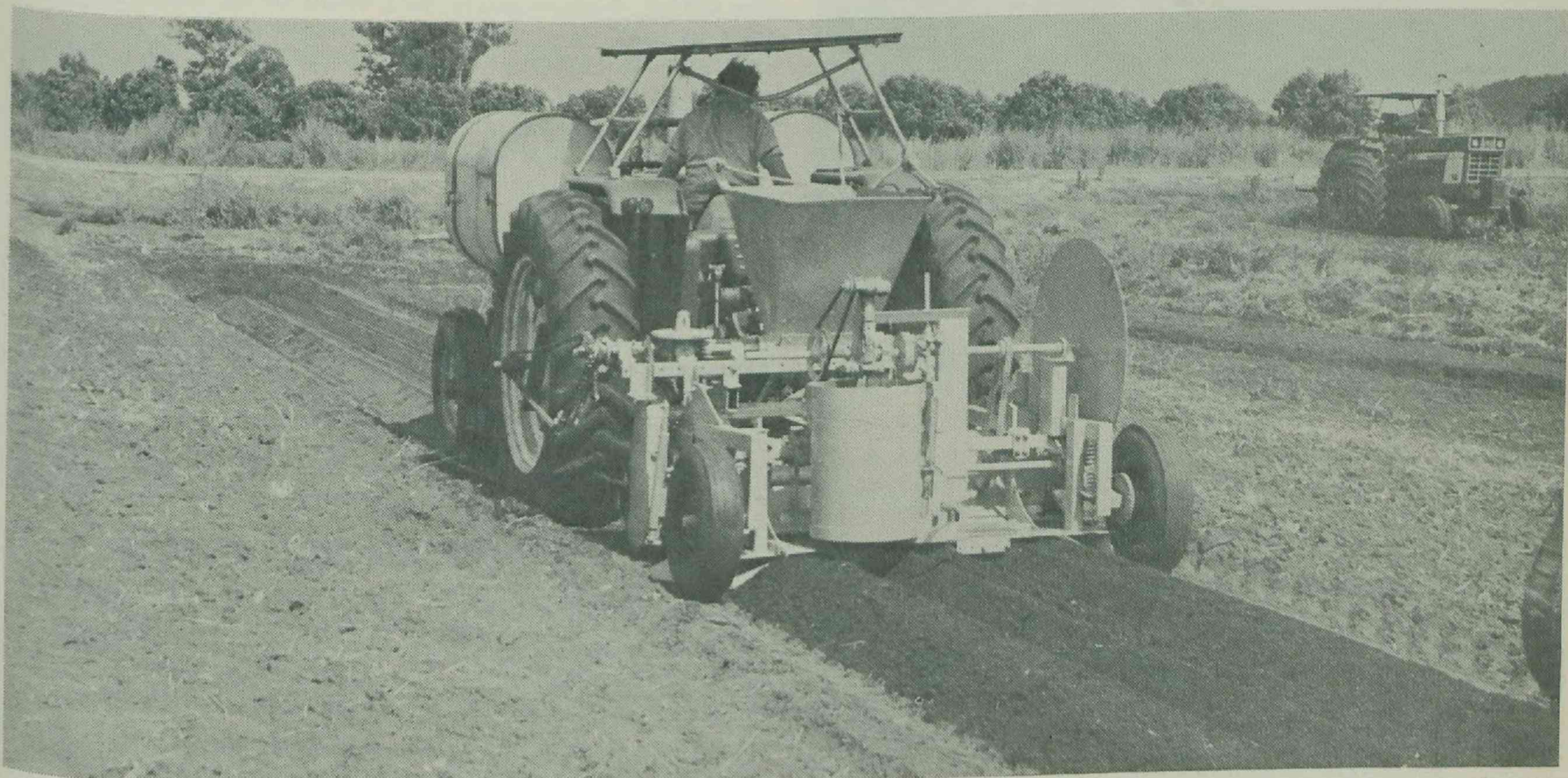
Increased interest is being shown in both avocado and custard apple plantings in the South Moreton District and the available planting material has been unable to meet the demand. Although root rot losses are still occurring in avocados, there has been a steady increase in the area planted.

There has been a general trend in the ginger industry towards locating the majority of the plantings in areas where irrigation water is readily available since repeated dry seasons have adversely affected crops on dry farmed areas.

For this reason, plantings have now spread from the Nambour-Buderim into the Gympie and Beerwah areas, with approximately one-third located in each. In recent years, greater emphasis has been placed on the confectionary trade. In 1977, large orders were placed by European countries and it will be necessary to extend the area under crop to satisfy this increased requirement. There is some concern regarding the increasing labour costs in ginger production and there is a need to investigate means by which these can be reduced.

There are indications of an increased interest in the growing of litchis in the North Moreton District and it is estimated that the annual requirement of potted or bare rooted 'marcots' could exceed 1000.

There is also considerable interest in several districts in the macadamia nut industry, largely stimulated by the attractive prices being offered for the nuts, the supply of which is currently unable to meet the market requirement. Prices paid by processors have risen from \$0.85 a kg (base price) for nut-in-shell in 1976 to \$1.20 in 1977 to \$1.50 in 1978, with some paying up to \$2.40 a kg for top quality nuts.



A locally-developed 'Plug-mix Planter' is demonstrated in the Bowen district.

Plantings are increasing rapidly and there is appreciable investment being made by businessmen. Unfortunately, many of these are being influenced by attractively prepared financial statements and predictions of lucrative returns.

The passion fruit industry in the North Moreton District is at present in a very favourable situation as growers cannot supply demands for fruit for both fresh and processing outlets. Plantings are expected to increase over the next few years.

Interest is also being shown in the production of pecan nuts, an industry which is in its infancy at present but could have a considerable potential.

There has been an increased demand on the Departmental soil and leaf analysis service as a means of developing fertilizer programs for both fruit and vegetable crops in the North Moreton District.

In the Burnett District, two issues of the Citrus Bulletin were published during the year and distributed to all Queensland citrus growers through local advisory officers. The popularity of this bulletin may be gauged from the fact

that the mailing list continues to grow and increasing numbers of requests for copies are being received from outside the State. The publication provides a means of conveying to all citrus growers the latest information emanating from recent research, and keeps them informed on current changes and developments in the industry.

The annual Citrus Orchard Spray Program booklet was also prepared by the extension staff at the Gayndah office. This contains the latest information on pest, disease and weed control, and is invaluable to citrus growers in all districts.

The extension program covering the introduction of vibra-packing to the Queensland citrus industry continues to make steady progress. It has now reached the consolidation phase permitting growers, agents and buyers to become completely familiar with vibra-packing and thus accept it as a facet of normal citrus marketing. The appreciable progress being made in South Australia with the acceptance of this system of packing should greatly assist in its general adoption both here and elsewhere.

The use of gibberellic acid as a pre-harvest treatment on Ellendale mandarins to delay rind ageing and extend storage life was actively promoted during the year by means of leaflets, published articles and personal contacts. As a result, all export growers used this technique for the 1977 season. Initial reports from overseas indicate that the treatment was very effective, and it is expected that it will become standard practice in the future.

The extension program in the Bundaberg area to impress upon growers the advantages of pre-cooling and cold storage of horticultural produce has encouraged additional installations of cool rooms. The good refrigerated transport service available from Bundaberg to southern markets ensures that the temperature of pre-cooled produce is maintained, resulting in a considerable reduction in wastage.

Interest in diversification of cropping in the Burnett district is still high and observation plots of stone fruit, mango and litchi have been established.

Crop logging has been initiated in the Central district and has become a continuous activity, with some pineapple growers forming 'self-evaluation' groups to discuss the condition of crops and the future prospects.



Tests are made in the field to make sure that the crop is well supplied with nutrients.

Servicing activities

Marketing extension service

This service continues to be received very favourably by growers, and the general improvement in the quality of fruit and vegetables marketed in Brisbane has been of considerable benefit to them. The general procedure is for information regarding unsatisfactory quality, grading or packing to be channelled back promptly to field officers in the districts concerned.

It is still very evident that individual grower expertise in the preparation of produce for sale is quite variable. It is also apparent that greater care should be taken in the handling and transporting of horticultural produce and appropriate education of all persons involved in the transport chain is required.

In the period under review, 287 notifications were issued giving details of consignments in which improvements could have been effected, as compared with 405 in the previous year and 710 in 1975-76. In the winter of 1977, some growers in south-east Queensland experienced difficulty in controlling the major pests of cabbages and cauliflowers, and, as a result, many market consignments showed moderate to heavy caterpillar damage.

Citrus budwood and seed distribution scheme

During the past year, Queensland citrus nurserymen were supplied with 118 000 citrus buds and 86 kg of citrus seed through the scheme. While the demand for budwood was similar to that of last year, the quantity of seed supplied was 25% higher.

The inaugural meeting of the Queensland Citrus Budwood Committee was held in February 1978. This committee, which comprises representatives of citrus growers and nurserymen,

the Committee of Direction of Fruit Marketing and the Department, will be responsible for the introduction and supervision of a new citrus budwood scheme. Under this scheme, budwood will be supplied to nurserymen from special budwood 'mother' blocks established on the properties of selected growers. These 'mother' trees will be grown from virus free true-to-type propagating material and maintained under specified conditions of isolation.

Strawberry runner scheme

This scheme has now been in operation for 15 years. Its main purpose is to provide commercial strawberry growers with virus free, high quality, true-to-type planting material, which is also as free from other diseases and pests as possible.

Considerable interest in the scheme was again evident this year with a total of 1.4 million runners being supplied to growers. Unfortunately, the demand for plants was higher than the quantity available for distribution. Some problems were encountered with pests and diseases in the contract runner multiplication areas, largely resulting from the unusually dry conditions. Difficulty was also experienced in fulfilling orders because one grower withdrew from the scheme after digging of runners had commenced. Efforts are being made to ensure that more contract growers are recruited this year.

Bean seed scheme

In the past, bean seed produced under this scheme was grown almost exclusively in the Burdekin and Bowen areas of the dry tropics, but plantings are now being extended into the Biloela area of central Queensland. Production has been steadily declining in recent years as a result of fewer contracts being let to growers by seedsmen. This is a reflection of the reduced demand for local seed by processors.

The total area grown in the Bowen and Burdekin districts was 495 ha. Unfortunately, as a result of the unseasonal flood rains in May 1977 which caused considerable damage to the crops, the final yield of seed was lower than had been expected.

The reduced demand for Queensland-produced bean seed has been due largely to lower sales of the processed product, importation of bean seed from overseas, and the claim that the quality of Queensland seed has been inferior to that of the imported product.

Several projects have been initiated with the objective of improving the quality of the local seed. An extension drive has been launched to make both growers and seed merchants aware of the necessity to modify and improve handling techniques to reduce damage to the seed during harvesting, cleaning, storage and transport.

Regulatory

Plant quarantine

Administration of the Commonwealth Quarantine Act, in so far as it applies to plants and plant products, continues to be a substantial commitment of this Branch.

It involves two distinct operations, one being the surveillance of passengers and cargo entering the State from overseas by sea and by air, and the other the supervision of plant introduction. The main purpose of this surveillance is to minimize the risk of some serious pest or disease of plants or plant products, or any serious weed species, from entering this country. It necessitates inspectional services at all points of entry, the main ones being Brisbane, Townsville, Cairns, Gladstone and Port Alma.

While every effort is made to prevent entry of pests, diseases and weeds, from time to time one of these may pass through the quarantine barrier and become established here. Such an entry was found to have occurred when an outbreak of the Giant African Snail was detected in Gordonvale in April 1977. Active measures to contain and eradicate the pest give promise of success, as continuous close inspection and baiting have resulted in the finding of only one live snail in the area during the last 6 months. However, surveillance will continue for at least 2 years after any snail is found.

Periodic trapping of fruit flies has been carried out throughout the year to give early warning of any movement of exotic species down through the Torres Strait Islands to the Queensland mainland. Arrangements are also in train for Plant Quarantine to avail itself of the services of a Cairns-based Commonwealth Transport Departmental vessel plying Torres Strait waters, to assess quarantine risks along the coast from Cooktown to Thursday Island, and in islands not covered by regular visits.

A valuable addition was made during the year to the Plant Quarantine service in the appointment to the Plant Pathology Branch of a plant pathologist who will be involved full time in plant quarantine work.

In general, quarantinable traffic has remained fairly static since last year, with an actual fall off in some categories.

The following table lists the volume of traffic in some of the main categories—

	1976-77	1977-78
Total number of passengers by sea and air	159 300	160 300
Miscellaneous packages	325 000	365 250
Containers from overseas	27 400	19 800
Timber in cubic metres	93 000	87 600
Consignments of plants released from Quarantine	203	275
Number of official forms issued	15 800	15 400

The value of a Plant Quarantine service continues to be evidenced by the interception several times throughout the year of serious pests such as the Giant African Snail and the Sirex timber wasp.

Banana Industry Protection Board

During the year, there has been a very slight fall in the total number of banana growers in the State and the figure now stands at 1 100. The total area under crop has increased

from 2 800 to 3 100 ha. The Northern Banana Quarantine Area is still free of bunchy top, but unfortunately this disease continues to be a problem in many districts within the Southern Banana Quarantine Area. The total number of plantations on which bunchy top was found during the year amounted to 83, while Panama disease was located on 148.

In the Southern Banana Quarantine Area, 1 337 bunchy top infected plants were found including those found on residential holdings.

The campaign to eradicate bunchy top in the Brisbane Metropolitan area has been intensified during the year, and very satisfactory progress is being made. However, it has become evident that the level of infection is higher than had been expected, and the project will take some time to complete.

Early in 1977, new legislation was gazetted aimed at assisting inspectors to obtain eradication of neglected plantations in which bunchy top had not been recorded. This was based on specified levels of leaf spot infection. During the past year, 14 notices have been issued under the provisions of this legislation requiring occupiers or owners to destroy bananas severely affected with leaf spot. This has resulted in considerable progress being made in the eradication of neglected plantations.

Last year, it again became necessary to increase the levy payable by growers on Queensland produced bananas by approximately 15%. Despite this increase and economies which have been effected, the indications are that a further increase may be necessary next year to offset the continually rising costs.

Agricultural Chemistry Branch

THE Agricultural Chemistry Branch has its main laboratory at Indooroopilly and has staff also stationed at regional centres.

The Branch provides agricultural, chemical and allied services to other Branches and Government Departments and to primary industry. In addition, it is concerned with investigations in the fields of plant, soil, and pesticide chemistry, cereal science, soil physics and soil survey.

Research

Chemical residues

Pesticide trials were carried out with apples, tomatoes and cabbages using spray programs recommended by the Department of Primary Industries. Good pest and disease control was obtained and analysis of the resultant produce showed that no samples had residue levels in excess of the maximum residue limits set by the National Health and Medical Research Council.

A bioassay method has been developed to test soils for the presence of a wide range of herbicides. By growing beans (*Phaseolus vulgaris*) in the suspect soil, different types of damage (caused by different herbicides) can be observed. The bioassay detects approximately 3 p.p.m. of most herbicides in the soil. This avoids costly and time-consuming chemical analyses where the specific herbicide may not be known.

The rates of decay of diazinon under field conditions in the Redlands area for both summer and winter growing seasons were determined. The rate of decay in summer is much more rapid than in winter.

Bees are important both for honey production and as the primary pollinators of large numbers of agricultural crops. They are susceptible to a wide range of pesticides. A repellent which could be mixed with the pesticide when sprayed would reduce losses considerably. To date, 12 potential repellents have been synthesized and some have been tested.

Plant chemistry

A rapid method for measuring linoleic acid, oleic acid and iodine value in sunflower oil was developed in the laboratory. This method, designed for field use, enables a rapid estimation of oil quality under non-laboratory conditions. A large range of sunflower samples was analysed under field conditions and results showed the method to be accurate and reliable over a wide range of sample types and conditions.

A program designed to incorporate the desirable 'high lysine' characteristics into existing Atherton Tableland maize varieties is progressing satisfactorily. Results to date have been promising in that many samples containing high lysine have the desirable hard vitreous endosperm of the Atherton Tableland varieties and not the soft, floury endosperm of the 'high lysine' parent.

Isolation of a phytotoxin from the maize fungus *Marasmius sacchari* var. *hawaiiensis* has reached a promising stage. Bioassays carried out on isolated fractions indicate that the phytotoxin is a peptide, and further bioassays are now being carried out on purified samples.

A study of selenium in Queensland poultry feeds has entered its final phase. Levels of the element in 'Depot' wheat samples for the last two seasons have been measured. A limited investigation of the relationship between low selenium grain and the geology of some of the growing areas has been completed.

In the study of gossypol in cotton, analyses of cotton square material for terpenoid aldehydes has continued in support of plant breeders and entomologists endeavouring to develop *Heliothis* resistance in cotton.

A co-operative study of the composition of Queensland molasses was completed and results published. As molasses is an important stock feed, knowledge of its composition is important to ensure adequate nutrition. Samples were obtained from each of the 30 sugar mills in Queensland on three occasions (early, mid and late season) and analysed for a total of 18 different constituents.

Results showed that, by world standards, Queensland molasses had high concentrations of nitrogen, potassium and sulphur but low concentrations of phosphorus, sodium, chloride, copper, zinc and total sugars. However, the data show that, if used as a major part of the cattle diet, molasses provides insufficient nitrogen, phosphorus and zinc for animal needs. Differences between mill districts and sampling times highlight the variable composition of molasses.

Soil survey samples

During the year, 2 500 samples from soil surveys were analysed. These surveys were conducted by Branch officers and by officers of the Division of Land Utilisation. Branch surveys were at Emerald, in the Burdekin Basin, the major pineapple growing areas, and the major grape growing areas.

Soil fertility surveys

In central Queensland, the detailed soil fertility project is being continued. Studies on gilgaied clays of the Highworth Land System, duplex soils of the Callide and Dawson valleys, and soils of the Brigalow Research Station have been completed. The current soils being studied are the basaltic clays. Soils have been sampled in the Nebo, Barmount, Moranbah, and Clermont districts.

To assist the agrostology legume evaluation program in central Queensland, nine experimental sites (three red earths, three clays and three duplex soils) were chosen and samples of soil screened in glasshouse experiments. The commonest deficiencies found were sulphur (seven soils), phosphorus (six soils) and molybdenum (five soils). Two soils were deficient in potassium and one soil deficient in zinc.

In north Queensland, red and yellow earths of the Mt. Garnet area are being studied. Soils from seven sites were screened in glasshouse experiments. Responses were obtained to sulphur (all soils), zinc (four soils), potassium (two soils) and molybdenum (one soil). Soil analyses showed all soils deficient in phosphorus.

Soil changes with development

The effect of fertilized, improved pastures on two soil types of the Tinana area near Gympie has been studied. The soils were screened for nutrient deficiencies in glasshouse experiments using Greenleaf desmodium as the indicator plant. Phosphorus, sulphur and molybdenum were the main nutrient deficiencies in the virgin soils. In spite of their previous fertilizer histories, the pasture soils were also commonly deficient in phosphorus, sulphur and molybdenum as well as potassium. The residual value of molybdenum appeared to be better on the sandier textured soils.

Soil and plant diagnostic criteria

GRASS-LEGUME PASTURES. In south-east Queensland, the emphasis has been on pastures based on white clover and Greenleaf desmodium. Four experiments with clover pastures and eight with Greenleaf pastures were conducted in the 1977-78 season. Results from these and previous experiments show that phosphorus is the commonest nutrient deficiency in pastures and that both soil and plant phosphorus analyses are useful in diagnosing the need for fertilizer.

Preliminary interpretations for clover suggest a critical soil test range of 26 to 29 p.p.m. P for bicarbonate extractable phosphorus and a critical plant concentration of 0.30 to 0.35% P. Correlations with soil acid extractable phosphorus were poor. Results for Greenleaf desmodium, based on the results of only 10 experiments, suggest that the critical soil test figure will be similar to that for white clover.

The phosphorus fertilizer requirements of Greenleaf desmodium are also being studied on the Atherton Tableland with a view to developing a method for predicting amounts of fertilizer required for optimum yield. Glasshouse work has shown that combining a measurement of the soil's ability to absorb phosphorus (sorption index) with the acid or bicarbonate extractable phosphorus measurement allowed a prediction to be made of the phosphorus required for establishment and for regrowth. This relationship is being tested in the field.

The use of the DTPA soil test for manganese toxicity on krasnozems soils has been studied in the glasshouse with both kikuyu grass and white clover. These species are very different in their tolerance of excess manganese. Kikuyu growth was not affected at soil test levels of 300 p.p.m. Mn while clover seedlings could not survive at the same level. A level of 70 p.p.m. Mn appears to be the maximum for clover.

SOYBEANS. Fertilizer experiments with soybeans in the South Burnett district continued with another seven sites being established. Severe drought conditions caused low grain yields and only one response to phosphorus and potassium. The inclusion of these sites in the soil test calibration increased variability and reduced the precision of the test.

On the black earths of the Darling Downs, responses to phosphorus have generally not been obtained at soil test levels where they would be expected, using the interpretations obtained from the Kingaroy work. Experiments are being conducted to explain the reason for the lack of response at low soil P status and to obtain an interpretation of the soil tests in these soils. Two long term experiments have begun, one in 1976-77 and one in 1977-78.

NAVY BEANS. Ten experiments have been completed in this project. Navy beans are very responsive to phosphorus, and the high cash return per hectare for the crop makes fertilizer use economical. Phosphorus fertilizer is recommended up to a soil test level of 60 p.p.m. P by acid extraction on the Kingaroy krasnozems soils.

SUMMER CROPS. Following the work on soil testing for the sulphur requirements of sward lucerne on the eastern Darling Downs, which was reported last year, a project was conducted with summer crops. Altogether nine sorghum, nine maize, and six sunflower fertilizer experiments were conducted. Of the 24 experiments, only one sorghum crop responded to sulphur. This site could best be separated from the non-responsive sites on the basis of sulphate sulphur in the 0 to 60 cm depth.

Crop and pasture nutrition

PHOSPHORUS IN TROPICAL SOILS. The response of established guinea grass-centro pastures to phosphorus was studied on krasnozems soils at Utchee Creek, north Queensland, over a period of 18 months. Centro dry matter yields were increased only when 160 kg/ha of phosphorus were applied. This high requirement for phosphorus is an indication of the soils' ability to immobilize added phosphorus. Changes in extractable phosphorus could only be detected where more than 80 kg/ha phosphorus were applied. On the other hand, the phosphorus

concentration in the plants was increased at lower rates. The long term requirements of pastures on these soils requires further clarification as does the availability of applied phosphorus.

A selection of soils used for tobacco growing in the Mareeba-Dimbulah irrigation area has been analysed for their phosphorus buffer capacities (calculated from sorption isotherms). This property has been shown to determine the amount of phosphorus required for optimum plant growth. The results suggest that the requirements of most tobacco soils would be similar. Only those with higher clay or sesquioxide contents would be different.

RICE NUTRITION. Preliminary experiments were conducted into a disorder observed in rice in the Burdekin area. It is thought to be a nutritional problem. Soil from the puff (poor growth) and depression (good growth) of the old gilgai pattern on a Baratta soil was sampled. In a glasshouse experiment, both soils were shown to be deficient in phosphorus, with the puff soil much more deficient than the depression soil. No additional deficiencies were detected to explain the difference in growth between the two soils.

PEANUT NUTRITION. On a soil low in both potassium and calcium, the effect of potassium rate on Virginia Bunch peanut yield was studied, together with the modifying effect of calcium. Peanut yields were increased by potassium up to 30 kg/ha and by calcium at each potassium rate. Gypsum and lime were both effective sources of calcium. The lime also improved peanut quality by increasing the percentage of edible kernel and decreasing the percentage pops, particularly at the higher rates of potassium.

SOIL SALINITY STUDIES, BURDEKIN. The study of the effects of clearing and irrigation of upland soils on down slope salinity continued. In recent cleared lands, there is no evidence of increased salinization. However, groundwaters have been sampled at a number of sites and some deeper water tables have been found to be saline.

Soil and land use surveys

Feasibility study and project planning soil surveys for irrigation development are still in progress in the Emerald and Burdekin areas. More detailed special purpose or reference area surveys have also been undertaken.

Following completion of 1:100 000 soil survey of Burdekin right bank areas to the Elliott River, survey at this scale has proceeded for left bank areas. Most field work has been completed for the northern part of this area between Clare and the Haughton River. Details of land use capability and soil limitations to crop suitability have been defined for more than 80 soil units mapped in these surveys.

Field mapping has been completed and sampling is in progress for the detailed soil survey of part of the Kalbar district in south-east Queensland.

A detailed survey of the Delta Horticultural Research Station, Bowen, was completed and a survey on the Collinsville area is in progress.

Soil physics

SOIL PHYSICAL PROPERTIES. A study of the deep profile soil water movement under rice is being undertaken in the lower Burdekin to measure the possible water accession to a water table. Results to date on a cracking clay soil indicate water movement to 4.5 m depth after one rice crop in an area not previously used for rice. This was associated with a drainage rate of 1.8 mm per day. In areas that have been used for rice for some time, a steady state water profile develops in which little change in soil water content occurs but water still moves steadily through the soil.

Soil physical measurements are being made on Lockyer Valley alluvial soils to determine ways of reducing soil clod formation in potato growing areas. The limited information to date indicates that an interaction between soil water content and cultural treatments may have a large effect on the formation of clods. Wax impregnated sections through the potato rows have been taken to measure the degree of cloddiness of the soil under different treatments.

ASSESSMENT OF SOILS FOR IRRIGATION. Assessment of the suitability of soil for irrigation is continuing in the Lower Burdekin Valley. The assessment is aimed at quantifying the water entry characteristics of the soils and also the amount of water the soils can hold which is available for plant growth, that is, plant available water.

The results indicate a wide range in plant available water capacity with the better soils holding over twice as much water as the poorer soils. This is, in part, a result of shallower rooting depth in the poorer soils. These soils appear to be wet at depth but the plant is not able to utilize the water present for plant growth.

An analysis of the data from the soil assessment studies in the Emerald irrigation area has been completed and the soils ranked in terms of their irrigation potential. Problems which could develop on particular soils have been indicated—for example, possible waterlogging, excessive drainage, and the need for careful soil management.

A prediction of the field behaviour from laboratory-determined soil properties, cation exchange capacity and salt content has been worked out and can be used as a preliminary soil assessment in future detailed programs.

Method development

Method development is a continuing part of Branch work and covers all aspects of Branch activity.

Methods for residues of 54 pesticides were compiled. Considerable information on thin layer chromatography and Maximum Residue Limits was also included. Fifty copies of the completed manual were printed.

A method for the analysis of fatty acids in vegetable oils has been modified from previous methods to reduce the number of manipulations which need to be carried out.

Nicotine and nornicotine can now be analysed by gas chromatography on the one extract from tobacco leaf.

Flameless atomic absorption spectroscopy (AAS) methods are being tested for the determination of cobalt and molybdenum in plant material. A flame AAS method is being tested for the determination of cadmium in plant and soil.

Regulatory services

The regulatory activities of the Branch concern, in the main, the provision of chemical and physical analyses of agricultural produce and agricultural chemicals, under provisions of the Agricultural Standards Act and the Agricultural Chemicals Distribution Control Act. In addition, the Branch is involved in the certification of fruit fumigation chambers and in the setting of standards for pesticide analytical methods and specifications both nationally and internationally.

The analyses provided for administrative purposes of the Agricultural Standards and Agricultural Chemicals Distribution Control Acts were—

Pesticides formulations	..	..	..	215
Veterinary medicines	..	..	..	66
Fertilizers and limes	..	..	..	163
Stock feeds	..	..	..	565
Pesticide residues	..	..	..	112

Entomology Branch

THE objectives and functions of Entomology Branch are—

To develop practical and economic methods of controlling insect and allied pests of plant crops (excepting sugarcane and forest products) and crop products grown in Queensland, and to make these control measures available to the primary producing community through the extension services.

To investigate the taxonomy, biology and ecology of economically important insects (whether pests or beneficial species) with the aim of establishing a sound, scientific basis for the development of pest management systems.

To provide an insect identification service for other branches of the Department, quarantine authorities, primary producers and the community in general.

To develop improved methods of beekeeping and to provide an advisory service to apiculturists.

The Branch operates on a decentralized basis from Branch headquarters at Indooroopilly, five field stations in southern Queensland and three each in central and north Queensland.

Major issues

Locusts

Significant locust activity in Queensland during the past year involved two locust species, the Australian plague locust (*Chortoicetes terminifera*) and the migratory locust (*Locusta migratoria*). For the greater part of the year, the spur-throated locust (*Austracris guttulosa*) was distributed sparsely throughout inland areas as scattered populations and, in contrast to previous seasons, was not a significant problem.

While the Australian plague locust was present in varying degrees of density in most inland areas, populations reached outbreak proportions only in the Maranoa region. In central, western and far south-western regions, populations persisted throughout the year as scattered individuals that did not cause any serious economic damage.

In the Maranoa region, hatching of the Australian plague locust from overwintering eggs occurred during August and led to a major spring outbreak. Extensive control measures were undertaken by ground-spraying teams and aerial contract operators, to avert substantial damage to crops and pastures.

As a result of successful spraying operations and a natural decline in populations, only scattered individuals have been found in the region since October.

Extensive hatching of overwintering, migratory locust eggs occurred in areas north and south of Emerald in the Central Highlands during the August-September period, resulting in the formation of a number of dense hopper bands. Wheat crops in the area suffered some damage and growers carried out a limited, crop-protection, spray program.

Breeding continued during spring and summer and the area of infestation shifted farther south to the Springsure district. Similar outbreaks were experienced in the Moura and Bauhinia Downs districts of the Port Curtis region during midsummer. By late March, numerous high density populations of late instar hoppers and adults were distributed widely throughout the southern areas of the Central Highlands and extended into the Moura district.

In some areas, the destruction of much needed pastures was considerable, but little damage to summer crops occurred. In anticipation of a severe locust outbreak, many growers in the Central Highlands had planted sunflowers in preference to grain sorghum. Unlike the spur-throated locust, the migratory locust feeds only on gramineous crops and does not attack sunflowers.

An organized control campaign was initiated in January while hopper bands were still small, in an attempt to suppress population build-up. Although good kills were obtained, the campaign did not achieve its aim of suppressing populations owing to the build-up of locust numbers in areas of rough country, inaccessible to the spraying teams.

Control operations carried out at the height of the outbreak in March and April again were plagued by the problem of re-infestation from inaccessible breeding areas. Spraying operations ceased in May and the populations of migratory locusts entered a natural decline. Extensive oviposition by female locusts undoubtedly occurred and it is highly probable that a further outbreak in the spring of 1978 will follow from the hatching of overwintering eggs.

Control campaigns against both the Australian plague locust and the migratory locust were organized on a district basis by the relevant plague grasshopper destruction committees and the Queensland Government again provided technical aid and financial assistance.

Fruit fly studies

Officers of Entomology Branch maintained surveillance of north Queensland areas for introduced, exotic fruit fly species as a vital part of the north Queensland quarantine program. The survey covers an area from the far north-west of Queensland (Gulf Country), eastwards to Cairns and north to Cape York. Localities along the east coast as far south as Brisbane (including islands off the coast) also are being surveyed.

The major immediate aim is to ensure early detection of the melon fly (*Dacus cucurbitae*) and the Oriental fruit fly (*Dacus dorsalis*) should they reach Queensland. Both insects are among the most damaging fruit fly species in the world.

The melon fly is established in Papua New Guinea while the Oriental fruit fly is widespread in south-east Asia and also has become established in the Northern Territory. The search for these pests has been very intensive but neither species has yet been recorded in Queensland.

An ecology study of fruit flies is in progress in an area consisting of rain-forest and open eucalypt forest at Cooloola in south-east Queensland. The study was undertaken with the aim of determining the capacity of 'wild host' areas to produce significant fruit fly populations which could invade orchards.

Large populations of pest species of fruit fly were found in the study area, including the Queensland fruit fly (*Dacus tryoni*) and *Dacus neohumeralis*, both of which are serious pests of fruit crops in Queensland. The ecology study provided a substantial amount of the information contained in a recently published book entitled *Economic Fruit Flies of the South Pacific Region*.

The book, which was produced by Entomology Branch in co-operation with the Department of Entomology, University of Queensland, and Division of Entomology, C.S.I.R.O., provides comprehensive and accurate information on the identity, geographic distribution, commercial plant hosts and methods of suppression and eradication of the known fruit fly pests in Australia and associated South Pacific islands. It is sure to be of considerable value to a wide range of research and extension personnel and will be particularly useful to plant quarantine officers engaged in the detection of exotic fruit fly pests.

A study using sophisticated genetic techniques and gel electrophoresis analysis of enzymes was begun during the year to investigate the identity of the strain of Oriental fruit fly (*Dacus dorsalis*) found in the Northern Territory. The techniques, which have been used successfully to clarify phylogenetic relationships of *Drosophila* flies in Hawaii, have been adapted for the study of Dacine fruit flies in Australia. Data have been accumulated which will enable a comparison of the Northern Territory population of *D. dorsalis* with strains from south-east Asia. It will be possible then, to determine the pest potential of the Northern Territory strain.

Grain storage pests

Intensive studies of newer materials with potential as grain protectants have continued under the guidance of a working party comprising representatives from Entomology Branch, C.S.I.R.O., the Australian Wheat Board, insecticide manufacturers and bulk handling authorities.

In a series of silo trials, grain temperatures at Dalby, Queensland, were higher and the residual life of the protectants shorter than at Billimari, New South Wales, and this was reflected in bioassay results.

Fenitrothion plus fenoxystrobin gave complete control of all test insects for the duration of the experiment (25 weeks) at Billimari. At Dalby, control of the highly resistant strain (CSO231) of the rice weevil (*Sitophilus oryzae*) from Western Australia was incomplete after the first 13 weeks.

Pirimiphos-methyl plus carbaryl was ineffective against CSO231 as previously reported, but controlled all other test insects for the duration of the Billimari experiment.

