Director,
East Brands

Queensland Department of Primary Industries

ANNUAL REPORT 1973-74

Presented to Parliament by Command

A. 63—1974-75

Discussion with graziers after a demonstration of artificial insemination and semen collection at a Brigalow Research Station field day in October, 1973.

D.P.I. officers discuss the results of bean trials with an interested group of growers.

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ORGANIZATION OF THE DEPARTMENT
As At 30 June, 1974

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

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General Manager, Agricultural Bank	F. J. Strutton, A.A.S.A., A.C.I.
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Soil Conservation Branch	H. W. Pauli, B.Agr.Sc., B.E.(Civil) (Director)

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QUEENSLAND DEPARTMENT OF PRIMARY INDUSTRIES

Annual Report 1973-74

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, 1974.

Yours faithfully,

J. M. HARVEY,
Director-General.

I. General Comments

In this preliminary section of the report, brief comment is made on points of particular interest related to production, departmental organization and staff matters, and miscellaneous aspects of the Department's operations.

PRODUCTION

The year 1973–74 was one of contrasts in the rural sector. Climatic conditions ranged from severe flooding with major losses in some areas to pockets of drought in others. Prices for many products rose sharply, but for others, notably beef and wool, markets fell substantially. Overall, however, the picture was one of improvement on the previous year.

The gross value of Queensland rural production at $1 059 m. topped the $1 000 m. mark for the first time. This exceeded the previous year's record by 10%. Although the value of production increased, the volume remained fairly stable, virtually the whole increase resulting from higher prices for a number of rural products. The beef, sugar, grain and sheep industries together accounted for more than 70% of the total value of production.

Extraordinary circumstances were experienced by the beef industry during 1973–74. Seasonal conditions were exceptional with record summer rainfall over most districts accompanied by widespread flooding in many areas. The Carpentaria, Central-west, Far-west and South-west regions were the most seriously affected. Ironically, some pockets of drought still persisted in border areas around Goondiwindi, Inglewood and Texas, and agistment of cattle from these areas was necessary.

Coolum Research Station was repeatedly under water last summer.

The flooding, coupled with serious depression of the export beef market during the first half of 1974, caused substantial disruption to the industry and resulted in a late start to the 1974 killing season. Abattoir throughputs were reduced and production of beef and veal for the whole of 1973–74 was down by 9·4% on the previous year. Despite this, however, the beef industry retained its position at the head of the State's rural industries with a gross value of $281 m. representing some 26·5% of the total value of rural output. The sugar industry ranked second only to beef in its contribution to the State's rural output. The gross value of cane cut was $207 m. which was substantially down on the previous year's figure of $227 m. Following high expectations at the beginning of the year, poor harvesting conditions resulted in the 1973 harvest being one of the most difficult on record. The 18·28 m. tonnes of cane harvested were slightly above the previous year's level but the c.c.s. was one of the lowest on record with the result that raw sugar production at 2·4 m. tonnes was some 11·42% below the 1972–73 level.

Prospects at this stage for the 1974–75 harvest are excellent and given a favourable harvesting season sugar cane production could go close to 20 m. tonnes.

The grains and oilseeds industry showed a substantial gain on the previous year in terms of production and value. Production of wheat, barley, soybeans, safflower and sunflower rose substantially and grain sorghum also increased, though to a lesser extent. Gross value of production of grains and oilseeds at $145·2 m. was an alltime record and greatly exceeded the previous record set in 1971–72.

The growing season for most grain and oilseed crops was much better than in the previous year and yields generally were substantially higher. Acreages under wheat, barley, soybeans, safflower and sunflower increased markedly but areas planted to grain sorghum, maize and linseed declined. However, in the case of grain sorghum, higher yields more than offset the reduced acreage.

Rice production was very disappointing and production was estimated at only 5 500 tonnes compared with 17 000 tonnes the previous year. The drastic fall in production was due almost entirely to cyclonic weather and flooding.

The wool industry continued to decline and production at 58·4 m. kg was down by 5% on 1972–73. Wool values also declined with the result that the gross value of production at $106 m. was about 8% lower. A similar downward trend also occurred in sheepmeat production, but there was a marked increase in values. Overall, however, the gross value of production fell by 7% to $15·4 m.

The sheep industry suffered heavily at the hands of the summer floods. Widespread flooding in sheep districts of the North-west, Central-west, South-west and Far-south-west caused losses conservatively estimated at 250 000 head.

Production and prices in the poultry industry increased and the gross value of the industry reached $38·4 m. some 32% higher than in the previous year.

Production of pigmeats fell by 13·4% to 43 051 tonnes. A shortage of pigs developed during the latter part of the year, largely as a result of earlier disposal of breeding stock by many producers during the first half of 1973 when pig prices were relatively low and feed prices high. As the year progressed, the feed situation improved as also did market prices for pigmeats so that a reversal of trend can be expected in the forthcoming year.

The dairying industry continued to decline and the number of dairyfarmers had fallen from 14 610 in 1963–64 to 5 310 by 1973–74. An increasing number of farmers are switching from cream supply to wholemilk delivery and this trend is expected to continue during the next few years.

Butter production fell further in 1973–74 to a new low of 11 700 tonnes compared with 15 749 tonnes the previous year. Queensland is now a substantial net importer of butter from southern States and the industry here has reached a critical stage where there is inadequate throughput to keep some of our dairy factories viable.

Gross value of fruit and vegetables for 1973–74 reached an alltime record of $91·7 m. This compared with $71·9 m. the previous year and represents a quite spectacular increase of 27·5%. The increase resulted primarily from a substantial increase in prices of many lines, particularly potatoes and other vegetables. The very wet summer of 1974 resulted in substantial loss of vegetable crops and inability to plant which gave rise to the substantially higher prices. Fruit crops were affected to a much lesser extent with the result that the value of fruit production was only marginally higher.

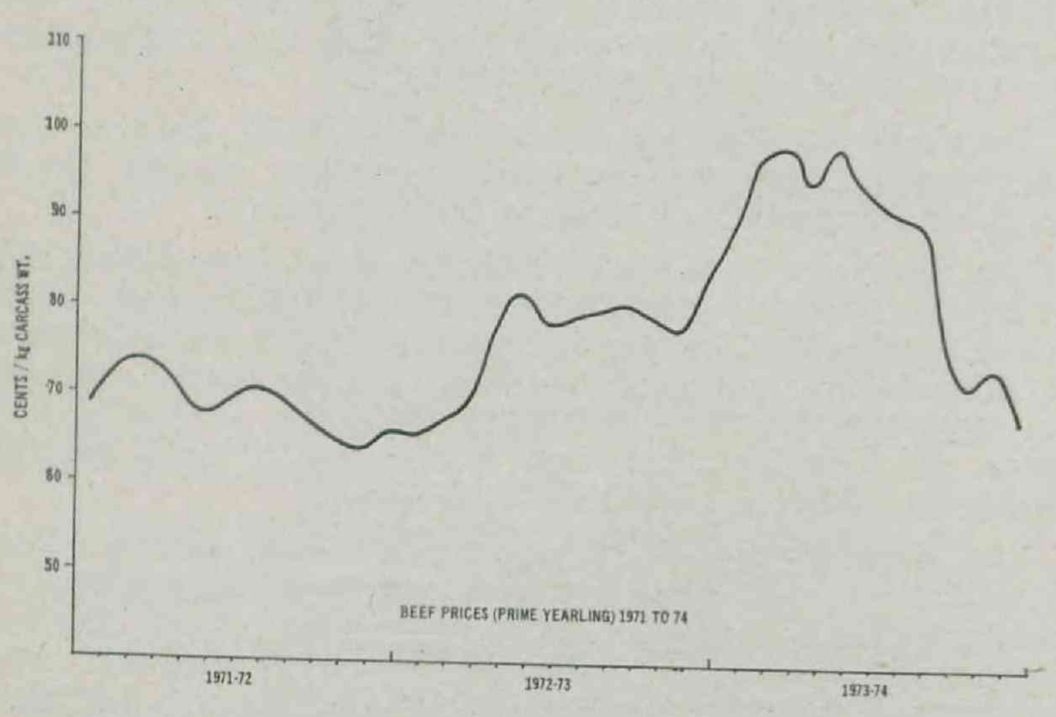
The 1973–74 cotton crop at 29 000 bales was a record, exceeding the previous year's crop by some 8 000 bales. On the other hand, the peanut crop fell from 38 000 tonnes to 28 000 tonnes due to dry conditions prior to harvest. The navy bean crop increased from 1 424 tonnes to 2 200 tonnes despite a reduction of over 40% in the area planted. Tobacco production remains fairly stable because of the influence of the marketing quota system which operates under the Tobacco Industry Stabilisation Scheme.

MARKETS AND PRICES

Beef

The Queensland beef industry is highly dependent on export markets for the disposal of its products. In 1972–73, for example, 83·7% of production was exported. As a result the industry is largely affected by changes which occur in overseas markets.

The booming beef export market of recent years continued to apply for the early part of 1973–74. However, towards the end of 1973, demand levelled off and then weakened alarmingly during the second half of the financial year.



The rise and fall in beef prices.

This export weakness was soon evidenced on fat stock markets where, by June 1974, prices for export-type cattle were down by some 50 to 60% on prices ruling 12 months earlier.

Australia's three main markets, namely the U.S.A., Japan and E.E.C. all weakened seriously, with Japan and the E.E.C. imposing total import restrictions on beef and the U.S.A. threatening reimposition of quotas and calling for voluntary restraint on exports from Australia.

Beef and veal exports from Australia in 1973–74 fell by 17·4% on 1972–73 levels and for the six months, January to June 1974, exports were down by 45% compared with the same period of 1972–73.

Factors which led to this depressed situation included a domestic meat glut in the U.S.A., adverse world-wide consumer reaction to the high meat prices of 1973, upward movement of the Australian dollar against other currencies, increased production and protection of domestic beef industries in most countries, and general restraint in the face of uncertain economic conditions and balance-of-payments difficulties, especially in Japan and Europe.

It is likely that most of the difficulties facing the export industry are of a short to medium term nature and some should be overcome during 1974–75. The underlying long term demand-supply relationships which led to the high level of prosperity for the beef industry in recent years continue to apply. However, it would be unrealistic for producers to expect a rapid return to the very attractive high price levels of 1973.

Sugar

A tight world supply and demand position, high world market prices and the absence of any economic provisions in the International Sugar Agreement led to increased Queensland sugar export earnings.

Final returns for the 1973 season were $129·85 per tonne for No. 1 Pool sugar and $134·95 per tonne for No. 2 Pool sugar. This compares with $118·66 per tonne and $113·93 per tonne respectively for the 1972 season.

A great deal of uncertainty and anxiety surrounds future domestic marketing arrangements for sugar following failure to renegotiate the Commonwealth–Queensland Sugar Agreement. The current agreement which expired on 30 June has been extended until 30 September in order to enable the terms of a new agreement to be resolved. The successful conclusion of a satisfactory new agreement is of vital importance to the continued economic well-being of the industry.

Australia exported almost 2 m. tonnes of sugar in 1973, a decrease of 260 000 tonnes from 1972. Japan continued as our largest market, taking 580 000 tonnes. The United Kingdom accounted for 338 000 tonnes, Canada 334 000 tonnes and the U.S.A. 231 000 tonnes.

The average London daily price for 1973 was equivalent to $A142 per tonne, 37% above last year's record average price. Strong upward price movements have continued into 1974 with the London daily price reaching the high level of $A368 per tonne.

Negotiated price quota exports to the United Kingdom are due to be phased out at the end of this year following the termination of the Commonwealth Sugar Agreement. Failure by the United States of America to enact new legislation leaves the position on that market insecure. Although initially increased quantities may be sold to the United States, longer term effects could well result in expanded production in the U.S.A., increased competition from other suppliers and lower prices.

The sugar industry is attempting to counter increasing uncertainty in world markets by establishing long term contracts with many of our trading partners. Contracts have recently been signed with Malaysia, Singapore, China and New Zealand.

Grains

Prices for Australian grains increased markedly during the year despite generally larger crops, and prospects for the maintenance of relatively high price levels, for the coming year at least, are good. World grain stocks generally are at fairly low levels and, despite attempts to increase world production, there appears to be little likelihood of a buildup in stocks during the next twelve months sufficient to exert any real downward pressure on prices.

In the light of the world market situation, the Australian wheat delivery quota for next year has been held at 14 m. tonnes. In addition a contingency quota of 2 m. tonnes has been provided to ensure that all wheat is delivered and sold whether or not any individual State exceeds its quota. Queensland's wheat quota for 1974–75 has been set at 1 165 000 tonnes, a figure which is unlikely to be reached.

Well-grown soybeans at Lowood.

Export prices for wheat reached a record $140 per tonne, at ports, during 1973–74 and returns to growers from the crop are also expected to reach a record level of around $100 per tonne, ports basis. This is almost double the expected return from the previous year's crop. While there was some downward pressure on world wheat prices earlier in 1974 as a result of record plantings in the United States of America, crops are not yielding up to expectations and prices are again rising.

Sunflowers are in demand as an oil-seed crop.

The world barley market also is buoyant. Export prices during 1973–74 reached $90 per tonne f.o.b. and returns to Queensland growers from the last crop are expected to average around $65 per tonne at farm gate compared with $48 the previous year. The market outlook for the coming year is excellent with prices expected at least to parallel those recorded in the last twelve months.

Export sales of grain sorghum from the 1973–74 crop will be well above those of the previous year and could well reach 450 000 tonnes. World prices during the year were very good and should average around $80 per tonne f.o.b. compared with some $65 per tonne last year. Prospects for a continuation of present buoyant market conditions are good and already some forward sales from the 1974–75 crop have been made at prices above $100 per tonne f.o.b.

Prices of other grains also rose substantially during the year with maize reaching $80 per tonne compared with $60 the previous year. World prices for long grained rice also rose to phenomenally high levels, reaching $500 per tonne f.o.b. during the year. Unfortunately, supplies were insufficient even to meet domestic market requirements.

Safflower—a re-emergent crop.

The market for Australian grown oilseeds continued to be undersupplied. Against an Australian crushing capacity of some 700 000 tonnes, production during 1973–74 was only about 350 000 tonnes. Prices for safflower seed increased from $115 per tonne to $160 per tonne delivered at mills.

Linseed prices increased from $105 per tonne to $120 per tonne and there is still an acute world shortage of this oil. Prices next year are expected to be substantially higher. Sunflowerseed prices rose from $150 to $160 per tonne and with the increasing demand for polyunsaturated oils the future outlook is very good. Soybean prices also increased during the year and reached $180 per tonne compared with $145 per tonne the previous year. Estimates by the Department's Marketing Division indicate that demand for soybean meal could exceed 100 000 tonnes by 1980. To meet this demand Australian production would need to be at least doubled.

Wool

The 1973–74 wool selling season opened at record values with sales of wool in Brisbane during July 1973 at an average of 274·9c per kg (greasy). However, as the season progressed, prices slipped steadily back to an average value in June 1974 of 134·04c per kg (greasy) which was 51·2% below the season's opening level. The overall average price for 1973–74 was 175·7c per kg (greasy).

The market was afflicted by uncertainty due to shortages of bunkering oil, economic slowdowns in consuming countries and exchange rate variations. Japan, traditionally Australia's major wool buyer, displayed a 'now and again' attitude to purchases with the result that the E.E.C. and Eastern Europe were the dominant market forces. The Australian Wool Corporation bought heavily to support prices.

In the longer term, the forecast worldwide slowdown in economic activity could result in some overall reduction in the demand for wool. Prospects next year for the textile industries in the major raw wool consuming countries appear even less favourable than in 1973. Expected downturns are likely to be most marked in the United States, Japan and the United Kingdom. A possible small increase in raw wool production in 1974–75 could also exert some downward pressure on the market.

Findings reported in the Wool Marketing Report of the Australian Wool Corporation were released in January, 1974. They recommended wide-ranging changes including acquisition of all export wool by the corporation in order to control large fluctuations in export price by matching demand and supply. No decision on the recommendations has yet been taken by the Federal Government.

Dairy Products

World prices for dairy products continued at high levels and butter stocks in the E.E.C. towards the end of the year were lower than 12 months earlier. Exports of butter and cheese to the U.S.A., Canada and Japan increased significantly and the demand from these countries is likely to continue in the short term at least. Unfortunately, Queensland had insufficient production to take full advantage of export markets.

Following discussions between the Australian Dairy Industry Council and the Commonwealth Equalisation Committee, agreement was reached to modify the Equalisation Agreement. The effect of this modification will be to ensure that those States which currently have little or no surplus production will receive the full benefits of the domestic price on at least 80% of their domestic sales. The scheme has been accepted for a trial period of one year commencing 1 July, 1974.

Pigmeats

Pig prices were depressed at the start of 1973–74 with 'on consignment' prime grade baconers realising 63·8c per kg. However, as the year progressed, supplies of pigs gradually tightened with a corresponding rise of price such that 'on consignment' baconers were realising around $1.00 per kg by the end of the year.

Prospects for the industry are cautiously optimistic with attractive prices and an improving feed supply situation. Some fears are held, however, that falling beef prices and a buildup of consumer resistance to high retail prices of pigmeats could result in some downward pressure on prices in the coming year.

Eggs and Poultry

High feed costs and uncertain supplies of protein meals caused considerable uncertainty in the poultry industry, and prices of both eggs and poultry meat increased. Returns to egg producers improved markedly but rising costs throughout the distribution chain are causing concern.

The introduction of the Hen Quota Scheme during the year should, in future, result in much greater stability in both production and prices. Some concern is being felt in the broiler industry that increased production coupled with the substantial fall in beef prices could result in an oversupplied market during the coming year.

Peanuts

Because of the smaller crop and improved marketing techniques the average selling price of The Peanut Marketing Board in 1973–74 is expected to be 57c per kg. Returns to growers are expected to average 26c per kg, nut-in-shell basis. In 1972–73 the average selling price was 42c per kg and the returns to growers 22c per kg. Export outlets were available at satisfactory prices, but exports were limited by the smaller crop.

Navy Beans

In order to encourage production, The Navy Bean Marketing Board negotiated a price increase of 16c per kg for 1974, bringing the new price to 41c per kg. As a result the return to growers is expected to increase to 39c per kg from the 1973 level of 23c.

Cotton

Although world cotton prices declined during 1973–74, returns to Queensland growers are expected to be 80c per kg, compared with 74c per kg in 1972–73. Market prospects for cotton remain good and this could well lead to further expansion of the industry.

Tobacco

The 1974 crop was the first to be marketed under the current extended Tobacco Industry Stabilisation Scheme. The Australian marketing quota was set at 15 422 000 kg for both 1974 and 1975 with Queensland's share remaining constant at 8 304 300 kg.

Some 8 375 440 kg of tobacco leaf were sold in Queensland in 1973 at an average price of 249·7c per kg. The average price realised was down slightly on the previous year but average prices during the first four months of the 1974 sales increased to 292·4c per kg. This increase reflects the increase of 36c per kg in the minimum price schedule agreed upon in February this year.

Fruit and Vegetables

Vegetable prices rose sharply during 1974, largely as a result of reduced supplies caused by severe flooding and almost continuous wet weather. In contrast fruit prices remained relatively stable and increasing costs are having a serious effect on some sectors of the fruit industry.

The National Banana Marketing Development Scheme continued to operate satisfactorily by clearing poor quality fruit off the market and ensuring a reasonable return for good fruit in times of oversupply.

The pome fruit industry in Queensland remained depressed and received a further setback with the removal of the sales tax exemption from soft drinks containing a minimum Australian fruit juice content. The situation was further complicated by the declining profitability of the apple export market. Some assistance for apple exports was offered by the Australian and Queensland Governments for the 1974 season but the effect on exports was minor.

On the other hand, citrus prospects are much better. Continuing interest is being shown in Queensland citrus for export, particularly Ellendale mandarins.

FLOOD AND DROUGHT

Perhaps there is no clearer illustration of the wide climatic range and variability of seasonal conditions under which Queensland rural industries operate than the coexistence of flood and drought within the State. The 1973–74 season was characterised by the worst flooding in Queensland's history while, at the same time, pockets of quite severe drought existed in the Stanthorpe, Inglewood, and Waggamba Shires.

The areas of most serious flooding from the rural industry viewpoint were the Gulf Country and the Far-south-west, but extensive damage also occurred in the North-west, Central-west and Border Rivers areas as well as along the coast.

It is impossible accurately to assess the full extent of losses to rural industry, but a conservative estimate places the figure in excess of $50 million.

Known stock losses included more than 200 000 head of cattle and over 250 000 head of sheep with a combined value of around $30 million. In addition, thousands of miles of fencing and hundreds of dams and watering points were destroyed, and severe damage was caused to farm buildings and equipment over a vast area.

The magnitude of these flood losses coming at a time when the pastoral industries were only starting to recover from prolonged drought and low wool prices means that full recovery will take years.

In recognition of the serious situation the State Government introduced a number of assistance measures including rail and road freight concessions on the transport of stock for restocking purposes, and flood relief loans up to a maximum of $40 000 at concessional rates of interest and repayable over a term of up to 13 years. Advances were provided to cover purchase of replacement stock, repair or replacement of structures and machinery, and necessary operating costs.

Although the floods were the major problem, the continuance of drought relief was necessary in some areas adjacent to the New South Wales border. Many individual properties were declared for relief purposes and assistance was made available by way of rail and road freight concessions on the movement of stock to and from agistment and for restocking. Rail freight concessions were also given on the transport of stock from affected properties for sale or slaughter and on transport of fodder.

RURAL FINANCE

Though not as difficult as during the previous period of prolonged drought and low wool prices, the rural finance situation is still of major concern. High interest rates, coupled in some cases with difficulty in raising credit, retarded rural development to some extent and were also partly responsible for a slowdown in soil and water conservation works. The problem was further compounded by the withdrawal of several taxation concessions which previously provided some incentive for development and conservation.

To some extent the substantially higher prices realised for a number of commodities enabled some capital works to be financed out of income, but the general air of uncertainty in rural industry resulted in the adoption of a wait and see attitude by many farmers.

The Agricultural Bank was increasingly called upon to bridge the gap between finance available from normal sources and the demands of rural industry.

On 1 July, 1973, the statutory advance limit under the Agricultural Bank Acts was raised to $30 000. This enabled the Bank to expand its activities in the financing of new business, providing long-term lending to new clients to meet the trend towards the purchase of larger and more economic farm units. The Bank was also able to increase its assistance to existing worthy clients to consolidate their present position. This increased advance limit, coupled with a general tightening of the availability of funds during the latter half of the year from other financial institutions, increased advances approved under the Agricultural Bank Acts by more than $11 800 000 over last year. Included in this increase is an amount of $509 015 approved under the Flood Damage Relief Scheme. An agreement between the Commonwealth and Queensland Governments provides for assistance at concessional rates of interest to eligible primary producers who suffered loss as a result of the disastrous floods which affected large areas of the State in December 1973 and January 1974.

Advances approved during the financial year 1973–74 under the various Acts administered by the Agricultural Bank were as follows:

Agricultural Bank Acts	$25 669 598
Farm Water Supplies Assistance Acts	$ 558 566
Soil Conservation Act	$ 713
	$26 228 877

Advance repayments by borrowers under the Agricultural Bank Acts showed an increase of more than $2 000 000 over the preceding year, despite abnormal seasonal fluctuations throughout the State generally. The increase in repayments follows increases in advances and in the rate of interest charged to new and existing clients. The new interest rate is commensurate with that charged to the bank on advance funds borrowed to enable it to carry out its function of assistance to primary producers.

Approvals in 1973–74 under the Farm Water Supplies Assistance Acts were approximately 20% lower than those of the previous financial year. This fall is attributable to the abnormal rainfall during the year. The level of advances in the coming year will likewise be determined largely by weather conditions. It is expected, however, that there will be a considerable demand for assistance to rebuild flood damaged water storages.

MARKET RESEARCH AND INTELLIGENCE

The rapidly changing fortunes of rural industries, domestic inflation, international currency realignments and general changes in trade patterns are making it evident that increased attention needs to be given to market research and to the provision of timely and accurate market intelligence. To this end the Marketing Services Branch of the department carried out a series of studies during the year and expanded its service to rural industries.

Research carried out involved a wide spectrum of topics of concern to both producers and consumers. 'A Survey of Factors Affecting Consumer Demand for Pigmeats in Brisbane' was published and work was also completed on a 'Consumer Demand Study of Meat Consumption in Brisbane', which will be released shortly. A 'Consumer Demand Study of Attitudes Towards Selected Fruits in Brisbane', for which field work has been completed, will be published in the near future.

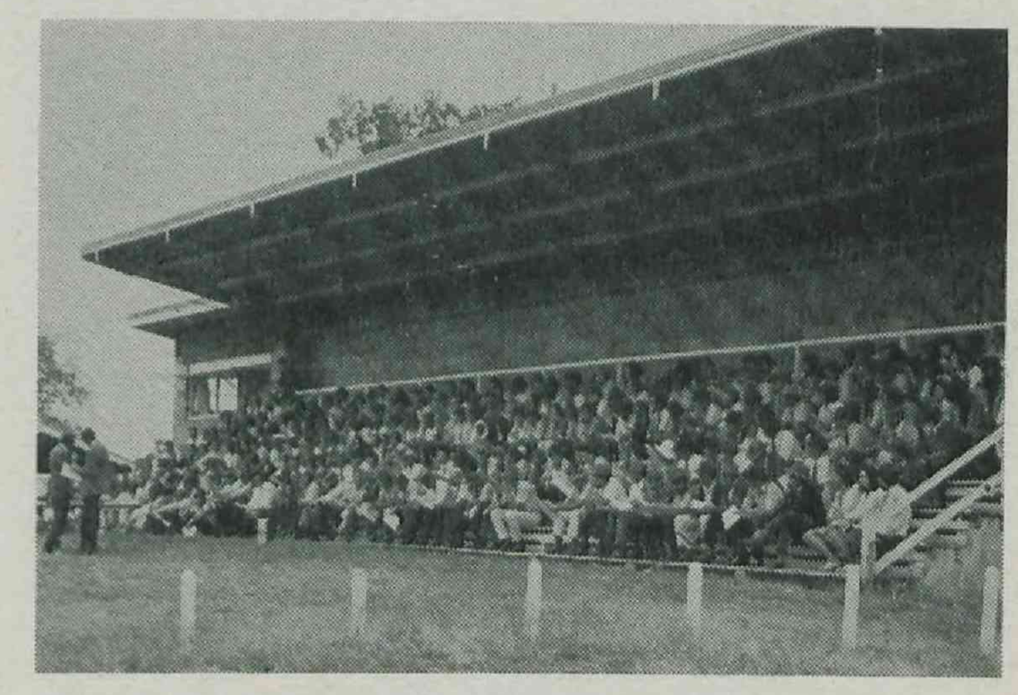
Producer-orientated research included 'A Report on the Prospects for a Queensland Wine Industry', 'A Review of the Australian Macadamia Nut Industry' and several localized feasibility studies concerning the reconstruction of the processing sector of the dairy industry. In addition, a study was completed concerning the best location of a soybean processing plant in South-east Queensland, and a study relating to the feasibility of the establishing of an apple products plant at Stanthorpe.

Investigations were made into applications from co-operative organisations and marketing boards for financial assistance under Government guarantee. The Marketing Services Branch also extended its financial and management accounting services to rural industry organisations, with particular emphasis on assistance to co-operatives.

The issue of crop forecasts, monthly reports on trends in rural production, and market price reports continued to receive wide acceptance from producers as well as banks and commercial undertakings servicing the primary producer.

Legislation now controls egg production following support by 78% of producers in the State.

Changes made during the year in standards required of country slaughterhouses aroused considerable comment and some criticism. Much of the criticism, however, was due to lack of understanding of the proposed manner of implementation of the new requirements for improved facilities and hygiene. Licencees were advised to submit to the Queensland Meat Industry Authority by 30 June, 1974 planned programmes for improvements. It is not intended that the required improvements be effected overnight, and a commonsense approach over several years will be necessary to achieve the desired result.



Not a football crowd, but an enthusiastic gathering of 300 cattlemen at the Emerald Hoof 'n Hook Field Day.

A project to promote tenderstretched meat throughout the State, which was commenced during the latter part of 1972–73, was continued. This project, which has the support of the Australian Meat Board and the C.S.I.R.O. Meat Research Laboratory, aroused considerable interest in housewives' organisations. A large number of meatworks, both private and service, now provide tenderstretched meat on demand. The main objection previously raised by butchers concerned the different technique required to break up carcasses and this has been largely overcome.

Slaughtering and Meat Inspection Branch officers worked with a group of Caboolture district butchers on techniques for breaking up tenderstretched beef carcasses.

QUALITY STANDARDS

Substantial progress was made in improving quality and hygiene standards for meat. Updated Meat Industry Regulations will ensure more adequate supervision of meat quality and hygiene from now on.

The licensing of abattoirs, slaughterhouses, public meat markets, poultry slaughterhouses and knackers' yards is now the responsibility of the Queensland Meat Industry Authority. Regional meat areas, in addition to public and district abattoir areas, may also be constituted.

Controls on the introduction of meat into Queensland from interstate sources have been introduced. Premises outside the State now have to be certified by the Chief Inspector. Certification is granted only if the premises comply with the prescribed standards of construction and hygiene which are operative in Queensland. Inspection of interstate premises was necessary, and certification has been refused to 14 establishments because of gross structural, sanitary and procedural deficiencies.

Numerous newspaper articles were prepared by officers throughout the State and published in local papers and the metropolitan press. Radio interviews and talks were given on both commercial stations and on A.B.C. television, and addresses were given to consumer groups at Toowoomba, Ipswich, Rockhampton, Gympie, Maryborough and Brisbane. Promotional material was supplied to butchers using the process.

A modification of existing techniques is needed for breaking up tenderstretched beef hindquarters. This technique was studied by Slaughtering and Meat Inspection branch officers in conjunction with officers of the Education Department's Food School and a commercial meat company in Brisbane. The techniques were demonstrated to butchers at displays at the R.N.A. Brisbane and in the mobile meat display unit at the Rockhampton Carnival and assistance was given on request to groups of butchers in Caboolture, Kilcoy, Maroochydore, Goomeri, Kingaroy, Murgon, Rockhampton, Maryborough, Gympie and Brisbane.

Widespread concern at the high cost of bruising to the Australian meat industry led to the decision to carry out a series of bruising trials. These were carried out by Slaughtering and Meat Inspection Branch and Beef Cattle Husbandry staff working with C.S.I.R.O. Meat Research Laboratory and the Australian Meat Board in collaboration with the Bruising Committee of the United Graziers' Association.

Three trials, with horned, hornless and mixed groups of cattle, were carried out in collaboration with a grazier in the Oakey area and at the Brigalow Research Station. Despite variations in method of transport and distance travelled, the results indicated a constant relative level of bruising. Horned cattle consistently showed twice as much weight of bruise trim as hornless. Mixed groups were intermediate.

To test the effects of dehorning adult cattle, and the effects of tipping on reducing bruising caused by horns, a further trial was done with cattle from 'Swan's Lagoon'. Tipped and dehorned animals suffered a significant setback due to the operation. Tipped animals appear to have had bruise trim weights which were not significantly different from horned animals.

In all trials, yarding and transport were observed in an attempt to study bruising during transport. In one trial of road transport, trucks carrying half the cattle stopped four times, which was normal for the trip. It was arranged for trucks carrying the other half to stop 10 times. Preliminary study of the results show that the extra stopping significantly increased loss through carcass bruising.

There is so far no standard way of describing carcass bruising but an attempt is being made to devise and use a simple, one man, diagrammatic method of recording bruising. This method seems to hold promise as an alternative to the laborious collection and weighing of bruise trimmings. It allows the location and depth of bruising to be recorded. Preliminary study of diagrams also reveals that different methods of transport may produce distinctly different patterns of bruising.

A significant difference between left and right sides of carcasses was noted. The fact that more bruising occurs on the side on which most animals fall from the knocking box suggested that this may be a knocking box effect. Further bruising trials are planned.

The seed testing station at Toowoomba became fully operative during the year and the station is now equipped to handle foreseeable future needs for the Darling Downs. The station processed some 1 800 seed samples during the first five months of operation, thus amply demonstrating the need for this service in the district.

Inspection services are now provided by the Standards Branch Officers in Townsville, Rockhampton, Cairns and Toowoomba. These services cover quality control over fruit and vegetables offered for wholesale and retail sale, quality maintenance for agricultural chemicals and other agricultural requirements and supervision of seed purity and quality.

The Standards Branch is represented on the Technical Committee on Agricultural Chemicals, a federal body which handles applications for the clearance of agricultural chemicals for use in Australia; on the Co-ordinating Committee on Seed Certification; and on the Chief Seed Testing and Regulatory Officers' subcommittee. Representation on the co-ordinating committee on seed certification gives the department a voice in such matters as uniformity in certification procedures within the O.E.C.D. Seed Certification Scheme, and the latter group nominate and elect Australian delegates to technical committees of the International Seed Testing Association.

AGRICULTURAL ECONOMICS

Demand for farm management advisory services increased, despite a buoyant situation in most rural industries over the greater part of the year. This is no doubt associated with the high risk inherent in rural enterprise, and the expectation that the spiralling cost inflation is likely to leave a high cost structure in its wake whereas commodity prices are largely unpredictable except in the short term.

Despite the buoyant price situation, reinvestment in development has been more than cautious.

A sense of concern has been prompted by the drought and flood situations over the last few years, currency revaluations, and the more recent and impending changes in subsidies and taxation concessions.

While inflationary trends were 3% to 4% a year, technological improvements enabled the producer to meet increased costs. In the present climate of 14% and rising, there is little or no incentive to investment. Moreover, it is more than likely that many marginally viable farm enterprises will find the going impossible when commodity prices recede.

There is a greater awareness by producers of the need to plan farm operations in advance. The basic requirements for farm planning are farm records and the ability to recognise and assess the outcome of alternative management strategies.

A major theme in the Beef Cattle Husbandry Branch's extension programme, that of raising branding percentages, attracted a keen audience at a Coal Creek (Brisbane Valley) Field Day.

A significant development within the Economic Services Branch was the organising of seminars involving public accountants who service rural industries. This enabled a better understanding of producers' problems and their accounting needs, which go well beyond the recording of information for annual taxation returns. Farmers' requirements for budgetary planning, financial strategies and property management generally are now more widely appreciated.

Progress was made in the standardization of farm management accounting. The branch participated in a symposium to consider computerised systems available through the Queensland Institute of Technology, the Bureau of Sugar Experiment Stations and this department.

The assessment of economic feasibility of proposed irrigation development continues to be a major exercise. Reassessments of previous proposals have been commissioned in the light of the current cost situation. Evaluations of the Three Moon Creek (Monto) Scheme and the Urannah Dam (Bowen/Broken Rivers system) are in the final stages of completion.

With regionalisation of the Department's extensive services, the accent tends to be more on a 'whole farm' approach, and the agricultural economist is receiving more demands on his services as a 'resource' officer for extension personnel. He is also becoming more and more involved in farm management training courses offered to primary producers.

A report on land use systems on holdings in the Condamine–Maranoa region will be completed in 1974. Data collected on land use systems in the Cape York Peninsula are being processed to provide a regional development pattern and a guide to future agricultural usage. An assessment is in progress to determine the interdependency of agriculture and other sectors of industry in the Burdekin Basin.

Structural changes in the pig industry are being studied, and field work should be finalised in August. Particular attention is being given to the recent increase in large-scale piggeries.

Research on decision-making in the harsh environment of the pastoral zone at Charleville and Roma, with financial support from the Australian Wool Corporation, received a setback in the loss of key personnel. The collection of basic cost and income data should improve decision-making abilities in the short term and in the long term provide a more informed basis for management strategies in this diverse region.

Important regional studies were initiated for the beef industry but a downturn in industry returns reduced the financial support the industry can offer. This will curtail the studies to some extent.

Dairy industry studies were associated with problems arising from the substantial reduction in numbers of dairy farmers and production. Over the next three years, the sharp fall in the number of suppliers is expected to continue. It is anticipated that there will be a substantial decrease in cream supply (about 50%) but the total milk supply is expected to increase by about 15%.

A gross margins study to obtain input/output data relating to horticultural crops in the Near North Coast region centred on Nambour was extended to cover additional crops. Similar studies in the Redlands area have started.

An economic assessment of the livestock and horticultural activities in the Southern Downs and adjacent border regions is in progress as part of a comprehensive overall land use study of the traprock region.

EXTENSION SERVICES

During the year Extension Services Section became fully operational. The long-term objectives of this are to co-ordinate all extension activities of the department in a manner which will provide the most effective service to the primary producer and to rural communities generally.

Eleven regional extension leaders and 31 district committees of specialist officers will assist some 500 field officers in extension planning and programming.

A 'Charter of Operations' has been issued to all staff involved, and meetings have been held throughout the State to ensure a common approach under the new operating procedures.

As might be expected in a reorganisation such as this, long-term objectives can only be reached slowly. Staff require the opportunity to put into practice the planning principles laid down, and to suggest ways in which these may be more easily applied to local conditions.

The short-term (1973–74) objectives for the section were to develop among staff an appreciation of, and some initial experiences in, working as local teams on problems recognised by local producers, officers, industry leaders or other members of the community. Staff were encouraged to adopt a planned approach to the more significant issues in need of extension work.

Two hundred extension projects were processed and it is anticipated that in a full year's operations some 400 planned operations will be undertaken by field staff. A number of the projects being implemented involve services to the community at large, rather than to producers of primary products.

During the year the Information and Extension Training Branch provided advanced training of departmental officers in extension skills and methods. Production of extension films and television segments was stepped up and with the co-operation of the media substantial additional information was made available to farmers through press, radio and television.

Commonwealth Extension Services Grant funds do a lot to help raise the quality and effectiveness of departmental publications.

In line with the Department's regional extension concept, regional information officers have been relocated to provide a better service. Emphasis has been placed, in the first instance, on the more dense farming areas of the Darling Downs, Burnett, Near North Coast, East and West Moreton and Central Coast regions.

A producer discussion group reviews the important aspects of mastitis detection and control with the help of C.E.S.G.–D.P.I. publications.

LAND UTILISATION

One lesson from the past is that future land use strategies must be based on assessments of the range of community needs for land, the suitability of each parcel of land for a defined use, and finally a reconciliation of needs and suitability. The Division of Land Utilisation has a major interest in land use issues, and has progressively shaped its activities so that it can more effectively discharge its obligations to the community.

The division's activities have been, and will continue to be, related mainly to agricultural and pastoral land use. This interest is reflected in the major soil conservation and land use programme launched mainly in the year under review. Major resource studies have also been made: the Western and Central Queensland programme involving an area of some 100 m. hectares of pastoral lands; the Burdekin catchment land capability and productivity studies covering 13 m. hectares, and the Darling Downs land use zoning programmes relating to 3 m. hectares of agriculture and pastoral lands.

The increased public recognition of a total community interest in the allocation of our land resources for all uses has emphasised that land capability studies and the programmed land use strategies based on these studies must also consider the suitability of various land units for fauna and flora conservation, and for forestry and recreational requirements. Determination of management needs of watersheds, even on associated agricultural and pastoral lands, also is essential to ensure the desired water quality and control of siltation in water storages.