Based upon the trial results, the Working Party recommended that the wheat industry proceed with pilot usage of the insecticide combinations, fenitrothion plus fenoxystrobin and pirimiphos-methyl plus carbaryl together with the combination chlorpyrifos-methyl plus bioresmethrin and also methacryfos which had been tested successfully in earlier silo trials. Application rates for unaerated storages which give higher grain temperatures are higher than for aerated storages.

All four combinations have been applied at each of 23 sites distributed among the mainland States. No visible insect infestation has developed in the treated storages so far and the materials clearly have considerable potential for use in the grain industries.

Seven synthetic pyrethroid insecticides have been evaluated against grain storage pests in detailed laboratory tests. Five of the candidate materials are more potent than the standard bioresmethrin and based on early projections, at least two, fenoxystrobin and fenvalerate, will have cost advantages. Data obtained so far established that the materials have considerable potential against the lesser grain borer (*Rhyzopertha dominica*). Further experiments will be necessary to determine whether the materials will be sufficiently active to control all members of the grain pest complex.

Detailed information was obtained on residue levels and on the efficacy of the treatments against resistant strains of common grain insects during 6 months' storage. Based upon the trial results, a treatment for sorghum of fenitrothion 12 p.p.m. plus carbaryl 10 p.p.m. has been recommended to the State Wheat Board and the Grain Elevators Board of New South Wales. This treatment not only will reduce infestations of the major stored grain pests in sorghum storages but will, at the same time, allow direct cost savings of approximately 33c per tonne of grain.

Other research

Control studies on lucerne aphids

Since the spotted alfalfa aphid (*Therioaphis trifolii* f. *maculata*) and the blue-green aphid (*Acyrtosiphon kondoi*) became established as serious pests of lucerne in Queensland early last year, intensive studies on the feasibility of various methods for their control have been carried out.

Field insecticide trials quickly established that monocrotophos, demeton-S-methyl and dimethoate provide good short-term control of aphid populations. Further trials added pirimicarb to the list of efficacious materials and determined the optimum application rates for all four insecticides.

However, obtaining a good kill of the pest species is not the only consideration in selecting an insecticide. With the aim of pest management through integration of differing but compatible control methods, the effect of pesticides on beneficial species must be taken into account.

The ladybird *Coccinella repanda* has some potential as an important predator of the lucerne aphids so laboratory testing of the toxicity of nine candidate aphicides to the predator was undertaken.

Of the insecticides currently recommended for aphid control, pirimicarb was the least toxic to the ladybird.

Long term control studies have centred on the introduction and use of an aphid parasite, *Trioxys utilis*, and the potential role of aphid-resistant lucerne cultivars.

The first release of the wasp, *Trioxys utilis*, which parasitizes the spotted alfalfa aphid, was carried out last August. Breeding stocks were obtained from C.S.I.R.O. and the progeny reared from these were used in supplementary field releases in September. The parasite has become established over a 4-ha release site at Gatton, but populations have not increased sufficiently to exert significant control on aphid numbers.

Trioxys failed to establish at other sites owing to the collapse of lucerne plants through drought or the collapse of aphid populations as a result of predation by the ladybird, *Coccinella repanda*. However, further material is being reared for additional releases.

Like most wasp parasites *Trioxys utilis* is vulnerable to chemical insecticides, so this problem was investigated in a field trial in the Lockyer Valley. Treatment with 13 different insecticides did not affect emergence of *Trioxys* from mummies, but residues of the insecticides methomyl and acephate proved moderately and highly toxic respectively to *Trioxys* adults after seven days.

Aphid-resistant lucerne cultivars would appear to have considerable potential in a pest management program and, as a first step, attempts were made to locate resistant plants of Hunter River lucerne in the field.

More than 300 000 seedlings of selected Hunter River plants were tested in glasshouse trials for resistance to aphids, but none proved suitable. Consequently, aphid-resistant parental material has been selected from CUF101, a line which was developed in California for resistance to three species of lucerne aphids and a crossing and selection program is in progress.

Cotton plant resistance to Heliothis

Studies on the effect of high levels of gossypol in cotton plants on the development of bollworm (*Heliothis* spp.) larvae continued with laboratory bioassay tests. Five different levels of gossypol acetic acid were added to the artificial rearing diet fed to 2-day old *Heliothis armigera* larvae.

As shown in previous tests, increasing levels of gossypol slowed development and reduced the size of pupae and adults of *H. armigera*. Mortality at the two highest gossypol levels was high. At an analyzed gossypol level of 1.4% only one larva in 20 completed development to reach the adult stage. These effects could exert a profound influence on long-term development of *Heliothis* populations.

Insect disease studies

For some years, Entomology Branch has conducted studies on the effects of pathogenic organisms on insects and their possible role in pest control programs.

A newly formulated, commercial preparation of a nuclear polyhedrosis virus (NPV) named 'Elcar' was tested against infestations of *Heliothis armigera* in grain sorghum in trials at Harrisville in south Queensland and at Biloela in central Queensland.

The Harrisville trial was a fully-replicated, experimental test involving varying rates of application. The Biloela trial, to a certain extent, simulated commercial practice in that a comparatively large experimental area was treated with only one dosage rate of the virus, applied by means of a crop-spraying aircraft.

In both trials infectivity of the virus was high. At Harrisville, the disease incidence in larvae from 'Elcar'-treated plots was always significantly greater than that in unsprayed plots, regardless of application rate. However, the influence of the NPV on the decline of the *Heliothis* population in the Harrisville trial was masked by other mortality agents and could not be determined.

At Biloela, virus-killed cadavers of *Heliothis* larvae were numerous in the 'Elcar'-treated area a week after treatment and uncommon in the unsprayed area. Even at 1 day after treatment, infection was high—a sample of larvae collected on that day registering 84% mortality after 11 days' incubation. At 11 days after treatment, numbers of live larvae recorded from 100 sorghum heads were 12 from the NPV-treated area and 53 from the untreated area. Furthermore, larvae in the treated area were still dying from disease infection 14 days after application of NPV.

Weather conditions and other environmental factors may exert considerable influence on the field performance of insect pathogens and it appears that the conditions existing at the time of the trials were favourable for the spread of infection.

Under a different set of conditions, the results may have been less spectacular. Nevertheless, it is clear that the formulation tested shows considerable promise for controlling *Heliothis* infestations.

Biocontrol of citrus scale pests

Outstanding success in controlling white wax scale (*Aspidiotus perniciosus*) and circular black scale (*Chrysomphalus ficus*) infestations in south Queensland orchards has been achieved in recent years by means of introduced parasites. Biocontrol of red scale (*Aonidiella aurantii*), while less complete than that achieved with white wax and circular black scales, still may be judged a success provided disruptive insecticide sprays are kept to a minimum.

The decline in importance of these three scale pests was accompanied by an increase in pest status for pink wax scale (*Ceroplastes rubens*), which is not attacked by the parasites that control the other scales. To overcome the problem, breeding stocks of another parasite, *Anicetus beneficus*, were imported from Japan, colonized in the insectary at Nambour and the progeny released at sites in south Queensland and one site in north Queensland. The parasite quickly established itself at six release sites in the south.

Subsequently, parasitism levels in pink wax populations reached 30% during spring and then fell to 15.4% in late summer. The introduced species, *Anicetus beneficus*, accounted for more than half of this parasitism, the remainder having been due to indigenous parasites. Pink wax populations in some areas of an experimental integrated control block at Palmwoods have started to decline as a result of parasite releases.

At a release site in a pepperina tree at Gayndah, the parasitism level reached 70% in late summer and the pink wax population was reduced by about 90%.

Progress to date must be considered encouraging and additional stocks of the *Anicetus* parasite have been forwarded to Mareeba for further releases in north Queensland.

Pineapple scale disinfestation studies

In recent years, the pineapple scale (*Diaspis bromeliae*) has become re-established as a significant pest in a number of pineapple-growing localities in south Queensland. An important aspect of the problem is the scale's dispersal on infested planting material, thereby extending the area of infestation.

Dipping in 0.05% diazinon plus 1 in 100 white oil will remove the scale from planting material, but sometimes scales in protected sites on the plant are able to survive this treatment. It was decided, therefore, to investigate the possibility of disinfecting pineapple planting material by means of gaseous fumigation.

Pineapple suckers infested with the scale were fumigated for 2 hours at 20°C with methyl bromide at doses of 24, 32, 40 and 48 g/m³ and ethylene dibromide (EDB) at 32 g/m³. Only the higher doses of methyl bromide eliminated the scale and all dosage rates of this chemical damaged heavily-infested suckers. 'Scale-free' crowns, however, were not damaged by the fumigant.

EDB provided effective disinfestation and caused no harm to the planting material. In a later trial, a dosage rate of 40 g/m³ methyl bromide successfully eliminated *D. bromeliae* infestations and produced no phytotoxic reaction in suckers, slips or crowns.

Services

Insect identification service

One of the responsibilities of Entomology Branch is the operation of an insect identification service to provide determinations for Departmental officers, primary producers, householders, quarantine authorities and workers of other institutions. During the past year, more than 1 500 insect determinations were provided through the examination of numerous insect specimens.

A continuing specialist insect identification service provided by the Branch involves the determination of the identity of specimens of Dacine fruit flies for various institutions distributed throughout Australia and the South Pacific Region.

Cotton pest monitoring

Cotton pest activity monitoring is a continuing service maintained by Entomology Branch with the aim of providing cotton growers in central Queensland with details of activity by the major cotton pests so that they can plan appropriate control strategies. Primary interest centres on the incidence and activity of the two bollworm species (*Heliothis armigera* and *Heliothis punctigera*) which are 'key' pests in the cotton insect complex.

Compared with previous seasons, activity during the recent summer was moderate, although large numbers of *Heliothis* moths were taken on occasions in light traps at Biloela and Theodore. As in previous years, *H. punctigera* was the dominant species early in the season, but this year its activity extended into the mid season period as well. *Heliothis armigera* did not become predominant until February and even then populations were comparatively slight.

Although larvae of the pink spotted bollworm (*Pectinophora scutigera*) caused considerable damage to bolls of early crops at Biloela, few moths were attracted to the light traps. This experience confirms earlier conclusions that the light trap is an unsatisfactory method of monitoring activity of this species.

In other respects, however, growers have found the service invaluable in assisting them to plan control programs.

Plant Pathology Branch

THE objectives and functions of Plant Pathology are—

- To develop and incorporate into field practice more effective and economical methods of reducing losses caused by fungi, bacteria, nematodes and viruses in pastures and in crops other than sugar-cane.
- To maintain a record of all plant diseases found in Queensland other than those in sugar-cane, with reference specimens stored in a herbarium and to maintain a collection of plant pathogens particularly fungi and nematodes; and
- To develop more effective strains of *rhizobia* for legumes, particularly tropical pasture legumes, and to improve their field performance.

Research

Field crops

BARLEY. In a trial on the Darling Downs, treatment of barley seed (cv. Lara) with carboxin, fenfuran or the experimental compound KWG-0519 reduced the percentage of tillers affected with loose smut (*Ustilago nuda*) from 12 to less than 3.

In another trial, seed treatment with KWG-0519 gave good control of powdery mildew (*Erysiphe graminis*) for 6 weeks after planting and increased grain yield by 18%.

MAIZE. Thirty-four hybrids were rated for resistance to leaf blight (*Drechslera maydis* and *D. zeicola*) on the Atherton Tableland. A N.S.W. hybrid, GH5004, was ranked first in blight resistance being slightly more resistant than hybrids QK413, KTW473, KTW442 and QK231.

Head smut (*Sphacelotheca reiliana*) on the Atherton Tableland continues to spread. In a crop survey, the disease was recorded in QK487, the standard smut resistant cultivar. The incidence was usually less than 1% but, in small restricted areas of some paddocks, up to 90% of the plants were affected. These affected areas were along headlands and around gateways where there was soil compaction and the soil moisture level at planting had been very low.

Foliar and tassel symptoms characteristic of crazy top downy mildew (*Sclerophthora macrospora*) were observed for the first time in Queensland, 15 to 20% of plants in a hybrid seed crossing block near Dalby being affected. Plants were stunted and had unusually striped leaves and distorted tassels. Inoculum from adjacent native grasses known to be hosts of the fungus may have been introduced while the crop was being flood irrigated at establishment.

NAVY BEAN. At Kingaroy, the effect of common blight (*Xanthomonas phaseoli*) on the yield of navy bean is being investigated to determine the importance of planting disease-free seed. The disease has spread through the inoculated plots causing leaf drop and yield data are awaited with interest.

Rhizobium strains have been selected from glasshouse tests and their effects on yield of navy bean are being assessed in field trials at Inglewood.

PEANUT. A survey of 13 peanut crops on the Atherton Tableland indicated that strains of the leaf spot fungus (*Cercosporidium personatum*) resistant to benomyl are still common, although little benomyl has been used in the last three seasons. In the South Burnett, collections from a large number of randomly selected crops all yielded some resistant isolates.

In a fungicide screening trial in the South Burnett, an experimental premixed fungicide containing a benzimidazole and maneb gave better control of leaf spot than chlorothalonil or fentin which are now recommended.

A survey indicated that the root-lesion nematode *Pratylenchus brachyurus* was prevalent in most crops on the Atherton Tableland except those planted in recently cleared land. The root-knot nematode *Meloidogyne hapla* was confined to the Tolga-Walkamin area.

POTATO. On the Atherton Tableland, preplant soil treatment with EDB or fenamiphos controlled the root-knot nematode *Meloidogyne javanica* and increased the yield of marketable tubers by more than 80%.

Potato leafroll virus was prevalent in the Lockyer Valley particularly in many late autumn crops. Aphid transmission tests on tuber samples from eight certified seed sources supplying seed for the 1977 spring crop revealed no leaf-roll infection. The rapid rate of leafroll build-up in the spring crop was almost certainly due to the planting of many crops before harvesting the heavily infected late autumn crops and subsequent spread by the vector aphid *Myzus persicae*. Transmission tests on some badly leafrolled crops in the Esk area suggested plant nutrition rather than virus infection as the cause of the symptom.

The incidence of purple top wilt disease was low and the confusing disease symptoms of the previous year were less evident. No single pathogen could be related to diseased plants and it is probable that the disease symptoms can be induced by several factors affecting movement of nutrients in potato plants.

SAFFLOWER. The search for a seed treatment to eliminate seed-borne inoculum of leaf blight continued. The fumigant propylene oxide gave slightly better control than soaking in mancozeb, the most promising treatment in earlier tests, but did not eradicate the causal fungus *Alternaria carthami*.

A plant pathologist inoculates sorghum plants with sugarcane mosaic virus to determine its effect on yield.



SORGHUM. The major part of co-operative project with Agriculture Branch was completed with the release to the seed industry in September 1977 of 12 parental lines resistant to sugarcane mosaic virus. The eight KS19 lines should make an important contribution to cultivar breeding as they are also resistant to rust (*Puccinia purpurea*), leaf blight (*Drechslera turcica*) and grey leaf spot (*Cercospora sorghi*).

The incidence of root and stalk rot (*Fusarium moniliforme*) has exceeded 75% in some cultivars including Tropic and F64a. Severe grain pinching was associated with the disease.

Symptoms of the disease known as 'crazy top' were common at Biloela and on the Darling Downs. Microscopic observations of oospores in affected tissue confirmed the presence of the downy mildew fungus (*Sclerophthora macrospora*) in sorghum in Queensland for the first time.

A comprehensive list of grain sorghum cultivars, which will be available for the 1978-79 season, with their reactions to sugarcane mosaic virus, head smut (*Sphacelotheca reiliana*), rust (*Puccinia purpurea*) and leaf blight (*Drechslera turcica*) was prepared for publication in the *Graingrower* and *Queensland Agricultural Journal*.

SUNFLOWER. In glasshouse experiments *Puccinia xanthii*, the fungus causing Noogoora burr rust, readily produced rust spots on sunflower seedlings but not on adult plants. This confirmed previous field observations and indicates that this disease is unlikely to become a problem on the sunflower cultivars now available.

TOBACCO. The fungicide Ridomil* applied fortnightly as a spray to tobacco plants in seedbeds or in the field gave complete protection from blue mould and will now be recommended. Ridomil also gave promising results as a soil drench but this aspect of its use requires further investigation.

Studies under controlled environmental conditions showed that temperature affected the severity of black shank (*Phytophthora nicotianae* var. *nicotianae*), the disease being more severe on the cultivars 26T68, Sirone and Hicks Q46 at day/night temperatures of 28°C/19°C than at 24°C/17°C or 20°C/15°C. These results may explain the decrease in importance of the disease with the change to earlier planting in north Queensland.

WHEAT. Information on the relative susceptibility of cultivars to crown rot (*Gibberella zeae*) was obtained from three trials. The cultivars Cook, Shortim, Timgalen and the line 2200-20 performed as well as Gala, the standard resistant cultivar. Gatcher, Oxley and QT4081 were moderately susceptible, while Durate, a Durum wheat, was very susceptible.

In the course of studies on the inheritance of resistance to crown rot one line from the cross Gala x Gluyas Early was more resistant than either parent. If this high level of resistance is verified in further tests, the line would be a very useful parent in breeding programs should this become necessary for crown rot control.

The difficulty of detecting low populations of the fungus responsible for common root rot in soil has been overcome by the development of a selective medium on which colonies of *Cochliobolus sativus* are readily counted.

In a field experiment seed treatment with KWG0519, an experimental compound, gave very good control of flag smut (*Urocystis agropyri*) from both seed-borne and soil-borne inoculum.

Pastures

Glycine spp. Three different viruses have been isolated from native *Glycine* species and their host ranges and insect vectors are being investigated. In particular, their importance on other commercial tropical pasture legumes and legume grain crops needs to be established.

LUCERNE. Hunter River lines resistant to both root rot (*Phytophthora megasperma*) and crown rot (*Colletotrichum trifolii*) produced in co-operation with the Division of Tropical Crops and Pastures, C.S.I.R.O., are now undergoing final testing. The advent of the aphid problems in lucerne will delay any commercial release as aphid resistance has now to be combined with disease resistance.

STYLOSANTHES. Anthracnose continues as a major problem in seed producing areas of north Queensland. Additional collections of the causal fungus *Colletotrichum gloeosporioides* from diseased *Stylosanthes* spp. have been made with a view to further searches for resistance.

* Registered trade name.



A new fungicide has given very good control of blue mould of tobacco in field trials.

Fruits

AVOCADO. Sunblotch is an important virus disease of avocado in the U.S.A. and South Africa. To provide Queensland nurserymen with sunblotch-free propagating material, a project with Horticulture Branch on sunblotch indexing to locate high yielding sunblotch-free seed source trees for the production of rootstocks was commenced.

These rootstocks will be used for the propagation of indexed budwood from California which is now held in a screenhouse at Indooroopilly and also for the propagation of the indexed seed source trees.

BANANA. In a field trial in north Queensland, the spray adjuvants NuFilm and Vaporguard proved ineffective substitutes for miscible oil in the leaf spot (*Mycosphaerella musicola*) and speckle (*Mycosphaerella musae*) control schedule. Chlorothalonil plus miscible oil caused severe phytotoxicity. The diseases were subsequently controlled with mancozeb with up to 2.5 times the recommended amount of miscible oil. No phytotoxicity was caused by these high rates of oil.

Attempts are being made by electron microscopy to locate virus particles in the phloem of stools affected with bunchy top. Isolation of virus from affected plants and vector aphids has so far been unsuccessful.

CITRUS. Virus indexing of the cultivars Valencia, Improved Lisbon, Washington Navel, Glen Retreat, Joppa and Ellendale continued. Budwood produced in a screenhouse at Indooroopilly has been worked on rootstocks in a Horticulture Branch nursery at Gayndah as the first step in the production of trees for the Citrus Budwood Scheme.

APPLE. In a collar rot control trial there was an increase in the number of resting bodies (sclerotia) of the causal fungus *Sclerotium rolfsii* in soil treated with sorghum compost and in soil drenched with captafol. The number of sclerotia in the soil and the number of trees which died as a result of collar rot following drenching of the soil with quitozene at planting and in September and January each subsequent year decreased.

Ascospores of the fungus *Venturia inaequalis* from fallen apple leaves are responsible for primary scab infections each season. In a field trial ammonium sulphate and paraquat ground drenches applied 6 weeks before green tip stopped the release of ascospores. Terbacil-diuron and urea drenches were less satisfactory as they only delayed the release of ascospores.

GRAPE. In a field trial, aliphos was as effective as mancozeb or copper oxychloride in controlling downy mildew (*Plasmopara viticola*).

In a grey mould (*Botrytis cinerea*) control trial, Rovral* and vinchlozoline were as effective as benomyl which is now widely used. In the benomyl treatments, there was a trend for improved control where blossom sprays had been applied in addition to two preharvest sprays.

PASSION FRUIT. In the last 5 years, woodiness in hybrid passion fruit has become a serious commercial problem particularly in the Redlands District. Two strains of passion fruit woodiness virus (PWV) have been found occurring together in severely affected vines from three different areas. One strain appears very similar to the strain isolated from mildly affected passion fruit.

PINEAPPLE. Root rot and heart rot caused by the fungus *Phytophthora cinnamomi* continues to be a major problem. In a field trial at Beerwah, the addition of dolomite increased heart rot. There was no increase when sulphur was added with the dolomite.

Sulphur is now recommended on soils very prone to produce crops affected by root rot. An initial drop in pH to 3.8 is necessary to guarantee root rot control.

Two new fungicides have given promising control of root rot and work is continuing.

STRAWBERRY. Crimp, a disease caused by the bud nematode *Aphelenchoides besseyi*, was a serious problem on one of the farms producing 'approved' runners. Fenamiphos has now been registered for treatment of affected plants.

Vegetables

FRENCH BEAN. Field blight, caused by the fungus *Sclerotinia sclerotiorum*, is a major problem in the Burdekin. This fungus produces resting bodies (sclerotia) which germinate in the soil to produce a fruiting body (apothecium). Spores from the apothecium germinate and infect the host plant. In glasshouse tests to study the behaviour of the fungus under north Queensland conditions, no evidence was found to indicate that germinating sclerotia directly infect beans. Most of the sclerotes which produced apothecia were less than 25 mm deep.

CAPSICUM. Bacterial spot (*Xanthomonas vesicatoria*) is a common disease of capsicum in wet seasons and is not easily controlled. At Redlands Horticultural Research Station, copper oxychloride, the standard treatment, gave better control than copper oxychloride plus chlorothalonil, cupric hydroxide, and cupric hydroxide plus mancozeb.

*Registered trade name.

CRUCIFERS. Ring spot (*Mycosphaerella brassicicola*) is a serious disease of crucifers in the Granite Belt. In a field trial, fortnightly sprays with captan, chlorothalonil or mancozeb reduced ring spot of Brussels sprouts. Copper hydroxide and cuprous oxide were phytotoxic.

CUCURBITS. Watermelon mosaic virus (WMV) is a serious problem in cucurbits producing, apart from leaf mottling, lumpy fruit in pumpkin and marrow and poor fruit set in watermelons. There are two strains of the virus—WMV-1 and WMV-2. A survey showed that WMV-1 predominates in north Queensland whereas both strains are common in south Queensland. WMV-1 is solely responsible for epidemics in watermelons. About 400 lines introduced from various sources are being tested for tolerance or resistance to the disease.

Fenamiphos, Ditrax* and EDB controlled root-knot nematodes (*Meloidogyne* sp.) and increased the yield of watermelon cv. Warpaint in a field trial at Kamerunga. Yield increases were greatest in plots treated with Ditrax, which also gave good weed control.

GINGER. *Fusarium* rhizome rot (*Fusarium oxysporum* f. sp. *zingiberi*) was the major disease problem.

A benomyl dip of 250 mg per litre (current recommendation) was as effective as dips of 500 and 1000 mg per litre for protecting seedpieces from rot. Lower concentrations of benomyl or 0.35% sodium hypochlorite were less effective. A delay of up to 8 hours between inoculation of seedpieces and dipping in benomyl at 1000 mg per litre did not reduce the level of control.

In a field trial at Imbil, six foliage sprays of oxamyl at 2 kg per ha gave control of the root-knot nematode *Meloidogyne javanica* equivalent to two soil treatments with fenamiphos granules at 10 kg per ha.

TOMATO. Bacterial wilt (*Pseudomonas solanacearum*) remains a major problem of summer-grown crops along the coast. The testing of progeny of crosses of the cvs. College Challenger, Tropic, Indian River, Walter and Grosse Lisse

with the resistant line VC9-1 continued. Various grafting techniques using commercial cultivars on resistant rootstocks were tested by growers.

New diseases

Records of particular interest were crazy top downy mildew of sorghum breeding lines (*Sclerospora macrospora*), foot rot of rice (*Gaeumannomyces graminis* var. *graminis*) and leaf spot of peanut (*Leptosphaerulina arachidicola*).

Extension services

The major extension activity has been the preparation of a Plant Disease Handbook containing colour illustrations of important plant diseases occurring in Queensland with notes on causal agents, sources of infection, method of spread, and control. It should be available for distribution by the end of 1978.

Diagnostic services

More than 3500 enquiries requiring disease diagnosis were handled through Indooroopilly and the seven country field stations. The majority of these were caused by fungi.

The specialist bacteriologist handled 130 accessions, many of which required detailed laboratory checking. The specialist nematologists processed 800 plant and soil samples. In the virology section more than 500 specimens were examined with the electron microscope and 240 were indexed in the glass-house.

Legume bacteriology

During the year, 68 rhizobial cultures were supplied to agronomists and farmers for 14 different legumes for which there are no commercial cultures. The quality of commercial legume inoculants sampled from retail outlets continues to be good.

Botany Branch

THE main objectives of Botany Branch are to acquire and store knowledge on the plants and plant communities of Queensland and to provide a service to other branches of the Department of Primary Industries, universities, other State and Commonwealth organizations and the general public by identifying plants and providing information on their properties.

Officers of the Branch operate in three interacting groups. A Taxonomy Group deals with questions concerning individual species growing in Queensland; an Ecology group studies plant communities in the State; and a Supporting Services group provides assistance to other groups and maintains the Queensland Herbarium.

Research

Taxonomy

Much applied botanical research, including work in the fields of range management, agrostology, ecology, phytochemistry and geobotany depends initially on correct identification of plants and ultimately on competent taxonomic research. Major objectives of the taxonomy group are the correct naming and description of all native and naturalized vascular plants in Queensland.

During the winters of 1975, 1976 and 1977, wild-oat plants were grown under glasshouse conditions as part of a joint project with the Queensland Wheat Research Institute.

Preliminary results have shown no consistent relationship between taxonomic groupings and dormancy status, an important agricultural characteristic affecting long-term control.

The manuscript of a 'Checklist of Australian Grasses' is nearing completion and should be published in the next financial year. The list is to be issued as a Botany Branch Technical Bulletin. A companion paper dealing with distribution of grasses in Australia is being prepared for publication. A chapter on Biogeography of Australian grasses written with Dr H. T. Clifford, University of Queensland, for a book on ecological biogeography of Australia, was completed.

A draft key to the species of *Aristida* in Australia was completed as a preliminary to revision of the genus in Australia. This key was distributed for testing and comment by selected workers on grasses throughout Australia.

Investigations into the role of fodder sorghums in the development of 'shattering off-types' in grain sorghums continued. An article on the subject has been prepared for publication and a radio-talk recorded.

Cytotaxonomic work on several genera of Liliaceae continued. Work progressed steadily on revision of *Dianella* in Australia with most work concentrated on cytological aspects. Much material was collected from plants in the field and chromosome-number determinations carried out in the laboratory. Species of *Stypandra*, *Thysanotus* and *Tricoryne* were studied. Chromosome counts were obtained from material collected during field work associated with other projects.

The cytological study of *Stypandra* is a preliminary to a revision of the genus. No significant progress was made in *Cordyline* studies during the year.

The final proofs of a revision of *Acacia* in Queensland, consisting of an introduction, key to 235 species and descriptions of 140 species, have been sent to the Government Printer for publication. The second part will be published next financial year. Studies of other legume genera *Tephrosia* and *Atylosia* continued.

Considerable progress was made towards a revision of Sapindaceae in Australia. The family contains a number of important rain-forest species and is considered to be taxonomically 'difficult'. Accounts of 12 genera, containing 127 species, have been completed. Nine of the species were previously undescribed and two are recorded for Australia for the first time.

Other groups of plants studied included the family Convolvulaceae, *Helichrysum* section *Chrysocephalum*, *Leucopogon*, *Homoranthus*, *Eremophila*, *Comesperma*, and the fern genus *Elaphoglossum*.

The compilation of a flora of south-eastern Queensland has progressed well. The text for the first of three volumes is almost complete, and about a quarter of the other volumes has been drafted. Arrangements for publication of the handbook to the Ferns of Queensland are in hand.

*Registered trade name.



Spinifex hirsutus (beach spinifex) open-grassland established where *Casuarina equisetifolia* var. *incana* (coastal sheoak) trees were previously growing Nine Mile Beach, central Queensland. (Livingstone Shire coastal vegetation investigation 1977.)

Ecology

Two botanists were engaged on the Western Arid Region Land Use Study being co-ordinated by the Development Planning Branch. The Study aims at producing an inventory of the natural resources and land use practices of south-western Queensland. Work on Parts 2 and 4 of the Study area were virtually completed. A draft map of the landsystems of Part 3 which takes in the area between Part 1 and the Maranoa-Balonne area, maps of which have already been published, was checked in the field. A vegetation map of the area will also be published.

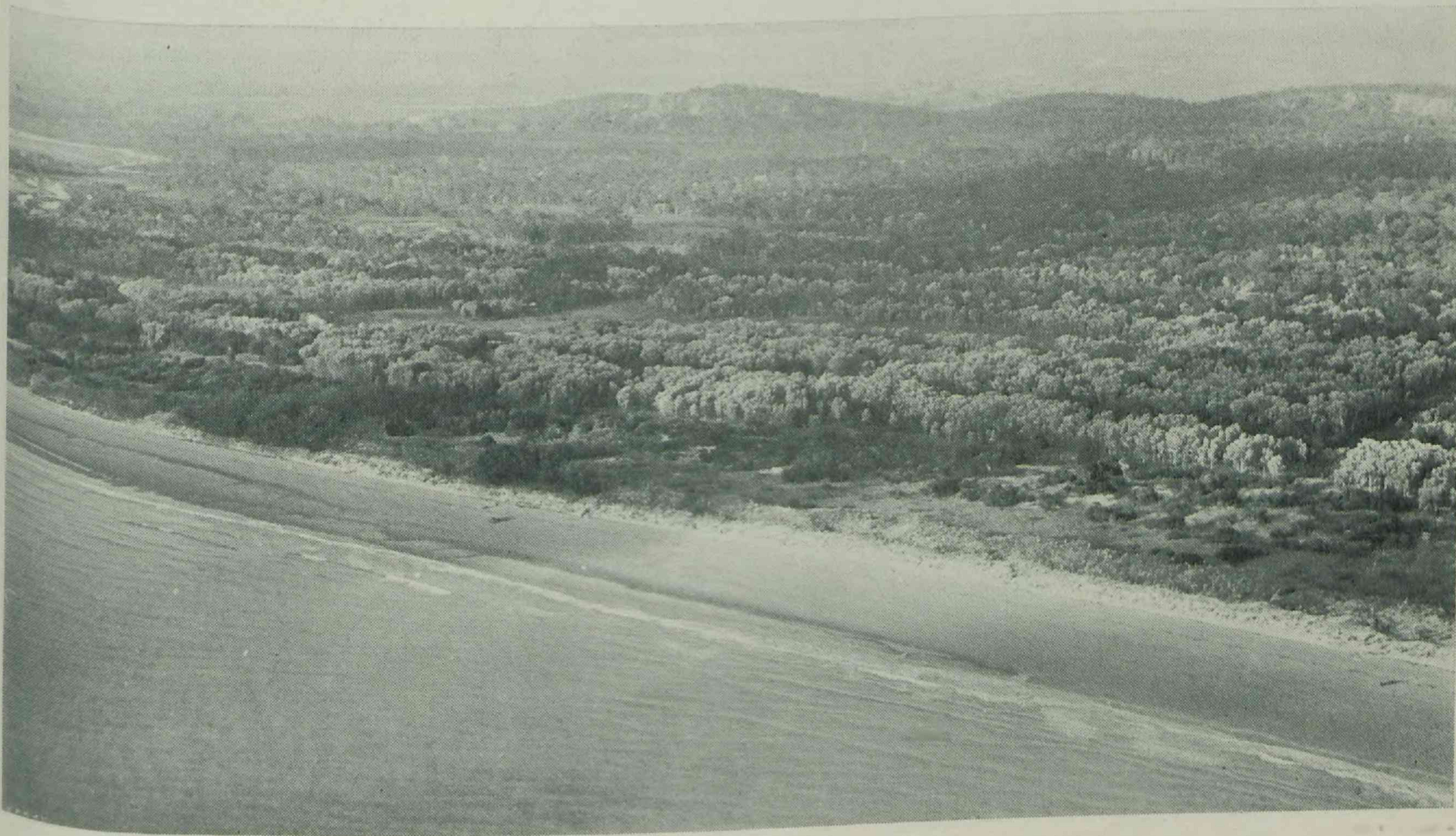
Field work in Part 5 (Longreach-Winton-Muttaburra area) continued during the year, and specimens collected in the area were identified. A reconnaissance survey of Part 6, which is a large area in the extreme western part of the State (including the centres of Boulia and Birdsville), was made during the year. Another three trips to the area are planned for next year.

Mapping and description of mangrove communities of Queensland continued. This project is being carried out in association with the Queensland Fisheries Service which is carrying out a project entitled 'Biological Resources Survey (Estuarine Inventory)'.

Three 1:25 000 scale maps of the coast between Round Hill Head and Tannum Sands were published. The explanatory notes are being printed. Field work for the area Round Hill Head to Theodolite Creek (south of Bundaberg) has been completed and the aerial photographs have been sent to the draughtsmen for map preparation. Some field work has been carried out south to Tin Can Bay.