The division has been more involved in multi-discipline studies during 1973–74, and substantial expansion of this activity is expected in the years ahead. These studies, which have been made in collaboration with other departments concerned, have been extended to environmental issues, as will be seen in the relevant parts of this report.

Statutory soil conservation programmes are being expedited to rectify the serious erosion problems on the Darling Downs. Erosion directly affects some 7 600 rural families in this area and indirectly affects the whole community because of the likely destructive effect on a region with an annual rural production exceeding $100 m. Problems in mounting the programme are progressively being identified and resolved.

A wide range of land resource studies, including a number of land development and water project investigations were co-ordinated and executed.

Multi-discipline teams based on specialists from Agricultural Chemical Laboratory Branch, Botany, Fauna Conservation and Development Planning Branches are actively engaged in the land resource assessments currently being undertaken on 100 m. hectares in the semi-arid pastoral lands of South-western, Central-western and North-western Queensland. These in-depth assessments will assist administrators with their decision-making with respect to best land use strategies based on long-term carrying capacity, property size and living areas.

Field activities were completed for Part I of the Western Arid Project, comprising 15 m. hectares in South-western Queensland. A detailed report covering the principal resources in this semi-arid region is ready for publication. Maps delineating the component land systems at a scale of 1:500 000, and vegetation and soils at a scale of 1:1 000 000 were published, and are available on request to graziers, banking houses and pastoral consultants.

An inter-departmental committee comprising senior officers from the Departments of Lands, Forestry and Primary Industries under the chairmanship of Mr. J. E. Ladewig continued to promote investigations into future land use strategies for the Coastal Lowlands and the Northern Wallum region. The committee commissioned certain studies, including a fauna survey and a recreation study, so that final assessments can take cognisance of a wide range of community needs. The suitability of various tracts of land for a number of competitive uses will be defined, with a view to arriving at decisions which will be in the best long-term interests of the community.

The first phase of the Fitzroy Basin (Brigalow) Land Development Scheme, involving the allocation of new blocks and the preparation of the initial development programmes, is nearing completion.

Broad-scale mapping of the region, based on C.E.S.G. funded activities, was completed during the year. When the Land Administration Commission has allocated the final blocks in Area III, late in 1974, a total of 67 ballot blocks with an aggregate area in excess of 560 000 hectares will have been allocated to new settlers. Property plans and land unit descriptions were provided for each of these ballot blocks. A total of 37 sale blocks, with an aggregate area of 283 000 hectares, will have been made available at public auction.

The study of the northern sheep zone embracing the shires of McKinlay, Richmond, Flinders, Winton, Longreach, Aramac and Ilfracombe is continuing, with further in-depth experimentation with an integrated physical and financial model. The general aims are to increase understanding of the overall climate-pasture-animal production system, particularly in relation to weather variability, and to determine whether management strategies exist which consistently enhance performance.

A broad spectrum of investigations, based on joint State-Commonwealth funding, is being undertaken in the Burdekin Basin by the Co-ordinator General's Department, the Irrigation and Water Supply Commission, the State Electricity Commission and the Department of Primary Industries.

Officers of the Irrigation and Water Supply Commission, Economic Services and Development Planning Branches have re-examined aspects of the 1971 report, which recommended, among other things, an extension of the Burdekin River Irrigation Project, based on the construction of Urannah Dam on the Broken River and a regulating structure, known as Clare Weir on the Lower Burdekin River. The proposal envisaged the supply of water to riparian holdings along the Bowen and Burdekin Rivers, plus the development of the flood plain Koberinga and Dalrymple soils on the right bank of the Lower Burdekin from Home Hill to the Elliot River.

As a result of changing market opportunities, two relatively high value crops, namely sugar cane and soybean, have been brought into consideration. Sugar cane, rice and soybean are likely to be the main agricultural opportunities should additional supplies of irrigation water become available. A joint supplementary report is to be presented to Cabinet by the Irrigation and Water Supply Commission and Department of Primary Industries.

Important soil survey reports were prepared by Agricultural Chemical Laboratory Branch officers on a number of projects including the granite and traprock area, Eton and Mareeba–Dimbulah irrigation schemes, Burdekin Basin appraisal study, and pineapple land in South-east Queensland.

SOIL CONSERVATION

There have been major innovations in machinery design aimed at linking production and soil conservation requirements.

Planting machinery has been designed and built to permit seeding into stubble-mulched seedbeds as well as orthodox seedbeds with a layer of dry surface soil. These innovations will not only allow farmers to plant their crops nearer the best time for optimum yields, but will also have important application in areas of soil erosion hazard.

The machinery development and demonstration programme operated from Toowoomba and Dalby was substantially expanded during the year. This programme relates to equipment suitable for stubble retention, minimum tillage and land levelling.

Good progress is being made in the acquisition of equipment required for soil conservation practices and the means of transporting it. As a consequence farmers in the Darling Downs and adjacent areas west to Goondiwindi, Roma and Wandoan are able to make their own observations concerning the means of applying the agronomic fundamentals of a soil conservation programme.

All grain growing areas in Queensland have shown an increasing interest in stubble mulch farming for erosion control, following a programme of farm demonstrations and trials using Department stubble mulching equipment.

Stubble from a substantial area of last year's winter grain crop on the Western Downs was retained.

Machinery had been made available to farmers for demonstration and testing in declared areas of soil erosion hazard on the Downs.

Machinery modifications for stubble mulching purposes in declared areas of soil erosion hazard are eligible for a 50% subsidy, up to a maximum of $500 a farm.

A disturbing feature of the State soil conservation programme has been the low level of farmer interest. Only 282 farmers entered the programme for the first time, representing by far the lowest growth since 1961. Compared with the previous year the Darling Downs and South-west regions dropped from 133 to 82 while the Capricornia region in Central Queensland dropped from 91 to 57. These were sufficient to account for the State decline, and the status quo was maintained in other regions.

Measures applied also declined sharply from 38 610 hectares in the previous year to 25 945 hectares in 1973–74 which is the lowest achievement since 1962–63. All regions shared in this decline though the most serious falls occurred in the Darling Downs and Capricornia regions which accounted respectively for 65% and 24% of the decrease.

In seeking the reason for the decline in farmer interest and application of soil conservation measures, one common feature emerges. The decline occurred in regions where agriculture is practised mainly on heavy clay soils. These soils, when wet, are difficult to survey or work. Having regard to the generally very wet year, this would appear to be the major cause of the decline in farmer interest.

Additional factors on the Darling Downs have been the relatively high proportion of existing co-operators together with the application of statutory programmes which until recently have required approval of project plans before work can proceed. Since project plans for a total area of 23 000 hectares are now being processed before approval, this problem should not recur. In the Capricornia region an additional factor was the preoccupation of farmers and some staff with locust control work.

The weather pattern throughout the year was conducive to good crop and pasture growth thus helping to maintain protective ground cover without which soil losses would have been substantially greater.

The trend towards increased cropping with sunflower, safflower and soybean has problems from a conservation viewpoint because these crops do not produce a good stubble cover. Some spectacular erosion occurred this year in the Mareeba–Dimbulah tobacco area where sloping granite soils were planted to soybeans and peanuts.

The clearing and cultivation of slopes in excess of 50% is causing concern in the Near North Coast region.

The inability of many farmers to get on to their land because of the excessive wet, highlighted the importance of trash clearance in secondary tillage and planting machinery. In many cases, failure to plant sorghum, for example, could have been avoided if the right machinery had been available to allow planting into standing wheat stubble.

The need for stubble retention and management is assuming greater importance in the Near South-west Region because of difficulties associated with contour cultivation under a large-scale farming system. The use of cultivation and planting machinery up to 14 or 15 metres in width is causing decreased interest in cultivation of irregularly shaped contour bays. Farmers argue that the 10 to 15% increase in time required to farm a paddock on the contour is uneconomical. Reports indicate that leaving an irregular width grass strip occupying up to 25% of the paddock is not popular, so the alternative is to provide parallel layouts and/or to embark on a comprehensive stubble retention and management programme.

The Boonyouin No. 1 and Haly Creek No. 1 project areas are performing satisfactorily but some problems are arising in stabilising the general benefit works in both schemes.

One area of soil erosion hazard declared during the year involved 56 680 hectares of land in the Isis district. The government has also endorsed the declaration of a further six shires on the Darling Downs during 1974–75. These are the shires of Glengallan, Rosalie, Wambo, Chinchilla, Millmerran and Crow's Nest.

In the Darling Downs soil erosion hazard areas soil types, land slopes and soil depths are being mapped in advance and stockpiled for use in project planning. Priority areas for mapping are based on the programmed project plan areas in each of the declared shires, and in those to be declared in the near future. A total of 27 100 hectares was mapped bringing the progressive total area mapped since October 1972 to 65 700 hectares. Data relating to 43 700 hectares of this land have been, or are being, used in the 1973–74 project plan programme.

Eight project plans were completed in areas of soil erosion hazard on the Darling Downs. These comprise part or the whole of 138 farms, the total area of which is 13 950 hectares. The estimated cost of on-farm works is $269 779, an average of $1 954 a landholder. However, there is a substantial range in costs per farm from $70 to $12 400.

On the basis of estimated costs for the individual properties, the likely total subsidy payments will be about $80 000. This is an average of only $577 per farm, even though the maximum subsidy payable is $1 000 a farm. However, some of the landholders with small costs have only part of their property in one project area and may be involved in greater costs in another.

The inspection period for four of the eight advertised project plans has now expired. Objections have been considered and are being reported upon prior to gazettal of the approved project plans.

A further seven project plans totalling 9 500 hectares are in an advanced stage of preparation.

In the Isis erosion hazard area where transfers from the more seriously eroded farms are under way, the first 24 landholders transferred were able to make a start on their new blocks in 1974.

A free service is provided to landholders who wish to adopt or continue soil conservation programmes. This includes farm planning, marking out areas for contour banking and contour working, the preparation of land capability and land use plans, surveys for parallel contour bank systems, marking of contour guidelines for pasture furrowing and pasture ripping, and assistance with the planning of property development or re-development.

During the year, 3 317 requests for assistance were received, and 3 387 property visits were made to assist with the development of soil conservation programmes.

Two hundred and eighty-two landholders commenced contour farming programmes for the first time, bringing the cumulative total of co-operators to 8 229, which is 21·5% of the total number of rural holdings in the area of operation.

PROTECTION OF THE ENVIRONMENT

Departmental activities with respect to the Register of Australian Environmental Investigations and The Queensland Environmental Control Council's Environmental Control Data Bank were co-ordinated by officers of the Development Planning Branch. Environmental impact statements were prepared in relation to the Burdekin River irrigation extension (Urannah Dam and Clare Weir), the Denison Creek Dam and Tallebudgera Creek.

Officers of the ecology group in Botany Branch concerned with environmental impact studies have completed or are in process of preparing vegetation descriptions and maps relating to land use surveys of the Western Arid Zone and the Stanthorpe, Inglewood and Rosenthal Shires and a land capability study of the Moreton district.

There was a marked increase in requests from other departments for environmental studies and impact statements associated with major developmental projects in Queensland, and seven major studies involving considerable field work have been undertaken. In addition, private consultants engaged in preparing environmental impact statements leaned heavily on the resources and expertise of the department.

Field work associated with the sandalwood (*Eremophila mitchellii*) survey of Queensland was completed. Information collected during the survey has been processed and a comprehensive report is nearing completion. Twenty major floristic associations which contain sandalwood have been defined and the effectiveness of various control measures have been related to these associations.

Studies continued on the vegetation of coastal sand dunes, and detailed vegetation sampling of two sand dune complexes in southern and central Queensland was completed.

Stable frontal dune with good grass cover and some casuarina trees; vehicle track is a potential site of instability.

Officers of the Department in conjunction with officers of the Department of Mines and the Lands and the Beach Protection Authority carried out inspections of revegetation on sand mining leases in Southern Queensland. The standard of work carried out by most companies continues to improve. However, there is room for further improvement in the stabilisation of some high dune areas, and the need to introduce woody species is being stressed.

Mt. Morgan Ltd. are attempting to do something about revegetating overburden areas at Mt. Morgan. The Ecology Section co-operated with the Agricultural Chemical Laboratory and the Mines Department in initial planning with a view to assisting the company with its problems.

In collaboration with Fisheries Branch, the Biochemical Laboratory examined oysters from eight leases in the Pumicestone Passage. The oysters, from an area receiving waters from streams draining cultivated forest, were examined for residues of herbicides. Samples taken at two weekly intervals for one year indicated no residues of phenoxyacetic acid herbicides above the detection limit of 0·05 micrograms per gram.

Samples of muscle, liver and gonads from mullet were also examined for a range of organochloride pesticides. No BHC, HCB, endrin, heptachlor or endosulphan was detected in samples taken at Luggage Point or on ocean beaches. However, both DDT and dieldrin were present in fish from both sites. The levels in ocean-caught fish were insignificant and one hundredfold less than those caught at Luggage Point, an area receiving sewage and industrial waste from Brisbane.

A collection of *Dianella* material from Eastern Australia assembled for critical study by a botanist.

The Brisbane Airport Environmental Study has been virtually completed. The fisheries of Serpentine Creek were investigated with a view to assessing the importance of the area to amateur and professional fishing.

A study of estuarine habitats along the Queensland coast commenced with a survey of Tin Can Bay and the southern portion of Sandy Straits. In this survey efforts were made to gauge the importance of the area to present and potential fisheries. The information gained will serve as a basis for future habitat reserve selection, and the development of a more firmly established estuarine conservation policy.

The Condamine–Maranoa Basin Evaluation of Resources Report has been completed. The area now supports 25% of the State's sheep, 6% of the cattle, and grows 30% of the wheat. Production problems in the area were defined and the technology available to the area assessed. Needs for further research and extension were highlighted. The diversity of plant and animal production has led to economic stability, but this productivity and stability of production can be further improved.

Forty investigations being carried out at the Charleville Pasture Laboratory are aimed at gaining a better understanding of soil/water/plant/animal relationships and at developing management systems that will lead to the continuing productivity and stability of the State's western lands.

CATTLE BREEDING

Low reproductive levels in the State's beef herds have long been recognised as a major weakness in the beef production chain. With increasing costs of production, producers are becoming more conscious of the need to improve efficiency in this area and are directing greater attention to breeding herd management. The main factors affecting reproductive rate have been defined and management techniques have been devised to ameliorate these problems. Basically, these consist of fairly simple, but practical measures aimed at conserving body condition in the breeding cow, mating her on a rising plane of nutrition and the control of infectious infertility diseases. These management practices have been tested under commercial conditions and increases of the order of 20% in conception rates have been achieved in herds under observation.

Imported semen from a wide range of continental breeds continues to be in demand. It should be possible in the next few years to assess the performance of these continental crossbreeds and their likely role in beef production under Queensland conditions.

The Department has continued observations on the performance of the various *Bos indicus* crossbreeds of cattle and this information is now becoming increasingly important in view of the upsurge in the use of *Bos indicus* cattle in commercial beef cattle production.

Hereford and Hereford x Simmental cattle on the Brigalow Research Station are the first progeny from a long-term trial that will attempt to evaluate the Simmental in semi-extensive areas.

At the Brigalow Research Station, the first Simmental x Hereford calves were born. There was a 13·6% incidence of difficult births as compared with 1·5% for Hereford-sired calves. Weaning weights in May showed a 17 kg weight advantage to the crossbreeds.

Studies on the mating of yearling heifers continued and confirmed the value of this practice provided nutrition is adequate and the higher risk of calving difficulties is recognised.

Field investigations on co-operators' properties continued to play a vital role in the research programme. In Central Queensland, data accumulated over many years on the relationship between breed, fertility, growth, age and time of mating are being analysed and results are being published on a series of trials designed to compare Sahiwal, Africander, Braford, Droughtmaster and Brahman crossbreeds.

Observations on reproductive performance on five properties in the North-west were concluded. Pregnancy rates varying from 70 to 92% were encountered even on properties where there was evidence of vibriosis and leptospirosis. These high pregnancy rates are probably due, at least in part, to good seasons but the level of management on the properties selected could be an important factor. The results are being used to draw attention to what can be achieved through thoughtful management.

Further trials are examining the value of vaccinating against vibriosis and leptospirosis, and comparing vaccines.

A new price structure for semen from Wacol A.I. Centre, providing for classification of sires according to merit and for discounts on large semen orders, has been well received by the industry.

Dairy breed semen from Wacol was used on approximately 16% of Queensland dairy cows. In addition, another 6% of dairy cows were inseminated with semen from beef breeds. Some 82% of all dairy semen and 40% of all beef semen used in the State was provided by the centre. Some 131 600 doses of semen were processed.

A new service provides current details of available beef and dairy breed sires to A.I. distribution centres and stockowners using A.I. District extension officers are giving appropriate priority to herd improvement in their regional extension programmes.

Exports of 9 546 doses of semen were made to five countries from the Redlands A.I. Export Centre, and the Artificial Insemination Centre, Wacol. Breeds represented at the Redlands Centre are A.I.S., Red Sindhi, A.M.Z. and Sahiwal.

A.I. Proven sires from progeny testing during 1973 are: *Australian Illawarra Shorthorn*.—Palm Grove Bounce's Pride rating + 264·9 kg for milk and + 14·5 kg for butterfat. *Friesian*.—Coolangatta Imperial rating + 472·1 kg for milk and + 22·2 kg for butterfat. *Jersey*.—Yarallaside Ludo rating + 186·9 kg for milk and + 7·2 kg for butterfat.

LOT FED BEEF

The upsurge in the feedlot fattening of cattle which accompanied the early high prices for slaughter cattle and the strong Japanese market has slowed considerably. Some of the larger feedlots have curtailed further development, and have reduced the size of their existing operation. The slump in cattle values in the face of a weak export demand and the continuing high price for feed grains have made feedlotting an unattractive proposition for the time being, and continuing operations are confined mainly to the well-established feedlots with secured beef contracts.

Despite the beef market outlook, a large feedlot and meat processing venture is being established by the formation of a subsidiary company of Elders G.M. with United States and United Kingdom shareholdings. The new company, Beef City Pty. Ltd., will operate the feedlot having an estimated yearly throughput of 60 000 head at Purrawunda near Toowoomba. An abattoir and boning complex will be built on the site to handle 300 cattle a day. Both are expected to be operating by the end of 1974.

The high price of grain and the depressed cattle market checked the increase in cattle numbers in grain growing areas.

BEEF CATTLE NUTRITION

At 'Swan's Lagoon' Cattle Field Research Station, trials confirmed the advantages to be gained from applying phosphate fertilizer to Townsville stylo, and established that these pastures can support 0·5 beasts per hectare throughout the year. A major trial designed to examine the management of T. stylo in conjunction with native pasture commenced during the year.

The phase of breeder supplementation trials now completed confirmed the value of dry season urea/molasses supplement in raising branding rates and reducing inter-calving intervals.

The construction of pen-feeding facilities and the installation of metabolism cages were completed. The first experiments in these facilities are concerned with the role of minerals in supplements.

A pilot trial on the safe storage and feeding of high moisture, early harvested grain sorghum indicated that this is a practical method of saving and using a grain crop, provided moisture levels are not excessive. At 38% moisture, difficulties arose in relation to feeding and acceptance of grain.

At 'Brian Pastures' Pasture Research Station, work was directed at improving breeder performance and growth rate by supplementation. Feeding of grain to breeders did not lift conception rates but did, apparently, reduce calf deaths. Urea/molasses fed to weaners on native pasture achieved results similiar to those achieved in North Queensland—i.e., a reduced winter weight loss that was not offset by compensatory gain.