A series of maps of the mangroves of Moreton Bay is being prepared. Some maps have been printed, and the remainder, with explanatory notes are being printed. A map and report of the mangroves of 'The Narrows' were forwarded to the Director, Queensland Fisheries Service.

Tea-tree open-forest established on parallel beach ridges between Cattle Point and Keppel Sands, central Queensland. The white parallel bands are *Melaleuca dealbata* (tea-tree). Livingstone Shire beach erosion investigation 1977. (Beach Protection Authority picture.)



Botany Branch is preparing surveys of coastal dune vegetation for the Beach Protection Authority for inclusion in their Beach Erosion Investigation Reports. Maps of dune systems and associated vegetation are prepared, together with a map explaining the map units defined. Following work in the field, a draft report for the area between Cattle Point and Sandy Point (Livingstone Shire) has been prepared, and marked-up photos of the area have been sent to the Beach Protection Authority so that maps can be drawn. The report on the Nine Mile Beach of the Shire is being finalized.

Special projects

Three projects are funded largely through Commonwealth Government grants. They are the Herbarium Data Storage Project (HERBRECS) supported by the Australian Biological Resources Survey, the Inventory of Plant and Plant Communities Project funded under the National Estate Program, and the Vegetation Mapping of Southern Queensland funded by grants from the Australian Biological Resources Survey.

HERBRECS involves the establishment of a computerized data bank based on information on labels of specimens incorporated in the herbarium. About 55 000 records were entered for the year bringing the total to 230 000, approximately 75% of the specimens incorporated in the herbarium. Because of the high cost of retrieval from the master file, only one retrieval was undertaken. Other requests were postponed until the master file was transferred to disc storage. This was accomplished in April 1977, but costs of retrieval have not yet been assessed.

The Inventory of Plant and Plant Communities project will result in the preparation of vegetation maps of south-eastern Queensland with accompanying descriptions of the plant communities. The explanatory booklet to accompany the Brisbane map sheet (1:100 000) has been published, as have the map and text of the Beenleigh sheet. Draft maps of the Murwillumbah and Caloundra sheets have been prepared and work on the explanatory booklets is well advanced.

Production of 1:100 000 maps will be discontinued, but mapping will continue at 1:250 000 with the Gympie, Ipswich and Warwick Topographic Sheets as base maps. A reconnaissance field trip was carried out for mapping the Warwick Sheet.

The objective of the Vegetation Mapping of Southern Queensland is the production of a vegetation map of the area from the southern border of the State north to latitude 25°S, to be published at the scale of 1:1 000 000. Data from mapping in south-eastern Queensland will eventually be used and the maps are to be compatible with existing maps produced in Western Australia and New South Wales. Field work for the area west of longitude 144°E has been completed and a map is being prepared. Agreement has been reached with New South Wales to ensure uniformity of standards between the two States.

Service and extension

The two major service functions of the Branch are the plant identification and advisory service maintained by the Taxonomy group and the preparation and examination of Environmental Impact Statements by the Ecology Group.

Approximately 17 000 specimens were identified. This is a considerable increase on the previous year, due to large collections associated with Departmental projects, redetermination of specimens already in the herbarium and identification of old specimens awaiting incorporation.

Identifications of *Cannabis sativa* continued at a high level. Eight hundred and seventy-nine identifications were made for the Police Department by three officers. This is slightly more than in the previous year (844) and required approximately 55 days of laboratory time. These officers attended court on 51 occasions (as against 97 in the previous year). Many of attendances were before the registration of two officers as State Botanists. In the last 6 months, officers attended court on only 10 occasions under the Health Act. Registration has meant a great saving in time expended in connection with *Cannabis*.

Microscopic examination and identification of roots which blocked sewerage pipes were undertaken on six occasions. Most enquirers with this problem are advised that identification

of offending plants and their removal is only a short-term solution. Repairs to damaged pipes give the best long-term solution.

Nine rumen samples from post-mortem of stock, submitted by the Animal Research Institute, Yeerongpilly, were examined for recognizable plant fragments which may have indicated a possible cause of death. With the co-operation of A.R.I., considerable time has been saved by examining only samples considered definitely associated with toxic plants.

The Ecology group continued to act as an advisory body to the State Government, examining Environmental Impact Statements, providing critical comment on their botanical content, and preparing botanical sections for other Government bodies.

A preliminary statement of impact was prepared for the Main Roads Department for the proposed bridge to North Stradbroke Island. Evidence was given in the Local Government Court on the Marina Gardens canal proposal at Bli Bli. Environmental Impact Study guidelines were prepared for a proposed conifer plantation project in the Ingham-Cardwell area and advice given on the preparation of an impact statement for a proposed canal development in the Maroochy Shire and an open cut mine at Collinsville.

Environmental Study Advice comments only were provided for nine projects involving electrical transmission lines and associated works, and two canal developments.

During the year, the last issue of 'Contributions from the Queensland Herbarium' was published. This was replaced by a new series 'Austrobaileya', the first number of which was published. The second number is in press.

Two more articles of the series on wildflowers of south-eastern Queensland were published in the *Queensland Agricultural Journal*. Three more have been submitted to the editor and five are in draft form. The first articles in the series were published separately as *Wildflowers of South-eastern Queensland* Volume 1. The first of a series of articles on aquatic plants of Queensland was submitted to the *Queensland Agricultural Journal*, and three more are being prepared. Publication of the book 'Weeds of Queensland' has been delayed but manuscript and illustrations are now in press.

Queensland herbarium

Lack of herbarium storage space for the incorporation of the backlog of prepared specimens is now becoming acute and only specimens collected in Queensland are being incorporated. Re-organization of specimens in the herbarium is continuing and additional space is now being allocated for Australian material at the expense of current exotic holdings.

Eight thousand specimens were incorporated during the year. About 4 500 specimens were received under exchange agreements with overseas and interstate herbaria. About 9 000 specimens were processed in inward and outward loans and the backlog of requests for loans was cleared.

The annual methyl bromide fumigation does not kill all insects in the building and it has been necessary to introduce systematic freezing of stored material followed, in some cases, by the addition of naphthalene.

The number of visiting botanists using the facilities of the herbarium and library declined slightly to 65 for the year.

Miscellaneous

The Director participated on a working committee organised by the Commonwealth Department of Health to draw up a new Commonwealth List of Prohibited Plants under Quarantine Proclamation 60P. He assisted in the preparation of material for 'Guidelines for Testing Herbicides' co-ordinated by the Commonwealth Department of Primary Industry.

Following a meeting of the heads of Australian Herbaria in Adelaide, the Director co-ordinated a vegetation mapping subcommittee of the Committee of Heads of Australian Herbaria to present views of Australian Herbaria towards the current Australian Biological Resources Study vegetation mapping project. He participated in another subcommittee set up to lay down guidelines for the production of a 'Series of Taxonomic Revisions' aimed at the production of a new 'Flora of Australia'.

Three officers of the Branch spent 3 weeks in the Mackay-Bowen area collecting herbarium material of the flora. Though the material has not been fully identified, it is known that more than 30 specimens are new records of the particular species from the South Kennedy district.

Division of Dairying

THE major activities of the Division of Dairying during the year were designed to assist the dairying industry to cope with adverse seasonal conditions and to adjust to continuing economic pressures arising from difficulties in the disposal of products on export markets.

The activities of the three Branches which form the Division are related to the following objectives—

1. To provide advisory services to producers in those farming practices related to dairy cattle feeding, breeding and management based on producers' perceived needs and officers' assessments.
2. To provide advisory services to processors in the manufacture, packaging, storage, distribution and quality control of dairy products.
3. To undertake research into problems which emerge from activities associated with dairy farming and dairy product processing.
4. To implement the terms of the *Dairy Produce Act* 1920-1974 and the *Margarine Act* 1958-1975.

Total butter production dropped by 36% over the last 12 months from 7 555 tonnes in 1976-77 to 4 800 tonnes during 1977-78. While there was no shortage of standard grade butter, it was necessary to introduce quotas for certain specialized, unsalted and cultured lines. A total of 8 410 tonnes of butter was imported from Victoria to supplement supplies for the domestic market.

Cheese production decreased by 9% from 10 838 tonnes to 9 872 tonnes, casein production fell from 1 065 tonnes to 938 tonnes, and milk powders decreased by 33% from 15 920 tonnes to 10 720 tonnes.

The quantities of milk utilized for the market milk trade continued to increase in line with population trends. The total volume consumed in a variety of forms increased from 246m litres to 252m litres, a 2.2% increase.

Coincident with the decline in the volume of dairy products processed, there was a decline in the number of registered dairy farms. Total farms decreased by 9% from 4 293 to 3 897, with the greatest drop-out occurring among cream producers. It is expected that this group will continue to decline in future years because of difficulties in providing economic transport between farms and factories.

Divisional staff were directly concerned during the year with the promulgation of special legislation for the dairying industry. In 1977, a new Milk Supply Act was formulated, and a Queensland Milk Board established to replace the Brisbane Milk Board which had operated since 1938.

The functions of the new Board are related to orderly marketing of market milk throughout the whole State. A special Milk Entitlements Committee was also appointed under this legislation to control the transfer of milk entitlements among processors and producers, and to effect a more equitable distribution of returns from market milk sales. The Dairy Produce Act 1920 to 1974 was consolidated and up-dated in a new Act to take effect in 1978-79.

Activities of dairy product research being demonstrated to high school students during a conducted tour of the Dairy Research Laboratory, Hamilton.



Close co-operation was maintained with the Lands Administration Commission in the administration of the Rural Adjustment Scheme for both dairy farmers and processing plants; with the Commonwealth Department of Primary Industry in the implementation of the Australian Code of Practice for Dairy Factories; and with the Australian Assistance Development Bureau in the provision of training programs for overseas personnel.

The major achievements which were attained during the year occurred in the following areas:

Dairy product quality

TOTAL BACTERIA COUNT. At the instigation of the Division, the industry replaced the Thermoturc Bacteria Count Test with the Total Bacteria Count Test in July 1977. All processing plants undertook regular testing of farm milk supplies with the standard procedure and adopted a quality standard of 50 000 organisms per millilitre. In general terms approximately 85% of all farm consignments satisfied this standard. Penalties were applied in varying degrees to milk which failed to attain the standard.

MASTITIS DETECTION AND CONTROL. The milk analysis program initiated in 1972 continued, using monthly samples of herd milk from approximately 2 900 producers. This was the first full year in which results were recorded as cell counts. Mean monthly counts varied from 477 000 to 664 000 with an annual mean of 583 000 cells per ml. This indicates there is room for considerable improvement in the quality of milk.

The results of an attitude and knowledge survey revealed that, between 1972 and 1976, there was an increased usage of running water for udder washing, teat dipping and dry cow therapy. Increasing interest has been shown by producers in individual cow cell counts, and pilot studies in several herds have been initiated.

RESIDUES IN DAIRY PRODUCTS. The incidence of residues of pesticides in butter and cheese products has continued to decline. The regular monitoring by Commonwealth and State authorities has identified problem districts and specific chemical residues, and industry has implemented remedial action. Apart from a low level of dieldrin residues (1.5%) and lindane (0.2%), there were no instances of above maximum residue limits for other chlorinated hydrocarbons and organophosphates.

Special attention was given during the year to the determination of iodine contamination in milk. This program was undertaken in response to charges of misuse of iodophor compounds by producers and processors. Similar analyses were undertaken by regulatory authorities in other States.

During 1977-78 it was found 77% of all samples satisfied the recommended maximum residue level of 500 ug/litre. A majority of processors installed special equipment to perform platform tests on individual farm supplies. It is expected that penalties will be applied during 1978-79 on consignments which fail to satisfy the standard.

QUALITY MONITORING PROGRAM. The Dairy Research Branch continued the extensive bacteriological and chemical analytical program. A total of 131 460 tests was performed on 69 766 samples of a range of dairy products either manufactured in Queensland for local consumption, or imported from interstate and consumed in Queensland. In addition, 373 samples were analysed and 108 N.A.T.A. certificates issued, for dairy produce being exported to various countries, or required for special purposes.

Testing procedures are being continually evaluated and updated, not only to meet the demands of the market place but also to ensure that the methods adopted are accurate, and reliable. An atomic absorption spectrophotometer is now being used to develop a quick, accurate method for the analysis of copper in butter. The presence of this metal results in flavour defects.

Dairy product research

Technological studies funded from the Dairying Research Committee relating to the manufacture of eye-type cheese using basically cheddar cheese-making equipment were continued. While it was possible to produce acceptable products of both regular and irregular eye cheese, difficulty was experienced in ensuring uniformity of quality. Causal factors are being investigated.

Successful pilot scale manufacture of cheese which was subjected to accelerated ripening was completed during the year. By the addition of an enzyme extract (B-galactosidase) to milk before cheese manufacture, flavour development which normally occurred at 6 months was achieved in 3 months. Commercial trials will be commenced during 1978-79.

Work commenced during the previous year to establish the incidence of mastitis pathogens in farm milk supplies relative to the total bacteria count, using somatic cell counting. The results, covering 34 farm milk supplies, indicated that in most cases, counts of the major mastitis pathogens did not exceed 1 000 per ml. Relationship between mastitis pathogen count and total bacteria count or somatic cell count were poor.

Studies on the methodology of determining total counts in raw milk were undertaken with particular attention being given to the clumping phenomenon. It was also established that changes in total numbers which occurred between the farm vat and the milk pasteurizer were due to increases in the number of psychrotrophic bacteria.

Two rapid gravimetric methods for determining moisture content in butter were found to give results which were not significantly different from those obtained with the official Kohman method.

Artificial breeding services

A total of 111 bulls, 99 dairy and 12 beef, were maintained at the Wacol Artificial Insemination Centre during the year. The Division continued to provide this valuable service to the industry at a time when severe decreases in financial returns were occurring.

Total movement of semen from sires increased by 28% during 1977-78. Due mainly to the sale of Sahiwal semen for a Friesian-Sahiwal cross-breeding program in Malaysia, interstate and export sales of semen increased significantly. Distribution of imported semen declined to 8 181 doses, a 28% decrease.

The occurrence of C.S.I.R.O. Strain 19 Virus in cattle in northern Australia late in 1977 resulted in temporary cessation of sales of semen to clients outside the State. There was a marked effect on sales to overseas countries. However, with the imposition of strict quarantine procedures and the reissue of appropriate health certificates, trading commenced again on a limited scale early in 1978.

The establishment of the two country depots at Rockhampton and Mackay continued to facilitate the usage of semen. Sales increased from 3 212 doses to 6 834 during the period. Twelve bulls were maintained at the special quarantine A.B. Centre at Redlands to meet demands for semen for export.

Herdsmen Courses in the 'Do-your-own' training programs continued to be popular. Training was provided for 170 persons and the majority of these purchased their own equipment for on-farm use. This is an important activity in fostering genetic improvement of dairy cattle.

Cow production recording

A total of 451 221 milk samples was analysed from 45 275 cows in 754 herds during the year. While this was a slight decline on the previous year, it is considered a major achievement in the circumstances. This represents a level of approximately 18% of all State herds. Modifications were introduced into the electronic data processing of records which reduced the turn-around of results to members. Trials in 'do your own' sampling schemes were initiated and it is anticipated such a service will be offered to producers during 1978-79 as an alternative to recorders visiting farms.

Initial development of a computer-based feeding information recording and analysis system as a management aid to producers was undertaken during the year. It is intended to combine these data with the breeding and production results obtained from the cow production recording scheme.

Cross-breeding program

Consolidation of the Australian Friesian Sahiwal cross-breeding program was undertaken during the year. The number of animals in the breed now exceeds 500 and a group of 800 animals of all ages is expected by 1980. A further group of four bulls with a satisfactory tick resistance is being progeny tested to provide a group of proven sires.

The comparison of production records of herds of selected A.F.S. and Friesian cows for the 1974-78 period showed the A.F.S. production was equivalent to 72% of the milk, and 87% of the butterfat produced by the Friesian herd.

A total of 60 cows is now located on 25 properties throughout the State to evaluate the animals under commercial conditions, and to familiarize farmers with the breed.

Evaluation of the production capabilities of Sahiwal sires used in the program commenced in 1977 and will become a permanent feature of the scheme.

Dairy cattle nutrition

Studies in the nutritional requirements for a range of animals and alternative feeding systems were continued both on research stations and under commercial conditions. Growth rate in young stock is a critical factor under Queensland environmental conditions and studies were directed to energy and protein supplements and helminth control.

The relative advantages of molasses versus grain feeding for lactating cows was again investigated. A highly significant linear relationship was found to exist between milk yield per day and level of molasses feeding when cows were grazing irrigated nitrogen fertilized couch-pangola pastures.

Because of the increased interest in filling the winter-spring feed gap, attention was given to irrigated ryegrass in association with legumes or nitrogen fertilizer. Several successful demonstrations were conducted in south-east Queensland and central Queensland. Milk production in excess of 17 500 litres per hectare over a 220-day period was obtained in one trial.

Herd health

Preliminary studies concerned with monitoring herd health under commercial conditions were commenced on three properties. It is planned to modify procedures adopted in other dairying countries to provide a management information service to producers in this subject. Difficulties are being experienced in providing a simple but detailed analysis for producers.

Special publicity

Special 'Open Day' tours were presented at the Dairy Research Laboratory, Hamilton, and the Artificial Insemination Centre, Wacol, during the year. At the laboratory, a 3-day program for young people, housewives and consumers, and industry personnel attracted groups of 450, 400 and 150 respectively. Displays depicting the wide range of activities undertaken by the sections of the laboratory were commented on favourably.

The 2-day program at the Wacol complex featured a parade of bulls, tour of the semen laboratories and an explanation of the several herd improvement activities being provided. A total of 300 producers attended. In addition to this promotion, visitors from 16 overseas countries were conducted through the centre.



Dairy product quality control services being demonstrated to consumers during a conducted tour of the Dairy Research Laboratory, Hamilton.

Dairy Field Services Branch

THE number and types of supply of registered dairies are detailed in the following table. Details for 1976-77 are included for comparison.

Type of Supply	1976-77	1977-78
Cream	1 010	761
Market Milk	50	3
Manufacture Milk	138	128
Market + Manufacture Milk	3 069	2 996
Cream + Market M + Manufacture M	0	1
Milk - Raw	26	8
Total	4 293	3 897
Goat Dairies	..	18

Overall changes represent a decrease of 9% which is slightly more than the reduction for the previous year. Despite the demand for a more equitable sharing of market milk trade, there are still 128 suppliers in the Darling Downs region not receiving some market milk payment. The decline in the number of cream suppliers escalated, and numbers are expected to fall further as collection costs increase and cream routes become uneconomic.

Production

With the decrease in the number of suppliers, there has been a decline in milk production but this was accentuated by the severe spring-summer drought. This has resulted in a marked decrease in the amount of manufactured products but pasteurized milk has increased slightly.

Total milk production for 1977-78 was 515.6m litres (including cream as milk equivalent), compared with 801.2m litres for 1976-77—a decrease of nearly 36%.

Product	Production		% Change in Production 1977-78 and 1976-77
	1976-77	1977-78	
Market Milk (including cream and flavoured milk) (m litres)	246.1	251.5	+ 2.2
Butter (tonnes)	7 710	4 968	- 35.6
Cheese (tonnes)	10 838	9 872	- 8.9
Casein (tonnes)	1 065	938	- 11.9
Milk Powders (tonnes)	15 920	10 720	- 32.7

Milk products such as modified milks and yoghurts are not included in the figures. There has been an increasing demand for products containing lowered fat content and increased solids and these may affect the sales of pasteurized milk in the future.

A total of 8 410 tonnes of choice butter was imported from Victoria to supplement local supplies for internal consumption. This was more than in the previous year, due to the low Queensland production, but is less than would normally have been expected, as per capita consumption has decreased.

Branch activities

Many dairy farmers, particularly in south-east Queensland, have been waiting for the outcome of legislation under the Milk Supply Act in order to sell their market milk entitlement and cease dairying. As a result, they have had little incentive to undertake any farm improvements and a 'laissez-faire' attitude has prevailed. It is expected that there could be fairly substantial changes in the coming 12 months, followed by a period of stabilization.

Officers have again devoted considerable time during the year to district extension programs, and they have co-ordinated well with other Departmental staff to ensure effective programming and work planning. A total of 188 staff meetings for this purpose was attended throughout the State.

One of the highlights of the year has been the expansion in the use of ryegrass for winter feed on irrigated farms throughout the State. This has been most spectacular in the Mackay area where every farm suitable for this has now planted ryegrass. There has also been interest in the use of kikuyu for autumn feed and then oversowing with ryegrass.

On dryland farms, there is a growing awareness of the economics of feeding molasses as an energy supplement rather than grain. This was helped by the drought and the high cost of grain, and has resulted in a demand for additional bulk storage tanks for molasses with reticulated feeding facilities. The Land Administration Commission, through the Dairy Farm Reconstruction Scheme, has recently made finance available to producers for storage facilities for molasses and grain.

The study material known as 'Project P', which is designed as an aid for discussion type meetings on pasture feed supplies for dairy cattle, is nearing completion.

The widespread destruction of lucerne by aphids seriously affected the nutrition program on the Downs and in the South Burnett where lucerne has played a major role in providing low-cost milk. Lucerne hay was a large component of most fodder conservation programs. The long term effects of aphids is not clear as populations have been variable. They have built up rapidly and after a time disappeared quickly. The aphid-resistant type CUF 101 has been planted fairly extensively this year but unfavourable weather has not given this new variety a fair trial under dryland farming conditions.

The Mastitis Cell Count program commenced in 1972 using the Wisconsin Mastitis Test (W.M.T.) to evaluate mastitis levels in all herd milks in Queensland. A Fossomatic Automatic Cell Counter was purchased in 1976-77 and has now allowed all milks to be tested using this instrument. As from July 1977, the advice notes to farmers detailed cell counts and not W.M.T. results.

Although these results are insufficient to allow any real assessment of the situation, the seasonal trend is similar to those noted in the W.M.T. program. Unfortunately, there is a poor correlation between cell count results and W.M.T. results, and it is not possible to compare the two and so continue the evaluation of work to date.

Routine calibration of the Fossomatic includes a monthly split sample check against the Coulter Counter, regular checks against the Direct Microscopic Cell Count and quarterly Australia-wide Cell Count Standardisation Trials. This latter check has provided valuable information, but has also shown variations in results from the several States and the instruments used.

An electronic interface was designed and built to allow results from the Fossomatic to be transferred directly to a Hewlett Packard 9825A programmable calculator. This has greatly improved data handling operations in this laboratory.

As a result of the changeover from W.M.T. to Cell Counts and the corresponding advice notes to suppliers, it was necessary to undertake an intensive extension program to inform producers of the changes.

Mastitis survey

A mastitis baseline survey was undertaken among dairy farmers in 1973 to determine their knowledge of mastitis and the level of adoption of mastitis control practices. A follow-up survey was conducted in 1976 and a full report on this has now been prepared. A third survey is planned for 1979. The improvement in the adoption of recommended practices is shown in the following results.

Recommended Practice	Adoption (% of Farmer)	
	1973	1976
Teat dipping	18	33
Dry cow therapy	13	61
Running water for udder washing ..	31	52

Increasing interest has been shown by farmers in cell counts of individual cows, particularly where cow samples are available through herd recording. This information could be useful for selecting cows for culling or for dry cow therapy, and may be useful for monitoring recovery after treatment for clinical mastitis.

Unfortunately there is little information available worldwide about levels of cell counts to be expected in udder samples from infected and non-infected cows and the variations that occur.

In order to provide some information, a series of trials involving four commercial herds has commenced. Cows are aseptically sampled monthly from each quarter and samples examined for cell counts, Bovine Serum Albumen (B.S.A.), N-acetyl-B-d-glucosamidase levels (NAG-ase) and conductivity (as measures of mastitis), together with bacteriological tests for mastitis pathogens.

This information should help in assessing the value of individual cell counts and should allow determination of thresholds to distinguish between infected and non-infected cows. Information on the value of other detection methods will also be obtained.

A pilot trial on this work has been operating for more than 12 months, with individual cow cell counts determined monthly but aseptic quarter samples taken only at the beginning and end of lactation. Results to date as detailed below suggest that cows with an average cell count of less than 250 000 over the lactation had no quarters containing pathogens at drying off and so need not be given dry cow therapy.

Herd recording

During the year, new herd recording sheets came into operation and the changeover caused problems in some areas. District meetings helped explain the new procedures.

As herd recorders and contract samplers become less involved in farm interests and confine their activities to sampling, field officers need to have a full appreciation of the herd record sheets and monthly production sheets. Trials with farmers doing their own sampling have commenced and are operating satisfactorily.

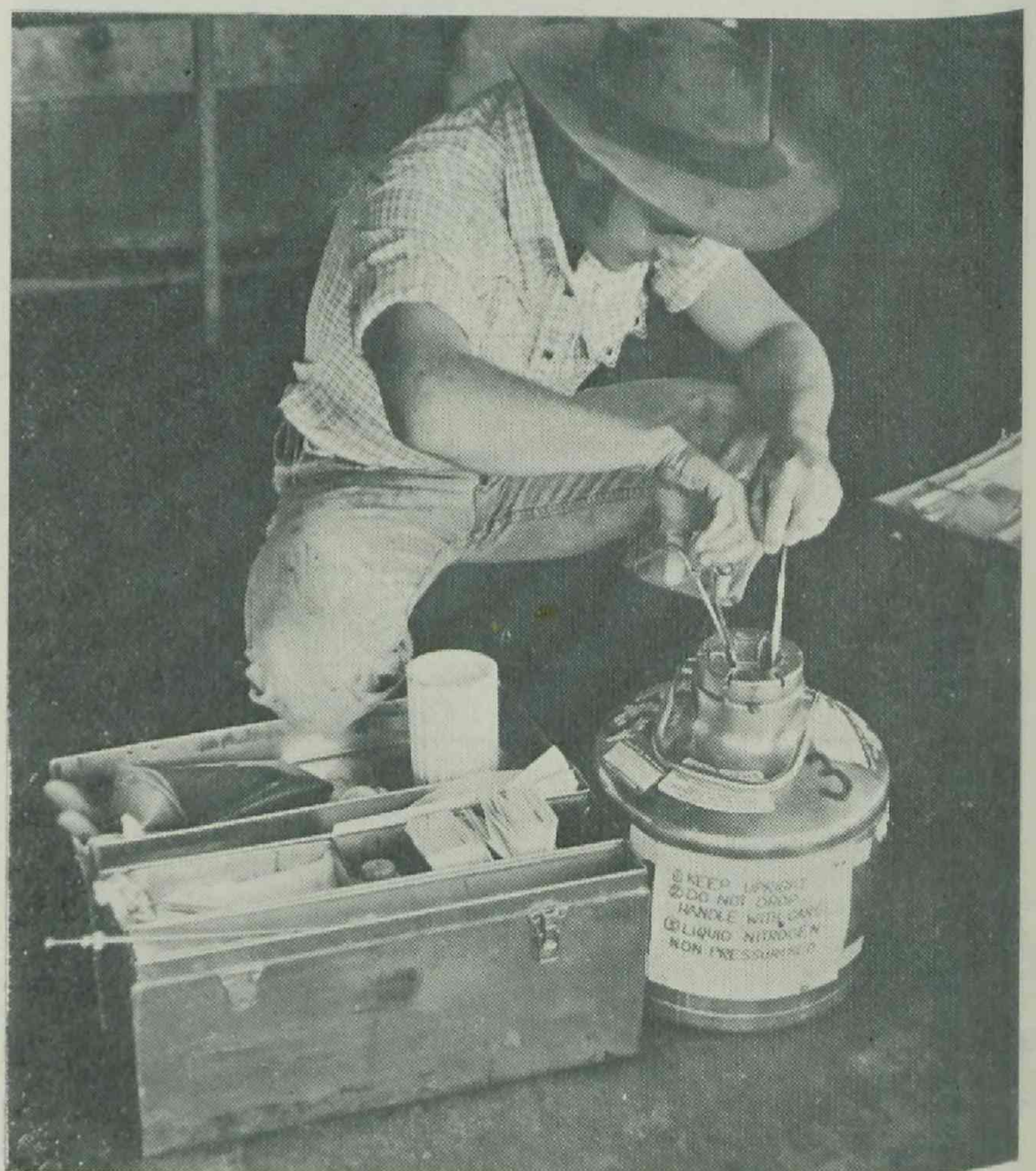
Artificial breeding

Herdsman Courses, training producers to carry out their own artificial insemination, have continued. Courses for 170 people were completed with the training team from Dairy Cattle Husbandry Branch receiving support from district officers.

The semen depots at Mackay and Rockhampton are operating satisfactorily and are valuable means of distributing semen in those areas. They provide a closer liaison between farmers and field staff.

Generally, the use of artificial breeding has declined, particularly in the Burnett region, due largely to the drought and poor returns from dairying.

A trainee inseminator removing semen from a liquid nitrogen container during one of the on-farm inseminator training courses in north Queensland conducted by officers of the Wacol A. I. Centre. These schools are increasingly in demand.



Calf rearing

As a direct result of successful calf rearing field days, 36 farmers have adopted girth tapes for measuring animal growth. In some areas, there has been an increase in calf rearing as a consequence of heavy losses due to the Brucellosis eradication program and farmers have had to rear their own replacements.

Two 'Open Days' at the Wacol Herd Improvements Centre attracted about 300 farmers and were very well received. Particular interest was shown in the display of bulls, the mastitis and butterfat testing and semen collection and processing. Officers from south-east Queensland assisted the planning of these activities and acted as guides for groups of farmers.

Discussion groups

After herdsman inseminator courses in the Quinalow, Bell, Mt. Mee, and Kerry districts, discussion groups were formed to provide farmers with additional information on aspects of herd improvement, particularly breeding and genetics. These courses were largely successful, although some sections were too advanced for a few of the group members. Similar activities in other regions would be worth while, with some modifications to the material that was used in these discussions.

Farm accounting schemes

In most regions, surveys are continuing with groups of farmers to ascertain costs of production under various farming conditions, particularly with respect to variable costs. The data have been manually analysed and gross margins compared with feed/fertilizer costs.

Discussions have been held with officers of Economic Services Branch and it is expected that a suitable computer program will be able to provide the necessary information more quickly and also allow more co-operators to take part in these data collection schemes. Interest in these schemes is increasing rapidly.

The schemes assist farmers to evaluate their own farming methods and feeding systems, and also provide officers with factual information on costs of production. This gives them the opportunity to talk with producers in monetary terms and gives the dairy farmers relative costs of alternative feeding practices.

Dairy Assistance Scheme

In most regions, officers have co-operated with the Land Administration Commission and have supplied farmers with details of this Assistance Scheme. The emphasis of the assistance has lessened from bulk milk conversion, and now is on carry-on finance and debt reconstruction. It is anticipated that there will be interest in schemes for the financing of A.B. equipment and molasses storage.

Australian Development Assistance Bureau Training

Branch staff have been associated with A.D.A.B., a Commonwealth agency of the Department of Foreign Affairs, and have been responsible for the organization and running of two International Training Courses, one in dairy technology, the other in animal breeding.

These courses were held over a period of 2 to 3 months and provided useful in-service training for 28 field staff in these subjects. A course in animal husbandry is at present being prepared for presentation later in 1978.

Regional communication

Regional information news sheets continue to be published in north Queensland, Mackay, Wide Bay, East and West Moreton, Darling Downs and South Burnett.

A major communication activity for this year was the printing of the 'Happy Jack' Calendar for 1978. This was financed by commercial firms and prepared by officers of East and West Moreton.

Herd improvement evaluation

An evaluation was made of the discussion group type meetings held at Bell, Maclagan and Kerry to assess the attributes of the farmers participating, the relevance and method of presentation of the material, and the knowledge gained by those participating. The personal interview method was used and results indicated the success of these groups. One group signified their desire to continue as a group to discuss other topics.

Film on dairy cleansers

In conjunction with Photography Section, a movie film on the use of detergents and sanitisers was made. Staff were actively involved writing the script and determining the photographic sequences desired, as well as finding suitable farmers and locations for the shooting. Some financial help was received from the Australian Chemical Specialities Manufacturers' Association.

Evaluation: Wondai Discussion Group

The Wondai Discussion Group has had a very successful operation for several years and has been of considerable value to farmers participating. An evaluation of the effectiveness of this group and its mode of operation has been completed and a report presented.

Statistics

The following tables summarize activities in the several subject areas described.

FARM VISITS

	Darling Downs	West Moreton	East Moreton	Wide Bay	Burnett	Central Qld.	North Qld.	Total
Routine	1 229	464	743	704	483	405	248	4 276
Quality Improvement	1 180	834	853	1 048	615	301	120	4 951
D.P.S.S.	127	47	17	32	46	13	29	311
Husbandry	1 162	816	666	752	709	615	402	5 122
Total	3 698	2 161	2 279	2 536	1 853	1 334	799	14 660

EXTENSION ACTIVITIES

Description	No.	Attendance
Farm walk; field day; tour	59	2 494
Method demonstration	30	158
Film-lecture evenings	47	761
Project clubs; Junior farmer	5	178
Farmer schools	22	205
D.E.A.C.; Q.D.O.; Disc. Group	171	3 585

These levels of association with industry are generally higher than the previous year, although farm visits have decreased slightly. This may be attributed to the cessation of the Dairy Pasture Subsidy Scheme where farm visits in the previous year totalled 1790. Discussion groups, field days and farm walks have attracted much increased attendances.

Processing advisory activities

There are at present 45 dairy product processing centres operating throughout the State. Several of these are functioning as multi-product plants as indicated below.

Butter	13
Cheese (cheddar)	10
Cheese (other than cheddar)	10
Pasteurized milk	21
Powders	11
Casein	4
Ice-cream	6
Yoghurt	4
Other dairy	5

Officers have serviced this section of the industry with routine visits to review quality control programs and by special surveys to identify causes of problem conditions. This service co-ordinates with the official gradings undertaken on manufactured products and the bacteriological and chemical analytical programs undertaken by the Dairy Research Branch.