On Coolum Research Station, severe flooding occurred repeatedly from January to May. Except during periods of inundation, fertilized pangola grass maintained 6·2 breeders per hectare throughout the year with conception rates of 90%. There was little difference in animal performance between set stocking and rotational grazing.

At Kairi Research Station, grass/legume pastures have produced 660–680 kg of liveweight gain per hectare per year at the optimum set stocking rate of 4 per hectare. Friesian steers grew faster than either Brahman crosses or Shorthorns.

At Parada Research Station, an examination of the performance of breeders on irrigated pangola grass continues. The highest safe stocking rate appears to be about 8 per hectare, at which rate fertility starts being adversely affected. At 10 to the hectare gross pasture deterioration is becoming evident.

Most Australian research has shown that rotational grazing offers little advantage in daily liveweight gains over set stocking. However, rotational grazing has encouraged a more vigorous pasture, and lifted carrying capacity. At Gatton Research Station, a pasture of setaria, Hunter River lucerne, Sirato and glycine has supported much better animal performance when grazed rotationally at 4 steers per hectare. In fact, at one stage, the rotation area was stocked at 5 per hectare, which is remarkable for a raingrown pasture.

A survey of the phosphorus status of pastures in South-west Queensland, through faecal studies, was terminated in May. Faecal phosphorus fell to similar low levels, 0·10% on all classes of country, but the peak levels during the wet season showed marked differences. The possible use of wet season peak faecal phosphorus levels as an indication of phosphorus status of pasture and animal is being further investigated. A similar faecal phosphorus survey is in progress in Bowen and another is planned for the Mareeba–Gulf districts.

In a phosphorus supplementation trial in Bulloo Shire, supplemented cows conceived earlier than those not offered supplements. Among the calves of supplemented breeders there was a 12% better survival rate though no difference in growth rate to weaning.

Other field trials are concerned with salt, phosphorus, urea, molasses and grain supplements with observation of growth rates of breeders, weaners, and steers, and reproductive performance on various classes of country and on various types of improved pasture, and with feedlot diets and pre-mixes.

TUBERCULOSIS ERADICATION

Under the tuberculosis eradication programme for 1973–74, about 1m. cattle were tested for tuberculosis with a reactor rate of 0·3%.

Since the inception of the national tuberculosis eradication programme in 1970, about 3·5m. cattle have been tested for tuberculosis with the removal of 12 000 reactors (0·3%).

Area surveying within the protected area has progressed to a stage in South-eastern Queensland where completion can be anticipated by 1975. This will allow tuberculosis-free areas to be defined in South-east Queensland. This is a vital first step in eradication. In Central and Northern Queensland, the completion of area testing is not likely before 1976.

Considerable progress is being made in our attempts to eradicate tuberculosis from infected properties. Testing has commenced or been programmed for virtually all infected herds.

Approximately 20% of the volume of testing undertaken annually in Queensland relates to infected herds, where the average level of reactors at the outset of testing has been approximately 1·5%.

Mechanical aids such as aircraft, helicopters and motor bikes are being used in an attempt to overcome the manpower shortage and to ensure effective mustering on extensive properties.

Volume of testing in the Gulf and Channel country, where the majority of heavily infected herds are located, is seriously hampered by shortages of manpower and material for mustering, fencing and yard building. Portable yards are doing an important job in the testing of cattle on the unimproved properties.

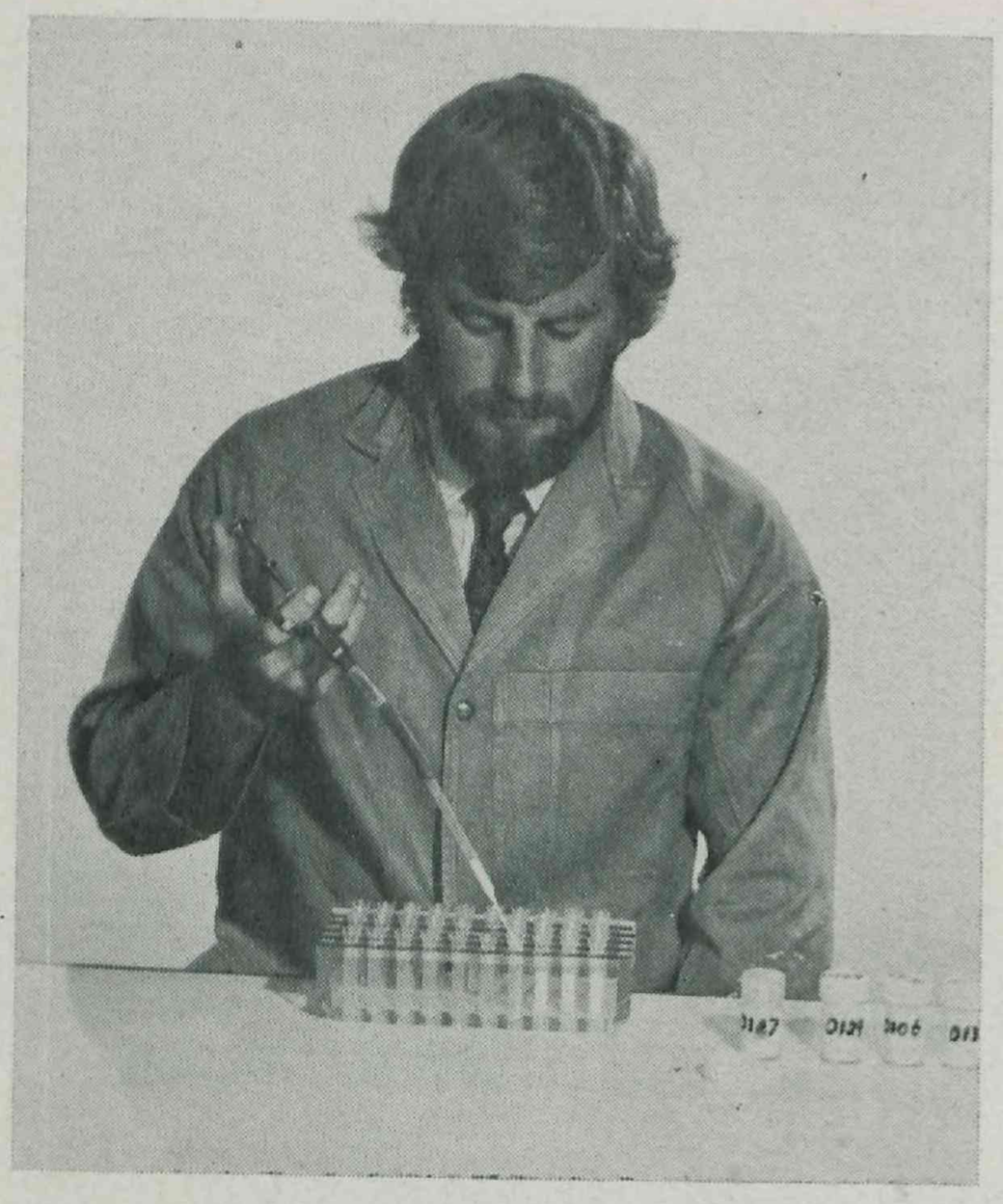
BRUCELLOSIS ERADICATION

In the brucellosis eradication programme, the preliminary aim is to reduce infection by strategic vaccination of beef and dairy herds to a level at which eradication by slaughter will be economically practicable.

This programme is well advanced in the protected area.

Brucellosis survey teams, using the Rose Bengal test on the property, were set up in February, 1973 in the Brisbane, Toowoomba, Maryborough and Rockhampton divisions to demonstrate the need to vaccinate individual herds. Of the 700 non-vaccinated herds surveyed, vaccination was considered necessary in only 10 per cent. During the year, nearly 200 000 samples from approximately 1 000 herds were tested for brucellosis.

Survey testing of beef herds for brucellosis is being undertaken. This photo shows blood specimens being collected in the Brisbane Valley.



Blood specimens being prepared for the Rose Bengal plate test, which gives a quick reading on brucellosis disease in cattle.

Because of a consistently low incidence of brucellosis infected beef herds in the Cairns and Townsville divisions, it is proposed to define an area north of the Townsville–Mt. Isa railway to include the Dalrymple, Etheridge, Mareeba and Cook Shires. Within this area properties will be classified and movement control adopted with a view to minimising the spread of brucellosis.

This procedure is a major step towards the adoption of eradication measures and the declaration of the first provisionally brucellosis-free area in Queensland.

The Atherton Tableland dairying area and coastal shires in the Cairns division will be excluded because of the high incidence of brucellosis infected herds.

The declaration of controlled movement areas in Queensland also satisfies the chief requirement for the introduction of cattle to the Northern Territory brucellosis protected areas. Cattle can now move to the protected areas of the Northern Territory from clean herds within this area subject to clearing tests prior to movement. This concession has been an incentive to many stockowners to present their breeding cattle for testing.

OTHER ANIMAL PESTS AND DISEASES

Ephemeral fever remained quiescent during the winter months, but the epizootic continued to spread throughout the southern areas of the State with the onset of moist spring weather. This important cattle disease is tending to recur more regularly than was originally the case.

Osteo-dystrophia-fibrosa disease of horses has become extremely widespread especially in the brigalow belt of Central Queensland. The condition makes horses unsafe to ride and represents a potentially serious disease for the grazing industry of Central and Coastal Queensland. Symptoms range from lack of stamina and obscure shifting lameness to loss of condition and enlargement of the facial bones. It is associated with the metabolism of calcium and phosphorus, and the Department is presently carrying out experimental work on it.

The disease was also reported from coastal areas including Cooroy, Proserpine and Tully. In the Cooroy area, it occurred in horses grazing on *Setaria* sp. dominant pastures. These grasses often have a high soluble oxalate content which binds calcium in the gut as insoluble calcium oxalate. The disease has also been recorded in horses grazing on para grass in northern coastal Queensland.

Four outbreaks of cerebrocortical necrosis in different cattle feed lots were recorded in prime, fat bullocks. These are the first occasions on which this condition has been diagnosed in feed lot cattle in Queensland, and it is now considered that other spasmodic feed lot losses may have been due to this cause. The condition was also diagnosed in grazing Merinos at Millmerran.

Marek's disease has been long recognised as the disease causing major loss in the poultry industry. During the year encouraging results were being obtained using a vaccine based on turkey herpes virus.

An aberrant strain of infectious bronchitis was isolated in chickens. This strain is antigenically different from the vaccine virus and consequently has caused outbreaks of the disease in vaccinated chickens.

Outbreaks of strangles were reported from Charters Towers, Townsville, Miles and Caboolture.

Equine infectious anaemia was diagnosed in horses at Charleville and Quilpie. Suspect cases were also reported from Cooroy, Toowoomba, Quinalow, Texas and Mungindi.

Fifty per cent. of a group of 140 horses showed signs of Change Hoof Disease (selenosis) in the northern Peninsula areas. The horses were shifted to the east coast where the poisonous plant *Morinda reticulata* is not as plentiful.

The very favourable seasonal conditions of the past two years have enabled the cattle tick *Boophilus microplus* to establish itself in areas which are normally tick free. This has taxed staff and equipment to breaking point and has shown the need to review systems of controlling outbreaks in tick-free areas. At the present time, 188 properties are under quarantine in the stock districts of Toowoomba (79), Warwick (24), Dalby (14), Wandoan (8), Kingaroy (63).

The mild winter of 1973 enabled the buffalo fly to overwinter in areas of Central Queensland from which it is normally absent. The moist spring and summer which followed allowed the rapid spread of the parasite both south and west in Central Queensland. It eventually spread as far west as Windorah and Birdsville and south to Wyandra, exceeding limits previously set by infestations of buffalo fly in previous years. Farther east it also spread south of Roma, Miles and Chinchilla and eventually to the Glenmorgan, St. George and Yelarbon areas. However, on the coast it did not spread any farther south than Lowmead. The fly caused considerable worry especially in areas where the stock were not used to the parasite and where no treatment facilities were available.

DAIRY DEVELOPMENTS

There was a further substantial decline in dairy farm numbers during the year, mainly in the cream-producing section. Smaller units are leaving the industry or are being absorbed by other properties. Some wholemilk producers also left the industry mainly due to the activity of land developers or because of the age of the owners. The industry has now reached a critical situation where it is no longer able to meet the State's butter requirements, and substantial quantities are being imported from southern States.

The decline in the number of suppliers combined with the phasing out of Commonwealth Government bounty will necessitate a major reorganisation of the industry, and the Divisions of Dairying and Marketing have commenced a joint study into the problem. This will involve an examination of present and future sources of supply of milk, and a plan of rationalisation of manufacture and distribution to achieve maximum returns to producers.

During the year the industry continued the changeover from cream to bulk milk supply to take advantage of the more profitable milk products market. Some 80% of Queensland dairy farmers supplying milk and 51% of all producers are now equipped with bulk vats and it is expected that the percentage will continue to rise during the next few years. The use of bulk milk refrigerated vats demands higher standards of hygiene than was the case with cream and also involves more extensive testing. Substantial improvement to farm buildings was effected during the year.

A Code of Practice for the dairying industry has been adopted by all States. This code will apply not only to factory structures but to hygiene associated with production and the manufacture of all dairy products. Meetings have been held between departmental and industry representatives to acquaint them with the requirements of the code, and to prepare for factory inspections when the code is introduced in 1974–75. The implementation of the code is planned in stages with the hygiene provisions being given first priority.

The first of a number of new dairy products developed by the Otto Madsen Dairy Research Laboratory was marketed during the year. This was an onion-flavoured butter-based savoury spread and is the forerunner of a range of flavoured spreads to be marketed in the near future. A vegetable oil-butterfat product has also been developed by The Butter Marketing Board in collaboration with the laboratory, and legislation to permit the manufacture and sale of this product by dairy factories has been passed by Parliament.

The Commonwealth Government discontinued the scheme of providing free milk for school children and announced plans to make adjustment assistance available to distributors, vendors, processors and producers adversely affected. Assistance will take the form of income maintenance payments,

and/or compensation for assets rendered unproductive, to those vendors whose income has been substantially reduced. Milk processors whose assets have become totally or partly unproductive may also claim compensation.

Research was continued at Biloela Research Station into multiple suckling of calves with the object of providing dairy farmers with a profitable complementary enterprise of rearing either beef calves or dairy replacements. Up to 9 calves per lactation were reared successfully and average weight gains of 0·88 kg per head per day were recorded.

In the Australian Friesian-Sahiwal breed development programme about half of the 45 heifers evaluated for tick resistance proved more resistant than control Friesian heifers. This indicates a useful range in tick resistance which should enable effective selection for this character. Unfortunately, milk yield of Australian Friesian-Sahiwal cows was only 70% of that of pure Friesian cows when fed on similar rations at Kairi Research Station.

Average yields recorded by the Australian Friesian-Sahiwals were about 3 000 kg milk per lactation.

PLANT BREEDING

Queensland plant breeders have scored another success, and the wheat industry will benefit from a new variety named Oxley bred at the Queensland Wheat Research Institute and released jointly by this Department and the University of Queensland. Oxley is a mid-season variety with a high yield potential and with good milling and baking characteristics. It is at present resistant to all races of stem rust so far identified in Queensland and northern New South Wales. The new variety is designed to replace Festiguay and Tarsa which are now susceptible to the stem rust races found in the field. In six 1973 mid-season varietal trials, Oxley's yield advantage over Tarsa was about 36%, and about 8% over the quick maturing variety Timgalen.

Plant breeders at the Biloela Research Station have developed two parent or restorer lines which could be released to commercial breeders within the next two years. These lines which carry virus resistance can be expected to further lift grain sorghum yields.

With the rapid development of the oilseeds industry in Queensland, sunflowers have assumed prominence in the departmental plant breeding programme. The work being carried out at the Hermitage Research Station involves both the selection and breeding of new varieties. New hybrids produced yields ranging from 2 090 to 2 870 kg per hectare. The hybrid lines are uniform for height, flowering and maturity as well as exhibiting resistance to rust. Screening of sunflowers for rust resistance has identified 10 lines showing generalized resistance. These will be used for crossing with varieties with better agronomic characters.

In the pasture field, 1974 has been the year of the stylos. After considerable testing and work in conjunction with C.S.I.R.O., the cultivar Verano was released, and better perennial stylos for the dry tropics are under test.

Early 1975 should see the culmination of more than 25 years' selection and testing aimed at producing an improved pineapple for canning. The Queensland Cayenne will be released for commercial production and planting material will be available. Both yield and product quality have been shown to be much higher than fruit currently being grown.

PLANT PEST AND DISEASE CONTROL

Queensland experienced its worst locust plague in more than 30 years. While crop losses were severe in some instances, action taken by departmental officers, farmers and local plague grasshopper destruction committees was effective in controlling the infestation. In Central Queensland, 50 two-man spraying teams from the Australian Army assisted with control measures which cost more than $450 000.

The control campaign occupied two phases. Early hatchings in border areas and in the Central Highlands were promptly sprayed. Generally this measure was successful. Numbers were reduced and for the remainder of the season the Australian plague locust was not a major problem.

However, some migratory locusts escaped early treatment and were able to reproduce, in Central Queensland. Later generations developed along with an outbreak of spur-throated locusts on the Darling Downs and in adjacent areas. The control campaign then entered its second phase of crop protection. In spite of supply difficulties, sufficient insecticide was obtained and the operation was generally successful. Crops of grain sorghum, soybean, cotton, sunflower and millet were harvested with minimal loss from locusts.

The whole exercise was an excellent example of the value of co-operative effort between the landholder, plague grasshopper destruction committees, the department, and the Government.

Research into biological control of budworm is under way. A *Trichogramma* sp., a parasite of budworm eggs was imported and released in cotton in the St. George district. The parasite appears to suppress budworms when the populations are relatively low. Investigations are continuing to determine the feasibility of using *Trichogramma* sp. as part of an integrated programme for the control of budworms. Work is also proceeding in the testing for resistance by budworms to insecticides.

Pests of stored grain have assumed major importance in the marketing economics of grain and oilseeds. Entomologists have investigated resistance to recommended insecticides and after considerable research control measures have been developed involving adequate design of machinery and storages, farm hygiene and fumigation techniques for storages and handling facilities. Entomologists have worked jointly with extension officers, the Queensland Grain Growers' Association and grain handling and marketing authorities in an extension programme aimed at controlling weevil infestation in stored grain.

Due largely to the effectiveness of departmental inspection and close attention to control measures by the State Wheat Board no complaints of infestation in shipments from Queensland were recorded during the year.

Die-back has for many years been the cause of major loss in the papaw industry. Until this year, 25 years of work had failed to isolate a causative organism. A recent breakthrough, however, suggests that die-back could be associated with a deficiency of calcium at the growing point, and this avenue is now being researched in depth.

BOTANICAL SERVICES

Rapid retrieval of botanical information is essential to scientists and others working in production and ecological studies. The development of a computerised data bank of botanical information will enable rapid access to information about the flora of Queensland which has been accumulated in the herbarium over a period of 80 years.

A survey revealed 20 major floristic associations containing sandalwood which is an important native woody weed. It has been possible to relate the effectiveness of various sandalwood control measures to these associations.

The preparation of vegetation maps and handbooks on Queensland flora was further advanced. Check lists of 20% of the State's flora were completed. Fifteen species of plants were identified and recorded as growing in Queensland for the first time. Six of these were exotic plants not previously recorded from Australia.

Some 14 500 plant specimens were received for identification during the year. In addition, examinations of 143 samples of stomach contents for evidence of plant poisoning of animals were undertaken.