A total of 1 156 and 109 investigational surveys was completed during the year by specialist dairy product officers. A total of 98 inspections was undertaken of milk depots and dairy product stores, excluding the routine grading visits by grading officers.

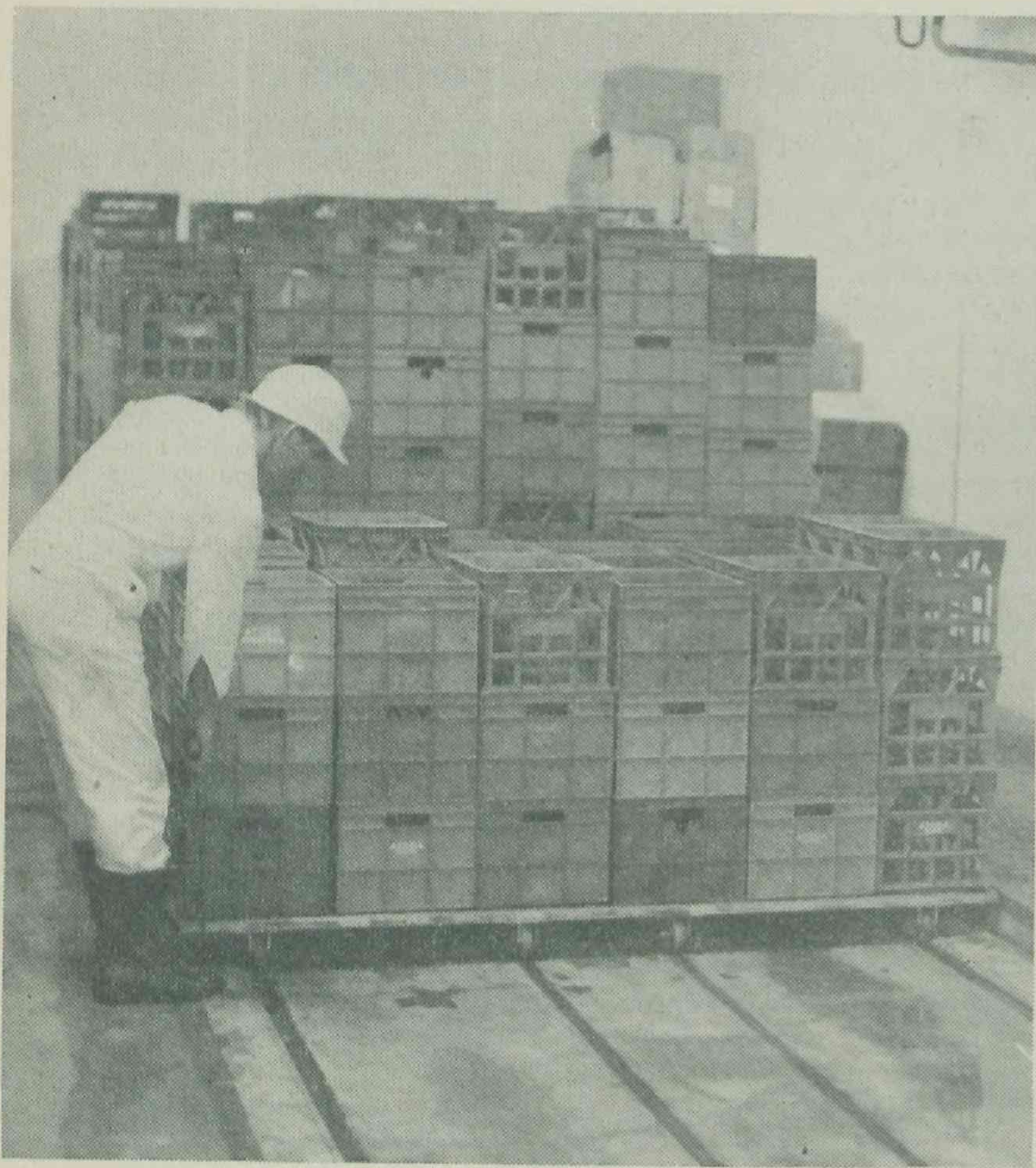
Factory changes

The Gympie factory of the Wide Bay Co-operative Dairy Association ceased manufacturing butter and all cream received is now transported to Murgon. This factory was once the largest butter factory in Australia, but with the decline in the butter industry manufacturing costs have become excessive.

The milk processing plant of Robert Gills (Pty.) Ltd. ceased operation and milk is now consigned to Q.U.F. Industries.

The Maleny and Caboolture Associations will amalgamate as from 1 July 1978. This will lead to a rationalization of milk usage with milk from Maleny being shipped to Brisbane for market milk, thus leaving milk at Woodford to allow cheese production to continue. It is expected that casein manufacture at Maleny will cease until returns for casein sufficiently improve.

Better cartoning equipment is being installed throughout the State with Pure-Pak, Haskon and Tetra Rex machines replacing the Perga machine. The bottling plant at Townsville will be replaced by a sachet machine. Four factories now are packaging milk in 2-litre cartons.



Cargonised facilities for milk handling in the Cairns depot.

Buildings

Major undertakings in the year have been: the completion of the cold store at West End by Q.U.F. Industries for storage of ice cream and frozen food lines; Cargon depots at Cairns for A.T.C.D.A. and Beenleigh for South Coast Dairy Association; the construction of a new milk processing factory at Murgon due for operation in July-August; and extensive alterations by Kraft Foods Limited at Kenilworth and Quinalow.

Factory operative training

In association with the Queensland Division of the Australian Institute for Dairy Factory Managers and Secretaries, four successful staff training programs were completed. Two of these were held in Brisbane for 12 factory operatives who were sitting for factory certificates in Milk and Cream Testing and Milk Grading.

A workshop on cheesemaking was conducted at the Queensland Agricultural College as a refresher course for 15 factory cheesemakers. A school on milk and milk products at Kirra gave valuable training to 14 senior factory operatives.

District officers provided training for bulk milk tanker drivers as part of the State-wide program to improve milk quality as determined by Total Bacteria Counts.

Production problems

One dairy association requested assistance with sandy texture ice-cream. The method of handling and stacking the ice-cream in the cold room did not permit rapid cooling and allowed some growth of lactose crystals in the finished product. The solutions to this problem were to change the stacking/shrink wrapping methods or to chill all ice-cream in a hardening tunnel. Some change in emulsifier/stabilizer may also improve the texture and this could be investigated further.

Pesticide residues in dairy products

The results of Commonwealth analyses of butter and cheese products manufactured during the 1970-77 period expressed as a per cent of samples above M.R.L. are listed below:

Year	Chlorinated Hydrocarbons					Organo-phosphates			
	DDT	Dieldrin	Aldrin	Lindane	BHC	HCB	Ethion	Dursban	Nexagan
1970 ..	5.7	0.4	0.1	0.2	0.8	5.1	10.8	3.0	Nil
1971 ..	3.2	3.7	Nil	0.1	1.8	6.3	9.8	0.2	Nil
1972 ..	0.6	2.4	Nil	Nil	1.6	3.2	11.4	Nil	Nil
1973 ..	1.5	0.9	Nil	Nil	Nil	1.2	7.6	1.3	Nil
1974 ..	0.9	2.2	Nil	0.1	Nil	1.5	*	1.5	Nil
1975 ..	1.2	0.8	Nil	Nil	0.4	0.1	0.2	0.5	Nil
1976 ..	0.6	2.8	Nil	Nil	Nil	Nil	Nil	0.9	Nil
1977 ..	Nil	1.5	Nil	0.2	Nil	Nil	Nil	Nil	Nil
M.R.L.	1.25	0.15	0.125	0.2	0.3	0.3	0.5	Zero	1.0

* M.R.L. amended during 1974.

There is no serious problem with most pesticide residues, although there is a need to investigate isolated instances where residues above M.R.L. occur. Dieldrin continues to be the pesticide causing most concern, and in many instances the source of contamination is not known and the incidences are quite sporadic. It is noteworthy that this is the first year in which no samples were found with DDT above the M.R.L.

Blue Vein cheese

Investigations have commenced on the keeping quality of portion packs of matured Blue Vein cheese. This investigation was initiated following the problem of slime growth on retail portion packs of Blue Vein cheese.

The Toowoomba factory has adopted our recommendation of packaging 'wheels' of Blue Vein in heat-shrunk Cryovac S bags immediately following salting, and maturing the cheese in these bags. Although this achieves relatively slime-free cheese at the point of retail packing, some slime regrowth does occur between the factory and point of sale. Because of this, it was suggested that wedges be packed in heat shrunk Cryovac S bags or stored frozen to control slime. Further treatments were then designed to assess their suitability as a means of controlling slime growth.

Results reveal that both Cryovac S bags and Barrier bags control slime growth, as do freezing and storage in a CO₂ atmosphere. However, vacuum-packed cheese has exhibited a fruity flavour at 6 weeks which is even more pronounced at 12 weeks of storage. Portions stored in CO₂ have shown excessive surface mould growth and 'musty' flavour. Of all the treatments, freezing appears the most successful with good flavoured cheese at 6 and 12 weeks. However, some batches have tended to be slightly chalky on thawing.

Because the Toowoomba factory is currently marketing portions of Blue Vein in Cryovac S outer bags, future work will examine expected shelf life in terms of flavour.

Legislation

DAIRY PRODUCE ACT. The new Act was passed by Parliament but has not yet been proclaimed. Regulations have been drafted and should be finalized early in 1978-79.

DAIRY BUILDINGS. Most farmers intending to convert to bulk milk have now done so and hence only 38 new buildings were erected and 53 renovations completed. Of the new buildings, 33 were herringbones, both high-line and low-line. A total of 49 bulk milk vats was installed under guidance of district staff in accordance with Regulation 220, many of these being installed in north Queensland as second vats.

MILKING MACHINES. In association with the reduced building program, there were 44 new milking machines installed and 54 second-hand machines placed into operation. This represents approximately 2.5% of all suppliers and highlights the generally depressed state of the industry.

In association with this supervision, officers completed performance testing on 654 milking machines (17% of operating units). It is again disappointing that a larger number of producers do not avail themselves more widely of this free service.

CERTIFICATE OF COMPETENCY. A total of 33 practical examinations was undertaken in connection with the Certificate examinations conducted under this Act. There are operatives in the industry who do not possess the required written qualifications to perform the skilled duties in factories and officers have undertaken to provide tuition to assist them in their examinations.

Dairy produce grading

Two officers were engaged full time performing grading duties. Regional officers carry out grading of local sales cheese and butter at factories within their respective regions.

Approximately 46% of the State's butter production was examined and the following table shows the overall quality.

	Quantity (boxes)	Percent
Choice	38 807	43.8
First	32 757	37.0
Second	11 582	13.1
Below second	5 435	6.1
<i>Total</i>	88 581	100.0

While the amount of choice butter has increased from 37.8% in 1976-77, there has also been an increase in the amount of second grade butter. This has probably been due to the problems associated with storage and handling of small cream supplies. Oxidation problems still persist in some butters.

All butter received in bulk from Victoria was graded by State grading officers. A total of 9 790 tonnes of butter was graded of which 8 410 tonnes were forwarded as Choice and 1 380 tonnes as lower grade butter for dehydration purposes.

The following table demonstrates the quality as determined by State graders of those butters submitted as choice.

	Choice	First	Second and below
Grade Points	93	92	91
%	82.50	10.26	4.39
			90
			2.41
			<90
			0.44

These results are almost identical with those of the previous year. Degrading to 92 points were due mainly to stale storage flavours in older butters. Degrading below 92 points were caused by stale, oxidised and rancid flavours.

A total of 5 884 tonnes of Queensland cheese, representing 67% of production, was graded as follows:

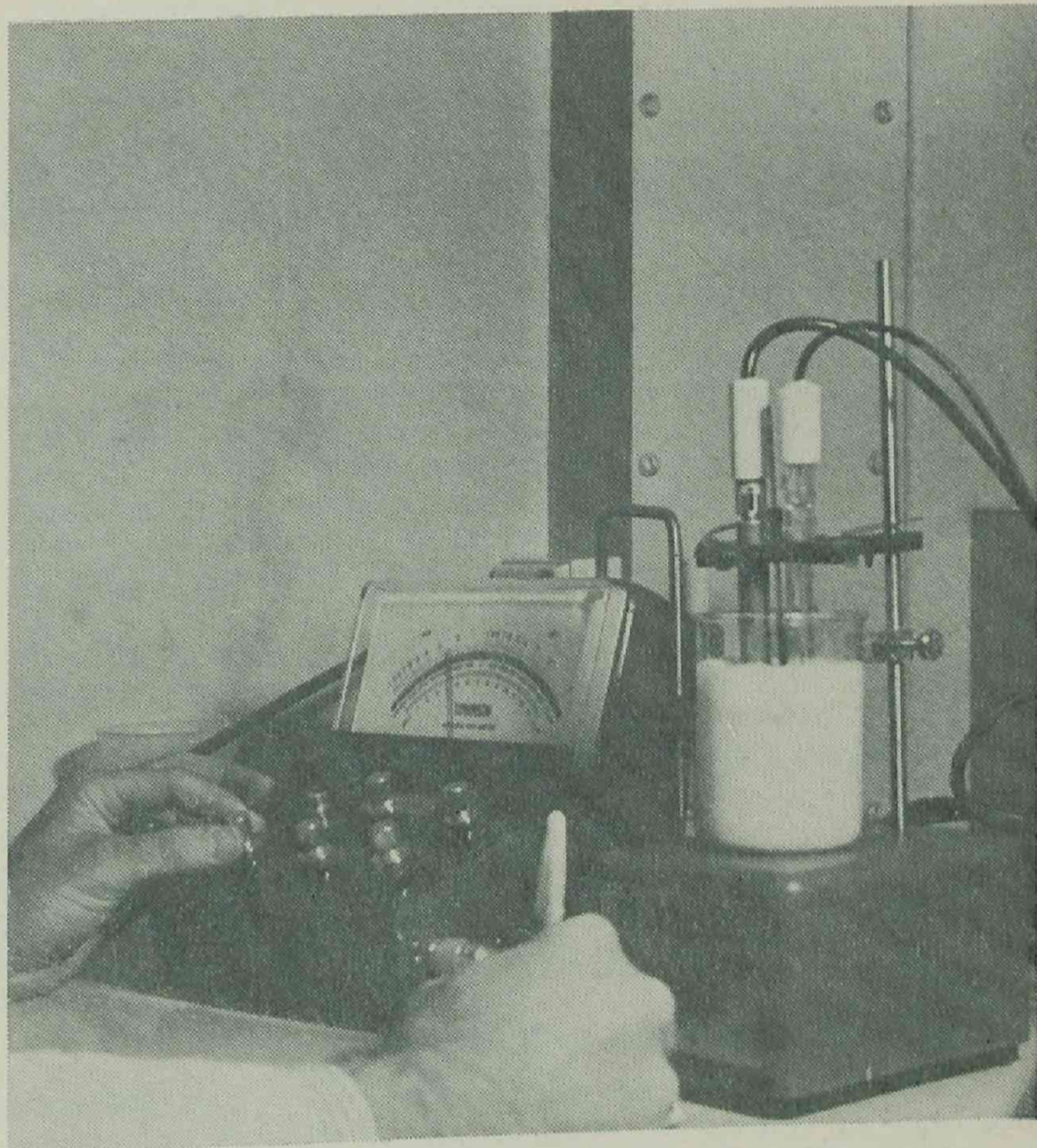
Grade	Quantity kg	Percent
Choice	1 167 861	19.85
First	4 344 217	73.83
Second	370 885	6.30
Below second	1 008	0.02
<i>Total</i>	5 883 971	..

These percentages are almost identical with those of the previous year. Two factories have had protracted problems with second grade cheese but both are now showing improvement.

Raw milk quality testing

As a consequence of the proposed amendments to the milk quality testing regulations, a comprehensive program relating to Total Count testing for raw milk has continued. Attention has been given to standardizing factory laboratory equipment and operations to ensure the industry is fully equipped to adopt procedures and testing methods which are satisfactory.

All factories except Ingham now test milk from suppliers at least three times a month for Total Bacteria Counts. A standard of 50 000 colonies per ml has been accepted for farm raw milk destined for the market milk trade. Milk at Ingham is checked using the Methylene Blue Test.



Specific ion electrode and meter equipment for determination of iodine residues in dairy products.

Residue contamination of milk

The incidence of iodine contamination in milk was again reviewed during the year and a rapid method of testing developed. This enabled a full-scale examination of milk from suppliers which has identified those with high levels, and allowed follow up visits by officers. As a result, there has been a general improvement in the levels of iodine, particularly in market milk.

In 1976-77, only 42.8% of samples of pasteurized milk complied with the standard of 500 µg/litre while 77.5% were satisfactory in 1977-78.

As a direct consequence of the drought, the quality of water used for cleaning milking machines deteriorated on many farms. As rain water supplies became exhausted, alternative sources were used and these were frequently quite hard. These waters were unsuitable for use with iodophors as the pH of the solution was too high for release of the iodine. Some farmers added extra iodophor to reduce the pH and this helped to compound the iodine problem.

Milk licensing

This has required considerable activity by field officers in the major cities of the State outside of the capital. Milk vending vehicles were required to be fully insulated by May 1977, and 98% of the 596 vehicles outside the metropolitan area now comply. In addition, officers were responsible for the co-ordination of licensing of more than 3 000 milkshops throughout the State.

Staff training

Miss C. Underwood began full time study at the University of Melbourne for a Masters Degree in Agricultural Extension. Mr J. G. Miller (Assistant Director) commenced full time study (in Business Management) at the Queensland Institute of Technology. The Director attended a Dairy Cattle Production seminar in Victoria. One officer undertook a study tour of cheese manufacturing plants in three States. One officer attended a special workshop in Victoria on non-cheddar cheese manufacture.

Dairy Cattle Husbandry Branch

DAIRY Cattle Husbandry Branch has responsibilities in two major areas—

DAIRY HUSBANDRY RESEARCH. This commitment involves developing technology which will enable farmers to overcome production problems or adopt more efficient production methods in their dairying enterprises. Technical fields covered include herd nutrition and management, with particular emphasis on grazing, improvement of reproductive efficiency and genetic improvement including breed development.

HERD IMPROVEMENT SERVICES. These services consist of dairy herd production recording, cattle artificial breeding services, and research and development within these services as necessary to meet the needs of Queensland stock owners.

Husbandry research

Dairy herd production technology

Current studies can be grouped under the following headings: 1. Nutritional requirements of different age groups. 2. Investigations into alternative farming systems. 3. Animal and pasture management studies. 4. On-farm pasture utilization projects.

Nutritional requirements of age groups

PRE-WEANING. Several years of research at Ayr, Biloela and Kairi Research Stations have been completed. We have now more understanding of the nutritional and managerial requirements of the preruminant calf in a subtropical environment. Techniques for reducing labour requirements and rearing costs have been investigated. The information obtained has been disseminated at field days, discussion groups or through extension articles, press releases, radio talks and scientific publications. The practices have gained wide acceptance in the farming community.

POST-WEANING TO PARTURITION. Research has shown that maximum lifetime milk production will be obtained by calving heifers at 2 years of age. Studies with the Friesian breed indicate a close relationship between liveweight at first calving at weights up to 450 kg, and first lactation milk production. For heifers calving at lighter weights, milk production is reduced by 7 kg for each 1 kg of liveweight below 450 kg.

To achieve 450 kg liveweight at 24 months, a growth rate of 0.6 kg/day from birth to parturition is required for Friesians. The theoretical maximum annual performance that can be achieved off tropical pastures is less than 0.7 kg/day for yearling cattle. The early weaned calf has a high requirement for both energy and protein, and its potential growth on pasture alone is very low.

Current research aims at quantifying nutrient requirements to achieve desired daily weight gains in the early weaned animal, and assessing the effects of environmental stress and internal parasites on these requirements and animal performance.

Poor growth of dairy herd replacements results in late maturity, increased cost and delayed entry to the milking herd. Most of the problem occurs in the immediate post-weaning phase. Earlier studies have shown that older animals will maintain satisfactory gains on good quality pasture plus grain. Response to grain feeding is approximately 0.1 kg grain/day per kg of grain fed. Young calves are not able to maintain satisfactory gains with grain supplementation only. At Ayr Research Station, a trial was undertaken to show the effect of variation in protein level in a supplement on growth of Friesian weaners.

This experiment examined the effects of energy and protein supplements on calf growth. Calves in five treatments were fed the same supplements containing varying proportions of maize and cottonseed meal from weaning at 2 months to 6 months of age. An unsupplemented control group was also used. Animals grazed irrigated, nitrogen-fertilized *Setaria* pastures.

In the first experiment using winter-born calves, unsupplemented calves gained at 0.34 kg/day. Maize increased this gain to 0.50 kg/day, while animals receiving additional protein as cottonseed meal gained 0.62 kg/day. This was achieved with only a small amount of added protein (5 maize: 1 cottonseed meal). A diminishing requirement for added protein was observed and response had disappeared by 6 months of age.

Although the response to protein is short-lived, protein raised calf performance by 29% at the period when animals are most susceptible to the stresses of their environment. Improved growth during this period may not only reflect in reduced age of heifers at mating, but will also influence animal health and survival. The cost of the protein supplement is less than the amount of extra grain which would be required to achieve desired growth rates.

Helminth control programs

Young calves are particularly susceptible to worm infestation as resistance to parasites is only acquired near maturity. Control of helminth in young animals is by therapy using regular levamisole-based antihelminthic injections. Effects of environment and management procedures will influence build-up of larval contamination in pastures, and it is probable that animal performance is depressed by sub pathological worm burdens.

This experiment used calves on six Monto district farms, and calves received nil or sub-cutaneous injections of levamisole-based antihelminthic at 28 or 56-day intervals. The trial received good co-operator support and aroused local interest. However, the dry season which eventuated effectively controlled helminth infestations, so that there was no growth advantage in treated calves, although worms are held to be a problem in most normal seasons. Subsequent farmer comment has stressed the superior growth rates of the treated calves, now in their first lactation.

The experiment illustrated the considerable effect that climatic conditions can have on build up of internal parasites, and hence animal performance. Although routine regular drenching is advocated for worm control, it is probable that good stock management combined with strategic drenching in line with seasonal conditions would be very effective.

Nutrition of lactating cows

Recent work has shown that, where maize or molasses is fed for most or all of lactation, both give between 0.9 and 1.1 kg milk per kg of supplement dry matter fed. There is an obvious economic advantage to feeding molasses in those districts where its cost is only one-third that of grain. On both the Atherton and Eungella Tablelands, there has been a marked swing to molasses feeding.

The current experiment showing the effect of level of molasses supplementation on the milk production of Friesian cows grazing irrigated, nitrogen-fertilized couch-pangola pastures at Ayr Research Station reinforces the Department's studies with molasses feeding. The effect of feeding molasses at different levels up to 3.6 kg/head/day was examined. A highly significant linear relationship was found to exist between milk yield per day and level of molasses feeding, indicating that efficiency of utilization of molasses is constant to 3.6 kg.

In an experiment on feeding maize to maintain milk yields during a short period of low pasture availability at Kairi Research Station, cows one-third through lactation were used to measure the value of increasing concentrate feeding during a short period of severe pasture stress, for example, a situation that occurs after frost.

During the 4 weeks of stress, milk response to maize was 0.2 kg per kg maize while cows were grazing adequate pasture, and 1.1 kg per kg on limited pasture. Milk yield of cows not fed maize fell from 12 to 6 kg/cow. Milk composition was also changed. All differences were removed between the groups fed maize, when cows on poor pasture had been relocated in good pasture paddocks for a period of 2 weeks.

It was concluded that the milk response to maize fed in this way would be temporary, but it would be an economic practice if the pasture stress was relatively severe.

In response to industry concern about substandard butterfat percentages in milk at certain times of the year, a trial was carried out with a commercial protected fat supplement (HI-EN) to show its effect on milk yield and composition.

Three levels of this supplement were fed to Friesian cows grazing irrigated, nitrogen-fertilizer tropical pasture. Levels were nil, 0.6 and 1.2 kg/head/day. In each case, total supplement allocation was made up to 2.7 kg dry matter/head/day with either molasses or grain.

Lactation milk and fat yields and butterfat percentage increased with increasing levels of HI-EN feeding. Although the supplement is expensive, its use may be economic to avoid penalties incurred by producers who supply milk of substandard butterfat content.

Investigations into alternative farming systems

GRASS-LEGUME PASTURE. The bulk of milk produced in Queensland is from grass-legume pastures. The strengths and weaknesses of tropical species have been well defined for the Atherton Tableland.

Trials at Kairi Research Station have established that, while production of milk per hectare increased almost linearly with stocking rate up to 2.5 cows/hectare, legumes would not be maintained at stocking rates higher than 1.56 cows/ha in the dryland situation.

Allied with these studies has been the investigation of fertilizer nitrogen as a means of boosting winter feed yields. This has generally been shown to be uneconomic at lower but economic at higher stocking rates. However, legumes do not persist in grass-legume pastures on which high stocking rates are supported by nitrogen fertilizer application.

GRASS NITROGEN PASTURES. With the continued increase in size of dairy herds, pastures with a higher carrying capacity than the traditional grass-legume pastures are required. Nitrogen-fertilized tropical grass pastures can support higher stocking rates, but little information on the potential milk yields from these pastures is available.

To define potential milk yield and the optimum stocking rate from this type of fertilized pasture, an experiment was commenced in November 1976.

The first year has shown that milk yields of 8 240 litres of milk/ha are possible at a stocking rate of 2.5 cows/ha. This stocking rate is much higher than the 1.6 cows/ha which grass legume pastures are able to support.

Under irrigation in north Queensland, nitrogen-fertilized pangola grass pastures stocked at six cows/ha consistently produce 18 952 litres of milk/ha when a molasses supplement is fed.

PASTURE UTILIZATION. The value of annually-sown, temperate species (ryegrasses, clovers, and sub-clovers) as a means of filling the winter-spring feed gap on dairy farms in central and northern Queensland is currently under study at Ayr Research Station in a trial to assess the milk production from irrigated tropical pasture oversown in April with ryegrasses and clovers. The work is being done at the request of Mackay farmers who were not satisfied with alternative means of filling the gap, such as grain feeding or growing oats.

Results have shown that, provided adequate irrigation is used, ryegrasses and clovers can be grown successfully in the tropics. Planted in April they produce excellent feed from May until December. Milk production has been in excess of 17 510 litres per ha over a 220-day period and is significantly higher than milk production from irrigated tropical species over the same period.

Animal and pasture management studies

Advice to farmers on pasture management often involves systems of rotational grazing to improve production. In an experiment to study the effect of grazing systems on milk production from irrigated pangola-couch pastures, it was found that, rather than increase milk production, rotational grazing had no effect in winter when feed was short, and in fact reduced milk yields when abundant feed was available.

It is evident that some sub-division of farms is essential for general farm management, but time and money spent on sub-division to improve production is not warranted.

In addition, high nitrogen fertilizer regimes had no significant effect on milk yield or composition. If nitrogen applications are already high, strategic winter nitrogen seems of doubtful value for improving winter production.

Many farmers and animal husbandry officers believe that milk production by grazing tropical pastures will be maximized by keeping the grasses in a short leafy condition. At Kairi, two grasses, *Gatton Panic* and *Brachiaria decumbens*, were chosen as representatives of erect and prostrate species and stocked at 4.7 cows/ha. Attempts were made to improve the quality of summer growth by slashing or adding stock. Management did not increase pasture quality in terms of leaf content, and pasture quality was limited at severe levels of slashing or variable stocking. Each time paddocks were slashed or stock numbers increased, milk yield/cow/day decreased.

The productivity of irrigated, fertilized kikuyu grass has been assessed at a property at Grantham. No supplements were fed and production yields of the experimental herd have been 12 923 litres milk/ha. This yield is 11% greater than for 1976-77. However, the control herd which was grazing other pastures decreased production/ha by 9%. This lower yield was due to poor pasture growth during the very dry winter-spring period.

Stocking rate trials using Friesian heifers to graze kikuyu pastures were continued in south-east Queensland, but it was possible to obtain lactation records in only two herds. On both properties, heifers were reared and continuously grazed in their respective paddocks at a low stocking rate of 2.5 per hectare and medium of 3.1 per hectare.

The first year's completed lactation records were reported last year for Messrs. E. R. Andrew, Peachester, and T. Deans, Maleny.

Again this year there is a definite site difference due to the length of lactation, time of calving and pasture availability. On the more productive farm of Mr Andrews, the second lactation yield per cow is very similar for each stocking rate, that is, low 3 361 litres milk and 147 kg fat and medium 3 755 litres of milk and 159 kg fat. However, the returns per hectare indicate a definite yield advantage of 3 290 litres to the medium stocking rate. This is consistent with the previous year's results.

In financial terms, this could mean an increased return of approximately \$197 at 6c per litre of manufactured milk on the medium stocking rate.

Mr Dean's property was adversely affected by the severe drought, which prevailed throughout the spring and early summer. This is reflected in the completed second lactation records for both stocking rates. Cows on the medium stocking rate of 3.1 per hectare had lactation yields of 2 280 litres/cow compared to the high stocking rate (4.2 per hectare) of 1 712 litres/cow.

One of the major problems facing the suppliers to the Mackay factory is the maintenance of milk supply during the winter-spring period.

To assess the value of annually sown ryegrasses and clovers for helping to fill this feed gap, 4-hectare demonstration areas were sown on each of two co-operators' farms at Sarina and Eungella. The aim of the demonstration areas was to determine the milk production potential and economics of temperate species and to evaluate a range of ryegrass and clover varieties.

Both areas proved highly successful. Milk production on both farms increased substantially once the grazing of temperate species commenced. On the Sarina farm, production increased from 950 litres per day in May to a peak of 1 500 litres in September. On the Eungella farm, production increased from 290 litres in May to 400 litres in September. These increases contrast to a marked decline in total supply to the Mackay factory over this period. Consequently, the Sarina farm has raised its quota in 1978 by 173 litres (24%) and the Eungella farm by 49 litres (22%). This compares to an average increase over all suppliers of 17 litres or 4%.

Excluding milking costs, milk from ryegrass costs a maximum of 5.7c per litre. This compares very favourably with the cost of milk from grain.

Research in animal breeding

THE AUSTRALIAN FRIESIAN SAHIWAL (A.F.S.) BREED DEVELOPMENT PROGRAM. The development of the A.F.S. breed of dairy cattle by combining the tick resistance characteristics of the Sahiwal with the productive capacity of the Friesian was continued on the Ayr and Kairi Research Stations, and with the assistance of dairy farmers on the Atherton Tableland, Mackay and south-east Queensland districts.

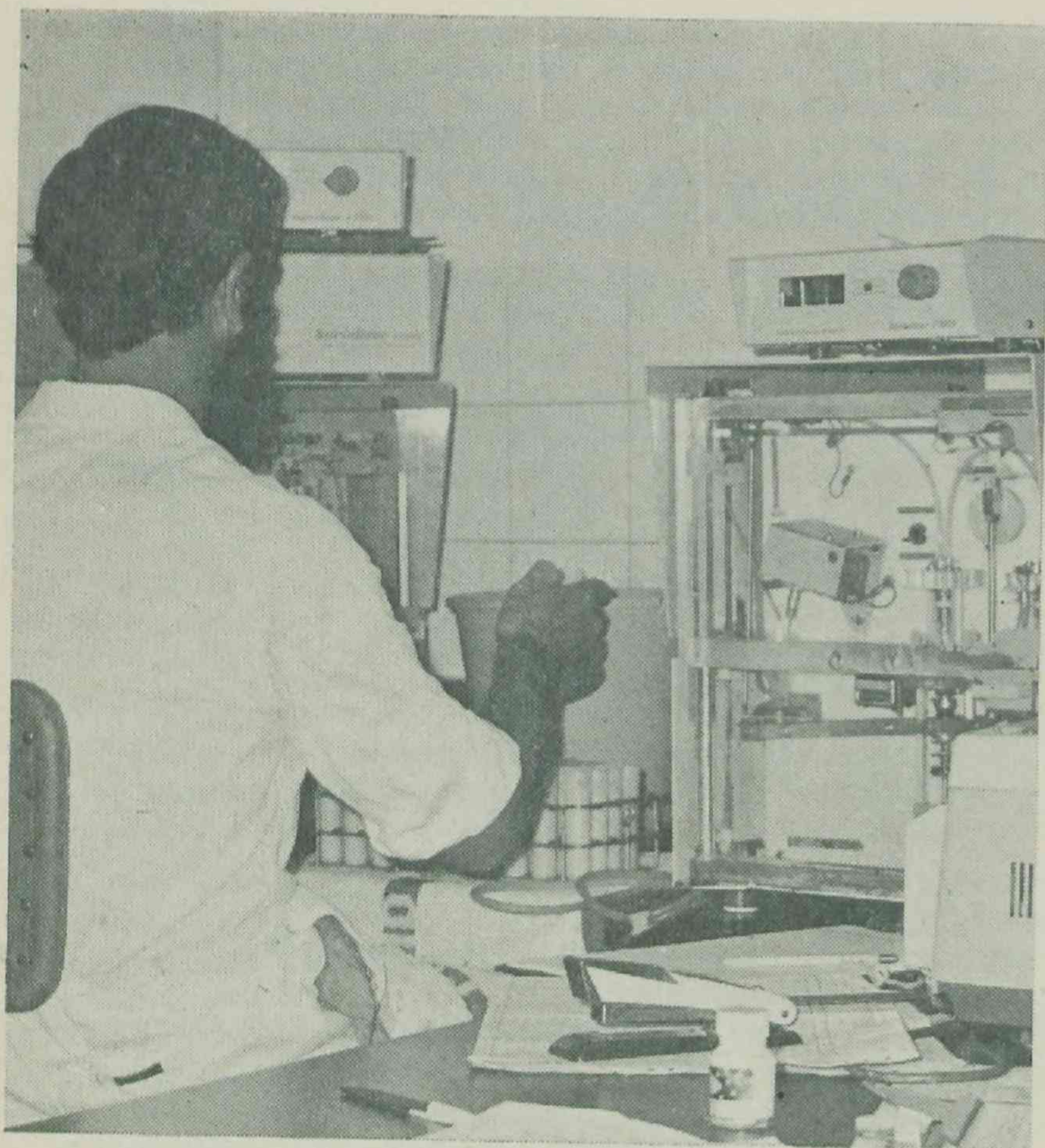
In general, the rearing and maintenance of young animals is undertaken at the Kairi Research Station; heifers on their first lactations are recorded for production at the Ayr Research Station and cows on second and later lactations are located in more than 20 co-operators' herds.