AGRICULTURAL ENGINEERING

The agricultural engineering group at Toowoomba was hard pressed to meet the demands of rural industries as well as the requirements of field research programmes and soil conservation. Workshop space is overtaxed but a substantial programme involving design, testing and fabrication of specialised machinery, equipment, farm buildings and storages was undertaken during the year.

A peanut harvesting efficiency study indicated that overall harvesting losses can approximate 5% of the total yield. Increases in ground speed and in drum speed cause increased losses of nut-in-shell and loose kernels. Tobacco curing is being studied in an experimental barn and an assessment of the performance of a mechanical harvester for tobacco is underway. A device for elevating tobacco leaves is also being designed.

Efficient seed cleaning machinery has been designed and fabricated for removal of stones, soil and broken grains from seed of pasture legumes, such as Sirato, and from commercial crop grains, such as navy beans. Existing experimental machinery has been modified and new machines have been designed and built to meet the needs of experimental programmes involving crop seeding, soil sampling and sterilization, and seed treatment.

A press wheel drill has been designed, built and tested for planting winter cereal crops under conditions of declining seed bed soil moisture. Special narrow seeding tines fitted with wings to move away dry surface soil have been devised and have proved successful. A detailed study of the press wheel principle in grain crop seeding is being planned and much of the equipment required has been obtained.

The pay-off from an agricultural engineering service can be substantial. For example, it has been estimated that at current production levels and prices, navy bean growers should receive about $30 000 extra each year from seed retrieved by newly developed navy bean seed cleaning equipment.

IMPROVED FRUIT PACKAGING

A portable, vibration, tight-fill fruit packaging system has been designed, constructed and demonstrated in the principal citrus growing areas. By pouring fruit into the package and settling by vibration, packaging has been mechanised thereby greatly reducing labour costs without reducing fruit quality and at the same time decreasing container costs.

In addition, an attachment has been developed and demonstrated for banana tight-fill in the major growing areas. Bananas are cut in singles from a bunch into a water bath from which they are removed on a mesh conveyor. After spraying with fungicides, the fruit flows into the vibration, tight-fill machine.

Because of the current paper shortage and rising fibreboard prices, an assessment was made of polystyrene foam boxes for commercial consignments from Bowen and Stanthorpe. The box performed well, particularly as the contents cooled in about half the time needed for the normal die-cut fibreboard cartons.

In view of the demonstrated advantages of pre-cooling of tomatoes, a fibreboard carton has been designed with sizing and spacing of ventilation holes to facilitate airflow under conditions of forced air cooling. The advantage of this special carton for pre-cooling has been demonstrated.

FRUIT AND VEGETABLE PROCESSING

The elimination of sales tax concessions on soft drinks containing Australian fruit juices has stimulated the search for alternative means of utilising the increased quantities of apples from the Granite Belt which are surplus to fresh market requirements. Food technologists have developed an apple crisp snack food with high consumer appeal. In addition these officers have provided valuable assistance in processing equipment design and dehydration techniques to a company which is establishing an apple dehydration factory in the district.

A feasibility study conducted in association with the Department of Commercial and Industrial Development has demonstrated that a viable fruit processing industry based on quick frozen mangoes, rockmelon and fruit salad could be established in the Bowen/Burdekin area.

Although two years ago the development of a tomato paste processing industry in the Bowen/Burdekin area did not look promising, rapid changes in production and marketing arrangements in southern States and the substantially increased efficiency of tomato production in North Queensland has again stimulated interest. Two major Australian tomato processors are studying the feasibility of establishing a factory in the northern production area. To keep ahead of this interest, plant breeders and food technologists are examining imported fresh and processing varieties, with particular reference to disease resistance, fruit quality, suitability for machine harvesting and paste production.

The combination of low rainfall and mild temperatures produced excellent quality wine grapes both in commercial and experimental plantings. The first batches of wine from trials have been processed and are maturing before testing. Increased extension activity with Granite Belt wine makers and the application of scientific methods of wine making have led to renewed interest in the development of a substantial wine industry in the Stanthorpe area.

FISHERIES

A forward step taken during the year was the setting up of the Queensland Commercial Fishermen's Organisation. This organisation which consists of a State council and district and local branches is designed to ensure that all commercial fishermen are able to have their views heard on all matters affecting the fishing industry.

The organisation will operate in a similar manner to other rural industry organisations of this type such as the Cane Growers' Council and the Queensland Dairymen's Organisation.

On the research side, an echo-sounder survey was made of the continental shelf between Noosa Heads and Indian Head for the purpose of delineating trawlable grounds. The immediate result of this survey was a catch of 140 000 kg of king prawns. Charts showing the trawlable areas have been prepared for sale to fishermen.

The research team at Mourilyan Harbour monitored crown of thorns starfish populations in the region between Townsville and the Whitsunday Islands and continued their studies of coral recolonisation and regrowth on previously attacked reefs between Green Island and Townsville. Recovery of faster growing corals on these reefs has been quite impressive.

During the year the East Coast Prawn Research Programme (a joint programme involving this department and C.S.I.R.O.) concentrated on the study of water chemistry in Moreton Bay, migration of king prawn post-larvae into Moreton Bay, the biology of adult king prawns in offshore waters above the continental shelf, the growth of juvenile king prawns in aquaria and the development of a new type of benthos sampler using artificial seagrass.

Action was taken to update fisheries legislation to bring it more into line with the needs of the industry while at the same time having full regard to conservation needs. It is expected that legislation to give effect to the necessary changes will be put before Parliament in the near future.

BUILDINGS AND EQUIPMENT

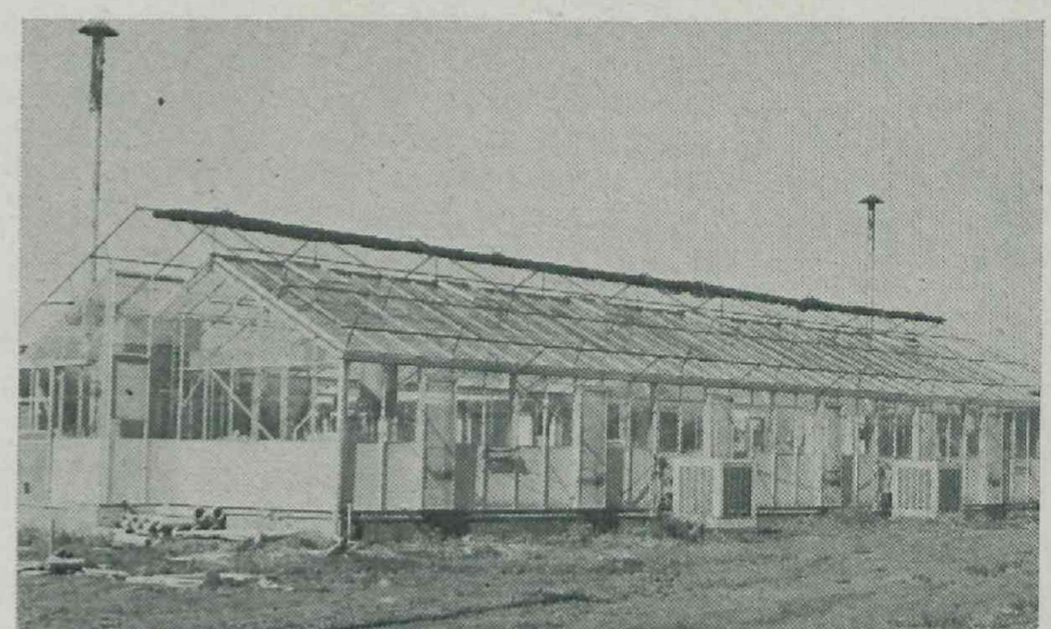
Primary industry in Queensland relies heavily on research conducted by the department, and the provision of necessary buildings and equipment to enable this research to be conducted in an adequate manner is essential. The problem in Queensland is substantially greater than in other States, partly because of the size of the State and partly because of the ranges of climate and types of crops grown. Our research must necessarily cover both tropical and temperate crops and in relation to the former there is not the wealth of overseas research on which to rely as is the case with most temperate crops.

Despite financial limitations, substantial progress was made during the year in the development of facilities at a number of research stations at country centres.

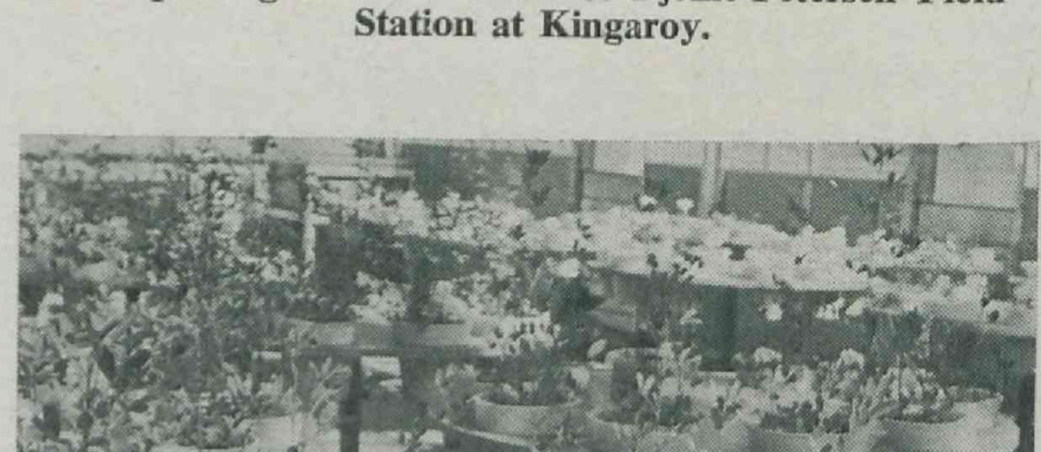
At Hermitage Research Station, a new office-laboratory with special areas for plant breeding and plant growth chambers was commenced and a beef cattle feed lot with supporting yards and sheds was completed.

At Gatton Research Station, a potato research laboratory with cold room and greening areas was completed. This will assist in the agronomy, seed production and varietal programmes designed to assist the potato industry in this State.

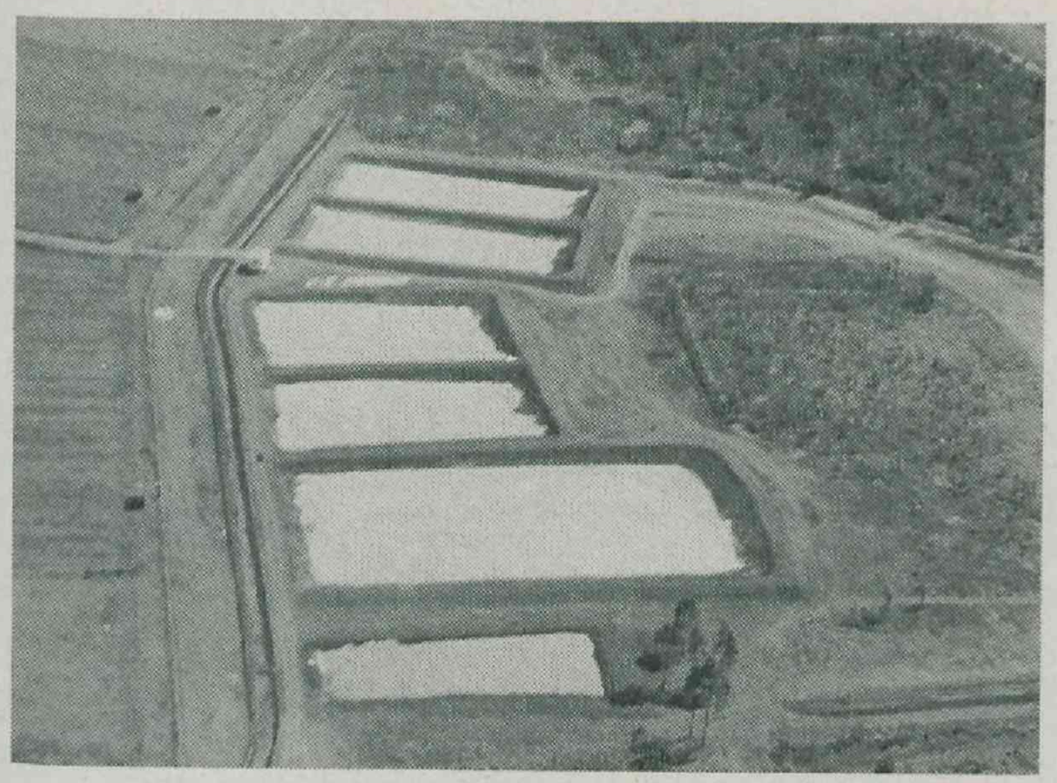
A small office with field laboratories was constructed at the Coolum Research Station. Construction of departmental offices and laboratories continued at the Field Station near Kingaroy, and associated farm buildings and a glasshouse were completed.



New plant glasshouse at the J. Bjelke-Petersen Field Station at Kingaroy.



New system for conducting plant trials at the J. Bjelke-Petersen Field Station.



Aerial view of constructions for the freshwater fish project at Walkamin Research Station.

Development of the large Brigalow Research Station near Theodore continued. Electricity was connected and a seed store building and quarters for single employees were constructed.

In North Queensland, improvements were made to farm buildings at Ayr, Millaroo, and Kairi, and ponds were constructed at the Walkamin Research Station for the study of freshwater fish.

Following the decision to locate pig nutrition studies at the Biloela Research Station, a new building was constructed for intensive housing of the herd, with special facilities for mating, farrowing and rearing. A small office and laboratory building was also provided to service piggery requirements.

STAFF TRAINING

In order to keep pace with changing technology and research developments, a continuing programme of staff training must occupy an important place in the activities of any highly technical department. To this end a series of inservice training schools and workshops were conducted during the year and a substantial number of officers undertook postgraduate studies at universities throughout Australia and overseas.

Inservice training of extension officers in farm management was carried out at two schools, one at Townsville and the other at Redcliffe. Some 500 officers have now received such training since these schools were initiated in 1963. In addition, 57 officers have received followup training at regional workshops.

The upgrading of officers' technical competence through a series of subject matter schools was also continued. Most of these schools were held regionally to meet the needs of district programmes and the officers concerned with such programmes.

The Department was represented at the first National Farm Business Management Extension Workshop in Perth in November, 1973 held under the direction of the Standing Committee on Agriculture, and at a Sheep and Wool Refresher Course held under the auspices of the Australian Wool Corporation.

In the field of postgraduate studies a number of officers have completed or are currently undertaking Ph.D. and M.Agr.Sc. degrees while others have completed or are undertaking postgraduate courses in agricultural extension at Queensland and Melbourne Universities and at Hawkesbury Agricultural College.

Dr. B. J. Wilson, of the Queensland Wheat Research Institute, joined this Department after obtaining his Ph.D. in weed science at Hawaii. Dr. V. E. Mungomery obtained his Ph.D. from the University of Queensland, and Mr. P. S. Brennan is studying at Saskatchewan in Canada.

Dr. John Leslie, Director of Q.W.R.I. is undertaking post-doctoral studies at the University of Western Australia.

Dr. W. J. Scattini (University of California), Mr. E. K. Christie (Macquarie University, Sydney) and Mr. D. A. Ivory (University of Queensland) completed Ph.D. studies and returned to duty during the year. The latter two await assessment of their theses. Messrs. K. Rickert (University of Western Australia), I. F. Beale (University of Colorado) and W. H. Burrows (Australian National University), have continued their studies and Mr. E. R. Anderson (University of Orange Free State, South Africa) began studies towards a Ph.D. during the year. Mr. D. Gramshaw (University of Western Australia) has taken up duties at Biloela after completing Ph.D. studies and Mr. B. Walker is undertaking an external Ph.D. from the University of Queensland.

OVERSEAS VISITS

I had the opportunity to assist the Minister for Primary Industries at the International Sugar Conference at Geneva, and to study agricultural developments and market opportunities in North America, the United Kingdom, Europe and Japan.

Mr. S. L. Everist, at the invitation of the United States National Academy of Science, joined a panel on Unexploited Tropical Plants of Promising Economic Value and attended a meeting of the panel in Washington, D.C. The panel considered over 300 species put forward as having potential for development as useful economic crops. At the same time he visited the U.S. National Herbarium, Smithsonian Institution for discussions on Pacific botany with Dr. E. Ayensu and Dr. F. R. Fosberg.

Mr. A. C. Peel, Director of Agricultural Standards, presented a Queensland submission to the Warsaw Congress of the International Seed Testing Congress, while overseas on private leave.

Mr. B. Parkinson, Director, Slaughtering and Meat Inspection Branch, visited Europe and the United States to study modern trends in meat processing and hygiene. While in Europe he attended the Food Hygienists' Conference in Denmark.

Mr. A. C. E. Todd made a study tour of pig establishments in North America, the Netherlands, Denmark, and the United Kingdom.

Messrs. D. G. Cameron, Assistant Director of Agriculture (Agrostology), D. L. Lloyd, Senior Agrostologist, Queensland Wheat Research Institute, Toowoomba, and L. Winks, Senior Husbandry Officer, 'Swan's Lagoon' Cattle Field Research Station, Millaroo, represented Queensland at the 12th International Grassland Congress in Moscow in June.

Dr. R. W. Johnson returned in January, 1974, from the U.S.A. where he completed his requirements for a Ph.D. degree. Before returning to Australia he visited a number of botanical institutions in eastern U.S.A. and in England, studying modern trends in herbarium administration, woody weeds control and computer processing of ecological data.

Mr. N. S. Kruger, Chief Horticulturist, will study floricultural crop production methods in Japan, the United States and Europe, and attend the 19th International Horticultural Congress in Warsaw, Poland.

Mr. F. Quinton, Husbandry Officer from the Wacol (Brisbane) Artificial Insemination Centre visited research and artificial insemination centres in South Africa and Kenya, and studied the developing export trade in semen in Thailand and Malaysia.

Mr. M. A. Burns was invited by the South Pacific Commission to lecture to a 2-week animal husbandry course for technical officers in Fiji.

A Senior District Adviser, Mr. K. Howard, was granted leave of absence to help drought relief operations in Ethiopia.

Mr. P. Meiklejohn, Agricultural Economist, received a Churchill Fellowship award to Western Europe, and will conduct a programme in product development with the English Milk Marketing Board.

STAFF RETIREMENTS

Retirements during the year included: Dr. L. G. Miles, Director, Division of Plant Industry, Mr. C. W. Winders, Director, Information and Extension Training Branch, Mr. N. C. E. Barr, Director, Dairy Cattle Husbandry Branch, Mr. J. Rosser, Director, Soil Conservation Branch, Dr. A. R. Brimblecombe, Director, Entomology Branch.

Mr. C. N. Morgan, Horticultural Adviser, and Mr. C. A. Schroder, Agricultural Adviser, so widely known for their contributions to the primary industries of the State, were also among our retiring staff members.

II. Livestock Research and Extension

The livestock industries covered in this section of the report comprise beef cattle, sheep, pigs, poultry and bees. These industries are given particular services by special branches, while a number of other branches also serve them.

The Beef Cattle Husbandry Branch undertakes field investigations and provides extension and other services in breeding, feeding and herd management. It operates a cattle field research station on the Upper Burdekin and is concerned with beef cattle trials on several other research stations.

The Sheep and Wool Branch conducts field investigations at Toorak Sheep Field Research Station in the north-west and on private properties. It conducts a fleece testing service for stud and flock owners.

The Pig and Poultry Branch is concerned mainly with extension in the respective industries but also undertakes experimentation and certain disease services.

The constituent branches of the Animal Research Institute—viz. Biochemical, Husbandry Research, and Pathology—provide research and diagnostic services for all branches of animal industry at various centres and conduct the pig and poultry testing services. The Veterinary Services Branch has a major responsibility for the health of livestock and for brands administration.