The number of animals in the breed now exceeds 500. By 1980, this number will have increased to approximately 800 if the present systems of breeding and selection are continued.

A major component of the program is the progeny testing of sires so that A.I. proven bulls will become available as soon as possible. Semen from the first group of young bulls was distributed in 1976. A further group was used in 1977 and this year four bulls with a satisfactory tick resistance will constitute the proving group.

When the first A.I. proven bull becomes available in 1980, he will be mated to the highest producing cows in the breed to provide the next generation of sons for progeny testing.

Before 1977, evaluation of the production capabilities of Sahiwal sires used in the program had not been made. This was commenced in 1977 and continued in 1978 by controlling matings so that contemporary comparisons with a sufficient number of daughters could be made.



Automatic butterfat testing machine being demonstrated to a visitor at the Wacol Open Day in March 1978.

A comparison of production records of herds of selected A.F.S. and Friesian cows at the Kairi Research Station during 1974-78 has shown that the A.F.S. production is equivalent to 72% of the milk and 87% of the butterfat produced by the Friesian herd. Both herds were fed on a uniform basis for the period during which measurements were made.

An analysis of production performance data of A.F.S. heifers which were tested during the 1971-77 period shows that second and third generation cows are far superior to those of the first generation. Approximately 60% of first generation cows fail to satisfy the production standards on their first lactations, but only 25% of second and third generation cows are culled for this reason.

Dairy farmers in regions where cattle ticks are prevalent have continued to support the program. Apart from those who are now maintaining A.F.S. cows, many have indicated their willingness to participate in the development of the breed.

TICK RESISTANT DAIRY HERD PROJECT. The extent of acaricide resistance by cattle ticks in Australia and the rapidity with which ticks have developed tolerance to successive insecticides during the last 20 years have alarmed tick control authorities and cattle producers in infested areas.

It is for this reason that a project has been commenced in 13 herds in the Atherton Tableland, Wide Bay and south-east Queensland regions. The technical and economic effects of developing tick resistant dairy herds will be examined by two alternative procedures in comparison with the continued use of European breed animals.

Rapid conversion of a commercial dairy herd by Sahiwal crossbreeding has not previously been attempted because of the poor dairy temperament and low milk production of a proportion of the first generation of heifers. It is anticipated that it will be possible to tolerate and reduce these problems by providing for a high culling rate, using Sahiwal bulls whose previous progeny have been above average, and providing co-operating farmers with knowledge based upon experience in the development of A.F.S. animals.

Dairy herd management information services

DAIRY HERD IMPROVEMENT. It has been the aim of the Branch to develop more sophisticated herd improvement services by providing an efficient low cost, on-farm operation, dealing with milk composition in a central laboratory and updating computer programs with more emphasis on herd management information.

During 1974-76, a low cost, on-farm segment, and the establishment of a central laboratory were successfully completed. The cost of the on-farm milk volume determination and sampling has been contained by employing recorders on a contract basis, and transporting samples to the central

laboratory where butterfat content is estimated. Previously, this latter operation was performed on the farm by Herd Recorders, whereas now a staff of four laboratory workers are able to carry out this work by using automated equipment.

In July 1977, revised computer programs, which constituted the chief component in the development of improved services, came into operation. These suites of programs provide the means to record, update and analyse information. Particulars of calves, cows and sires can be recorded so that dairy farmers receive regular outputs of information on all animals in their herds.

During the year, several refinements were introduced to the computer programs to improve operational systems, and now the processing and output of information is progressing satisfactorily.

Farmers' own sampling trials were commenced this year in a number of districts within the State. Co-operators are very satisfied with the success of the trials and are keen to see a farmers' own sampling system introduced as an alternative to the present system where recorders are employed to carry out the field work of Herd Recording.

MILK PRODUCTION RECORDING. The testing of all milk samples for butterfat determination at the Centralized Testing Laboratories, Wacol, is continuing. The milk samples are received from all dairying areas of the State. The overall quality of the samples received is very good.

A total of 451 221 milk samples was tested for butterfat content and 2 100 samples were tested for protein determination during 1977-78. This represents a slight decline to last year when 454 800 fat and protein samples were tested.

The highest number of milk samples tested in any calendar month was in November when 41 931 butterfat determinations were made.

The total number of dairy herds tested fell slightly from 770 in 1975-76 to 754 in 1976-77. The total number of cows tested was 45 275 compared with 46 726 in the previous year.

GOAT RECORDING. Fifty-nine goats completed official lactations during 1976-77 recording year. The average milk production was 904 litres of milk. This is the highest production ever recorded by goats since recording commenced in 1956.

'Pinerock Prestige 2nd', owned by Captain and Mrs J. Low, produced the greatest amount of milk and fat for the year. She produced 1 852 litres of milk and 74 kilograms of butterfat breaking the Junior 4 age class record for both milk and fat.

The interest in production recording was maintained and it is expected that the number of goats recording in the 1977-78 recording year will increase significantly.

Artificial breeding services

WACOL A.B. CENTRE. The total movement of semen from sires increased to 121 959 doses (compared with 95 278 doses in 1976-77), an increase of 28%. This increase is due largely to sales of Sahiwal semen to New Zealand, increases in sales from semen depots at Mackay, Rockhampton and the Atherton Tableland, and interstate movements.

The amount of semen sold in 1977-78 was 22 610 doses (an increase of 30.7%) more than in 1976-77, when 73 582 doses were sold.

Sales of semen from Consignment Stocks held at the Atherton Tablelands A.B. Co-operative increased by 4 011 doses. The sale of semen from this depot fell sharply last year (2 594 doses) due to a fall in the expectations of dairy-men in the area. The 1977-78 sales have surpassed the 1975-76 sales (4 256 doses), due mainly to the increase in the number of D.Y.O. operators trained in the area.

Sales from the Rockhampton and Mackay semen depots have continued to rise with 6 834 doses being sold in 1977-78 compared with 3 212 doses in 1976-77, a rise of 113% on 1976-77 sales.

Sales of semen held on consignment by Wacol Consignment agents (other than Tablelands A.B. Co-op.) increased from 3 096 doses in 1976-77 to 3 945 doses this year, an increase of 27% on 1976-77 sales.

Distribution of imported semen from Wacol A.B. Centre decreased from 10 503 doses in 1976-77 to 8 181 doses in 1977-78, a fall of 28% on 1976-77 sales.

There are now 111 bulls at the Centre, an increase of six for the year. Of these there are 12 beef sires and 99 dairy sires.

Co-operation with C.S.I.R.O. has extended to the housing of Africander and Belmont Red bulls for a limited production every year. The 1978 A.M.Z. team of bulls which were bred in conjunction with the C.S.I.R.O. program are producing semen.



Proven tropically-adapted Friesian bulls being paraded in front of a large gathering at the Wacol A. I. Centre Open Day in March 1978.

A total of 360 000 doses of semen was in storage at all locations in April 1978. This is an increase of 39 500 on last year's stocks. Sixty nine consignments of unlicensed semen were despatched during the year.

LICENSED SEMEN PRODUCTION. Twelve privately owned bulls were housed at the licensed semen production unit. Eighty-six collection attempts were made with 12 980 doses stored, representing an 88% success in processing.

Last year, 130 collection attempts were made. The marked drop in production from privately owned bulls in 1977-78 reflects conditions in the beef and dairy industries.

UNLICENSED SEMEN AND CUSTOM FREEZE SERVICE. During the year, 18 bulls were housed at the Unlicensed Centre. Twelve bulls were collected successfully and 6 241 doses were processed of which 5 067 doses were of a suitable quality for storage. A further nine A.F.S. bulls were kept at the Centre for tick resistance testing and semen evaluation.

There was a marked decline in the use of the Custom Freeze Service this year as 8 550 doses of semen were processed compared with 16 811 doses in the 1976-77 year. The overall success rate in processing was 79%.

INSEMINATOR TRAINING. A total of 170 persons was trained as inseminators, and 21 inseminators' certificates were issued. The trend to 'do-your-own' inseminations is expected to continue, but some decline in the demand for training is expected in 1978-79 as programs have finished in districts where demand for training was greatest.

Two refresher training courses were conducted. These were attended by 39 inseminators from the Maryborough, Monto, Ubobo and Eungella districts.

Fifteen 'on-farm' training courses were provided. These were held in the Atherton Tablelands, Mackay, Lowood, Biloela and Toogoolawah districts.

Twenty-six persons, including 14 from an International Training Course, received instruction at a herdsman or commercial level at the Wacol complex. Eleven of these trainees were granted inseminators' certificates.

PUBLICITY AND PROMOTIONS. A.B. promotion and extension has centred around providing the trainees in the insemination courses with information on the services and semen available from Wacol.

Two very successful 'Open Day' functions were conducted. The program was based on a complete tour and explanation of all herd improvement activities undertaken at the Wacol complex. Some 300 farmers attended.

Visitors from overseas included diplomats, scientists and primary producers from Bolivia, Brazil, Colombia, El Salvador, France, India, Indonesia, Japan, Malaysia, Netherlands, North Vietnam, Pakistan, Philippines, Sarawak, United Kingdom and United States of America.

Representatives of a number of State Departments of Agriculture visited the Centre, as did a large number of local stud and commercial cattlemen.

REDLANDS A. B. CENTRE. The movement of semen from the Centre consisted of the export of 5 945 doses and the supply of 1 725 doses within Queensland. All of the exported semen was from Sahiwal sires.

During the year, 82 159 doses of semen were processed with a success rate of 63% compared with 60 808 in 1976-77 with a success rate of 80%. The lower success rate this year was because of several difficulties with Sahiwal bulls.

There are 94 591 doses in storage at the Centre of which 71% is from A.I.S. bulls and 14% from Sahiwal bulls.

During the year, 12 bulls were located at the Centre.

The Centre is ideally situated to become an elite 'Quarantine' A.B. Centre to provide semen for specialist export markets.

Dairy sire progeny testing and breeding

BULL PROVING. Matings of teams of young sires of the A.I.S., Friesian and Jersey breeds of dairy cattle continued in 1977.

The 1977 groups were composed of young bulls with particularly good pedigrees. These animals had been especially bred for bull proving, by mating proven sires (local, interstate and overseas) with high-producing cows. This method of securing bulls for a progeny test group gives a greater concentration of desirable genes in the young sires, which should result in an overall improvement in the genetic makeup of the State's dairy herd.

The 1977 A.I.S. team comprised of three locally-bred bulls, and one bull recommended by the Queensland Committee of the A.I.S. Society as being a bull likely to improve the quality of this breed.

The Friesian team from 1977 contained three young bulls by proven New Zealand sires, one by a proven English sire and one by a proven Canadian bull. The Friesian Cattle Club nominated a bull for bull proving but, due to the age of the animal and the closeness of its breeding to other bulls being used in the proving group, it was mutually agreed that no breed society nomination would be used in 1977.

Two of the Jersey bulls in the 1977 group were sired by the A.I. Proven sire 'Yarallaside Ludo', while a further bull was a grandson of a New Zealand proven sire.

The number of cows nominated for bull proving is satisfactory in the Friesian breed, but few are offered in the A.I.S. and Jersey breeds. As the Friesian breed continues to expand while the A.I.S. and Jersey are on the decline, it becomes more difficult each year to obtain sufficient numbers of cows of these latter breeds for progeny testing.

Friesian nominations for matings to bulls in the proving group were 2 149 cows, A.I.S. 1 197 cows and Jersey 682 cows, a total of 4 028 animals.

The number of cows nominated was 1 160 fewer than in the previous year.

The reduction can be attributed to a number of factors, such as a reduction in the number of dairymen in the State, fewer dairymen production recording and using artificial insemination, as well as a lack of confidence in the dairy industry.

Latest proven sires

FRIESIAN. The latest proven Friesian bull resulting from matings made in 1973 was the English sire 'Bierspool Astronomer'. This bull will be contract mated to breed a team of young bulls for 1980.

Insufficient semen is available from him for sale, therefore the second sire in the group, 'Wattle Vale Hope Parader', will be offered to dairymen as the A.I. Proven sire.

A.I.S. 'Lemon Grove Supremacy' was the leading sire of this breed from the 1973 test group. He will be contract mated to breed future sires. Adequate semen is available from him to meet commercial requirements.

JERSEY. The proven Jersey sire was, 'Crystal Brook Page Boy'. Contract mating with this bull has been made and sufficient semen is available from him for industry needs.

Extension of Friesian bull proving

The Friesian Cattle Club (Queensland Branch) and the Department are co-operating in extending the Friesian scheme to cover breeders of pure bred cattle.

Two young Canadian sires from England and two locally-bred sires are to be used in a group of four bulls during 1978-79. These bulls will be used over registered Friesian animals only and the best sire from this group will be assessed. A number of the progeny should also be classified, which will give a type rating for these sires.

This scheme should prove a valuable adjunct to the normal bull proving project.

Swine A.I.

Main activities have continued to involve the handling and preservation of boar spermatozoa at 16°C, 4°C and -196°C using various diluents. Artificial insemination techniques have been examined also.

A.I. trials using chilled semen resulted in a pregnancy rate of 74% while an average litter size (foetuses present at slaughter) of 8.5 was achieved.

Research, involving the recovery of spermatozoa from the uteri of sows previously inseminated with preserved semen, allowed various aspects of pig A.I. to be investigated.

Three pig-farmers were supplied with chilled semen for insemination of their own sows. An average of three insemination doses per litter yielded a pregnancy rate of 100% with an average litter size of 8.

Dairy Research Branch

THE Dairy Research Branch continued to provide technical services to the dairying industry and for the protection of the consuming public, by means of its regional laboratories in Murgon, Malanda and Toowoomba and its facilities in Brisbane which include well equipped laboratories and pilot plant.

In addition, regular monitoring of margarines produced or consumed within the State was carried out.

So that the quality of dairy products could be effectively assessed, more than 70,000 bacteriological analyses were performed on 39,000 samples and more than 61,000 chemical analyses on some 30,500 samples.

Results of the tests were sent to producers and manufacturers to assist them in upgrading or maintaining quality and were also used by field staff of the Dairy Field Services Branch and the Queensland Milk Board to perform required trouble shooting, advisory or regulatory duties.

Recourse to legal samples was required on 19 occasions; 186 were for butters suspected of being overmoisture and the remaining eight were milks. In addition, analyses on 373 samples destined for export to various countries or required for special purposes resulted in 108 N.A.T.A. certificates being issued.

Raw milk

There has been a change in the Total Bacteria Count standard over the last year. For farm milk the standard is less than 50 000/ml and for all other raw milk the standard is less than 150 000/ml.

Results of tests were—

	No. samples	No. complying
Farm-to-factory tankers ..	1 201	995
Factory-to-factory tankers ..	1 496	445

No comparison can be made with results from previous years owing to the change in standard.

A total of 144 samples of farm supplier milk was tested on behalf of the Milk Board.

There was an increase in samples failing to meet the legal requirements for solids-not-fat and total solids, compared with the previous year. Of 2 965 tanker milks tested, 237 failed to meet the S.N.F. standard and 113 failed to meet the total solids standard. The severe drought conditions experienced during the present year would probably have contributed to these results.

The same number of samples as above was tested for freezing point. Of these, 120 failed the standard compared with 27 for the previous year. Of these, 56 were adulterated with greater than 1% excessive water compared with only five in 1976-77. Again, the drought conditions would have been largely responsible for these failures.

Pasteurized milk and cream

Samples representing all products from all factories in Queensland were received and tested on a regular basis. In addition, samples were tested from interstate, including Norco thickened cream and fortified flavoured milks, and Bulla thickened and synthetic cream.

Most products passed the keeping quality test and complied with the total count standard. More samples failed the coliform test than any other microbiological test. Empty containers from many factories failed the Total Bacteria Count test and some also failed the coliform test.

Efficiency of pasteurization is indicated by the phosphatase test. Of 5 669 samples, only 22 failed the phosphatase test.

The standard for fat in skim-milk was raised during the year from 0.1% fat to 0.15%. This has resulted in fewer skim-milks failing this standard. However, as with whole-milks, more skim-milks than last year failed to meet the S.N.F. requirements.

Butter

A total of 7 117 chemical tests was performed on 1 814 butter samples. The number of samples tested was 18% lower than for the previous year. This reduction was due to a number of factors including the closure of Kingaroy and Nanango factories and reduced butter manufacture due to drought conditions.

A total of 1 236 samples of butter was tested bacteriologically and 4 226 tests were carried out. More samples were tested this year compared with last year, but fewer tests were done.

Butter imported from interstate accounted for about 80% of all butter received by the Butter Marketing Board. This means that, while interstate shipments were similar to those of the previous year, Queensland receipt was considerably lower.

As from 30 May 1977, at the request of the Manager of the Butter Marketing Board, every churn of cultured butter (both unsalted and Royal) manufactured in Toowoomba and patted in Brisbane has been microbiologically tested to determine the eligibility of each churn for commercial use. This continuous supervision has taxed the resources of the Dairy Products Microbiological Laboratory and accounts for 40% of the butter tested in the last 12 months.

An improved schedule of butter analysis was instituted for the Butter Improvement Service. Owing to the decline in the number of butter factories and the quantity of butter produced in Queensland, some factories are over-surveyed while others produce butter for local consumption only and do not consign excess butter to the Butter Board. In an endeavour to achieve a widespread coverage of all butters manufactured in Queensland, all butter factories are to submit three of their pats per month to Brisbane for analysis.

During the year, thermophilic, penicillin-resistant bacteria continued to be present in probable spoilage bacteria count in butter. The presence of these heat-resistant organisms rendered the interpretation of the results difficult and inaccurate. It was therefore decided that the probable spoilage test be discontinued and the psychrotrophic count at 7°C for 10 days be substituted as from July 1978. The psychrotroph count will assess probable spoilage and the possibility of adverse changes during storage.

Chemical and physical analyses show the Queensland butter results to be similar to those of the previous year. Overmoisture results remained at slightly over 3% of the butters analysed routinely. Extraneous matter results still need much improvement.

Results of tests on Victorian butter were generally satisfactory, but overmoisture samples amounted to about 5.5% of the samples tested routinely.

Cheese

Only 100 cheese samples for export were tested in Brisbane and eight from Malanda compared with 301 for the previous year. The low number of samples submitted was due mainly to low production because of drought conditions in south-eastern Queensland, a greater demand on the home market, and a decreased quota to Japan in the case of cheese produced by the Atherton Tableland Co-operative Dairy Association.

The main points to note with regard to cheese composition are an improvement in both bacteriological and chemical points score and an overall improvement in the average extraneous matter score in comparison with the values for the previous year.

Yoghurt

Of 971 samples of yoghurt tested, 948 passed the coliform test, but of 969 samples tested for yeasts and moulds only 427 passed. All factories were involved in the poor yeast and mould results.

Milk powder

Twenty-two milk powders intended for local consumption were sampled at local supermarkets. These were analysed in detail and, while the results were generally satisfactory, 11 of the samples were considered to have stale or objectionable flavours when sampled by the State Graders.

Casein, milk powders and Junex for export

Since 1 January 1978, the Commonwealth Department of Primary Industry has required that Total Bacteria Count and coliform test be performed on caseins and milk powders in addition to the tests for *Salmonella*, phosphatase and penicillin. The N.A.T.A. certificates issued by the Dairy Research Laboratory now include Total Bacteria Count and coliform tests results.

Residues monitoring

Monitoring of milk and dairy products for chemical residues was another activity of the Branch.

A total of 24 878 samples was tested for antibiotics, with less than 0.4% positive for penicillin and 0.2% for other inhibitory substances. While the percentage of samples free of antibiotics has been more than 99% for the last 3 years, the incidence of penicillin has decreased and there has been a concurrent increase in the detection of other inhibitory substances.

PESTICIDES. A total of 444 samples of raw and pasteurized milk and raw cream was tested for the presence of pesticides. Nineteen samples contained more dieldrin than the maximum level recommended by the National Health and Medical Research Council, and one sample contained more than the maximum recommended limit for lindane.

IODINE. A total of 1 579 samples comprising raw and pasteurized whole milk and skim-milks was analysed in the past 12 months. This represents a considerable increase in testing over the 365 analyses carried out in 1976-77.

An improvement in iodine levels has been observed in pasteurized milks and skim-milks, but there was little improvement in raw milk samples. Of the pasteurized milks, 88% had iodine levels less than 500 µg/litre in March 1978 compared with 56% passing this standard 12 months earlier.

Monitoring of iodine levels is now being carried out State-wide by all Dairy Research Laboratories, by Field Services and by some factories. Samples have been analysed by several different methods as part of an Australia-wide program to develop rapid methods for the Standards Association of Australia.

AFLATOXINS. Aflatoxins are toxic substances produced by the mould *Aspergillus flavus*. If this mould grows on cattle fodder, the possibility exists that aflatoxins may find their way into milk.

Twenty-three samples of bottled pasteurized milk, representing all Queensland districts, and three farm milk samples from cows fed peanut meal or peanut hay were tested for the presence of aflatoxins. All samples were free from aflatoxin contamination.

Eight cheeses analysed for aflatoxins also gave negative results.

NITRATE. Sodium nitrate is added to cheese milk in some countries as a preservative. The possibility exists that bacterial action might convert the nitrate to nitrite and thence to the carcinogenic nitrosamines. Methods for the detection of nitrate and nitrite in cheeses have been developed and testing of imported cheeses will commence shortly.

HEAVY METALS. Following the purchase of an atomic absorption spectrophotometer, a method has been developed for the analysis of copper in butter to replace the existing time-consuming method.

Methods for determining other heavy metal contamination in dairy products are being developed.

Margarine quality

Ten brands of locally manufactured margarine were sampled and tested regularly. Bacteriological quality of these products was generally high. Of 44 samples, 30 had a total bacterial count of less than 100/g. Only one brand had consistently high counts.

Seven brands of margarine from southern states were tested regularly, including one new brand 'Mother's Choice'. Bacteriological quality of these margarines was poor, but chemical composition (moisture, salt and extraneous matter) was satisfactory for all samples.

Twenty of the polyunsaturated margarine samples were analysed for their fatty acid profiles by gas-liquid chromatography. Because available gas chromatographic systems are incapable of resolving geometrical isomers of the C18 unsaturated acids, the level of cis-methylene interrupted polyunsaturated acids (as required by the amendment to the Margarine Act of 1975) could not be determined.

Some of these margarines were also analysed for cholesterol content. Investigations were carried out in an attempt to develop a rapid method that was accurate enough to measure down to the 5 mg/100 g permissible in table margarines. However, the methods available were found to be not specific for cholesterol.

Other analyses

Eighty milk samples from Kairi Research Station were analysed for their milkfat fatty acid profiles as part of a Dairy Cattle Husbandry Branch project. These analyses were used to indicate the level of energy intake of cattle fed at various stocking rates on fertilized pastures.

Farm supplies to Felton factory were tested for freezing point several times. Milk from a raw milk vendor having difficulty producing milk of legal composition was checked at weekly intervals to assist the Husbandry Officer in his feeding recommendations. Assistance was given to Dairy Advisers on several occasions to help them locate sources of contamination on farms.

Four surveys were undertaken to monitor the extent of Brucellosis infection in dairy herds on the Atherton Tableland. A total of 1 222 samples was tested.

Technical services to industry

Slime problems in Blue Vein cheese

Further work was carried out on the problem of slime redevelopment on the surface of retail packs. The effect of various sanitizers on the slime-forming micro-organism was investigated. It was found to be fairly resistant to iodophor, hypochlorite and CB19 (phosphoric acid). However, of the three, iodophor appeared to be the most effective.

As the main problem lay in development of slime on cheese after it left the factory, storage trials were conducted whereby blue vein wedges were subjected to a particular treatment and examined after 2 and 4-month intervals. Treatments included various storage temperatures, use of barrier and Cryovac bags, freezing, use of inhibitors and flushing with CO₂. Results of the first trial indicated that freezing or a CO₂ atmosphere stopped slime redevelopment. Also enclosing foiled wedges in barrier and cryovac bags produced clean surfaces but taste was affected.

Cottage cheese and quarg

Industry problems characterized by gritty texture in quarg products were investigated. This defect was evident when the curd was rubbery and hard to cut. It was found that, when the rate of cultured growth is slowed, rennet action exceeds acid development. Setting temperatures above optimum growth temperature of the cultures contribute to the problem.

Investigations into lumpiness in quarg revealed clotted casein particles which tended to form a sludge in the bottom of the vat. This defect, which was attributed to agglutinin in the milk, created problems with quarg separation and cheese-cake manufacture.

Research

The main objective of the research in the past year has been to develop a test that will enable the prediction of the storage stability of butter, with particular reference to the development of butyric off-flavours. Another area of research has been the development of a new enzymatic test for the determination of the extent of heat treatment during the production of milk powders.

Many micro-organisms that contaminate milk secrete heat-stable enzymes which, even at very low levels, can cause a deterioration in quality of stored dairy products, such as butter and cheese. The optimum conditions for the production of some important hydrolytic enzymes from psychrotrophic bacteria isolated from milk and cream have been studied, and an initial investigation into the properties of the extra cellular lipases undertaken. Methods for the detection of very low levels of lipase activity in dairy products have been developed. These include agar-well diffusion procedures and sensitive colorimetric and fluorometric methods. Sensitive procedures for the measurement of low levels of breakdown products (that is, free fatty acids) have been evaluated. Using these analytical procedures, trials aimed at predicting the storage stability of pilot plant and commercially manufactured products are currently being carried out.

In attempting to monitor the breakdown products of butter, it became obvious that the composition of the aqueous phase of butter was not well characterized. Consequently, a more detailed study of the butterserum has been undertaken and protein, triglyceride phospholipid and enzyme components have been identified. These components are the point of attack for many of the hydrolytic enzymes originating from contaminating psychrotrophic bacteria.

Cheese ripening

An allowance of \$9 000 was provided by the Dairying Research Committee in 1977-78 towards continued research into the development of methods for accelerating the rate of mature flavour development in cheddar cheese.

The most successful method has involved the addition of an enzyme extract from the yeast *Kluyveromyces lactis* before cheese manufacture.

This extract causes partial hydrolysis of the milk sugar (lactose) which results in more rapid acid production, followed by increased proteolysis and flavour development. Under ideal conditions, flavour that normally requires 6 months' cool storage can be obtained in 3 months. Pilot scale manufacture has now reached the stage where commercial trials are being planned.

The other methods investigated have involved either addition of large amounts of a non-acid producing mutant of the normal cheese starter bacteria, or storage of the cheese for an initial period at ambient temperature before cool storage. Both methods have resulted in some reduction in storage time, but further trials are required to specify the exact conditions required.

Subnormal milk composition

Most of the work on this project has been completed and a final report is being prepared. This report will indicate how the freezing point test as applied to milk can best be interpreted in view of such factors as seasonal and nutritional conditions, milk composition and herd health. All these factors affect the freezing point and have not been studied before in Queensland.

A freezing point survey of raw farm milks is still being undertaken in south-east Queensland. This survey will finish in October and will test the validity of the current freezing point standard.

Sampling programs for non-cheddar cheese

In the investigations, manufacturing runs of cottage cheese, bakers' cheese, Gouda, Edam and eye-type cheese are being monitored at commercial manufacturing plants or the Otto Madsen Dairy Research Laboratory pilot plant for a range of micro-organisms variously regarded as indicators of hygiene and keeping quality or as specific food-borne pathogens. The data obtained during manufacture are then related to microbiological and/or organoleptic quality of the cheese at intervals during ripening or storage.

In this way, tests to be applied during manufacture as sensitive indices of cheese quality can be selected. Blue Vein cheese is also being studied, but here the attention is focused on ways and means of improving the keeping quality of the matured cheese during wholesale and retail distribution.

Milk sampling programs

The objectives of the sampling programs for liquid and powdered milks are—

1. To establish controls for storage and handling of raw milk before processing.
2. To develop a sampling program for milk and milk powder from production through to transport, storage and processing.
3. To establish the significance of processing conditions in relation to compliance of milk powders with microbiological specifications.

RAW MILK. During the year, trials assessing the changes in total bacteria count and psychrotroph count between the farm vat and the pasteurizer were completed. The most significant factor appears to be growth of psychrotrophs during factory storage of raw milk.

POWDERS. Monitoring of microbiological flora during powder production has begun. A preliminary survey on commercial whole and skim-milk powders from a supermarket was carried out to determine the extent of microbiological flora. Ten out of 11 samples had total counts of less than 1 000 organisms per gram.

Cheese technology

Work continued on the technology of eye type cheese with a view to applying existing knowledge to manufacture. During the year the Dairying Research Committee provided financial support to the extent of \$3 500 for this project.

Trials were conducted to establish guidelines for manufacture and control of composition of cheese with irregular eyes, to compare the influence of curing temperature on ripening of this cheese, and to investigate methods of salting the cheese.



An experimental eye-type cheese designed for Queensland domestic markets.

For the manufacture of cheese with regular eyes using propionic bacteria, a study was made of lactic acid and gas formation by starter cultures. The rate of acid development at different temperatures of select starters was determined and used to optimize efficiency in the cheesemaking process. An additional technique using *S. diacetylactis* and *L. citrovorum* to initiate eye formation was introduced. Results are promising.

A program designed to study constituents which contribute to the flavour of eye type cheese was commenced. Samples from different stages of manufacture and curing are being examined for acetic, propionic and butyric acids, proline and diacetyl.

Mastitis studies

During the past 12 months, work has been directed towards two main areas, these being the application of the NAGase test and conductivity measurements in an overall mastitis monitoring program, and studies on the origin and molecular properties of bovine milk NAGase.

Both NAGase and conductivity measurements have been found to be extremely useful in detecting abnormal secretions from individual quarters of cows. The reliability of these two tests in detecting problem animals is as good as the traditional somatic cell count test. However, the interpretation of the results of these tests; when carried out on composite milk samples (ex milk meter) is not as yet clearly defined and work is at present continuing in this area.

The enzyme, N-acetyl-B-D-glucosaminidase (NAGase) has been purified from bovine mammary gland homogenates. It exists as two iso-enzymes called the A and B forms which can be separated by electrophoresis or gel filtration. The level of this enzyme in bovine mammary gland tissue is extremely high, and comparative studies with the enzyme from blood and white blood cells have shown that more than 90% of the NAGase found in milk originates from the secretory epithelial cells of the gland.

Work was commenced the previous year to establish the incidence of mastitis pathogens in farm milk supplies relative to the total bacteria count and the somatic cell count. The 34 farm milk supplies being monitored in this survey were each examined several more times during the year. The results have indicated that, in most farm milks, counts of the major mastitis pathogens do not exceed 1000/ml. Relationships between mastitis pathogen count and total bacterial count or somatic cell count were poor. Recent work has been directed towards establishing the level of mastitis pathogens and total counts in individual cow milks.

Pasteurized cream storage

The objective of this work was to establish whether the keeping quality of pasteurized cream stored in nitrous oxide-propelled whipping devices was superior to that of cream stored under a normal atmosphere. Storage trials with both commercially-pasteurized cream and cultures added to sterile cream have indicated that the commercial preparation of nitrous oxide used does have anti-bacterial properties, and that acceptable storage life of the cream is extended as a consequence of this. Greatest enhancement of keeping quality occurred when the initial quality of the cream was high and storage temperature low (4°C or less). Work directed at identifying the actual inhibitory mechanism is now in progress.

Other projects

RAPID MOISTURE TESTING OF BUTTER. Moisture testing of butter is essential for both factory process control and legislative purposes. Since the introduction of continuous butter-making machines, fast, accurate moisture control has been necessary to stabilize operating conditions and avoid losses due to incorrect moisture content.

Two rapid gravimetric methods for determining moisture content in butter were compared with the standard technique of oven drying. There were no significant differences between the mean moisture determinations of the three methods, all of which had comparable variability. The average times to complete the moisture tests using an infra-red moisture balance and a commercial microwave oven were 5.2 and 3.5 minutes respectively compared with approximately 2 hours for the standard oven drying method. An article outlining these results has been prepared.

RAPID ESTIMATION OF UNDENATURED WHEY PROTECTION NITROGEN IN SKIM-MILK POWDER. Buyer specifications for skim-milk powder often include a heat treatment classification which will determine the functional properties and end uses of the powder, for example, recombined products, baby food and bread manufacture. The undenatured whey protein nitrogen content of powders provides a measurable index of heat treatment.

Existing procedures for this estimation are time-consuming, and therefore a simplified rapid method has been developed using the Pro Milk Tester Mark II. Since most denaturation of whey protein occurs before drying, Pro Milk readings obtained with the milk concentrates give an indication of the final nature of the powder. Such information is of considerable importance in process control and production economy.

INCIDENCE OF PSYCHROTROPHIC SPORE-FORMING BACTERIA IN RAW AND PASTEURIZED MILKS. The main objective of this project was to determine the incidence of psychrotrophic spore-forming bacteria in pasteurized milks in Queensland, to identify representative isolates, and to study the growth and sporulation patterns of some of these isolates. Psychrotrophic spore-forming bacteria were found in 31% of milks tested, and were found to belong to the *Bacillus* genus. Most isolates grew well at 1°C and 4°C with a vegetative cell inoculum, and some were capable of spore germination at 1°C and 4°C. The ability of some of these psychrotrophic spore-formers to survive pasteurization and grow in the cold stored product could be a significant factor in limiting the shelf life of pasteurized milk and cream products.