The Slaughtering and Meat Inspection Branch is concerned with hygiene in the production of meat and meat products, including pet foods, and with classification and grading of carcasses.

Various branches of the Divisions of Dairying, Marketing and Plant Industry provide services related to animal production. Services to beekeepers are provided by the Fauna Conservation Branch.

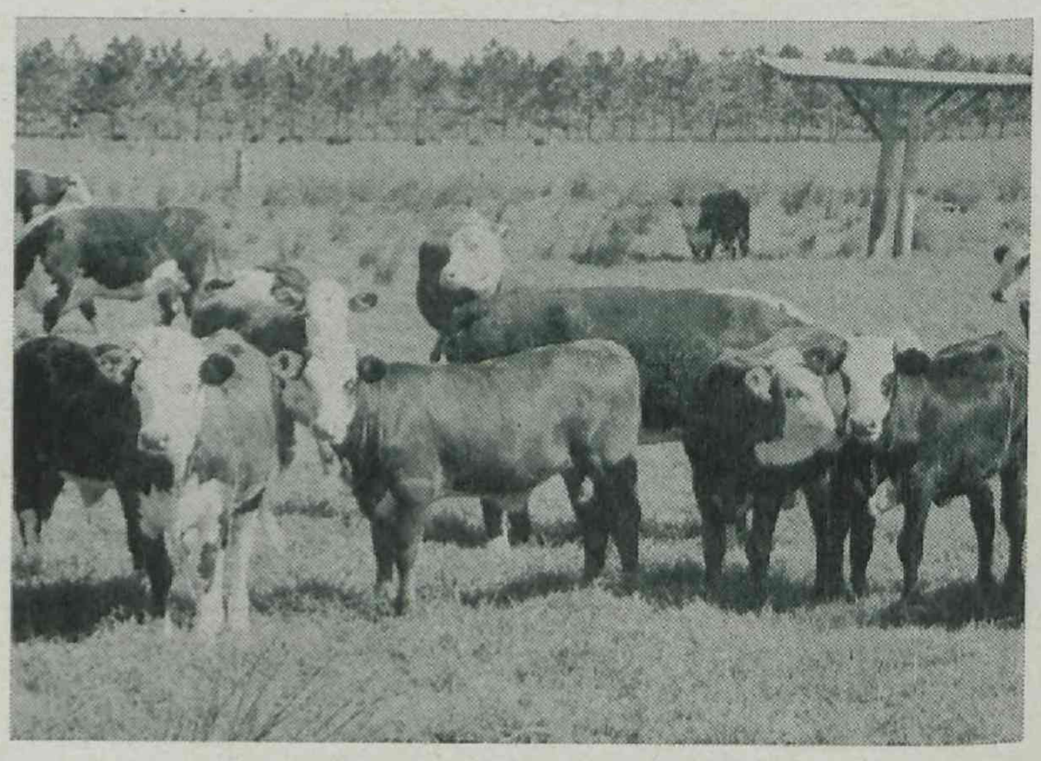
BEEF CATTLE

Research at 'Swan's Lagoon' Cattle Field Research Station confirmed the performance of steers on Townsville stylo fertilized with superphosphate to be superior to that of steers grazing either unfertilized Townsville stylo or spear grass pasture, especially during the wet season. However, for the first six weeks after the initial storms, weight gains were highest for steers grazing native pastures. On fertilized Townsville stylo, a year-round stocking rate of 0·5 beasts per hectare proved to be safe, but much of the hayed-off Townsville stylo was wasted because of excessive mould development during winter. Research into the management of Townsville stylo is continuing, with a study to determine the effects of varying ratios of Townsville stylo to native pasture and of restricted grazing of Townsville stylo during the wet season.

In the first year of one new supplementary feeding experiment, the performance of Brahman cross yearling steers on native pasture was similar when fed urea/molasses supplements with either 115 g or 230 g molasses per day plus added sulphur. Overall liveweight gains, but not daily gains, were lower than in previous years because of the early break in the season. The importance of molasses level and sulphur in response to urea/molasses supplementation will be examined more closely in future series of pen studies.

The breeder supplementation project showed that, in each year, dry season urea/molasses supplementation increased pregnancy rates and improved the body condition of breeders. Urea supplements and to a lesser extent urea plus phosphorus, by significantly shortening the average calving to conception time and intercalving interval meant that these breeders calved and conceived earlier in the season. By comparison phosphorus supplementation in the wet season failed to give any reproductive advantage not achieved by dry season phosphorus supplementation. Furthermore, dry season supplementation is more practical. The second phase of this project will investigate further the role of dry season urea and of phosphorus supplementation in improving the performance of Brahman cross cows and their calves to weaning, grazing Townsville stylo and native pastures. A January-April mating will be used, rather than the September-January mating of the first phase, so that breeders will calve closest to the expected break in the season, November-December.

In contrast with previous years the 1973 dry season liveweight advantage in yearling steers due to feeding urea was the same at each level of urea—30 g, 60 g, and 90 g a day. The advantage of 18 kg was subsequently reduced to 11 kg by April, because of compensation by the unsupplemented steers. This approaches the point at which supplementation ceases to be economic. Although liveweight gains during the season by Brahman cross steers were greater than by Shorthorns, gains did not vary with the level of urea.



Well-grown ¼ Sahiwal calves in breeding performance studies at Coolum Research Station.

Feeding of the standard 60 g urea/230 g molasses supplement during the dry season gave a 22 kg liveweight gain which was increased to 48 kg when molasses was available at all times to Brahman cross steers grazing spear grass pastures. By comparison, unsupplemented steers gained 13 kg. The benefits of the additional energy in itself and in permitting the full use of the 60 g of urea are apparent. At the end of April, 93% of the 26 kg liveweight advantage due to unrestricted molasses supplementation remained. The average intake of molasses to early September was 4·3 kg a day, which steadily decreased after the early rains to 1·3 kg.

Pasture spelling as a tick control technique consistently depressed liveweight gain, regardless of the level of tick infestation, though these steers carried fewer ticks than the undipped control steers. From August, 1972 to June, 1974, the fixed four-monthly spelling regimes reduced liveweight gains on both Townsville stylo and spear grass, largely because the rotation interval for tick control meant a reduction in

pasture quality. The variable rotation (maximum four months in winter and minimum two months in summer) based on pasture availability depressed gains on spear grass only, but not to the same extent as with the fixed rotation. The performance of steers in paddocks which were not spelled was not affected by strategic dipping during the autumn/winter period.

Brahman cross steers consistently carried fewer (60 to 70%) ticks than Shorthorns and did not require dipping. Shorthorns grazing in the same paddock reached 40 engorged ticks per side on five occasions from August, 1972 to May, 1974, and had to be dipped. The liveweight gain of 254 kg for the Brahman steers was 30% higher than that of the Shorthorns.

The fourth new project was conducted in conjunction with Slaughtering and Meat Inspection Branch. It compared the performance, amount of bruising and resultant loss in carcass value of horned bullocks with that of bullocks dehorned or heavily tipped within 6 months of slaughter. All animals grazed the same paddock until one month before slaughter. In the first 28 days after dehorning and tipping, liveweight gains were depressed by 27% (8 kg) and 43% (12·4 kg) respectively compared with the average gain of 28·5 kg for horned bullocks. The average weight of bruise trim per carcass for horned bullocks was 1·11 kg. Although reduced to 0·43 kg with dehorning this failed to overcome the loss in carcass value because of reduced liveweight gains. The result was similar with the tipped animals except that bruising was not reduced.

Further progress was made in the development of two herds of 50% and 75% Brahman content. The Sahiwal herd has reached a three-sire breeding unit at which it will be consolidated.

Brigalow Research Station. Evaluation of the Simmental breed under Central Queensland conditions commenced with the first calving of F1 Simmental x Hereford calves in spring of 1973. The 13·6% calving difficulties for Simmental-sired calves compared with 1·5% for Hereford-sired calves clearly reflected the influence of the larger breed, the Simmental, on ease of calving. There were more stillbirths for the Simmental (10·7% v. 2·9%). Dystocia was more frequent in heifers than mature cows. Simmental-sired calves had a longer average gestation period by four days and were heavier at birth (37·5 v. 32·5 kg) thus partly explaining their higher incidence of difficult births. Although performance to 4 to 5 months was similar as the maternal influence declined the Simmental cross calves outperformed the Herefords. A comparison of their weaning weights in May demonstrates this being 189 kg for Simmental cross calves and 171 kg for Herefords.

Evaluation of the Simmental is being continued with a comparison of the growth and carcasses of Simmental cross and Hereford steers grown on improved pastures and finished on either pasture plus a grain supplement or forage crop at 22 to 28 months of age.

Yearling mating of heifers is not a common practice in Queensland. In other parts of Australia and overseas, with good nutrition, heifers are mated to calve at two years without detriment to reproductive performance. Hereford weaner heifers overwintered on crop were 51 kg heavier at mating in November than heifers on improved pasture, but their pregnancy rate of 84·6% after 14 weeks mating was only 2·5% greater. At calving, the liveweight difference was 20 kg. By comparison, 95·8% of heifers mated at two years conceived within 6 weeks. Thus heifers mated as yearlings calved an average of 24 days later, meaning they would by comparison remain late calvers. Throughout Central Queensland very favourable 1973 winter conditions meant a higher than normal incidence of difficult births. Even so, the higher incidence for yearling than two-year-old mated heifers indicated the comparative risks involved in mating yearling heifers. Regardless of the management of their dams, calf growth to 4 to 5 months of age was similar, being 0·62 kg a day. After remating, pregnancy rates were 85% for those originally mated as yearlings and 100% for two-year-olds.

Research continues into ways of improving the performance of weaners and older cattle on improved pastures during winter. In an attempt to improve the post-weaning liveweight gains of steers, a daily supplement of 2·7 kg sorghum grain-cottonseed meal was fed. In 1972, supplementation increased winter gains from 0·26 to 0·42 kg a day, then during the more favourable 1973 winter from 0·34 kg to 0·62 kg. At the end of autumn, 69% and 87% of the resultant liveweight advantages remained. In 1972–73, the maximum advantage from supplementation was achieved only when steers were finished on crop. These steers were the most suitable for local trade, with an average carcass weight of 195 kg and 4·7 mm fat cover. The carcasses of previously unsupplemented steers finished on crop were heavier (179 v. 171 kg) and had a greater fat cover (3·5 v. 2·1 mm) than supplemented steers finished on grass. The average dressing percentage for those steers finished on crop was also greater than for those finished on grass (54·5% v. 52·6%).

An investigation into the use of high grain moisture supplements to improve weaner performance on buffel grass found that daily grain intake, and therefore liveweight gain, decreased with increasing grain moisture level. Moisture levels were 12·5%, 19·5%, 23·5% and 38%. Differences in liveweight after 9 weeks feeding to November still remained at the end of summer. During the initial stages, acceptance problems were encountered with the 23·5% and 38% moisture levels because of grain spoilage. This was overcome by reducing the interval between removal of grain from the silage pits and feeding out from three to two days. Of particular interest was the increased winter daily liveweight gain of 0·87 kg a day for the 12·5% moisture grain compared with 0·42 kg for the unsupplemented steers. The difference of 28 kg in November also remained in February. Four kg of grain were thus required to achieve each additional kg of liveweight gain at this moisture level (12·5%).

'Brian Pastures' Pasture Research Station. In an attempt to improve the reproductive efficiency of young breeders, maiden heifers were fed a low level energy supplement of 1·8 kg sorghum grain a day and urea for eight weeks before commencement of mating in September, 1972. Although the supplemented heifers maintained their liveweight during this period in contrast to the controls which lost 10·5 kg, there was no effect on pregnancy rate. The most significant difference to date has been the reduced calf losses with supplementation (8% v. 16%) to give a similar percentage of 83% viable calves for each treatment. Heifer losses at calving were the same for both treatments. Heifers were again fed a sorghum grain supplement before mating as first calf heifers. Early 1974 pregnancy rates are very satisfactory.

The use of urea/molasses as a low-cost, long-term supplement to improve post-weaning performance has proved effective in North-east Queensland. However, there is little factual information for the southern spear grass region. The feeding of a urea/molasses supplement to weaner heifers grazing native pastures reduced winter liveweight losses from 24 kg to 11 kg between mid May and August 1973. With the same rate of gain, 0·44 kg a day during summer for both supplemented and unsupplemented heifers, the 13 kg liveweight advantage due to supplementation was retained. In early February, the supplemented heifers weighed 227 kg and the unsupplemented heifers 214 kg.

Coolum Research Station. Severe flooding was a major problem between January and May 1974, when on five occasions the experimental area was completely flooded and all animals had to be removed. Consequently, this disrupted the experimental programme and made the interpretation of data very difficult.

The performance of Hereford cows and spring-born calves whether rotationally or continuously grazing pangola grass pastures continued to be very similar. The stocking rate is 6·2 breeders per hectare throughout the year. Pregnancy rates in 1973–74 were the same and again high at 90%, with similar average calving to conception intervals of 80 to 82 days and intercalving intervals of 366 to 370 days. Calf weaning weights were 187 kg and 190 kg for calves in the rotational and continuous grazing treatments respectively. The major differences betwen the two systems concern the effects of management on the pastures. Following periodic severe flooding and frost damage in winter, the continuously grazed pangola grass recolonised at a much slower rate. Hence a greater invasion of sedge and swamp nut grass occurred than with rotational grazing. A more vigorous pangola grass pasture persisted with the rotational grazing system.

A pilot study in 1973 suggested that molasses supplementation in conjunction with high stocking rates may be one method of improving animal gains on pangola grass. Santa Gertrudis x Hereford steers weighing 352 kg in October 1973, and grazing pangola grass at 7·4 animals per hectare, gained 0·88 kg a day to early January 1974. Restricted supplementation to provide 2·7 kg molasses a day increased daily gains very slightly to 0·94 kg. For unrestricted molasses feeding with and without added phosphorus, the respective gains were 0·87 and 0·93 kg. The severe flooding during summer and autumn especially disrupted this project, which was originally scheduled to continue until April. It will be repeated in 1974–75.

As in other regions, the performance of weaner cattle during their first winter is often unsatisfactory. Hereford cross steers (192 kg) grazing cold-tolerant setaria and pangola grass pastures gained 0·34 and 0·32 kg a day, respectively, between weaning in April and mid-July 1973. Steers grazing tropical grass-legume based pastures on the higher ridge area gained 0·31 kg. As a result, half of the steers were salable as prime vealers. The remainder were finished on either pastures or oats for future sale as yearlings.

For some time, internal parasitism has been considered a likely cause of the unsatisfactory performance of weaners on south-eastern coastal lowlands pastures. Untreated weaner steers, as well as those treated for either round worms (nematodes) or stomach fluke during winter all gained 0·28 kg a day between April and mid-July. However, simultaneous treatment for both nematodes and stomach fluke increased daily gains to 0·38 kg, a 9 kg liveweight advantage by July (216 v. 225 kg).

At *Kairi Research Station,* beef production on rain-grown green panic-Tinaroo glycine is being examined. In each of the years 1971 to 1973, Brahman cross steers gained 0·70 to 1·08 kg a day during summer. Thereafter, gains decreased to become weight losses during the winter spring period. Regardless of season, with the increase in stocking rate from 2·5 to 5·0 steers a hectare, liveweight gains and also the period of liveweight gain decreased. In 1971 and 1972, steers grazing at 5·0 a hectare were removed because of insufficient feed in July and in October for those grazing at 4·0 a hectare, whereas at the lowest stocking of 2 a hectare the steers continued until December. Pasture quantity, and not quality, limited animal performance. All steers, except at the highest stocking, were suitable for slaughter for the local trade. In each year, liveweight gains a hectare of 660–684 kg were highest at the intermediate stocking rate of 4 steers a hectare, with the lowest variation in gains between years. In an attempt to improve productivity and the effective grazing period on these pastures, the possible role of molasses supplementation is being examined.

Friesian steers continue to grow at a much faster rate than either Brahman cross or Shorthorn steers, especially during the winter-spring period. Liveweight gains from February to December, 1973 were 155 kg for the Friesians, 132 kg for the Brahman cross and 118 kg for the Shorthorn steers. The stocking rate was 3·7 steers a hectare.

Most of the research overseas and by this Department on the beef production potential of pangola grass pastures grown under irrigation with high levels of nitrogen fertilizer has been with fattening steers. However, at *Parada Research Station* the performance is being studied of Brahman cross cows and calves rotationally grazing irrigated pangola grass throughout the years. In both 1972 and 1973, pregnancy rates tended to be depressed at the higher stocking rates of 8·2 and 10 breeders a hectare, a reduction which was not counteracted by increasing the nitrogen fertilizer level. In 1972–73, calf weaning weights, daily gains and carcass weights clearly reflected the expected trends of decreasing weights with increasing stocking rate and, at the same stocking rate, of gains being greater with 670 kg than 500 kg nitrogen fertilizer a hectare. Calves were slaughtered as vealers at the average age of 285 days. Their average carcass weight was 108 kg, to give 0·28 kg a day estimated daily carcass gain. At this stage the 670 kg nitrogen x 10 breeders a hectare treatment shows some signs of 'crashing' with a reduced pangola grass component in the pasture and considerable invasion of sedge grass.

Two years' observations at *Gatton Research Station* clearly demonstrated advantages of rotational grazing over set stocking with high stocking rates of 4 steers a hectare on a mixed grass-legume pasture. The pasture comprised Narok setaria with the legumes Hunter River lucerne, Siratro and glycine. The most significant feature was the superior performance of the rotationally grazed pasture, with adequate pasture always available and much earlier spring growth. Under set stocking there was no build-up of pasture. and there were indications of reduced pasture vigour and the likely disappearance of the legumes. In both years, animal performance was similar until mid-autumn, when the set stocked steers started to lose weight. Liveweight gains with set stocking from October to May were 0·52 kg a day (427 kg a hectare) in the first year and 0·37 kg (345 kg) in the second year. With rotational grazing gains were much higher, being 0·64 kg a day (521 kg a hectare) and 0·55 kg (558 kg) respectively. In fact, because of the build-up of dry matter under rotational grazing, it became desirable in the second year to increase the stocking rate to 5 steers a hectare from February to May. Rotationally grazed steers, although lightly finished, were suitable for slaughter, whereas the set stocked steers required further 'topping-off' in both years.

Field investigations. Field investigations continue to play a major role in Beef Cattle Husbandry Branch research by complementing the programme of research stations, investigating local problems and demonstrating methods of improving beef production. One large-scale field project is being conducted on a property typical of the forest country north of Biloela in Central Queensland. The performance is being studied of Hereford, Brahman and Santa Gertrudis breeds of cattle involved in a three breed rotational crossbreeding programme. From 1972–1974 the average pregnancy rate for $\frac{5}{8}$ Hereford cross females was 95%, compared with 91% for $\frac{5}{8}$ Brahman and 81% for half-bred Santa Gertrudis females. Differences between the breeds were more evident for yearling and two-year-old lactating heifers than mature females. Pregnancy rates for mature breeders after selection, except the half-bred Santa Gertrudis, were similar. These results all indicate that, to improve fertility, a higher degree of selection intensity is required for Santa Gertrudis than Brahmans and very little for Herefords. Breed of sire significantly influenced weaning weights and continued to do so up to one year, when average liveweights were 271 kg for Brahman, 272 kg for Hereford and 260 kg for Santa Gertrudis sired steers. Liveweights were similar by slaughter, but carcass grades favoured the Hereford because of their better fat distribution and less bruising.

On the same property, the performance of the progeny of Belmont Red and other tropical breeds is being compared. In both 1973 and 1974, Belmont Red calves were heaviest at weaning (241 kg). However, in 1973, the performance of steers of all breeds was similar at 17 months of age.

Another large-scale project will evaluate the performance of Sahiwal crosses relative to Brahman and Africander crosses under Central Queensland conditions.

Observations on the performance of breeders and their progeny are vital to the detection of factors limiting productivity. For example, a survey is to be conducted in the near south-west region to determine the incidence and losses due to difficult birth.

On a property north of Cloncurry over a number of years, Droughtmaster type calves born from October to March averaged 153 kg at six months, presumably due to the very favourable pastoral conditions during the late spring and summer. Heifers born during the dry season from April to September were lighter at six months, averaging 141 kg. Hence the closer calves are born to the break in the season then the greater their liveweight at six months, but because of the relationship of time of birth to the fluctuating pastoral conditions, the lighter those heifers are at 12 months. However, the overall trend appears to be for all heifers grazing Mitchell-Flinders grass associations to reach 300 kg, the accepted liveweight for mating maiden heifers at 18 to 22 months of age.

On Mitchell grass downs country south-east of Richmond, preliminary results of breeder performance indicate that the available nutrition should support high reproductive levels, such as pregnancy rates of 91·6% for maiden heifers and 92·6% for first calf heifers. Further, 87·8% of the 1972 first calf heifers were again pregnant in 1973, having an intercalving interval of 13 months. By comparison, maiden heifers introduced from the Mt. Garnett area had a pregnancy rate of 88·6%, but only 68·1% of the first calf heifers were pregnant, reflecting a poorer nutritional background and a need for adaptation.

Guinea grass from Kenya under grazing at Utchee Creek. The grass shows improved cool season growth and is proposed for release in 1974.

On forest country north of Biloela, high pregnancy and branding rates, with little variation between years, have been maintained in a controlled October–February mating programme for two-year-old maiden heifers, three-year-old lactating heifers and mature breeders. Slightly lower rates were recorded for yearling and two-year-old lactating heifers, also with more variation between years. Age of dam had the greatest influence on weaning weight. The increase in weaning weight with age of dam was greatest from two to three and from three to four years of age.

Phosphorus deficiency is known to be widespread in a number of the important beef producing areas, and previous research has indicated definite reproductive and growth responses to supplementation.

On a property south-west of Cunnamulla, a definite response was recorded in 1973 to phosphorus supplementation, despite an average intake of 3 g P a day. With controlled mating from January to July, 96% of supplemented breeders and 91% of the unsupplemented breeders were pregnant. Of more importance, by the end of April, 78% of the supplemented breeders were pregnant but only 53% of the unsupplemented ones. The majority of supplemented cows conceived in March–April, which coincided with the dramatic increase in faecal P (0·12 to 0·31% P) following the summer rains. The majority of the unsupplemented cows did not conceive until April–May. Supplementation did not affect calf weaning weights, but provided the only explanation for the difference of 12% in calf survival. Foetal and calf losses to weaning were 12·4% for the phosphorus treatment and 24·4% for the controls.

To assess the phosphorus status of herds in the Charleville area, a survey was undertaken in 1972. Faecal phosphorus levels were found to be below 0·2% P for 8 to 10 months of the year. Minimum levels in the 1972 dry season (a below-average rainfall year) were 0·11 to 0·13% P. Regardless of type of stock, the main differences between classes of mulga country were evident in the peak levels of faecal phosphorus during the wet season. Maximum levels in 1973 (an above-average rainfall year) varied from 0·25% P on mulga-box to 0·40% P on 'soft' mulga country. Clinical signs of phosphorus deficiency were observed on only two properties, those having the lowest peak levels—0·25% on mulga-box and 0·28% on mulga-bloodwood country.

The performance of Brahman cross weaner steers grazing native pastures at a beast to 2·5 ha on sandy forest country north-west of Theodore was superior to that of Herefords. For both breeds, post-weaning gains during winter were higher with a grain/urea supplement than molasses/phosphorus, gains being 0·22 and 0·11 kg a day respectively. This was undoubtedly due to the higher energy intake with the grain/urea supplement, because of their similar total phosphorus levels. The unsupplemented steers lost 0·08 kg a day liveweight during the winter, and subsequent compensatory growth failed to cancel the liveweight advantage due to supplementation.

Performance Recording

Over 900 herds, covering most breeds, are enrolled in the National Beef Recording Scheme. Enrolments to date have been greatly assisted by contracts made with the Simmental and Limousin Breed Societies who now have performance-pedigree register facilities with the Agricultural Business Research Institute of the University of New England. There are approximately 300 Simmental and 200 Limousin herds enrolled in the scheme. The actual number of Queensland herds enrolled is not known, but must number about 200. Field staff are actively promoting performance recording. Many have undertaken specific projects designed to promote performance recording among bull sellers and to educate bull buyers to the use of a genetic index of bull value. For too long, bull buyers have made purchases purely on appearance or pedigrees that bear little relation to genetic quality.

During 1974, over 600 000 calves are expected to be recorded in the national scheme.

Only 5 of the 12 Polled Hereford bulls which commenced performance testing at the Animal Husbandry Research Farm, Rocklea, survived the flood. The two best bulls of these 5 were in the top 3 of the 12 bulls tested, and were forwarded to the A.I. Centre, Wacol. Their average daily liveweight gain from 250 to 450 kg liveweight was 1·18 and 1·10 kg respectively; feed conversion ratio was 7·06 and 5·92, and predicted fat depth over the eye muscle was 14·1 and 12·0 mm.

Nutrition

Experiments continued on the intensive finishing of steers, mineral metabolism of cattle, a comparison of the Hereford and Simmental x Hereford, the supplementation with grain of forage-fed cattle, and the effect of phosphorus deficiency on reproduction.

Various proprietary growth-promoting substances are available for use with high grain diets for cattle in commercial feed lots. Chlortetracycline is registered in Queensland for use in cattle diets and molasses distillers dried solubles (E C feed) is used in pre-mixes. It has not been tried in all grain diets. A further growth promoting substance, the anabolic agent 'Ralgro' is registered in countries importing Australian beef but not in Australia. These three compounds and zinc bacitracin were tested singly and in combination to determine their effect on the productivity of steers fed an all-sorghum grain diet. Chlortetracycline and zinc bacitarcin were added at 70 mg/head/day, E C feed at 3% of the diet and 'Ralgro' as an implant at 36 mg/head. Groups receiving chlortetracycline, zinc bacitracin or 'Ralgro' had better daily liveweight gains (1·23, 1·28, 1·24 kg compared with controls 1·06 kg) and feed conversion ratios than the control group; groups with E C feed had lower liveweight gains and poorer feed conversion ratios. There were no differences in the carcass composition of cattle from the various treatments. The difference between the carcass fat percentage determined by Charles' anal fold method and dissection techniques was large.

Semen from exotic breeds has been imported into Australia for some years. Heaviest importations have been made for the Simmental breed. A comparison of the productivity of Simmental crosses and Herefords on high grain diets was begun. Following artificial insemination, 20 mature Hereford cows were pregnant to Hereford semen and 14 to Simmental semen. At calving at 280 days (Hereford) and 292 days (Simmental x) no cows had difficult births. The birth weight of the male calves was 30·8 kg (Hereford) and 38·0 kg (Simmental x). The birth weight of the female calves was 29·9 kg (Hereford) and 33·5 kg (Simmental x). In the early post-calving period, the crossbred calves had better liveweight gains than the Hereford calves.

In feedlot finishing of cattle in Australia, various methods of treating grain are employed to obtain better use. Methods include ensiling grain harvested with a high moisture content or ensiling grain following reconstitution with water. In some areas it may be advantageous to harvest high moisture sorghum before lodging occurs. Experiments comparing dry barley grain and reconstituted barley (25% moisture) showed no difference in use, their dry matter digestibilities being 71·7% and 72·5% respectively. Sorghum grain harvested at 40% moisture was better used (D.M. digestibility 77·5%) than dry grain (D.M. digestibility 71·9%). There was no difference between grain harvested with 25% moisture and dry grain.

The Biochemical Laboratory continued long-term collaborative studies into the mineral requirements of various classes of cattle. Projects undertaken included investigations into the effects of sodium deficiency on pregnant and lactating cattle, sodium supplements for steers grazing native pastures, physiological changes associated with phosphorus deficiency in mature, nonlactating cattle, and a preliminary study using ceruloplasmin (serum copper oxidase) activity rather than whole blood copper as an index of copper status of cattle, particularly those grazing improved wallum country.

Pests and Diseases

Brucellosis and Tuberculosis.—Strategic voluntary vaccination of cattle within the protected area continues to be the principal, preliminary step in the programme to reduce brucellosis infection within herds to a level where eradication measures can be adopted.

About 70 000 dairy and 200 000 beef heifers are now vaccinated annually with strain 19 vaccine. This represents about 20% of beef heifers and 50% of dairy heifers retained for breeding annually, within the protected area.

Additionally 10 000 dairy cattle and 35 000 beef cattle are vaccinated with strain 45/20 vaccine to control outbreaks.

Strain 45/20 vaccine is also used in infected herds in the more remote areas where calves cannot be vaccinated with strain 19 within the maximum age limit.

With the object of defining the brucellosis status of non-vaccinated beef herds in the protected area and extending the use of vaccine to infected herds, brucellosis survey teams using the Rose Bengal plate crush-side test were established in the Brisbane, Toowoomba, Maryborough and Rockhampton Divisions early in February, 1973.

Of the 700 non-vaccinated beef herds surveyed in south-eastern areas 26% were found to have one or more reactors with overall reaction rate of 1%. Vaccination was not considered necessary in 90% of the beef herds surveyed. In these herds eradication measures could be initiated immediately without provision for compensation, when there is an avenue for disposal of reactors at meatworks.

The wet weather in coastal Queensland during the second half of 1973 led to the cancellation of much work because of wet yards. The situation got much worse during the first quarter of 1974, and little field surveying was possible. The onset of the killing season was also delayed and this affected meatworks testing.

Before an eradication programme can be considered on a State-wide basis it will require the support of a comprehensive compensation scheme, details of which are now before the Commonwealth Industries Assistance Commission. Assuming the Commission supports the scheme, it is not likely to operate before 1976. When the ban on the disposal of brucella reactors at meatworks is removed, it is possible that some owners of lightly infected herds may undertake voluntary eradication measures even before the compensation scheme operates.

Negotiations are in major progress on a Federal level with the A.M.I.E.U. to lift their ban on the handling of brucella reactors at the major meat export works. On a national level, a committee convened by the Industries Commission of N.S.W. comprising representatives of the pastoral industry, Commonwealth and State Governments, meatworks operators, meatworks employees, and medical authorities, chaired by Mr. Justice Cahill, met in Sydney on 28 November, 1973. Unfortunately there does not appear to be any prospect of this problem being resolved in the near future. Until it can be resolved our activities must be confined to surveying beef and dairy cattle to ascertain the prevalence of infection on a herd and area basis. Because of the ban, cattle undergoing survey testing are not identified. This causes considerable frustration to graziers particularly in cases where incidence of brucellosis is very low, as in these circumstances the owner would normally be anxious to eliminate infected animals. About 75% of the properties on which infection has been found would fall into this category.

Bulk milk ring testing of dairy herds with the object of extending vaccination to infected herds continued throughout the State in co-operation with officers of the Division of Dairying. Recent trials to identify infected animals within an infected herd showed a close correlation between the individual milk ring tests, the Rose Bengal test and laboratory blood tests. It therefore appears likely that a milk sample could be used as an alternative to a blood sample to test individual animals in dairy herds.

On the basis of a consistently low prevalence of brucellosis infected beef herds surveyed recently within the Cairns and Townsville Divisions, it is proposed to define an area north of the Townsville–Mt. Isa railway to include the Dalrymple, Etheridge, Mareeba and Cook Shires, within which properties will be classified and movement control adopted, with a view to minimising the spread of brucellosis in this area.

This procedure is the first major step towards the adoption of eradication measures and the declaration of a provisionally brucellosis free area in Queensland. Unfortunately the adoption of voluntary eradication measures, even in herds with a low incidence of brucellosis, will not be possible until there is an avenue for disposal of brucella reactors at export meatworks. There is a limited outlet for disposal of reactors at the Mareeba Meatworks while it retains its present classification as a non-export meatworks.

Although the control of movement from infected properties into and within this area has already been instituted, control of the movement from non-surveyed properties will not be introduced until about 70% of the properties have been surveyed within each shire on the basis of random sampling at the 99% level of confidence to reveal an 0·5% level of infection. It is anticipated that surveying will have reached this level within the first half of 1974–75.

The Atherton Tableland dairying area and coastal shires in the Cairns Division will be excluded on account of a high incidence of brucellosis infected herds.

The declaration of controlled movement area in Queensland also satisfies the chief requirement for the introduction of cattle to the Northern Territory brucellosis protected areas. Cattle can now move to the protected areas of the Northern Territory from clean herds within this area subject to clearing tests before movement. This concession has been an incentive to many stockowners to present their breeding cattle for testing.

Results of surveying show that the prevalence of brucellosis infected herds in the central-western area is of a similarly low incidence to that found in Dalrymple and Etheridge shires of Far North Queensland. Unfortunately, in the far western Channel country the prevalence of brucellosis infected herds is very high. Prolonged droughts in this area appear to have been responsible for a high infection rate of both tuberculosis and brucellosis.

On properties with a dual infection it is proposed to vaccinate heifers with strain 45/20 vaccine while tuberculin testing is being undertaken.

Since the inception of the tuberculosis eradication programme in October 1970, approximately 3·5 m. cattle have been tested with the removal of 12 322 (0·34%) reactors. The two principal objectives are eradication from known infected herds, and area surveying within the protected area.

The highest infection is to be found in the Gulf and Channel country areas. In the Channel country almost 100% of properties west of the dingo barrier fence have a tuberculosis problem. On an average, the initial incidence of reactors in infected herds in the more remote areas has been approximately 2%. On the worst infected properties, odd mixed breeding groups, which have included a high proportion of aged cows, have shown an incidence of up to 30% on the initial test. The overall incidence of reactors within the protected area is approximately 0·18%, with less than 2% of herds surveyed showing evidence of tuberculosis. Approximately 25% of the testing has been concerned with infected herds outside the protected areas, where approximately half of the reactors have been found. The average reactor level in cattle tested outside the protected area is 1·4%.

Definitions for provisionally free and free areas have been adopted by the National Committee. At the present rate of testing in the Brisbane, Toowoomba and Maryborough Divisions it may be possible to declare south-eastern portions of the state provisionally free of tuberculosis by 1975. Stockowners who normally supply store cattle for the New South Wales market have expressed a desire to have certain shires, especially those bordering New South Wales, declared free from tuberculosis.

In the far western shires of Paroo and Murweh, immediately to the west of the protected areas where stockowners who have traditionally supplied store cattle for the New South Wales market have undertaken testing at their own expense, it is understood that the bulk of properties have now been tested. Applications have been made from some of these properties for registration for the purpose of using back tags.

Although the adoption of compulsory testing has not been considered necessary up to the present, it is possible that a time limit may have to be applied to those stockowners who have avoided having their herds tested under the area survey programme.

The complete testing of cattle in mixed farming areas such as those engaged in sugar cane, pineapples and orchards presents administrative problems, as such testing is usually uneconomic to the practitioner especially if adequate facilities are lacking.

Conditions of entry of breeding cattle to New South Wales from Queensland have become more stringent as the whole of New South Wales is now declared a protected area. The State has been classified into two categories with a varying limit on the interval between testing and entry, i.e., 14 days and 30 days to the protected area. Cattle from infected properties must undergo two clean tests in isolation before entering New South Wales. Back tagging to identify cattle from tested properties which are eligible to enter New South Wales without a prior test continues for the benefit of the New South Wales buyers.

Although the wet season extended over a longer period than usual, it is anticipated that the present volume of testing will be maintained during the ensuing year. A greater volume of testing will be undertaken in the Gulf and Channel country areas with the increased availability of practitioners,

Unless present cattle prices improve it can be expected that some owners will not be prepared to outlay additional expenditure on the testing of cattle. This could affect the prospects of short-interval testing which is necessary to ensure a successful outcome of an eradication programme in an infected herd.

Although the level of reactors has remained fairly constant over the past two years a reduction is expected during the ensuing year as most infected herds have undergone an initial test, and retesting should reveal a much lower incidence of reactors.

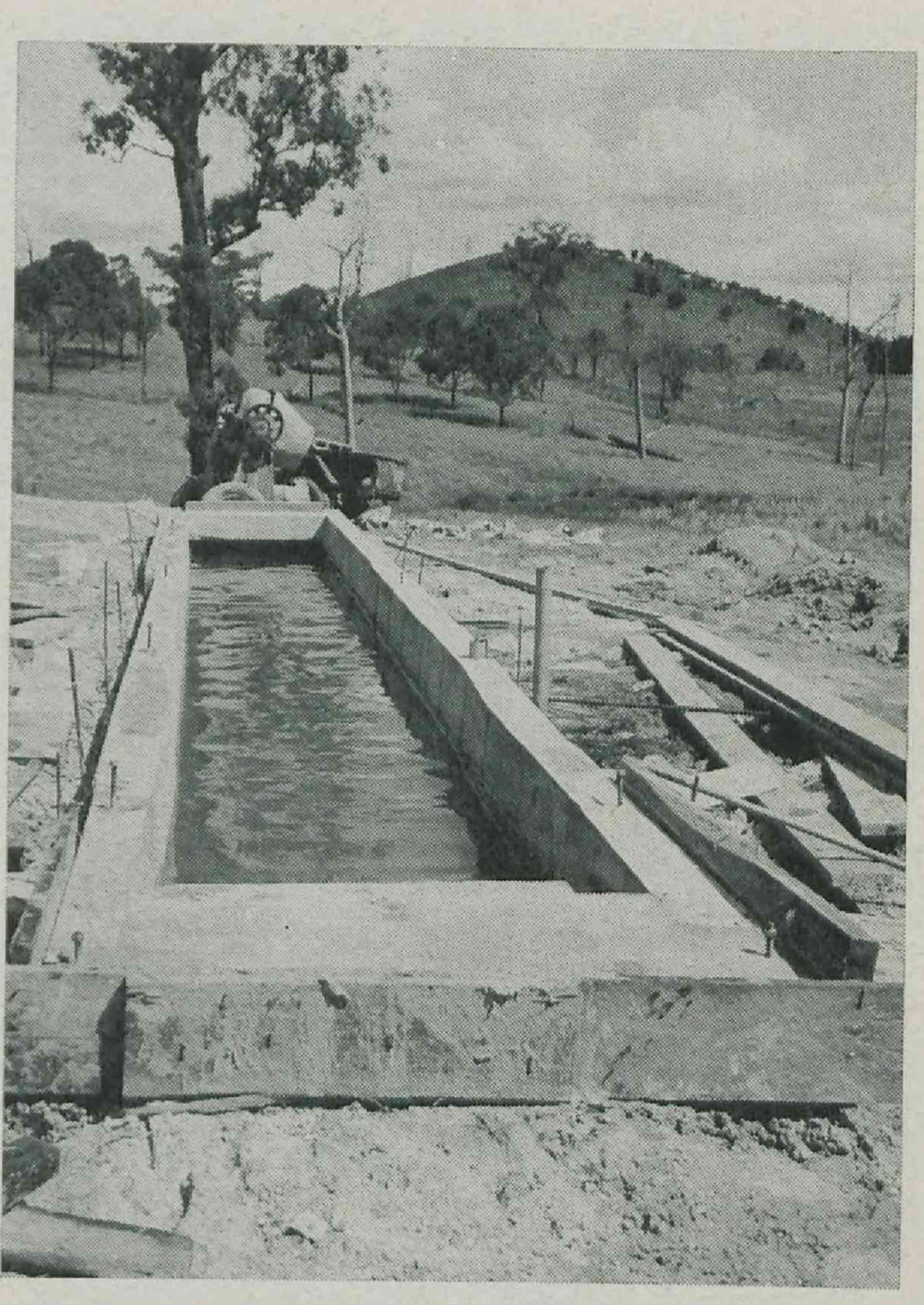
There will be a demand for the disposal of reactors on properties as the present salvage value at meatworks is unlikely to cover freight and handling charges. It can also be expected that meatworks will be reluctant to handle reactors until the cattle market returns to normal.