STUDIES ON THERMODURIC PSYCHROTROPHIC BACTERIA IN PASTEURIZED MILK AND CREAM AND BUTTER. The objectives of this project were to determine the incidence of thermophilic psychrotrophs among the bacteria isolated from pasteurized milk and cream and butter by two direct enumeration techniques for psychrotrophic bacteria, to identify any such isolates, and to determine minimum heat treatments necessary for their destruction. It can then be established whether a psychrotroph count is an accurate reflection of post-pasteurization contamination. Some thermophilic psychrotrophs have been isolated and, at present, work is continuing on identification and ranges of heat resistance.

Cream whipping

Development of equipment for whipping and dispensing cream reached the final stage with the preparation of a documentary film to promote the commercial use of this equipment.

Trials were conducted to measure the dispensing rate and over-run of cream produced under various pressure conditions in order to assess operational efficiency of the creamer. The wide range, from 100 to 300%, over which the over-run can be controlled highlights the practical advantages of the development.

Cleaning trials were undertaken to test the efficiency of sanitizing the equipment using conventional and quaternary ammonium cleaning compounds. This aspect of the work is important as restaurants, like dairy factories, experience problems in training and motivating staff to clean dairy product handling equipment effectively. The cleaning unit developed in the pilot plant has now been extended to simplify controlled dosing of rinse water with cleansers and/or sanitizers.

Modified butters

Storage trials on butters manufactured during the previous year were completed. The grades of butters manufactured from choice grade cream and from recombined cream blends containing up to 35% anhydrous milk fat and soft milk fat fraction ranged from 92 to 94 points. These grades were well maintained during storage at -10°C.

During 1978, work has continued with manufacture of butter from factory cream blended with 40 to 95% recombined cream. Following a favourable benefit/cost analysis, this program was planned to assess the practicability of recombining imported anhydrous milk fat and blending it with existing cream to satisfy Queensland's butter needs.

Open days

In September, a series of Open Days was held to mark the tenth anniversary of the opening of the Hamilton complex. Displays were set up in the laboratories and pilot plant to illustrate the Branch's activities, and invited members of the public (school children, women's and consumer groups, and industry personnel) were conducted through the buildings.

The official opening of the Open Week was performed by the Acting Minister for Primary Industries (Mr Tomkins), at the luncheon held in the grounds at Hamilton. A seminar at which Branch staff and invited industry speakers presented talks provided industry and Departmental workers with the opportunity to assess the role of the laboratory in relation to the current dairy industry situation.

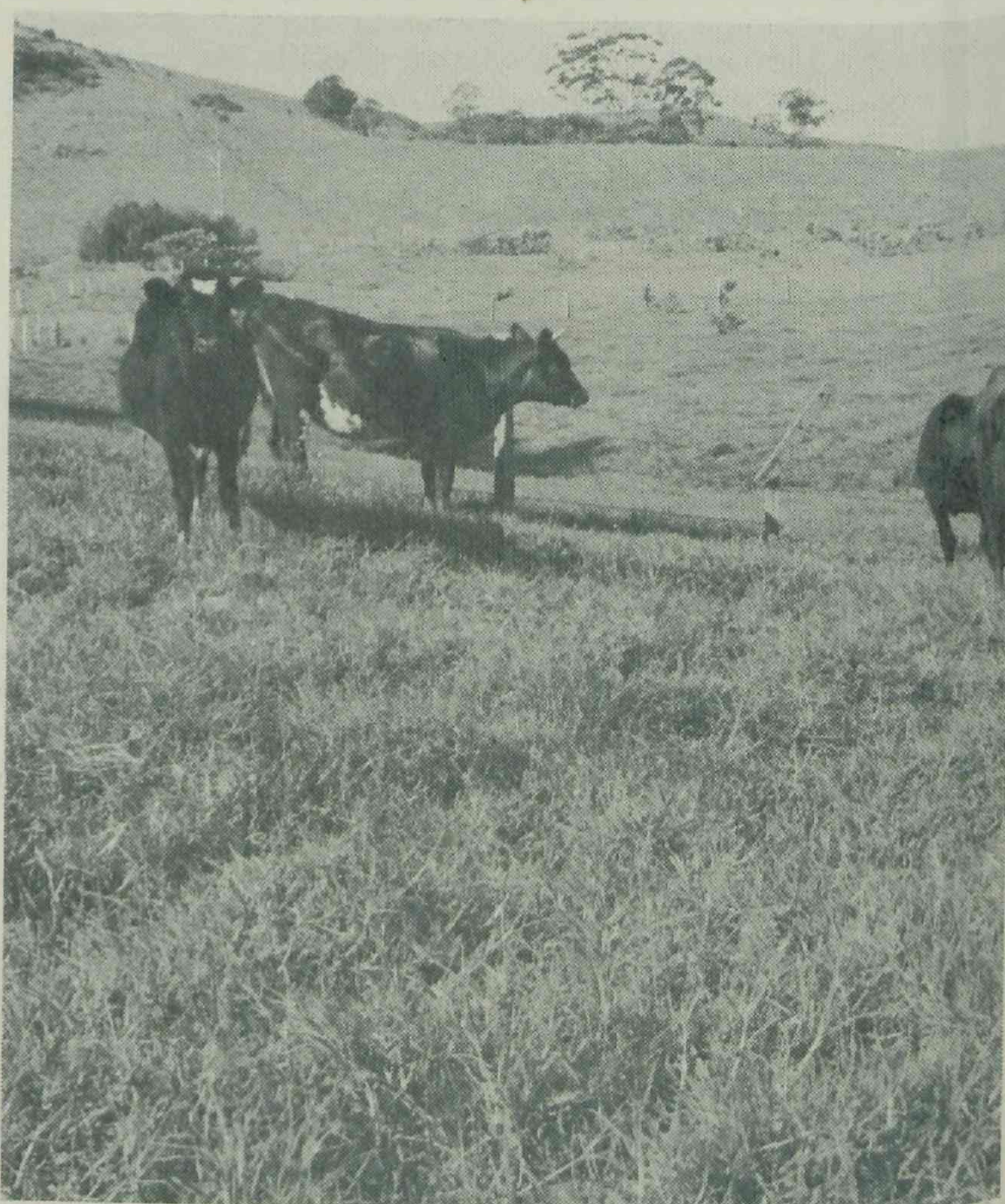
Dairy Pasture Subsidy Scheme

FINAL payments in the Dairy Pasture Subsidy Scheme were completed during the year. While the receipt of applications under the Scheme terminated on the 9 February 1977, the payment of claims for approved plantings continued during 1977-78.

Details of total claims paid, total area approved for payment and total subsidy paid during the full term of the Scheme are summarized below.

Year	Total Registered Dairy Producers	Total No. of Claims Paid	Total area Approved for Payment	Total Subsidy Approved for Payment
			hectares	\$
1966-67	12 146	2 144	13 472.3	404 257.22
1967-68	11 080	3 138	19 043.8	600 053.64
1968-69	9 650	2 926	16 969.2	530 661.64
1969-70	8 826	2 909	20 739.1	613 710.38
1970-71	8 125	2 205	16 737.9	477 749.63
1971-72	7 420	2 996	22 199.3	623 059.15
1972-73	6 602	2 002	14 547.2	429 446.67
1973-74	5 494	1 580	11 433.3	338 321.08
1974-75	5 104	1 170	7 908.0	238 976.66
1975-76	4 694	1 015	7 250.2	206 005.43
1976-77	4 290	271	1 604.1	48 221.14
1977-78	3 897	174	1 529.0	49 606.65
Total	..	22 530	153 433.4	4 560 069.29

The contribution of Government funds to the support of this development program was a significant factor in increasing per cow and per farm production during the period of its operation. Successful implementation of the Scheme was effected through the excellent service and co-operation of a large number of Departmental officers and industry representatives. The knowledge of pasture and legume species, fertilizer treatments and establishment and maintenance practices gained by producers who participated will have long term benefits in the industry.



Dairy heifers grazing kikuyu grass pastures at Eumundi. The Dairy Pasture Subsidy Scheme made possible the establishment of more than 150 000 ha of highly productive improved pasture.

Division of Marketing

THE main function of the Division of Marketing is to provide necessary advisory and regulatory services relating to the marketing of Queensland primary produce. This involves the provision of marketing intelligence, financial and economic advice, management planning and quality control services, all of which are supported by appropriate research.

The extension, research and regulatory functions of the Division are carried out by three branches, Marketing Services, Economic Services and Standards. The Division also provides assistance in matters related to Acts administered by the Department and in the general policy area. At 31 May 1978, 192 staff were employed in the Division of Marketing. During the year, Mr D. R. Lewis, Director of Marketing Services retired and Mr D. R. J. Densley was appointed to the position.

During the year, the emphasis of the Division's work tended to shift further towards the solution of marketing problems and provision of marketing and financial advice. This shift in emphasis is a direct result of depressed economic conditions being experienced by several of the State's major rural industries, particularly the beef and dairying industries.

Legislation

Legislation was enacted enabling the constitution of a Queensland Meat Industry Organisation and Marketing Authority to replace the former Meat Industry Authority. The new Authority has been given wide ranging powers in relation to the marketing of meat and industry organization generally. Because of its increased functions, representation on the Authority has been widened to provide for greater producer representation and representation from other major organizations involved in the meat industry.

New legislation was enacted to provide for the setting up of a Queensland Milk Board, an associated Milk Entitlements Committee and Milk Appeals Tribunal. The operations of the new Board will embrace the whole of Queensland in several respects and consequently representation on the Board has been widened to ensure that all sections of the industry have an adequate voice in milk industry affairs.

The City of Brisbane Market Act was amended to provide for more effective control over the wholesale marketing of fruit and vegetables within the City of Brisbane area. The Brisbane Market Trust is now empowered to fix selling hours within the market and it is expected that this should lead to more effective competition.

The Hen Quotas Act was amended to provide a more flexible system of dealing with transfer of quotas and at the same time to change the quota year to one commencing on 1 January instead of 1 July. The new quota year is better suited to current production practices in the egg industry.

Because of problems faced by a number of co-operatives wishing to transfer their registration from under the Primary Producers' Co-operative Associations Act to the Co-operative and Other Societies Act and vice versa, amendments were made to both Acts during the year. These amendments provide for a much simpler procedure for transfer of registration in cases where the nature of a co-operative's business has so changed as to warrant a change in its registration.

The position of vigneron registered under the Wine Industry Act was improved by an amendment to the Liquor Act. This amendment reduced the fee payable by a vigneron.

This should assist in the establishment of the infant wine industry in Queensland on a sound basis. A detailed examination is being made of other legislative aspects of concern to this industry and further developments are likely in the coming year.

Other legislation administered by the Division, which is currently under review, includes The Farm Produce Agents' Act, the Agricultural Chemicals Distribution Control Act, the Agricultural Standards Act, the Wheat Industry Stabilisation Act, the Primary Producers' Co-operative Associations Act and the Primary Producers' Organisation and Marketing Act.

A statutory organization for pig producers was constituted during the year under the Primary Producers' Organisation and Marketing Act. This organization will consist of a Pig Producers' State Council, District Councils and Local Branches. The State and District Councils are already operative and Local Branches are in the process of formation. The new organization will ensure that Queensland pig producers, in future, have an adequate say in industry affairs at local, State and National levels.

Industries Assistance Commission

During the year submissions were made to the Industries Assistance Commission on behalf of a number of Queensland rural industries. These included the citrus, tobacco and wheat industries and vegetable oils and fats.

The Division continued to maintain a close watch on matters referred to the Commission for enquiry and enters an appearance before the Commission whenever it is considered that this may be to the advantage of rural industries which may be affected.

Agricultural Chemicals

The Division, and the Standards Branch in particular, have become increasingly involved in problems associated with the registration, control and distribution of various agricultural chemicals.

During the year, Mr A. R. Hughes, of the Standards Branch, represented the Department at a meeting of F.A.O. in Rome which considered possible means of achieving greater world-wide uniformity in the registration of pest control chemicals.

With increasing public fears concerning possible problems, real or imaginary, which may be associated with incorrect use of some agricultural chemicals, it is necessary that stringent control be exercised over the registration and use of such products.

This has placed an increasing load on the Standards Branch in the areas of registration of the chemicals themselves and in the administration of the Agricultural Chemicals Distribution Control Act. The extent of supervision over aerial and ground spraying of such chemicals in Queensland is the highest in Australia.

Research and extension

The fifth edition of the *Farm Management Handbook* was released in February 1978 and nearly 2 000 copies have since been sold. The handbook is now extensively used by teaching institutions involved with rural industry.

Depressed conditions in some of our major rural industries have resulted in an increasing demand by producers for assistance in rural adjustment, particularly in the preparation of budgets for use in connection with applications for finance. Officers of the Economic Services Branch have been heavily committed to this field.

An economic assessment was made of water storage options in the Burdekin area for hydroelectricity generation and agricultural use. This study, which was carried out by Economic Services Branch, formed part of an overall investigation by an inter-departmental working group which is to report in July 1978 to the Burdekin Project Assessment Committee on future development in this region.

An interesting feature of the analysis was an assessment of secondary benefits arising from large scale investment in an irrigation project. The sector multipliers used in the assessment were developed from an earlier input/output study in the Townsville region. This research received favourable comment from regional science experts at the second Australian Conference of the Regional Science Association held in Sydney early in 1978.

Economic aspects of soil conservation are being studied on the Darling Downs, in association with officers of the Division of Land Utilisation, to provide a basis for policy decisions on the apportionment of costs of erosion control among the beneficiaries, namely the landholder, local community and government.

Through representation of economists on departmental research station committees, the Economic Services Branch is becoming more involved in the economic assessment of research projects. Benefit costs studies of selected departmental extension and research projects were undertaken in 1977 as part of an interstate review collated by the New South Wales Department of Agriculture for submission to Standing Committee on Agriculture.

Large scale capital investment in farm machinery prompted the need for publications to assist producers in selecting and financing farm machinery. An important role has been played in developing methodology for decision making in this field. This work received a favourable response when presented to a National Workshop on Farm Machinery Extension in South Australia in May 1978.

The information needs of prospective farmers have been catered for in an introductory series of farm notes providing guidance in fields such as assessing the sale price, determining whether the farm will pay and examining taxation aspects of buying and selling property.

A series of financial feasibility studies was undertaken by Marketing Services Branch officers in connection with applications by various Marketing boards and co-operatives for government guaranteed loans. In addition, the Branch continued to supervise the financial operations of boards and co-operatives wherever outstanding loans were subject to government guarantee.

Initial steps were taken towards the institution of a meat and livestock price reporting service. It is expected that, subject to availability of the necessary staff and finance, the service could commence early next year.

Research undertaken by Marketing Services Branch covered such diverse fields as trade and protection, feasibility of establishing a new cotton gin at Emerald, crop forecasting methodology, the use of remote sensing in crop forecasting, consumer attitudes to eggs, taxation as it relates to rural organization and future market prospects for crops in north Queensland.

Standards Branch continued its regulatory activities in respect of fruit and vegetables and agricultural requirements and intensified efforts in the field of fruit and vegetable marketing extension. As a direct result of these efforts, there have been noticeable improvements in the quality and presentation of fruit and vegetables received at the Brisbane Market.

The fruit industry was assisted through the maturity testing of grapes, citrus, avocados and pineapples by officers of Standards Branch. A service was also provided to the fruit

industry by way of supervision of fumigation of interstate consignments of various fruits to control fruit fly infestation.

As a result of research carried out by Standards Branch officers, there have been a number of new developments in the fields of seed testing, seed viability and seed processing. The results achieved have attracted substantial overseas interest.

Officers from all branches of the Division participated in numerous field days, workshops and conferences relating to rural industries.

Other activities

The three branches of the Division were heavily involved in various training programs. These programs included courses, seminars and workshops for primary producers, rural industry organizations, Departmental officers and officers from Agriculture Departments and industry organisations in overseas countries.

Officers from Standards Branch attended the Asian-Pacific Weed Science Society Conference in Indonesia, an International Seed Testing Workshop at Wageningen and an F.A.O. Conference on registration of pest control chemicals in Rome.

An officer from Marketing Services Branch assisted the South Pacific Commission in conducting a training course in agricultural marketing in the South Pacific Region, while another officer investigated remote sensing techniques for use in crop forecasting in the U.S.A.

Marketing Services Branch

THE principal function of Marketing Services Branch is to provide supporting services to the rural sector in Queensland in all aspects of the marketing of rural products.

In fulfilling this function, the Branch provides representation on statutory marketing boards, provides advice to Government and the rural sector on organized and orderly marketing systems, operates market reporting and market intelligence services, undertakes marketing research, provides advisory services and fulfills a regulatory role.

During 1977-78, an expanded financial management advisory service was provided to rural organizations throughout Queensland. The Branch also conducts training courses in marketing for executives and members of marketing boards and co-operative associations. Similar courses have also been conducted for Departmental extension staff. Workshops relating to finance and international trade were also conducted.

In addition to administering a wide range of legislation concerned with marketing of rural products, the Branch in 1977-78 became responsible for administering the Farm Produce Agents Act. The Branch Director was appointed the Director-General's representative on the Brisbane Market Trust.

To fulfill these functions, the Branch has a total staff of 42, comprising 21 graduate marketing officers, 13 technical officers and eight supporting clerical staff. Three officers were overseas on study or other leave during the year.

During the year Mr D. R. Lewis, Director of Marketing Services, retired after 11 years as Branch Director. He was replaced in December 1977 by Mr D. R. J. Densley, previously a Senior Marketing Officer in the Branch, but who, before his appointment as Branch Director, was head of the Division of Planning Economics and Marketing in the Papua New Guinea Department of Primary Industry.

Opportunity was taken following the appointment of a new Director to review the role and functions of the Branch. This review has led to a restructuring of the Branch into three sections—

Policy and Organized Marketing

Market Intelligence

Finance and Research

Reallocation of staff and responsibilities within these three sections is aimed at meeting expanding responsibilities in the fields of financial management advisory services, fruit and vegetable marketing, preparation of submissions to bodies such as the Industries Assistance Commission, review of marketing legislation, training aimed at increased effectiveness of marketing systems, and provision of market information to a wide range of users.

A more formalized in-service staff development and training program was inaugurated. This program, which is being developed in conjunction with marketing boards, will allow younger staff members to have greater exposure to the increasing complexities of organized marketing, supply-demand management systems and Government intervention measures which now operate in many rural industries.

Branch officers also attended a variety of training courses conducted by either the Public Service Board or the Information and Extension Training Branch of the Department. The Branch was also represented at the National Outlook Conference, the Australian Agricultural Economics Society Conference, the Kellogg Rural Adjustment Unit Workshop on Beef

Industry Stabilisation, the National Bean Workshop and the Peanut Industry Workshop.

Policy and Organised Marketing

1977-78 saw increasing attention paid by Governments throughout Australia to problems faced by the beef industry. Considerable efforts have been directed towards changes in marketing organization, methods of livestock selling, carcass classification, and to the reporting of livestock and meat prices.

In Queensland, legislation was enacted in December 1977 to restructure the Queensland Meat Authority as the Queensland Meat Industry Organisation and Marketing Authority with wider powers to control meat marketing. Branch staff have been involved with the Authority, officers of the Division of Animal Industry and officers of Departments in other States in the examination of livestock selling systems, the development and implementation of a system of carcass classification and the development of a livestock and meat market reporting service.

The Branch has been involved heavily in Commonwealth and State Government initiatives to introduce new marketing equalization arrangements for the dairy industry and especially Stage II arrangements as recommended in the 1977 Industries Assistance Commission report. Staff of the Branch were involved in the formulation and implementation of legislation designed to give greater access to the Brisbane milk market by milk suppliers in south-east Queensland.

The grain industries have required considerable attention during the year with submissions presented to separate Industries Assistance Commission hearings into the oilseeds industry and on future wheat stabilization arrangements. An examination of the implications of recent moves for each State grain handling authority to assume full responsibility for costs associated with handling facilities in its State has been initiated.

In May 1977, details of future stabilization arrangements for the tobacco industry to operate through to 1983 were announced. The Branch was involved in negotiations at Australian Tobacco Board level leading up to these arrangements. Evidence was presented to Industries Assistance Commission hearings on primage duties on tobacco.

Emphasis in the fruit and vegetable industry has been on marketing procedures in the Brisbane terminal market at Rocklea. The Brisbane Market Trust, which administers the Brisbane Market, was given additional powers to control the orderly marketing of produce in this market. The Branch, during the year, was given the responsibility for administration of the Farm Produce Agents Act which provides for the registration of commission agents selling fruit and vegetables on behalf of growers. Branch staff were appointed as Registrar and Deputy Registrar, as well as Inspectors under the Act.

A submission was made to the Industries Assistance Commission enquiry into the citrus industry. This enquiry arose as a result of concern as to the likely effects of imports of citrus juice on the Australian industry. The Branch continues to represent the Department on the National Vegetable Panel which is concerned with monitoring developments in the marketing of processing vegetables, especially beans and peas.

A drop in world cotton prices in the latter half of 1977 resulted in some liquidity difficulties for The Cotton Marketing Board. Assistance was given to the Board in making arrangements for financial accommodation. The Board also has been faced with expanding cotton production in the Emerald irrigation area and high transport costs in moving seed cotton to the gin at Biloela.

An examination was made of the options open to the Board. A comprehensive feasibility study supported the Board's conclusion that the most viable option is to establish a further cotton gin at Emerald provided cotton production in the year of establishment is 10 500 bales and around 18 000 bales within 3 years of establishment.

Legislation

Legislative developments with which the Branch was involved included the following—

DAIRY INDUSTRY.—The *Milk Supply Act* 1977 and associated regulations provided for the establishment of the Queensland Milk Board to replace the previous Brisbane Milk Board. The new Board has extended powers over the whole of the State in the areas of pricing, licensing provisions and the regulation of the supply and distribution of market milk.

This legislation also provides for a Milk Entitlements Committee with powers to determine the amount of milk which a factory or producer can provide for market milk purposes. The Committee also will operate a system for the controlled transferability of entitlements between co-operatives or group organizations.

A Milk Entitlements Appeals Tribunal has been established to hear appeals by anyone aggrieved by a decision of the Milk Entitlements Committee.

The Branch was also associated with the Division of Dairying in the formulation of the *Dairy Produce Act* 1978, particularly in the co-ordination of its provisions with those of the Milk Supply Act.

FRUIT AND VEGETABLES.—For the Brisbane Market Trust more effectively to control the wholesale marketing of fruit and vegetables outside the markets, but within the limits of the City of Brisbane, appropriate amendments were made to the *City of Brisbane Market Act* 1960–1978. In addition, the Trust was given the power to set selling hours within the markets.

The administration of the *Farm Produce Agents' Act* 1964 was transferred to the Branch during the year. Previously the Act was administered by Standards Branch. Currently, a review of the Act is being undertaken with a view of bringing it into line with recent developments in the marketing of fresh produce.

The Committee of Direction of Fruit Marketing, the Queensland Chamber of Fruit and Vegetable Industries Co-operative Limited, the Brisbane Produce Merchants' Association and the Fruit and Vegetables Retail Traders' Association have been invited to suggest improvements to the Act.

The review is expected to be completed during 1978-79.

BEEF INDUSTRY.—Amendments to the *Meat Industry Act* 1965–1977 provided for the establishment of the Queensland Meat Industry Organisation and Marketing Authority to replace the former Queensland Meat Industry Authority. The authority is responsible for maintaining close liaison with the Australian Meat and Live-stock Corporation and has the power to act as an agent for the Corporation or any other private meat or livestock marketing organization.

The new authority also has the responsibility for development of carcass classification systems and has a direct interest in improving marketing information available to producers.

WINE INDUSTRY.—The Department was involved with initiatives to amend the Liquor Act aimed at reducing the impact of licensing fees on vignerons. Amendments to the *Wine Industry Act* 1974 aimed at promoting wine sales are under consideration.

POULTRY INDUSTRY.—Amendments were made to the *Hen Quotas Act* 1973–1978. The defined season was changed to a 12-month period commencing 1 January as opposed to 1 July. In addition, the necessity to specify annually the State Hen Quota was removed. A degree of flexibility was introduced into the transferability of quotas and the Hen Quota Committee was given the power to amend quotas during the currency of a season.

Financial advisory service

Increasing demand has been placed on the financial management advisory service of the Branch.

This service provides assistance covering the preparation of submissions for Government guaranteed loans, capital investment analysis, advice on accounting systems, super-annuation funds, taxation provisions, and training of Board and co-operative staff in various aspects of finance.

Research into finance and taxation aspects of rural co-operative associations has been initiated.

Branch Extension—Market Intelligence

Recent developments in the rural sector have further brought home the importance of providing the means by which producers may be better informed on what is happening in various markets. Market developments and price changes vitally affect producer incomes and more complete information is necessary to enable producers to make management decisions.

In the area of crop forecasting, the Branch issues 13 crop forecasts each year, three each on summer grains and seeds, winter grains and seeds, and peanuts, navy beans and soybeans, and four on potatoes and onions.

A monthly *Marketing Newsletter* is circulated to Departmental officers working in country centres. The purpose is to provide extension officers with comment on the latest developments and news from a marketing point of view.

A *Weekly Trend Report*, which gives all associated with rural industry an up-to-date picture of the current situation in the State's major rural industries, is issued as also are daily and weekly reports on fruit and vegetable prices.

Increasing attention is being focused throughout Australia on the deficiencies in marketing information being supplied by State and Commonwealth Governments concerning fruit and vegetables. Moves to examine the possibilities of a national fruit and vegetable supply forecasting service have been initiated.

In line with the expressed aim of the Government of improving the marketing of livestock, the Branch is planning to introduce a meat and livestock market price reporting service. It is expected that the service will collect, analyse and publish daily and weekly price data based on nationally agreed descriptions of carcasses and livestock. The data will be based on prices paid at point of slaughter for livestock consigned to meatworks.

Price reporters also will visit selected saleyards in Queensland and report prices paid for nationally agreed criteria of livestock directly to the service headquarters in Brisbane.

It is proposed to give top priority to the beef industry, followed as soon as possible with the pig industry and sheep meat industries.

Training

During 1977-78, the Branch conducted three training courses in various aspects of marketing for Departmental external staff. These were designed to keep extension staff abreast of what is happening in rural marketing in Queensland, particularly in the fields of organized marketing and the various Government programs affecting marketing. Two courses were held for executive members and management of rural marketing boards and co-operative associations. Generally these courses were well supported and are considered to fill an important need at a time of considerable change in rural marketing in Australia.

There is increasing recognition of the need for more in-depth discussion on specific marketing and financial issues. To meet this need, the Branch organized workshops on finance and on Queensland-Japan trade in rural products.

The Branch continued to provide assistance and training at an international level and is committed to a further training course on behalf of the Australian Development Assistance Bureau in early 1979. As in previous years, an officer of the Branch assisted the South Pacific Commission in their training program in agricultural marketing.

In conjunction with Information and Extension Training Branch, planning is well advanced toward the development of an overall staff training program based on individual indications of needs.

Research and reports

Papers have been prepared on trade and protection and on the objectives and operations of marketing boards for presentation to the Economics and Marketing Committee of the Standing Committee on Agriculture. A paper was presented on production and usage of edible dried beans in Australia to the National Bean Workshop in Melbourne. Considerable work was undertaken on a study of the Queensland cotton industry with particular reference to the feasibility of establishing a cotton gin at Emerald.

A major thesis on crop forecasting methodology was completed together with a report on remote sensing in crop forecasting in the U.S.A. following a visit of an officer in mid 1977. A report on livestock market reporting services in Victoria and New South Wales has formed the basis for planning for a similar service in Queensland.

Other studies currently being undertaken by the Branch include a study on consumer attitudes to eggs, the effectiveness of various marketing organizational structures, rural organization taxation, future market prospects for a range of crops in north Queensland, grain marketing arrangements, as well as an evaluation of the various training courses conducted by the Branch.

Economic Services Branch

THE functions of the branch are to play a major role in farm business management extension to the rural community and to undertake economic research and provide advice on the rural sector of the State to primary producers, industry organizations and government.

To fulfill these functions, the branch has 24 regional Agricultural Economists stationed in 17 centres throughout Queensland with a support staff of 10 economists in head office who are mainly involved in research and administration. The staff position has been relatively stable during the year. Two officers resigned and replacements have been appointed.

Staff inservice and farmer training

During the year under review, a systematic approach to staff training was introduced, covering the areas of personal development, basic technical expertise and specialised individual training.

Three branch workshops were held in 1978 dealing with beef property management, irrigation economics, and methods of economic analysis. Funds did not permit the involvement of all branch staff and participants were selected on the basis of training needs and contributions they could make to selected topics.

Officers also participated in inservice training activities conducted by other branches and those officers specializing in industry economics also took part in relevant workshops conducted by technical branches. This is a welcome development as the economist is kept informed on technical matters, and economic aspects are discussed where appropriate.

Nine officers attended professional conferences to keep up to date with developments in farm management and agricultural economics.

Post-graduate training

Mr T. D. Wilson, Agricultural Economist, Division 1, Rockhampton was awarded an A.M.R.C. studentship and commenced a Masters' Degree in Extension Education at Guelph, Canada, in September, 1977.

Mr W. E. Holmes, Agricultural Economist, Division 1, Charleville, was granted study leave to take up an A.W.C. studentship to undertake a Masters' Degree in Agricultural Science (Extension) at Melbourne University in February 1978.

Schools for primary producers

The demand for farm office management schools continues both for basic and follow-up schools. This activity will be continued in the coming year and additional schools have been planned in northern and western Queensland.

General extension activities

Regional economists participate fully in departmental extension services. They are represented on all District Extension Committees. Two economists are District Extension Leaders and five are secretaries of District Extension Committees.

Regional economists are also directly involved with the farming community through the mass media and provide advice to individual producers on request. During the year under review, they produced a large number of press items which were circulated widely and covered 50 different subjects giving advice on topics such as farm purchase, machinery replacement and taxation.

An average of 37 farm visits were made by each country economist, as a result of direct farmer requests or for the purpose of obtaining information from producers. This contact represents a slight increase on last year.

In addition, the average number of office enquiries requiring follow-up work also increased this year: 105 compared with 87 last year.

The preparation of individual farm budgets is an important activity, particularly in the area of rural adjustment with an average of 21 budgets being prepared by each regional economist.

A new and encouraging development has been the formation of a Farm Management Discussion Group in the West Moreton. The two-way flow of information between the economist and participating producers is of mutual benefit. Two similar groups are in the process of being formed in the Bundaberg region.

Farm management publications

The publication of books, reports and leaflets dealing with agricultural economics and farm management continues to be a major branch activity. These publications are in demand

by producers, educational institutions and professional people, and contribute significantly to a better understanding of farm management by a wide cross section of the community.

The fifth edition of the *Farm Management Handbook* was published in February 1978. The book is in keen demand and a second printing is with the publishers. The book, which sells for \$4.00 a copy, fills a definite need of producers, educational institutions and business organizations. Approximately one-quarter of the books are sold interstate.

The second edition of *Accounting and Planning for Farm Management* is still in steady demand throughout Australia. Sales reached 750 copies during the year and this national text in farm accounting will be revised next year.

Four new Extension Series booklets were published during the year bringing the total to 17 publications in this series. Distribution of these booklets reached 7 000 this year and it is estimated that 75% would be in the hands of primary producers.

Leaflet series

Regional economists produced a large number of local publications dealing with the costs and returns associated with a wide range of crops. Of particular interest were a series of leaflets designed to give information to 'new' farmers which were released at the Expo 5 field day at Queensland Agricultural College which attracted more than 6 000 visitors in May 1978.

The branch is involved in the Agdex system of storage and retrieval of agricultural information. Seven refnotes and seven farm notes were produced in the Branch.

Research

Regional studies

The Northern Region Input/Output Study was completed and the report is being published. Already the project has contributed significantly to research work in this field and has led to branch involvement in other studies of this nature in Queensland. This research was reviewed favourably by regional science experts attending the second Australian Conference of the Regional Science Association. The sector multipliers derived from the study have been used in the evaluation of the Burdekin irrigation project.

A technique for the Generation of Regional Input/Output Tables (now called G.R.I.T.) was used to develop input/output tables from non-survey based data for the 10 Statistical Divisions of Queensland and for the State as a whole. The study was completed in December 1977 and the final report has been received favourably in Australia and overseas. The methodology has been adopted by other research workers in regional studies.

As a flow-on from this project, the study team was commissioned by Comalco Ltd. and the Department of Commercial and Industrial Development to analyse the impact of the establishment of various new industries on the economies of Gladstone/Calliope area, Fitzroy Region and the State of Queensland.

A study of the relationships between regional economic activity and structural activity has also been initiated. It will examine the relationship between various economic attributes and regional economic activity and identify the principal components of regional economic decline in specific Queensland shires.

The report evaluating resources in the Condamine Maranoa Basin was published during the year. This was a joint project with Agriculture and Sheep and Wool Branches.

Economic sections of the five Shire Handbooks were published during the year.

Industry studies

Pig industry

A report on the Queensland Pig Industry Survey 1970-73, financed by the Australian Pig Industry Research Council, was published during the year. This comprehensive report also contained information on trends in intensive pig raising since 1973.

The profitability of pig raising was examined in detail and the booklet 'Consider the Alternatives' was revised and reprinted with financial support from the Australian Pig Industry Research Council.

An investigation was made into the costs associated with selecting breeding stock using on-farm performance testing. Costs were \$4.82 per sow or \$11.76 per pig selected.

The factors which affect the price for porkers were also studied. There was no correlation between fat estimated by wholesalers and objective fat measurement. It was concluded that pricing accuracy would improve if some objective measures were used.

Beef industry

Stabilization within the beef industry has been one of the objectives of various proposals for improving conditions in the beef industry. This led to a study of the likely effects of the stabilization scheme proposed by the Queensland Beef Industry Committee and the role that carcass classification might play.

The Branch is represented on an advisory committee to supervise the introduction of a State price and market reporting service for the beef, sheep and pig industries. It is planned to have this service operating by the end of 1978.

Work has continued on other beef research projects. The 'Kolan Model', a computer aid for budgeting changes in management strategies of a beef property, has been completed and a draft report prepared. This model is being used to analyse data from trials carried out at the C.S.I.R.O. research station at Narayan to determine optimum stocking rates and pasture development.

Further progress has been made with 'Monto Model' for comparison of intensification or diversification options of development.

The economics of pasture improvement in the Coastal Burnett were examined in detail. It is still profitable to invest in improved pasture on cleared or treated country. Work is continuing on the evaluation of the C.S.I.R.O. grazing trials at Rodds Bay and optimum use of fertilizer in the coastal foothills.

A simulation study of decision making in the pastoral zone was finalized. The project has resulted in a computer model which is potentially useful for long-term budgeting, demonstrating the effect of changes in various management strategies.

Agricultural industries

At the request of the Queensland Cotton Marketing Board, this Department undertook a feasibility study of building a new cotton gin at Emerald in the Central Highlands. The Branch prepared a comprehensive review of economic aspects of cotton growing throughout the State

for incorporation in the overall industry report being collated by Marketing Services branch.

An analysis was made of the economics of changing from conventional to bulk systems of tobacco curing. Profitability was sensitive to the level of tax payable, condition of existing barns and the level of throughput.

At the request of the Australian Tobacco Board, this Department will co-operate with the Victorian Tobacco Board in constructing an index of tobacco production costs for the various tobacco growing areas in Australia. Movements in the cost of producing tobacco, as shown by the index, will be considered when determining the price to be paid for Australian produced tobacco.

The profitability of the alternative production strategies available to rice farmers in the Burdekin was investigated. Double cropping was found to be the most profitable system with limited land availability provided quality could be maintained. A build up of red rice would necessitate fallowing or rotational cropping for control.

Costs associated with harvesting of rice in the Mareeba area are being monitored to assist growers with machinery purchase decisions.

Economic factors, such as high capital investment in specialist equipment, rather than lack of technology are proving a deterrent to much needed expansion in the peanut industry.

This Branch undertook an economic assessment of water storage options on the Burdekin as a member of an inter-departmental working group. A report is being prepared embodying recommendations to government for the future development of this region.

The first stage of a study to construct and estimate a model of the Australian oilseeds complex was completed.

Economists are becoming increasingly involved in the economics of farm machinery purchase, maintenance and replacement.

In north Queensland, the *ad lib.* feeding of molasses has been evaluated on the basis of trial results. The costs associated with on-farm maize drying on the Atherton Tableland have been evaluated. The need for such research has arisen mainly through the representation of economists on all departmental research station committees.

The Farm Management Accounting Service membership has declined with 86 farmers completing the 1976-77 recording year. The reduced membership has made it difficult to produce adequate group averages and provide reliable data for research and extension purposes.

Standards Branch

THE main functions of Standards Branch are to provide a quality control service for agricultural requirements and agricultural produce and to ensure the maintenance of prescribed standards.

Under State legislation, Standards Branch exercises regulatory control over the quality of defined agricultural requirements and over fresh fruit and vegetables when these commodities are offered for sale. The Branch also provides an agricultural chemical registration service as well as considerable secretarial and technical support in the control of distribution of agricultural chemicals.

Government seed testing laboratories operated by the Branch at Indooroopilly and Toowoomba supply information to support regulatory activities relating to seeds, and also provide seed test results to facilitate seed transactions at both local and international levels. The Queensland Seed Certification Scheme, which is administered by Standards Branch, relies on quick and accurate seed test results.

Branch services, which supplement the regulatory function, include free seed tests to farmers who wish to sow their own seed, research in seed technology, fruit maturity testing and the supervision of fumigation for fruit fly sterilization of certain kinds of fruit and vegetables moving to southern States. A Fruit and Vegetable Marketing Extension Service operates to assist all members of the fruit and vegetable industry in improving marketing procedures.

The Branch also administers Commonwealth legislation concerning export requirements for seed for sowing, birdseed, grains, flour and fruit and vegetables as well as miscellaneous commodities such as nuts.

Agricultural standards

An important objective under the *Agricultural Standards Act 1952-1972* is to ensure that Queensland buyers of agricultural chemicals receive materials which, when used as directed, will be effective for the purposes for which they are sold.

This is achieved by registering agricultural chemicals and by regular follow-up inspections, sampling and surveillance over these products.

A total of 4 915 applications for registration, including re-registration and renewal, was processed; an increase of 897 over the previous year.

Registration work required prior consideration by The Agricultural Requirements Board of claims by manufacturers regarding the efficacy of 1 674 preparations. One fertilizer and one pest destroyer were refused registration.

The following table provides an indication of the Board's activities—

	1974-75	1975-76	1976-77	1977-78
Pest destroyers	766	881	1 111	509
Veterinary medicines ..	433	555	282	919
Stock foods	211	82	88	162
Fertilizers	30	11	16	47
Growth regulating materials	6	8	17	37
Total	1 446	1 537	1 514	1 674

The marked increase in the number of veterinary medicines considered for registration occurred through the enforcement in August 1977 of the registration of veterinary 'ethicals'. Ethicals comprise preparations scheduled S4 in poison regulations and also substances used exclusively by veterinary practitioners.

Subsequent action taken by inspectors regarding the registration of ethicals resulted in an increased number of seizures and corrective action.

Similar inspectorial work, involving sampling and follow-up action, applied to the sale of fertilizers, limes, stock foods, fodder and feed grains. The following table sets out details of action taken on agricultural requirements (excluding seed for sowing) not complying with legislation—

ACTION FOLLOWING NON-COMPLIANCE WITH LEGISLATION

Particulars of Action Taken	Packages					Total
	Fertilizers	Limes	Pest destroyers	Veterinary medicines	Stock foods	
Initial action						
Seized by inspectors	1 410	184	1 080	16 886	35	19 595
Otherwise withdrawn from sale .. .. .	..	..	40	152	5	197
Subsequent action						
Destroyed .. .. .	..	..	297	216	22	535
Reformulated/fumigated .. .. .	..	..	41	42	5	88
Registered and/or relabelled	1 410	184	68	6 702	7	8 371

Aqua-ammonia samples were taken at Townsville, Ayr, Abergowrie, Ingham and Yuruga. All tests proved satisfactory.

Cane growers executives appreciate this quality control service but request more sampling of aqua-ammonia supplies. Arrangements have been made to sample and test this fertilizer on a monthly basis from June to October 1978.

A sampling program for stock foods was organized at factory and retail levels. Deficiencies have been corrected and advice given on labelling, mixing and formulation.

Regular inspections have been maintained on hay and chaff arriving at major railway yards and distributing outlets in the Metropolitan area.

Seed standards have also been enforced; seed for sowing not complying with standards being withdrawn from sale until such seed is made to comply. Insect infestation was a major problem in stored seed at Rockhampton and Brisbane.

An important development in January 1978 was an amendment to 'The Agricultural Standards (Seeds) Regulations of 1969' providing an additional table of Restricted Seeds. This amendment, which provides for tolerance levels, has enabled the sale of packages of seed for sowing even though they contain a small number of restricted seeds, provided the packages are appropriately labelled.

The following table shows action taken by inspectors with respect to seed not complying with legislative requirements.

ACTION FOLLOWING NON-COMPLIANCE WITH LEGISLATION

Particulars of Action Taken	Bags
Initial action	
Seized by Inspectors	845
Otherwise withdrawn from sale	12 986
Subsequent action	
Destroyed	1 223
Recleaned/fumigated	7 291
Processed for stock food	1 793
Bags/relabelled	308

ACTION ON FRESH FRUIT AND VEGETABLES NOT COMPLYING WITH LEGISLATION 1977-1978

Kind of fruit/vegetable	Packages	Bunches	Count	Weight (kg)
Fruit and vegetables condemned and destroyed				
Mixed fruit	45 167+	1		
Pineapples and avocados	100 bins		423+	
Watermelons .. .. .	..		4½ doz.	74 599
All vegetables	31 888+	3 740	29 doz.	14 474
	114 bins		35 doz.	
			+9 046	
Fruit and vegetables ordered to be reconditioned				
Mixed fruit	10 802			
Watermelons .. .. .	..			480
All vegetables	22 150+		120	
	4 bins			
Fruit and vegetables ordered to be regraded				
Mixed fruit	15 505+			
Grapes	2 bins	693		
All vegetables	10 145			

Under the Queensland Seed Certification Scheme, the Branch provides the secretariat for administering the Scheme under the Agricultural Standards Act. Additional Branch services which facilitate the smooth running of the Scheme include giving technical advice and in storing and, when necessary, distributing lines of plant breeders' and basic seed.

The following table indicates the extent of Departmental involvement in seed certification—

SEED PRODUCTION FROM AREAS REGISTERED FOR SEED CERTIFICATION

	1975-76 Certified (kg)	1976-77 Certified (kg)	1977-78 Certified (kg)
Hybrid maize ..	261 219	203 290	144 946
French beans ..	66 089	52 114	43 030
Navy beans ..	5 727	27 800	47 416
Pasture species ..	710	981	1 704
Tomato ..	221	495	358
Grain sorghum ..	47 150	0	0

Fruit and vegetable quality

A major objective under the *Fruit and Vegetables Act* 1947-1972 is to maintain efficient quality control over the sale of fresh fruit and vegetables at both wholesale and retail levels throughout the State.

The following table shows total quantities of fruit and vegetables on which inspectors at the Brisbane Market and at major country centres took appropriate action.

Inspectors have reported a considerable overall improvement in the quality of fruit and vegetables received at the Brisbane Market. However, a number of categories of produce required urgent attention.

Over-stored apples posed problems and some consignments of rockmelons displayed ground rots and other fungal infections. Cucumbers and tomatoes were over-supplied at times, the former becoming old and yellowed and the latter over-ripe and diseased.

More care should be exercised by growers in selecting potatoes, onions and pumpkins for market. It was necessary to order some 22 000 bags to be picked over resulting in the destruction of 7 410 bags. The magnitude of the reconditioning process is reflected in the charge of more than \$1 300 for re-inspection fees.

Testing for fruit maturity was carried out at centres within the Metropolitan area, at Mundubbera and at Rockhampton. A total of 324 consignments of grapes, 248 consignments of citrus, 32 consignments of avocados and nine consignments of pineapples was tested.

Supervision of ethylene dibromide (E.D.B.) fumigation to control fruit fly infestation was carried out in conformity with the legal requirements of southern States at fumigation rooms at Clapham Junction and at Gayndah and Mundubbera. The following fruit were fumigated.

Fruit fumigated	Gayndah/Mundubbera (packages)	Clapham Junction (packages)
Mangoes .. ..	.. ..	42 433
Oranges	26 030	3 160
Lemons	2 934	651
Mandarins	83 346	6 472
Grapefruit	5 765	3 157

The dipping of 31 722 cartons of bananas, comprising 213 consignments, was supervised and certificates were issued for the Murrumbidgee Irrigation Area.

Under the provisions of the Diseases in Plants Act, 103 consignments of stone fruit from Victoria and South Australia were checked for *Sclerotinia laxa* certificates. Similarly, 306 consignments of grapes from interstate were checked for *Phylloxera* certificates.

Ninety-five samples of diseased and insect-infested fruit and vegetables were collected for identification by Plant Pathology and Entomology laboratories.

Largely as a result of the operation of fruit and vegetable quality control, coupled with the efforts of the fruit and vegetable marketing extension service, the quality of fresh produce available to consumers is improving. Rapid cooling and refrigeration for highly perishable commodities, for example, broccoli and sweet corn, is now a well established practice with pre-cooled lines attracting a premium price. There has been a corresponding increase in demand for these commodities and new markets are developing.

Co-ordinating activities within the marketing chain has been highly successful in establishing better co-operation between the various sections of the industry and improving the quality of commodities available to the consumer.

The formation of the Combined Fresh Produce Industries Committee (Queensland) within the Brisbane Market is seen as a significant step in this direction.

A new scale of unloading charges incorporating incentives for palletized and unitized shipments was introduced during the year and a range of eight general purpose packages for use in the marketing of fresh fruit and vegetables was developed.

The Granite Belt again showed substantial improvement in the presentation of fruit for markets. This is illustrated by the fact that only 68 instances of inadequate quality and presentation were referred back for corrective action compared with 108 in 1976-77 and 221 in 1975-76. This was brought about mainly by an improvement in apple packs.

The importance of keeping pre-cooled produce under refrigeration is now well recognized at the wholesale level. This is evidenced by the fact that a large percentage of the new storage space that will become available with planned extensions by the Market Trust will be used by agents for cool storage facilities.

During the year the Branch continued to provide information on various aspects of fruit and vegetable quality and presentation for regular publication in *Fruit and Vegetable News*. Articles dealing with colour grading of tomatoes cooling of sweet corn to maintain quality and various aspects of packaging and handling were also published. Publications were supplemented with radio talks and displays.

Agricultural chemicals distribution control

Standards Branch provides secretarial and technical support to the Agricultural Chemicals Distribution Control Board. Under the *Agricultural Chemicals Distribution Control Act 1966-1972*, this Board is responsible for licensing agricultural pilots and commercial weed control operators, and for issuing statements on investigations into cases of damage alleged to have been caused by the operations of licensed operators.

An important aim is to offer some protection to land-owners from the drifting of agricultural chemicals distributed by licensed commercial users.

The main areas of involvement continued to be the issuing of new and renewed licences for agricultural pilots and weed control operators; ensuring contractors hold security for recompense in cases of accidental damage or injury to crops and stock; the investigation of complaints of such damage; and the consideration of requests for permits to use restricted chemicals in Hazardous Areas.

Seventy-four examinations for licences were held in 23 centres during the year, and 136 applicants for commercial operator's licences and 11 applicants for pilot chemical rating licences were examined. From these and earlier examinations the following licences were issued or renewed—

- 117 unrestricted commercial operator's licences issued
- 125 restricted commercial operator's licences issued
- 1 081 commercial operator's licences renewed
- 37 pilot chemical rating licences issued
- 57 pilot chemical rating licences renewed

Twenty-nine notifications of complaint on damage were received and investigated during the year. Two of these related to injury to honey bees and another involved the investigation of a complaint of damage to grain sorghum by pesticide residues allegedly as a result of drift from insecticides sprayed on neighbouring cotton.

Nineteen applications for the issue of permits for the distribution of restricted weedkillers in Hazardous Areas were received. Fourteen of these applications were for the use of restricted herbicides in Hazardous Area No. 1 (Near North Coast of Brisbane) and five were in Hazardous Area No. 2 (Eastern Darling Downs).

An application for a permit from a Shire Council to spray 2,4,5-T butyl ester onto African boxthorn in part of the Shire during the summer months was refused. Alternative control methods were advised and a permit was issued for the spraying of 2,4,5-T in certain restricted areas at definite times.

The fourth set of amendments to the standard reference for weed control operators, 'Commercial Operator's Manual', was published and issued during the year.

Export supervision

Inspections were carried out at Metropolitan and major country centres, under Commonwealth Export Regulations, relating to export of seed for sowing, birdseed, barley, wheat, sorghum, flour, fruit and vegetables and nuts.

Total export shipments of barley and sorghum were 131 064 tonnes and 317 048 tonnes respectively, representing about one-third of the quantity of barley, and half the quantity of sorghum exported last year. These reductions are attributed to unfavourable growing conditions. The quantity of wheat exported (489 152 tonnes) was only slightly less than that during 1976-77.

There was an increase over last year in exports of seed for sowing, carpet grass (*Axonopus* sp.) being the major seed shipped. Exports of birdseed and peanuts decreased.

Total flour exports remained stable although there was a substantial increase to 4 000 tonnes in flour exports from the Darling Downs. This increase can be attributed mainly to a swing to shipping containers for the Papua New Guinea run.

The use of shipping containers for exports involves inspectors in pre-loading inspection at a number of Metropolitan depots. During the year, a total of 1 716 containers was inspected, 118 rejected and a further 175 ordered to be cleaned before acceptance.

Favourable marketing conditions existed in Europe for Valencia oranges and 81 000 cartons were exported. Increased quantities of Imperial mandarins were exported to Europe and Canada. Because of late frosts, Ellendale mandarins were reduced in yield, but fruit was of large size and high quality. A total of 273 350 cartons of this variety was exported, representing 86% of total mandarins exported. During the year, increased quantities of Imperial mandarins were exported to Europe and Canada.

Pineapple exports to New Zealand increased because of the use of containerized shipping.

Miscellaneous items exported included 4 616 bags of pecan nuts and more than 10 tonnes of processed macadamia nuts.

Seed testing

The following table indicates the extent of general seed testing carried out conjointly during the year by the Queensland Seed Testing Station at Indooroopilly and the Seed Testing Sub-station at Toowoomba.

Source of samples	No. of samples
Inspectors	
(a) Survey/official samples	2 743
(b) Samples of seed for export	552
(c) Samples of imported seed	54
Government Seed Certification Scheme	500
Seed research officers	522
Samples submitted by—	
(a) Farmers	883
(b) Merchants	7 907
(c) Government authorities	658
(d) Scientific institutions	160
(e) Other	36
Total	14 015

As well as providing information for regulatory purposes and verifying seed quality for research purposes, the seed testing service aims at assisting the intending purchaser in selecting seed of an appropriate quality for planting. Tests on seed submitted by an owner for his own sowing are carried out free of charge.

Research and publications

Nine seed research projects involving the study of seed germination problems from the immediate post-harvest stage, when dormancy difficulties predominate, until seed has reached the non-dormant phase were continued. This approach is much more revealing than the study of seed lines of unknown history and age.

In addition, a further five research projects were initiated.

Numerous vigour tests for bean seed were devised and tested. Work on relative conductivity tests showed that bean seed which produced leachate with a conductivity in excess of 250 micromhos per gram of seed material were unlikely to contribute to field stand even under good conditions. At conductivities less than 200 micromhos per gram, seed could establish under somewhat adverse conditions while seeds in the intermediate range (200 to 250 micromhos per gram) would establish in good conditions but fail under poor conditions.

Parthenium hysterophorus seed was shown to be capable of surviving at least 7 days in water without any detrimental effect, thereby suggesting that this weed could be spread down river systems by water transport of the seed.

A method by which grass seeds are germinated on a slope (60°) instead of on horizontal trays has been developed. This will increase the capacity of germination cabinets threefold and thereby reduce costs.

Field services staff are endeavouring to develop an efficient three-way sample divider. Work on a prototype sloping screen for use in export grain inspection is continuing. Preliminary tests are promising.

A pamphlet containing basic information on pest destroyers available in Queensland, including details of approved uses, methods of application, limitations and toxicology has been expanded and updated to cover recent developments in the field. The information is presented in the form of data sheets and is useful resource material for extension and advisory staff in their work in advising on the safe effective use of pest destroyers.

An article on 'Processing Seeds of Tropical Pasture Plants' by B. Linnett was published in the *Journal of Seed Science and Technology* under the sponsorship of the International Seed Testing Association. The article has created substantial interest in overseas countries.

Other activities

Officers of the Branch participated in District Extension Committee meetings in the Widege, Sun Coast, East Moreton, Darling Downs and Townsville areas and were involved in co-ordinated extension programs in the Eastern Darling Downs and Townsville districts.

The Branch also participated in various workshops and field days and provided display materials, information and articles relating to seed for sowing, pesticide usage and safe disposal of empty containers.

Advice was given to transport operators concerning recommended storage temperatures for fruit and vegetables undergoing long-distance haulage.

A service was provided to new retailers of fruit and vegetables to acquaint them with grade standards and new growers were advised concerning packaging requirements.

During the year, Mr A. R. Hughes represented Queensland at a meeting of F.A.O. in Rome which was convened to consider means of achieving greater world-wide uniformity in the registration of pest control chemicals. Mr Hughes also visited Holland, Denmark and the United Kingdom on matters associated with registration and use of pesticides.

Miss H. M. Low attended an International Seed Testing Workshop at Wageningen in 1978 and studied seed testing procedures at government seed testing laboratories at Copenhagen, Oslo, Cambridge and Edinburgh.

Mr A. C. Arvier visited Indonesia in July 1977 as the Departmental representative at the Asian-Pacific Weed Science Society Conference.

Division of Land Utilisation

DURING the year, special emphasis has been placed on achieving the following objectives:—

Continuation of the high rate of implementation of soil conservation measures on the Darling Downs.

Completion of a Land Use Study of the Pittsworth plains and associated upland catchments on the Darling Downs.

Completion of the Commonwealth–States Collaborative Soil Conservation Study.

Adoption by Government of the Lower Mary River Irrigation Project.

Consolidation and introduction of Core Measures for financial assistance to primary producers affected by Natural Disasters.

Progress in soil conservation

Record rates of implementation with the Darling Downs statutory soil conservation program were achieved. Details for the last 3 years are set out below.

The first subsidy payments for the implementation of soil conservation works on sugar lands in the declared Area of Erosion Hazard at Gin Gin were made during the year.

The high level of implementation of soil conservation measures achieved last year, following substantial increases in the previous 3 years, was maintained in 1977-78. A total area of 48 310 hectares was treated during the year with soil conservation measures.

Requests from landholders for technical assistance on soil conservation matters declined slightly from 3 940 in 1976-77 to 3 796 in 1977-78. Property visits on the other hand rose by 6.5% to 7 506. The number of new co-operators, 425, is similar to that recorded in recent years.

DARLING DOWNS STATUTORY SOIL CONSERVATION PROGRAM

	Units	1975-76	1976-77	1977-78
Requests from Farmers	Number	1 327	1 528	1 479
New Co-operators	Number	106	115	125
Implementation				
Intensive measures	Hectares	8 197	10 865	10 802
All Measures	Hectares	10 704	15 086	16 547
Project Plans				
Number of Farms	Number	217	132	160
Area	Hectares	31 836	16 573	22 566
Provisional project plans				
Number of Farms	Number	254	347	321
Area	Hectares	46 996	66 160	62 399
Subsidy payments				
Payments	Number	275	524	688
	Dollars	82 934	182 521	257 400

Land use study—Pittsworth plains and associated upland catchments

A comprehensive land use study of the Pittsworth plains and associated upland catchments was completed during the year. This detailed study relates to an area of 50 000 hectares.

The report, which has been forwarded to all affected district landholders, outlines proposals for the control of soil erosion in the uplands of Rocky Creek, Learmonth's Gully and adjoining minor catchments. It provides alternative plans for minimizing the effects of erosive flooding, silt deposition and waterlogging on the Pittsworth plains, downstream from the upland catchments.

Commonwealth–States Collaborative Soil Conservation Study

The Commonwealth–States Collaborative Soil Conservation Study 1975-77 was completed during the year but the main report of the study, 'A Basis for Soil Conservation Policy in Australia' had not been printed at the end of the year. The report contains 32 recommendations—one basic recommendation of national application, six concerning Commonwealth action, five concerning Commonwealth–State relations, 12 related to the activities of State governments, six concerning State–Regional relations and two concerning local government.

The purpose of the study was to provide the Commonwealth and State Governments with information for the formulation of policy on soil conservation and associated land and water management programs. While the main report concentrates on policy issues, there are 12 supplementary reports mainly of a technical nature.

One of these reports (Report 10) is an economic evaluation of the first five Project Plans gazetted in the Darling Downs statutory soil conservation program. The economics of investment in soil conservation in these projects, and in a similar soil conservation project in the Eppalock catchment in Victoria (Report 9), were shown to depend strongly on the incorporation of intensive land management practices in an overall package of soil conservation measures comprised of both works and practices.

Lower Mary River Irrigation Project

A joint report prepared by the Department of Primary Industries and the Irrigation and Water Supply Commission dealt with proposals for the Lower Mary River Irrigation Project involving conservation of the waters of the Mary River and Tinana Creek and for their use in conjunction with water released from the existing Borumba Dam on Yabba Creek for irrigation of sugar-cane lands assigned to the Maryborough sugar mill.

The scheme, which will increase and stabilize farm incomes, provides for an expansion of annual sugar production from the project area of between 35 800 and 42 400 tonnes. The project is estimated to cost \$11 700 000 and at completion is expected to considerably benefit the Maryborough regional economy.

Natural disasters

Drought reappeared over a wide area of the State. It tended to be concentrated in the cropping and intensive livestock areas of south-east Queensland. By January, a total of 54 Shires had been declared drought-stricken but subsequent

relief rains alleviated the situation in the south-east only to see a spread of drought along the south-west border and into the central and north-west regions. The seasonal outlook for the latter areas is not encouraging. A shortage of stock water looms as one of the most disturbing prospects.

In cases of widespread natural disasters, there has been a Commonwealth-State arrangement that the Commonwealth will assist if the relief measures exceed the State's financial capacity.

At the Premiers' Conference in October 1977, agreement was reached on what have been termed 'core measures' of relief which the States may now introduce without negotiation with the Commonwealth. In Queensland, they are

applicable once State expenditure on natural disasters in a financial year exceeds \$2 million and provided that expenditure on relief measures for an individual event exceeds \$200 000.

The core measures relevant to primary producers are—

- Grants for relief of personal hardship and distress
- Concessional loans for carry-on, re-stocking and repairs and/or replacement of equipment
- Road and rail freight subsidies
- Subsidy on carriage of water to central dispersal points (drought)
- Assistance to State, Local and semi-Government Authorities for the disposal of helpless and unsaleable stock.

Development Planning Branch

THE principal responsibility of Development Planning Branch (established in 1962) is to undertake resource investigations and to identify opportunities for development of rural land throughout Queensland.

The Branch also co-ordinates technical and economic information contributed by other branches and presents this in the form of reports which indicate the agricultural, pastoral and economic prospects for proposed developments.

Current projects outlined in this report are funded mainly from Consolidated Revenue.

Development investigations and studies

Activities reported under this heading follow closely upon those reported in the previous year. Studies have not extended to new areas but have involved the examination of aspects dependent upon the basic study.

Mary River-Tinana Creek Study

This was a co-operative study with the Irrigation and Water Supply Commission and the Bureau of Sugar Experiment Stations. The major objective was to provide the

Irrigation and Water Supply Commission with the necessary land resource information for the planning of the Lower Mary River Irrigation Project. The opportunity was also taken to develop a land suitability classification for sugar-cane lands under irrigation in this area.

The whole study area of 32 077 hectares was classified in terms of suitability for sugar-cane production, the suitable areas being divided into five sub-classes. Within this area the Irrigation and Water Supply Commission has developed a proposal for an irrigation scheme based on weirs on both the Mary River and Tinana Creek with a connecting channel between the streams and some reticulation in the inter-stream lands.

The area to benefit from such an irrigation scheme has been delineated. Land within this benefited area has also been classified. Results are as follows:—

SUGAR-CANE LAND SUITABILITY (IRRIGATED)

MARY RIVER-TINANA CREEK

	Suitable				Unsuitable	Total (hectares)
	Class I	Class II	Class III	Class IV		
ha	2 282	3 752	6 283	5 328	14 432	32 077
%	7	12	20	16	45	100
BENEFITED AREA						
ha	1 090	1 104	4 962	2 267	9 677	19 100

The total area of suitable soils in the benefited area is 9 423 hectares. Land presently assigned to sugar-cane in this area is 3 264 hectares. Suitable land is thus not a barrier to expanded cane production.

Maryborough-Elliot River (Coastal Lowlands) report

A recommendation of the Maryborough-Elliot River report was that approximately 8 000 hectares of vacant Crown land be reserved for agricultural purposes. Portion of this area has been leased to a private company for a large-scale investigation into the use of cassava for starch production. Exploratory plots have been planted and large-scale timber clearing has begun. Close liaison with this work is being maintained.

It is desirable to hold some land in reserve pending the examination of erosion-prone lands in the Hervey Bay, Yerra-Pilerwa and Bauple areas currently producing sugar-cane but which may prove unsuitable for sustained production. Work on this aspect is planned for the coming year.

Northern Burdekin Region study

The land capability classification for this area indicated that of the Upper Burdekin and adjoining inland areas some 34 000 hectares were suitable for cropping on a regular basis and 270 000 hectares suitable on an intermittent basis.

To assist with determining future land use potential, an agro-climatic analysis using rainfall data from 52 centres was completed. The analysis highlighted the large variability in crop yield potential due to moisture stress. Results of the

analysis indicate that approximately half of the region is climatically suitable for dryland sorghum production if restricted to the best soil types.

BURDEKIN BASIN REAPPRAISAL. Further to the State-Commonwealth report entitled 'Resources and Potential of the Burdekin River Basin Queensland', a report is required on the agricultural, hydro-electric, flood mitigation and urban water supply implications of a major water storage on the Burdekin or a major tributary of it.

This report is being prepared by an inter-Departmental Committee under the chairmanship of the Co-ordinator-General. The Committee has formed a Working Group to which agricultural and evaluation inputs are presented.

Resource investigations and studies

Land resource assessments and land use studies extending over a wide area of the State are a major Branch program. While providing technically sound information on land characteristics, the aim is to present reports in a manner acceptable to the major users. These include primary producers, industry organizations, extension officers, banks and officers of other Departments and agencies. Management guides for the identified and classified land units are provided in the recommendations.

During the year, a high degree of integration has been achieved with the Soil Conservation Research Group and it is necessary to peruse the report of that Section to obtain a comprehensive view of current land resource assessment activities.

Granite traprock study

This study, concluded last year, classified 8 650 square kilometres of land in the Warwick-Stanthorpe region according to potential uses. The land capability map of the region is reproduced on the inside back cover of this report. One concern arising from the report was the lack of knowledge of the state of erosion on the intensively used horticultural lands which, although relatively small in area, are highly productive.

With the co-operation of other branches, a survey was conducted to ascertain the current erosion status of horticultural properties in quantitative terms. A sample of 49 farms was visited and detailed studies conducted on three properties to estimate soil loss rates.

On the basis of the survey data, about 10% of the horticultural lands were assessed as being satisfactorily protected from soil erosion. A further 70% are affected by slight or moderate sheet and rill erosion. Of the 20% considered to be severely affected, severe sheet and rill erosion was evident on most properties with significant gullying a factor in a minority, actually one-fifth of this category showing severe effects.

Soil loss rates calculated for areas classified as affected by moderate erosion indicated a soil movement off paddocks of about 6 to 7 tonnes per hectare annually. Losses of this order are not necessarily regarded with alarm by soil conservationists.

However, of greater concern in terms of production and profitability, was the indication that from 25 to 40 tonnes of soil per hectare are moved by erosion but redistributed within the paddock boundaries. This process results in lower productive capacity on the upper slopes and probably increased cultural and disease problems in the areas of deposition.

The results of this survey have been presented to relevant staff and a co-ordinated approach is being made towards the development of appropriate land management techniques.

Western Arid Land Use study

The objective of this study is to describe, classify and map the land characteristics of the remaining unmapped areas of western Queensland and to provide recommendations on management of the component units. Project teams involving Botany and Agricultural Chemistry Branch staff are formed for each area and assistance is also provided by the Department of Lands and C.S.I.R.O.

The total area of 60 million hectares has been divided into six regions or parts for the purpose of reporting. The current position is that Part 1 of 15 million hectares has been published and well received by interested agencies. It comprises the area in the south-west corner of the State. Part 2 adjoins the northern boundary of Part 1, while Part 3 is located between the eastern boundary of Part 1 and the western boundary of the Balonne-Maranoa region reported on by the C.S.I.R.O. Division of Land Use Research. Part 3 area includes the townships of Charleville and Cunnamulla. Part 3 and the area immediately to the north (Part 4) are the most intensively used sections of western Queensland.

Field work is nearing completion on Part 3 and is now concentrated in a section where photo-interpretation has proved inadequate. The report on Part 4 is being printed.

Part 5 comprises approximately 10 million hectares lying north-west of Part 4 and includes the townships of Winton, Longreach and Barcaldine. Field work is proceeding smoothly and tentative land systems established. Some remapping will probably be necessary as a result of ground checking of the more complex land types.

The remaining segment, lying west of the boundaries of Parts 2 and 5 and extending to the Northern Territory border, is Part 6. Photo-interpretation is well advanced and one field reconnaissance trip made to verify boundaries of vegetation and landform patterns discerned during air photo-interpretation.

The current aim of the program is to have all areas mapped and reported on by the end of 1980. There will then be information of a uniform and usable nature on the land resources of this region. It will form a factual basis for the determination of future policy on the use of these lands.

Woongoolba Land Use study

The objective of this work was to identify and locate additional areas available and suitable for sugar-cane production within an economic distance of Rocky Point Sugar Mill.

This area epitomises the developing conflict for land in areas where established agricultural lands are being sought for more intensive use, notably hobby farms and residences in a rural setting. There is a growing concern at this trend, particularly in sugar-cane production areas because of the interdependency of individual growers and mill proprietors. To remain viable, millers are forced to modernize and upgrade equipment and this requires a certain level of throughput if

it is to be justified economically. The trend has been for the prospects of an expanding throughput to justify modernization and upgrading of equipment.

Where mills are isolated, as for example at Rocky Point and Nambour, a failure to continue operations automatically means the loss of livelihood of the sugar-cane suppliers. This would have serious ramifications right through to the national level.

The caneland suitability classes for this area were developed in co-operation with staff from the Bureau of Sugar Experiment Stations. A land suitability map of the area, together with estimates of suitable areas, has been prepared in draft form and discussed with representatives of both millers and growers. Some draft maps have been supplied to interested agencies as a matter of immediate need. The final map and text should become available in the coming year.

At a policy level, close contact is being maintained with industry and other involved agencies and it is foreshadowed that this land suitability study will provide a factual basis for policy determination.

Walloon Soil Studies—Glengallan Shire

This is one of a number of key area studies undertaken by the Division primarily to provide information for field officers engaged in farm planning. The study area, representative of approximately 86 000 hectares on the Darling Downs, has been subdivided on the basis of vegetation types and the information is to be presented in three maps and a text.

Air photo-interpretation proved of limited value in this work due to some extent to the fact that this is one of the oldest farmed districts in the State and consequently a great deal of the native vegetation has been removed. In addition, cropping of lands over a long term has produced some changes, the significance of which is only revealed by detailed analyses.

Methods employed in this survey were used to prepare a land suitability report on the Hermitage Research Station which is located within the area.

Ross River Dam investigation

This study was undertaken in conjunction with the Department of Local Government with financial support from the Thuringowa Shire Council. Officers of this Department and of C.S.I.R.O. at Townsville assisted in technical aspects relating to land capability and soils.

The objectives of the study were: (i) to assess land capability of the catchment area for arable agriculture, horticulture and the pastoral industries; (ii) to determine hazards to landscape stability and water quality in the catchment due to existing and possible future land uses; (iii) to discuss the outdoor recreational attributes of the natural environment; and (iv) to make recommendations on land use planning policies for the catchment in the light of the foregoing assessments.

The catchment area comprises 66 000 hectares. Of this, some 8 000 hectares are considered suitable for irrigated horticulture but only 4 000 hectares have access to water for irrigation. Expansion of this industry is not recommended in the catchment area because of the water pollution hazard.

The area considered suitable for irrigated cropping or pastures comprises 5 000 hectares but the scarcity of water for irrigation limits such development. Some 6 600 hectares are considered suitable for dryland cropping but climatically the region is only marginally suitable.

Beef cattle grazing is a suitable use for a further 26 000 hectares and this activity has little adverse effect on the environment. About 20 000 hectares of steep and stony land are considered unsuitable for any primary industry.

The catchment is considered to have little potential for land-based outdoor recreation.

Ewan Maddock Dam Catchment—Landsborough Shire

At the request of the Water Quality Council a report was prepared on agricultural developments and land management practices in this catchment of 1 552 hectares.

A land capability classification showed that no land was suitable for sustained, broad-acre cropping and only 3% of the area had a slope of less than 2%. Two-thirds of the area—about 1 000 hectares—has slopes exceeding 10% with no cropping potential.

Current usage is of low intensity with 7 hectares under horticulture, 390 hectares for grazing, 67 hectares for urban use and the remainder unused. Of this, a State Forest comprises 422 hectares and a National Park 118 hectares.

Much of the available land appears to be owned by non-residents. The catchment contains some 100 properties less than 10 hectares in area and largely unoccupied at present.

Only minor land degradation is apparent but intensive use of the shallow duplex soils would increase the soil erosion and hence siltation hazard.

Soils and Rural Land Use—Wide Bay—Burnett Region

At the request of the Co-ordinator-General's Department a report on soils and rural land use for this area has been compiled. The report is of a broad-scale nature based on existing information on soil types and land use. A soils map, based on the Atlas of Australian Soils, and a map delineating the major areas of cropping have been provided.

A more detailed study of this region has now begun with the objectives of preparing land suitability maps, assessing and mapping existing and potential areas of land degradation and providing management recommendations for the mapped units.

Financing policy for soil conservation

Leadership has been provided for a group set the task of recommending a basis for cost-sharing of soil conservation works among land-holders, the regional community and the State.

Specific studies have been made in the Linthorpe-Aubigny catchment on the Darling Downs. On-farm subsidy arrangements and agreements with Local Authorities on road cross-drainage have also been considered. Finally, the experience of Victorian and New South Wales authorities has been evaluated by means of a study tour.

The key part of the study is the evaluation of an overall package of policies for works of both general and private benefit. A draft report is expected to be available early in the 1978-79 financial year.

Special activities

Branch officers have continued to collaborate with other agencies on relief schemes for primary producers affected by drought and other major natural disasters.

Natural disasters

Community involvement in the relief of drought effects reached an unprecedented level through a grass clippings and fodder collection exercise appeal co-ordinated by three districts of Lions International. A central co-ordinating committee was established for the purpose of arranging appropriate distribution of donated fodder or fodder purchased with donated funds, with corresponding local committees operating within their districts.

Distribution of fodder at little or no cost to recipients amounted to 650 tonnes of molasses and over 15 000 bales of forage by the end of May 1978. Development Planning Branch provided secretarial and administrative services to the central committee.

Bushfires on a large scale burnt for about 3 weeks in November in the north-western sheep areas, centred on the Shire of McKinlay. About 500 000 hectares of grazing land were affected. Estimated losses were 63 000 sheep, 400 cattle and 500 kilometres of fencing.

An especially unfortunate feature was that some graziers had suffered stock losses as a result of cyclone 'Ted' a year earlier. If necessary, they may receive special consideration regarding the repayment of relief loans associated with cyclone 'Ted'.

Severe hailstorms brought considerable damage and loss of produce, estimated at over \$3m, to the horticultural areas of the Granite Belt in late 1977.

Soil Conservation Branch

THE prevention and mitigation of soil erosion is the main duty of the Branch under *The Soil Conservation Act of 1965*. Related duties include research and investigations into the nature and extent of soil erosion.

Nature and extent of soil erosion

The Commonwealth-States Collaborative Soil Conservation Study was completed during the year.

In the study, some 57% of the land used for agricultural or pastoral purposes in the State was identified as requiring the application of land management practices only, or a combination of land management practices and soil conservation works. Land management practices alone were assessed as sufficient for the control of erosion on some 34 million hectares of arid grazing land, 14.8 million hectares of non-arid grazing land, 400 000 hectares of extensive cropping land and 100 000 hectares of intensive cropping land.

In contrast to the relatively inexpensive land management measures, more costly soil conservation works are required on 9.6 million hectares of arid grazing land, 8.1 million hectares of non-arid grazing land, 1.8 million hectares of extensive cropping land and 250 000 hectares of intensive cropping land.

The study indicated that the economic merit of investment in soil conservation works is greatest in the intensive cropping lands and decreases progressively through the extensive cropping lands, arid grazing lands and non-arid grazing lands.

Erosion and land degradation studies

Land degradation studies—Bremer River catchment

Degradation to some degree is evident on 82 000 hectares or just over 41% of the Bremer River catchment. Sheet erosion alone accounts for 46 000 hectares of the degraded land in this region. More than one-third of the degradation occurs on alluvial, basalt and geologically intrusive land units which have a capability for cropping.

The highly productive clay soils of the Fassifern Valley and Marburg area have the greatest proportion of degradation with almost 60% of the area of this soil unit affected.

Land degradation and management—Upper Nogoa River

Soil erosion investigations on pastoral lands of the upper Nogoa catchment are continuing. The role of vegetation is an over-riding factor in the control of erosion on pastoral

lands and the development of grazing and stocking management systems compatible with sustained productivity of those lands is the eventual aim of this program.

Land degradation—Mackay canelands

The objectives of this study are to develop and test methods of measuring soil erosion in canelands, to quantify soil losses and evaluate existing soil conservation measures.

Preliminary results indicate soil losses of the order of 100 tonnes per hectare per annum on sloping canelands. This rate of soil loss is regarded as inconsistent with sustained and long-term production.

Soil loss measurement in pineapples—Nambour

The objective of this project is to measure the extent of soil loss under pineapple culture and to measure the relationship between rainfall, run-off and soil loss under specific conditions of slope, soil type and crop management. The soil losses measured suggest that some form of soil protection is necessary for sustained pineapple production on slopes in excess of 4%.

Field observations

Dry conditions prevailed during spring and summer and, by January, more than half of the State had been declared drought stricken. Rainfall in the remainder of the year was generally above average and poorly distributed.

Isolated high intensity storms in late summer caused severe erosion in a number of areas throughout the State: on the Darling Downs in the Southbrook, Greenmount, Bringalily and Boodua areas; in the South Burnett in the Mondure, Bye and Boobie areas; and in central Queensland in the Rockhampton, Mackay, Central Highlands and Dawson-Callide areas.

The use of land for purposes for which it is not suited, inappropriate land management and cultivation methods, and the lack of adequate vegetative cover combined with poorly maintained soil conservation structures were the main contributing factors to soil losses.

Severe erosion in January-February of flood plains in the Callide Valley below the Callide Dam caused concern. Floods near Jambin were reported as being up to 25 kilometres in width.



Part of a soil conservation scheme on a farm near Goomeri in the South Burnett. Contour banks were constructed, fence lines relocated, minor gullies between banks filled and the steeper land retired from cultivation to pasture.

Land use and conservation practices

A major objective of the Soil Conservation Branch is to encourage landholders to maintain soil cover and apply conservation land management practices such as stubble mulching and contour cultivation.

Throughout the State, the value of plant cover or plant residue in the control of soil erosion was again demonstrated. Wheat stubble, cover crops and standing sugar-cane proved to be highly effective in controlling erosion.

Although conservation land management practices continue to improve throughout the State, large areas of fallowed land in fine tilth and without crop or pasture cover during summer months continue to create major erosion hazards. Expansion of areas used for irrigated small crops on steep lands without soil conservation measures is also of concern.

Steep lands continue to be used for pineapple production in the Nambour area where conventional soil conservation measures have proved to be inadequate for controlling erosion. Concrete waterways show some promise in providing stable water disposal areas on the less steep pineapple lands.

Substitution of steep caneland in the Isis and Gin Gin Land Use Study Areas is continuing, and the program in the Isis area is nearing completion.

In the Western Downs and Central Highlands, grass strips are being recognized as inadequate to control erosion and are being replaced by contour banks.

There has been a substantial increase in the area requiring soil conservation measures in the Brigalow Development Area No. 1 and in the Monto and Mundubbera districts because of the conversion of grazing land to cultivation.

The ploughing out of grassed drainage lines in the Central Highlands and the brigalow lands of the Western Downs makes difficult their future stabilisation as water disposal areas.

Burning of pasture land in the Moreton region is leading to excessive run-off and erosion during summer storms.

Land resource assessment

The report on this study on the Darling Downs is ready for publication. The objectives of the study were to classify the agriculturally important soils in the Westbrook Land System, identify any significant differences between the 'scrub' and 'forest' soils, develop zoning criteria, indicate land use limitations and make recommendations on land management. The findings in the report have relevance for the farm planning activities in the Darling Downs soil conservation program.

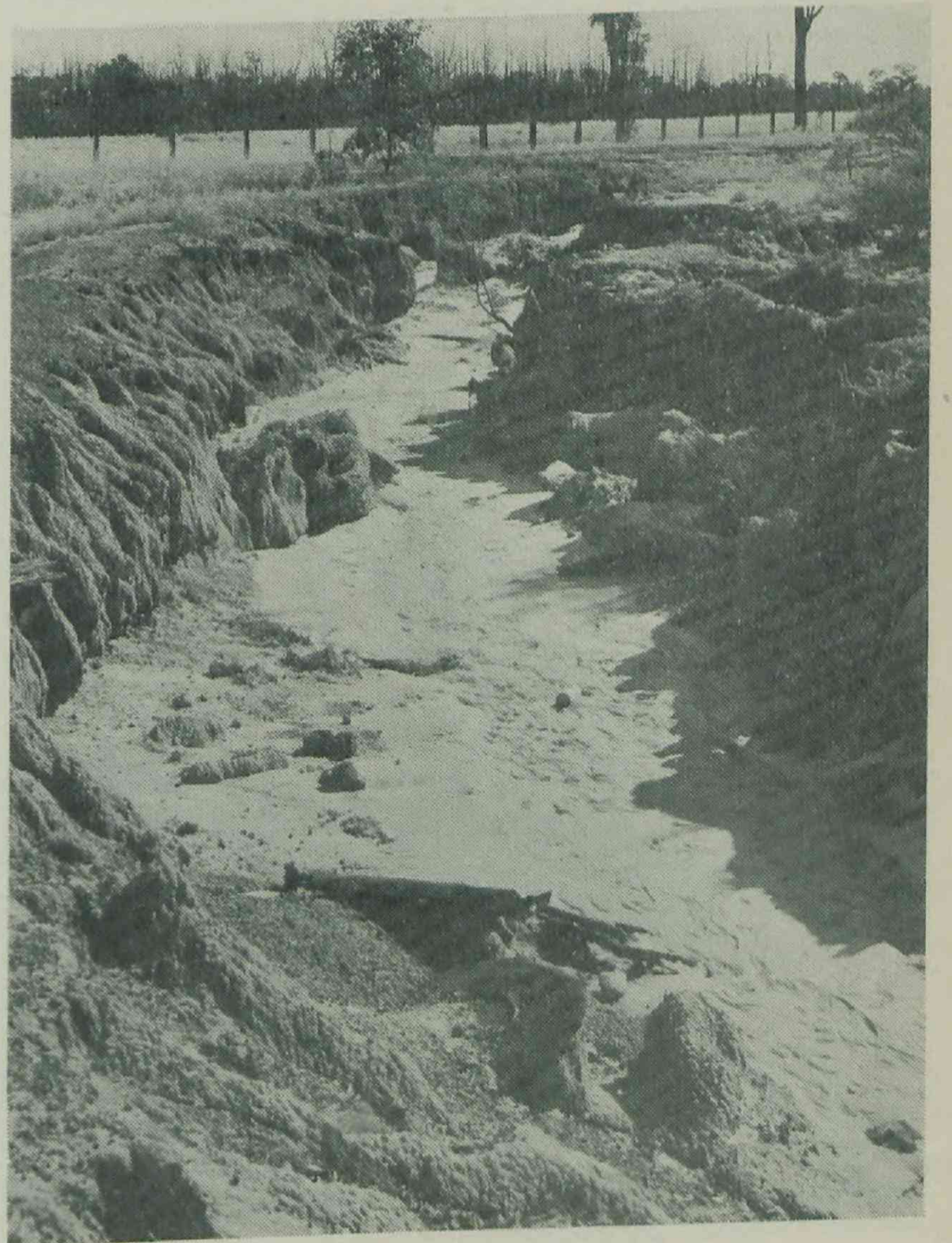
Research and investigations

Erodibility of soils

Investigations were continued into the erodibility of soils and the effectiveness of various soil surface cover and tillage practices in reducing soil loss to acceptable levels within the constraints imposed by economic land use.

It was demonstrated that surface cover improved the infiltration rate of most soils under laboratory simulated rainfall conditions.

Disregard and disturbance of the natural drainage pattern combined with poor location of fence lines and access tracks can lead to severe gully erosion as shown here.



The surface management program that was commenced last year has involved field measurements of soil loss using natural and simulated rainfall. In the Toowoomba area, work with the portable rainfall simulator indicates that surface sealing is a major limitation to infiltration in the field—a finding quite consistent with the laboratory observations. Run-off velocities down the slope were generally of the order of 0.2 metres per second, while in erosion rills the velocities were up to 0.6 metres per second.

These figures are considerably greater than the maximum design velocities currently used in planning soil conservation structures. Work to date has indicated that the size of soil particles available for transport by water is a major factor in soil erodibility.

Waterway stabilization investigations

These investigations have shown that most waterway failures can be attributed to poor design, inappropriate construction methods, lack of appreciation of the need for maintaining vegetable cover and unfavourable seasonal conditions for the establishment of a vegetative cover.

Data collection, processing and analysis

Indices of the erosive nature of rainfall are used in the design of soil erosion measures. Until recently, reliance has been placed on an interpretation of data from other areas. A complete Erosion Index analysis for 47 rainfall stations in Queensland is now available.

A computer recording system for the Darling Downs statutory soil conservation program is being established to improve the administration of the program and to provide better service to farmers.

Extension and landholder interest

In most parts of the State, farmer interest remained at the high level established during 1976-77, with the number of requests for services totalling 3 796 this year. The most notable increases in requests for services were in central Queensland, the Darling Downs and the Moreton region.

Property visits for the year totalled 7 506, an increase of 6.5% over that for 1976-77. A total of 425 new co-operators in soil conservation resulted from these visits.

Every effort was made to stimulate the interest of landholders by numerous on-farm discussions and by the use of mass media and group extension activities. The mass media program was based on 94 press articles, 22 radio talks and one television segment. Extension activities included 38 field days, 14 show displays and 102 meetings.

Landholders' interest in soil conservation is usually translated into action only if they have the financial capability to apply the required measures. Since soil conservation is seen by farmers as reducing rather than increasing income in the short term, this activity is given lower priority for investment by them at financially critical times.

The State Government dollar-for-dollar subsidy scheme was increased during the year from \$1 000 to a maximum of \$1 500 for farms in the Darling Downs region. This increased financial incentive has helped to stimulate interest in soil conservation and to increase the area and standard of intensive measures applied.

Subsidies totalling \$257 400 were paid during the year on contour banks, diversion banks, waterways, grass strips, tillage machinery for conservation farming, dozer blades purchased for contour bank construction and payments to local authorities under section 58 of "The Soil Conservation Act of 1965". This amount is 41% higher than the corresponding figure for 1976-77. Some 688 landholder claims for subsidy were processed compared with 524 in 1976-77—an increase of 32%.

Many farmer organizations with branches located outside the declared Areas of Soil Erosion Hazard have been seeking access to subsidy payments for landowners. During the year, meetings were attended to discuss the principles of statutory soil conservation plans and to explain the impossibility of applying them generally while the principal intent of "The Soil Conservation Act of 1965", that of encouragement of local sponsorship and management of soil conservation program through constitution of Soil Conservation Districts, is not being adopted.

In declared Areas of Soil Erosion Hazard, financial assistance to local authorities for road cross-drainage structures required in approved soil conservation schemes is paid through Agreements signed under section 58 of "The Soil Conservation Act of 1965". A total of \$19 474 was paid during 1977-78. In the other areas of the State, a Treasury subsidy is available for road cross-drainage works essential for approved soil conservation schemes.

During the year, seven farmers obtained approval for loans totalling \$22 543 from the Soil Conservation Assistance Fund established in the Agricultural Bank under the Soil Conservation Act. This is only a small increase on the use made of this fund in recent years.

Planning

Special emphasis was continued during the year on planning activities in the statutory programs on the Darling Downs and in the Isis and Gin Gin areas. In these programs, Project Plans or Provisional Project Plans form the basis for the implementation program and payment of subsidy.

During the year, 321 individual farm plans on the Darling Downs comprising an area of 62 399 hectares were prepared as Provisional Project Plans. In addition, 16 Project Plans covering 22 566 hectares and involving 160 farms were prepared and advertised. Since the start of the Darling Downs statutory soil conservation program in 1973, plans covering 251 208 hectares and involving 1 468 farms have been prepared.

The first Provisional Project Plan for the Gin Gin Area of Soil Erosion Hazard was prepared and two Project Plans covering 1 450 hectares and involving 19 landholders in the Isis Area of Soil Erosion Hazard were advertised.

Planning within those parts of the State not covered by statutory programs continued at a high level during the year, particularly in the Central Highlands, and the Burnett, South Burnett and Moreton Regions. Land use plans covering an area of 5 983 hectares were compiled in the Monto area, 3 930 hectares in the Dawson-Callide, 6 019 hectares at Mackay, 2 180 hectares at Nanango and 917 hectares at Gatton.

Implementation

The total area of cropping land which requires land management practices and soil conservation works is estimated to be 2.5 million hectares. The progressive total of land protected by readily recordable soil conservation measures throughout Queensland over the last 30 years now totals almost 750 000 hectares. Thus 1.75 million hectares remains to be treated.

At the current rate of application of soil conservation measures, it will take over 35 years to apply treatment to the cropping lands of the State. This does not allow for any protection of the State's grazing land, or for any reduction in the ability of farmers to apply the measures or any increase in the area of cultivation.

The high level of implementation achieved last year, following substantial increases in the previous 3 years, was maintained in 1977-78 in spite of a decline in Branch staff numbers and continued financial difficulties experienced by many farmers throughout the State. A total area of 48 310 hectares was treated during the year with soil conservation measures and represents a slight decrease of 4% on the 1976-77 figure.

During the year, contour banks were installed on 35 110 hectares, slightly down on the 37 678 hectares protected in 1976-77. However, significant increases were recorded in the Far North and Western Downs where 889 and 4 302 hectares were protected compared with 567 and 2 052 hectares, respectively, in 1976-77.

Special activities

Liaison activities—Soil Conservation Authority

The fourth Advisory Group Committee representing the North Eastern Downs was established during the year. Advisory Group Committees are now established for all of the declared Areas of Soil Erosion Hazard on the Darling Downs. These committees are serving a very useful purpose in providing a link between the Soil Conservation Branch and the rural community.

A follow-up to the Linthorpe and Aubigny catchment study carried out during 1976-77 was undertaken during the year. This included an economic study of the soil conservation proposals within the catchment and a visit to New South Wales and Victoria by two officers of the Division of Land Utilisation and representatives from the Advisory Group Committees and the Queensland Graingrowers' Association. Reports on these activities will be finalized early in 1978-79.

A study of the Rocky Creek and Learmonth Gully catchments was carried out during the year, and the report on this study was released to all affected farmers.

At the request of the Southern Downs Advisory Group Committee, the Branch has been involved in seeking a solution to the control of a gully that threatens the Warwick-Toowoomba railway line at Emu Creek in the Cambooya Shire.

The Darling Downs Inter-Departmental Soil Conservation Committee was established during the year. The primary role of this committee is to act as a technical committee which assists, informally, local soil conservation officers in the planning and implementation of soil conservation programs on the Darling Downs and advises the Soil Conservation Authority on any technical or policy matters limiting the program development.

A seminar was held in February to consider the report of the overseas study tour undertaken by Messrs. Ward and Norris of the Division of Land Utilisation and Mr. Ellwood, a farmer of Memerambi, and Mr. Middleton, a farmer from Brigalow. This tour was organized to investigate the conservation tillage techniques and systems used in the U.S.A. and Canada. Experience gained from this tour is being used to plan the future activities of the machinery evaluation groups.

Engineering Services Section

THE principal function of the Agricultural Engineering Section is to provide agricultural engineering advice and guidance to farmers and to Departmental officers requiring specialist advice.

During the year, an increasing amount of agricultural engineering advice and technical support was sought by primary producers, industry groups and Departmental officers in areas outside the established and manned regions in south-east Queensland. With the limited engineering manpower resources available, it has not been possible to establish full-time agricultural engineering services in central and northern Queensland. It is planned to increase publication of agricultural engineering extension materials for use by the rural community.

Special research projects

APPLICATION OF NEW TECHNOLOGY TO FRENCH BEAN SEED INDUSTRY. This project, funded by the Rural Credits Development Fund, is being carried out in conjunction with the Horticulture and Standards Branches. Germination trials were completed with beans harvested at different maturities and dried by different methods. Engineering assessments will be made at the next harvest of the various harvesting techniques which produce the least seed damage.

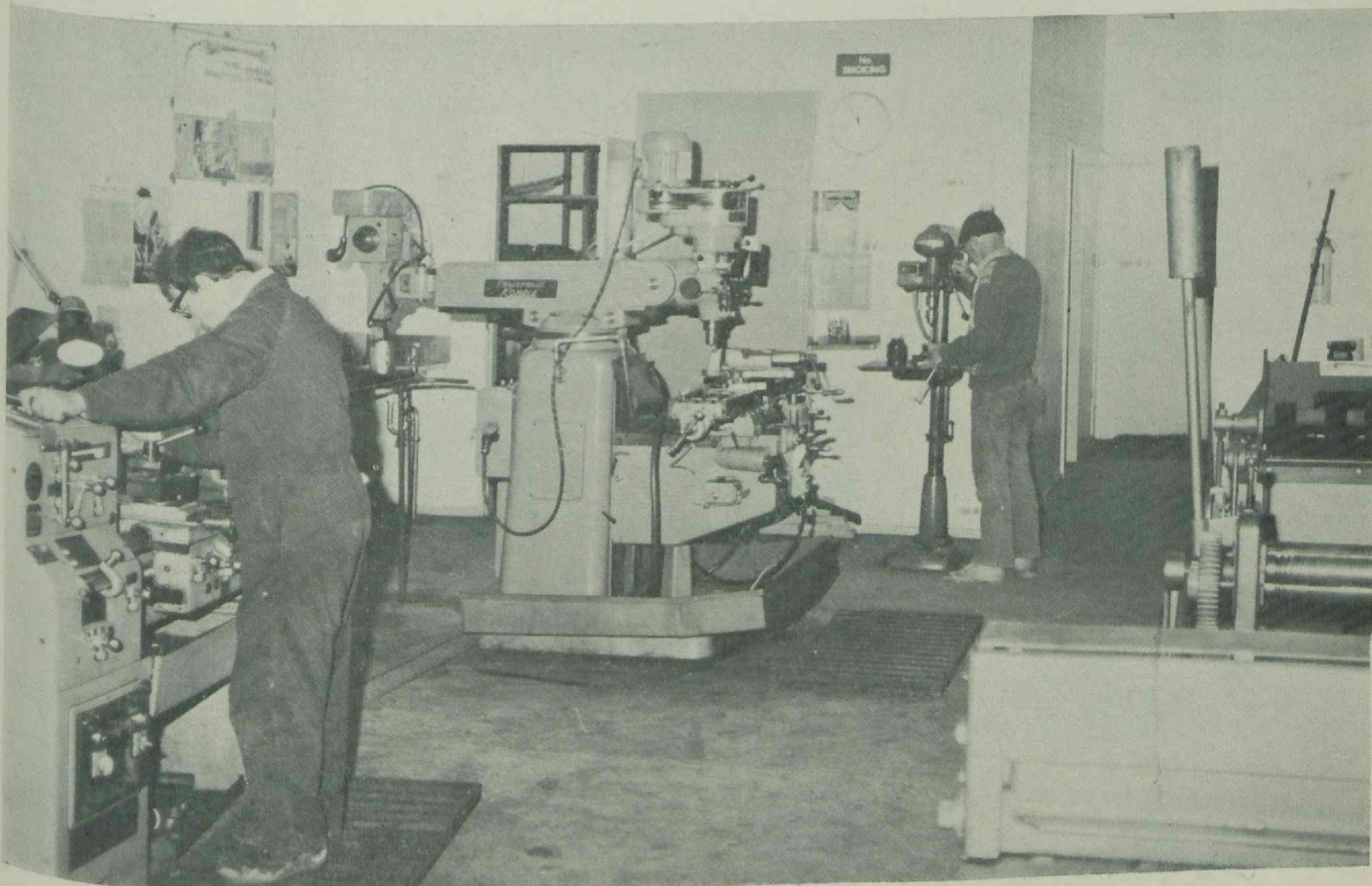
METHODS OF DISINFESTING WHEAT HARVESTERS. This project is being funded by the Wheat Industry Research Council. During the survey phase of the project, contact was made with industry people in each of the wheat-producing States. During the test phase, harvesters were cleaned using four different methods—high pressure water, exhaust powered air gun, compressed air and vacuum cleaner. The latter two cleaning systems were found to work best in combination.

DEVELOPMENT OF TRACTOR POWER METER. This project is funded by the Wheat Industry Research Council. The electronic components of the power meter have been developed with assistance from students at the Darling Downs Institute of Advanced Education. Laboratory testing has been completed. A tractor has been prepared for mounting of the prototype power meter and field tests will commence shortly.

PRESSWHEEL PLANTING TECHNIQUES. This project, to investigate enhancement of seedling emergence, is funded jointly by the Queensland Graingrowers' Association and a Commonwealth Special Research Grant. Replicated planting trials aimed at identifying components of planting systems that improve emergence and establishment have been completed. Two reports have been prepared based on the results from the project. A paper, titled 'The effect of Tine Type and Presswheels on Sorghum Emergence', was presented at the 1977 Australian Cereal Agronomy Conference. An updated version having a broader data base will soon be published as the final project report.

WORKSHOP FACILITIES AND ACTIVITIES. Additional specialized machines were installed during the year. These included a metal cutting bandsaw, which has significantly increased workshop potential, as the major role of the workshop relates to the fabrication and development of prototype equipment for experimental purposes.

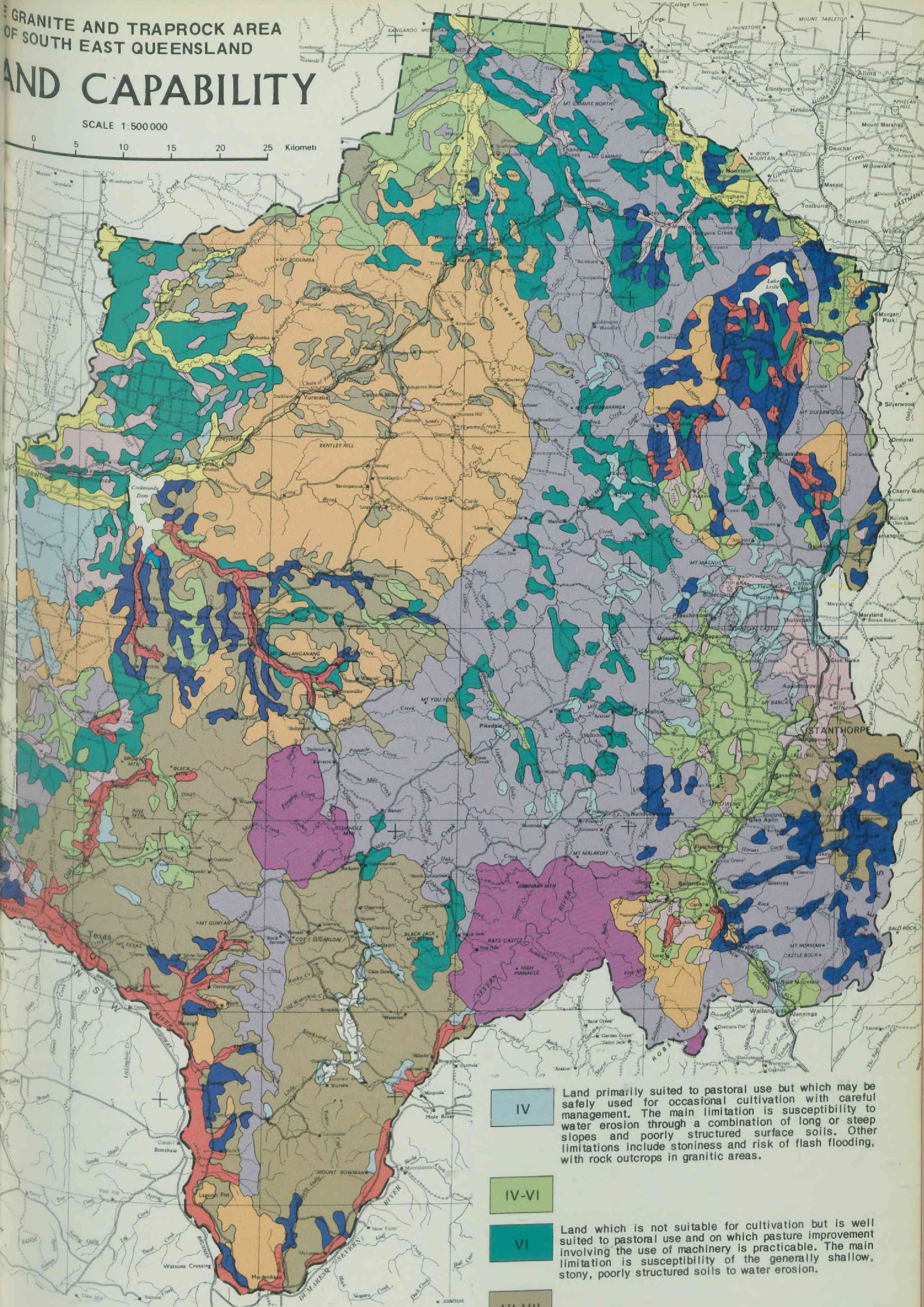
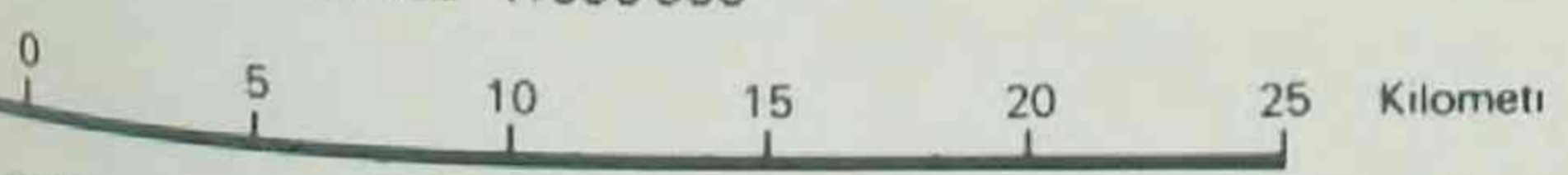
Fabricating components for experimental farm machinery at the Agricultural Engineering Development Workshop, Toowoomba.



GRANITE AND TRAPROCK AREA OF SOUTH EAST QUEENSLAND

LAND CAPABILITY

SCALE 1:500 000



REFERENCE

- II** Land suitable for all agricultural uses, but slightly restricted by wetness and flooding.
- II-III**
- III** Land suitable for all agricultural uses, but moderately restricted by susceptibility to water erosion, often combined with shallow effective soil depth, susceptibility to flooding or poorly structured surface soils.
- III-IV**

- IV** Land primarily suited to pastoral use but which may be safely used for occasional cultivation with careful management. The main limitation is susceptibility to water erosion through a combination of long or steep slopes and poorly structured surface soils. Other limitations include stoniness and risk of flash flooding, with rock outcrops in granitic areas.
- IV-VI**
- VI** Land which is not suitable for cultivation but is well suited to pastoral use and on which pasture improvement involving the use of machinery is practicable. The main limitation is susceptibility of the generally shallow, stony, poorly structured soils to water erosion.
- VI-VII**
- VII** Land which is not suitable for cultivation and on which pastoral use is possible, only with careful management. Pasture improvement involving the use of machinery is not practicable. The main limitations are susceptibility to water erosion, and stoniness in the shallow, skeletal soils.
- VII-VIII**
- VIII** Land which has such severe limitations that it is unsuitable for either cultivation or grazing. This land is inaccessible and deeply dissected with an extremely rough landsurface. The areas would be suitable as national or environment parks, or wildlife reserves.