Two years of well above average rainfall have stimulated tick propagation and have resulted in a large number of infestations in the tick-free areas of the Toowoomba and Maryborough Divisions. These stretched man power and equipment facilities to the limit and made it necessary to review present methods of control and eradication. Action against the large Kaimkillenbun outbreak, involving 13 properties and 55 surrounding holdings, has progressed very satisfactorily and no ticks have been found since July 1973.

Properties under quarantine at the end of the year in the various subdistricts were, Toowoomba 79, Dalby 14, Warwick 24, Kingaroy 63, Wandoan 8. The Shire of Rosenthal and Parish of Wildash, and a small area near Wallangarra, were declared Special Areas.

From June 1973 to May 1974, 423 tick samples were tested with the following results: Mt. Alford Strain 35, Biarra Strain 230, Mackay Strain 19, Gracemere Strain 3, Ridgelands Strain 74, no resistance 62. There is increasing multi-resistance appearing in Central and Northern Queensland.

The favourable seasonal conditions resulted in tick infestations in many marginal areas some of which are normally free of infestations. Some of these areas became quite heavily infested and were often associated with outbreaks of tick fever.



To help producers install good dipping facilities, the D.P.I. secured two sets of dip moulds and these have been keenly sought after. These photos show the moulds being used to install a dip at Woodford.

There was a tremendous demand by graziers for the use of the two sets of dip moulds which were obtained by this Department, and there is still a long waiting list for their use. A couple of fibre-glass dips were installed and are being observed with interest. The possible advantages associated with these include speed of installation, light weight, movability, ease of repair, no corrosion or corners, pliability, and simplicity of installation.

Although heavy rain depressed tick numbers in some coastal areas of North Queensland, elsewhere showery weather caused disruption in dipping programmes. In many areas, therefore, heavy tick numbers were allowed to build up in pastures during the autumn of 1974. During the past year a new acaricide, Dipofene, capable of killing all strains of ticks, was released.

The Biochemical Laboratory while monitoring the residue characteristics of acaricides observed wide variations in residues of chlordimiform in the tissues of cattle. Subsequent experimentation showed twofold decrease in residues in all tissues when the formulation was prepared with an acidic buffer as in field dipping as compared with the unbuffered preparation.

There was a high incidence of tick fever spread almost throughout the year, and approximately 140 confirmed field outbreaks due to *Babesia argentina* were recorded. Tick infestations in marginal areas increased markedly due to suitable seasonal conditions and this was often associated with tick fever. The most important individual property losses included 250 head on a property near Cloncurry where boggy conditions prevented treatment or vaccination of animals, 30 head at Miva, 12 at Proserpine, 15 at Rolleston, 9 at Taroom, 9 at Moura, 9 at Widgee, and 8 at Wandoan.

Anaplasmosis continues to be a disease of increasing importance in Queensland and there were approximately 45 confirmed outbreaks of this disease. On a Gulf property, 10 animals died and another 20 were sick from the disease, while 12 head were lost in a mob of 500 at Taroom.

While *Babesia bigemina* is not a problem on the whole, it can present a worrying problem to individuals. Deaths and/or sickness due to *B. bigemina* were reported from 9 properties.

Scrub ticks were again very active in the range country especially from Toowoomba to Nanango, as well as in other rainforests of Queensland. They cause serious economic losses in animals during the spring months. A 3–host tick spraying trial was carried out in the Crow's Nest district primarily to check the efficacy and residual protection offered by the newer tickicides.

A mild and relatively moist winter allowed the buffalo fly to overwinter in areas where this does not normally occur. In early spring it was reported to be infesting cattle in the Cloncurry area and west of the Dividing Range in the region of Jericho. It was not long before areas such as Muttaburra, Longreach and Blackall in central western Queensland and Injune, Wandoan and Taroom areas on the western Downs were infested. During the first quarter of 1974 the fly spread as far as Birdsville, Windorah, Quilpie and Wyandra in the Charleville district and to south of Roma, Miles and Chinchilla, and eventually to the Glenmorgan, St. George and Yelarbon areas. However, on the coast infestations did not extend any farther south than Lowmead.

Probably due to reduced vaccination of breeders and a different suspending agent for parasitised red blood cells, haemolytic anaemia appears to be decreasing in importance as compared with the situation several years ago.

Ephemeral fever after being quiescent during the winter months, appeared again in the early spring and was reported to be affecting cattle up to 2 to 3 years of age in the Bundaberg and Maryborough districts, and also in the Rockhampton district; 2 properties near Kunwarara were reported to have lost about 50 head. Those affected were 2 to 3 years old fat steers grazing on virtually treeless marine plains, which caused the disease to be exacerbated by heat exhaustion and dehydration.

Moist spring weather saw the disease quickly spread to the Burnett and Wide Bay areas, while in the Brisbane Division the disease recurred in the Samford and Moggill areas during the first week of October and rapidly spread throughout the east and west Moreton. It also increased on the western Downs and during December cases were reported from the Warwick district but not the northern section of the Eastern Downs. However, in the new year it spread over the Eastern Downs, south through Dalby and the last area to be affected was the Goondiwindi district; 40 head were lost on a Dalby property during rainy weather.

In the Townsville district the disease became fairly generalised during late February and March and similarly in the Roma Division, while it caused some mustering problems in the Channel country.

Arsenic and lead were the most important toxic agents causing stock losses. There were 35 confirmed outbreaks of arsenical poisoning, the most spectacular being 51 pigs which died in 2 days following the feeding of grain contaminated by a leaking arsenic container, while 12 head of cattle at Inglewood died after gaining access to an old arsenic store shed. Sources varied from arsenic containers such as drums of weed killers, while some cattle were lost when their owners resorted to an arsenical spray as a means of controlling resistant cattle ticks. Excessive medication with arsenilic acid caused nervous symptoms to develop in 400 baconers at Mundubbera.

There were 29 confirmed instances of lead poisoning, many of them associated with the consumption of sump oil.

Insecticides caused some sickness and losses, especially in calves following dipping in O.Ps. In one case, 9 calves died after dipping in ethion after mustering on a Charters Towers property. Another owner at Walkamin lost 34 head after spraying stock with Azinphos, a horticultural O.P., which the owner mistook for Asuntol.

A wide range of toxic plants were associated with losses and sickness in stock throughout Queensland.

Miscellaneous.—Widespread losses from blackleg were reported from the Downs, Brisbane and Burnett areas and also from Charters Towers. The most serious single loss consisted of 22 unvaccinated animals which died at Rathdowney.

The increasing importance of leucosis in shown by the large number of laboratory confirmations which exceeded 20. One herd with a leucosis problem at Jimboomba yielded 55 positives and 17 suspicious out of 111 specimens collected for haematological examination. Another herd at Innisplain yielded 18 haematologically positive animals out of 121 bled.

Botulism caused some severe losses especially in North Queensland, and included 50 head on a property near Proserpine and 15 on a Charters Towers property. On the whole, however, botulism vaccination is reported as being widespread and increasing in use.

Four outbreaks of cerebrocortical necrosis were recorded in prime bullocks at different feed lots. It is now considered that other spasmodic feed lot losses may have been due to this cause. The disease was also diagnosed in grazing Merino wethers near Millmerran.

Two further diagnoses of trichomoniasis were made, both the result of specimens submitted from abattoirs. These originated in cows from Thargomindah and Bowen.

Haemonchosis was widespread in weaners throughout coastal and subcoastal Queensland. This condition was responsible for the loss of 40 10-month old weaners out of a mob of 170 at Charters Towers, while a further 40 were severely affected.

Extension

Extension activities have been influenced by seasonal and market conditions. The latter have further reinforced the programmes directed at improved efficiency, i.e., higher reproduction and genetic improvement, as compared with intensified production involving high capital and running costs.

Field days and beef schools were well attended, and moves were made to involve bankers and stock and station agents who have considerable influence on graziers' decisions. There was also greater involvement in Rural Youth Groups and Rural Science Discussion Groups.

The first Beef Cattle Husbandry officer to complete the post-graduate course in rural extension returned to field duties. The first diplomate officer to attend the Hawkesbury Course started in April.

A branch workshop held in Rockhampton for Central Queensland staff was devoted almost entirely to breeding and genetic improvement. A field day at Brigalow Research Station was very well attended. The branch played a major role in conducting part of an international training course in beef cattle production sponsored by the Department of Foreign Affairs.

In feedlotting enterprises, greater attention was given to pollution control, and members of the Water Quality Control Council were assisted in drawing up guidelines for local authorities.

Economics

The generally buoyant prices in the earlier part of the season allowed many properties to consolidate their financial positions. However, the slump in cattle prices dampened the outlook of many graziers. There were fewer inquiries for development budgets and more for rural reconstruction.

Beef and fertilizer prices will have the greatest effect upon those contemplating development of sown pastures.

In the Townsville region, a co-ordinated programme is being developed to increase beef productivity based on increasing reproductive rates. This ties in with the results of a functional analysis study which identified breeding percentage as being one of the more important factors affecting property cash income.

SHEEP

Conditions in most of the sheep country were good in the first half of the year. The north-west and the Cunnamulla areas were dry and drought persisted north of Barcaldine and from Eulo south to the border. The floods in January caused heavy losses of sheep, fencing and property. Sheep losses were estimated at 0·25 million.

Excellent pasture growth followed the flooding but some areas at Charleville, Blackall, Barcaldine and Winton have become rank.

The south-eastern sheep areas did not receive the heavy rains, and country west and south-west of Warwick has remained drought stricken.

Sheep numbers at March, 1973, were 13·34 million. The preliminary estimate at 20 June, 1974, is 13·16 million. Decreased sheep numbers are more pronounced in the Darling Downs east, Darling Downs west, Roma and north-west divisions where cattle numbers have increased.

Although the percentage of cattle increased in the central west, south-west, and far west divisions, the change was small, as most sheep producers in these divisions are maintaining a flexible position against price fluctuations in wool and beef.

Reproduction rates were reasonably good throughout the pastoral zone due to the favourable season, and lambings are generally above average in most districts, indicating an increase in numbers for 1974–75. Spring and early summer lambings ranged from 60 to 117% at Cunnamulla, 50 to 80% at St. George, 80 to 94% at Blackall, and some properties at Roma marked above 100%.

Field officers continue to help sheep owners with technological and management decisions. Type of enterprise, such as sheep only, sheep and cattle, sheep and grain, financial management, wool marketing, clip preparation, labour saving devices, are now part of the extension work of sheep husbandry.

During the July-May period of 1973–74, field staff gave 2 172 advices and demonstrations. These were, parasite control 48%, sheep breeding and selection 35%, property management 10%, feeding 7%.

Grazing and mulesing trials continued at Blackall and Barcaldine.

Interest by Merino stud and flock breeders in fleece measurement increased. The number of wool samples received was 51% higher than the 1972–73 period.

In the semi-arid zone of north-west Queensland, neonatal deaths of lambs is approximately 25%. Many of the lambs which die have low birth weights thought due to either poor nutrition and/or heat stress of the ewe in late pregnancy. In an experiment in the environment house at Toorak, ewes in the last 30 days of pregnancy were subjected to heat stress. They were compared with equivalent ewes at lower temperatures and it was shown that heat stress alone resulted in low lamb birth weights and low survival. Thus the lambs of ewes adapted and therefore tolerant to this environment are less likely to be affected by environmental heat stress during late pregnancy, and this points to the need to be able to identify these ewes and to determine the genetic significance of this attribute.

A survey of ewes throughout the sheep growing areas of Queensland showed that ewes in most areas had less than optimal levels of thyroxine. This suggests that the ewes would have sub-optimal milk production and that lambs of these ewes would have less than their genetic potential for the subsequent production of wool and meat. Groups of ewes in either a high or a low plane of nutrition were drenched with solutions of potassium iodide (to stimulate production of thyroxine) during the last 40 days of gestation and compared with non-drenched sheep. Lambs from treated ewes had heavier birth weights than lambs of undrenched ewes, and the early post natal growth and survival of lambs from treated ewes was better than that of lambs from untreated ewes indicating an increase in milk production of the treated ewes. The liveweights of the ewes on comparable feed were the same.

In times of nutritional stress it would be advantageous to be able to rapidly diagnose pregnancy in ewes so that the pregnant ewes could be drafted from the non-pregnant ewes and given preferential treatment. A simple abdominal ballottement technique for pregnancy diagnosis in the ewe has been developed for ewes pregnant 100 days or more. The diagnosis can be done on about 150 sheep an hour.

Results of diet selection studies of sheep show that in the Mitchell grass downs country of the north-west, Mitchell grass is an important component of the diet right through the year, even though its contribution may be as low as 15 to 20% when the new season's growth is available. Flinders grass makes an important contribution only when it is in a lush green state, and near the peak of quality. Pterigeron is very acceptable to sheep, and the contribution to the diet is related to availability in the pasture. Other grasses and forbs can make up to 50 to 60% of the diet while in the green succulent state, though they may be less than 10% of the pasture available. The rate of wool growth reaches a maximum 6 to 8 weeks after the rains of the wet season but declines as pasture quality deteriorates. Low rates of production occur at the end of each dry season.

At Charleville, in controlled pen feeding studies with mulga, sheep gave marked production responses to supplementation with molasses/urea. Body weights were increased by up to 52% over control groups with supplementation of 200 grams dry matter molasses/head/day fed over a 4-month period; 44% at 100 grams and 31% at 50 grams. Wool production was increased over the same 4 months by up to 77% at 200 grams; 66% at 100 grams and 59% at 50 grams. Intakes of mulga dry matter were, in some cases, almost doubled with the supplementation of molasses or molasses/urea.

Further research into the biochemistry of humpyback disease in sheep was undertaken by the Biochemical Laboratory. Results indicated that the marked increases in the activity profile of the enzymes Crestine Phosphokinase (CPK) and Lactate Dehydrogenase (LDH) in the plasma of affected sheep will aid diagnosis.

Serious blowfly strike occurred in the February–March period of 1974. Body strike of 20 to 70% in woolled sheep occurred in the flooded regions of the north west, far west, central west, south west and border areas.

Barber's pole worm, *Haemonchus contortus,* and hair worm, *Trichostrongylus,* infestation of sheep were detected at Winton, Aramac, Barcaldine, Blackall, Charleville and Cunnamulla. South eastern areas all reported some trouble from these worms.

Anaemia, and illthrift of young sheep caused by eperythrozoonosis infection occurred at Barcaldine, Blackall and Augathella.

Pulpy kidney, nasal bot, infectious labial dermatitis, tetanus, mycotic dermatitis, hypocalcaemia, pregnancy toxaemia, plant poisoning, grass seed infestation, and fertility problems occurred throughout the sheep areas during the year.

The pastoral industry is perhaps one of the most difficult to service in terms of management advice. Any one property can consist of four or five basic land types which in themselves are very diverse. In addition, rainfall variations within annual range of 13 to 25 inches add to complexity. There is also a lack of useful research data.

Obviously, there is a great deal of work and research to be done, particularly in the South-western regions, and the development of a financial management policy suited to the region must have a high measure of priority.

The change-over wool price, that is the price of wool at which it is more profitable to change from one sheep enterprise to another, determines the optimum enterprise for the semi-arid areas. An extension article 'Ewes or Wethers' was prepared as a basis for extension work in this direction.

An Economic Services Branch publication on wool futures will shortly be available for release. It seems that many graziers have not taken advantage of the futures market to protect themselves against adverse price movements. It is estimated that a grazier using the futures market before the slump would have increased his income by about 30%.

Research on decision making in the pastoral zone is being undertaken at Charleville and Roma with financial support from the Australian Wool Corporation. Progress was made on the preparation of a computer programme to simulate the growth of a livestock herd. Field data obtained from the pastoral zone study were used taking into account seasonal changes in property management.

The programme has been modified to handle a range of requirements in the generation of livestock herds over time. A descriptive manual is being prepared and will be field tested to check its suitability to handle routine herd generation in budgeting and other planning situations.

PIGS

Pig production records continued to be collected and collated from an increasing number of producers. Individual results provide a useful means of monitoring various aspects of herd performance as an aid to management. State figures from over 84 co-operating herds showed a slight reduction in numbers born and weaned but, as weaning age and farrowing interval were reduced, annual sow productivity increased. Average weaning age dropped to 35 days during 1971–72 with a farrowing interval of 170 days. Subsequent figures showed that weaning appeared to have stabilized at this average age. While it is evident that an appreciable number of herds are obtaining very satisfactory results from weaning at an even earlier age, this cannot be generally recommended.

One officer in southern Queensland conducted on-farm performance testing of boars and gilts on selected properties as part of an industry research project. A total of 1 356 boars and 2 060 gilts were tested on 7 properties. Similar work was carried out by an officer in North Queensland, but on a more modest scale.

Comprehensive advice on all aspects of nutrition continued as an important feature of district work. This was supported by specialist assistance from husbandry officers, including the publication of a revised edition of a 40-page advisory leaflet, 'Feeding Pigs', the computer formulation of least cost diets, and the commencement of a project at Biloela Research Station.

One more pig reared per sow per year means better use of farrowing accommodation and more profit.

Five schools for pig producers were held in various parts of the State, organised in conjunction with producer and other organisations, and officers continued to conduct discussions and other group meetings.

With the active assistance of the Branch engineer, all officers provided considerable advice on the design and construction of buildings and equipment for pigs. This ranged from planning complete units to assistance with the development of equipment to heat treat soybeans on the farm.

Advice on various aspects of the treatment and use of effluent was given to both producers and local authorities. A survey on existing methods of treatment and disposal was conducted with the assistance of funds provided by the industry.

Officers of the Pig Section concluded the Queensland share of a survey of pig carcass measurements at selected abattoirs throughout Australia. This work involved measurements on some 4 800 pigs in three metropolitan abattoirs. Results are awaited from New South Wales, the State co-ordinating this work.

Judging at some 30 carcass competitions held in various centres was conducted by officers of the section at the request of show societies. On various other occasions, carcasses were appraised as part of stock improvement programmes.

In North Queensland, a group of 8 producers continued to co-operate with the local adviser in a continuous recording scheme aimed at establishing the margin over feed costs. From the information recorded it is of interest that despite an increase in feed costs the efficiency of conversion of feed into meat declined. This reflects the difficulty experienced by the industry in obtaining suitable high quality feedstuffs.

In other districts, officers have introduced similar recording methods, in co-operation with officers of Economic Services Branch, aimed at monitoring the financial situation on the units concerned. While on a small scale, these schemes provide much useful data on which to base more general advice on the profitability of intensive pig production.

Last year it was reported that, in sorghum-soybean meal diets, 50% of the soybean meal could be replaced with sufficient lysine to make the diets lysine equivalent without affecting production. In similar experiments conducted with wheat up to 66% of the soybean meal was replaced with lysine without affecting production.

The biological evaluation of peanut meal was made in tests similar to those described in previous reports for other protein concentrates. Peanut meal was 29% inferior to the reference soybean meal but when it was balanced with lysine and methionine it was only 7·5% inferior.

The usual practice in commercial piggeries is to severely restrict feed allowance particularly in the finisher phase after 50 kg liveweight in order to reduce superficial fat deposition and obtain the necessary factory gradings to avoid economic penalties. Results from performance tests indicate that farmers are too severely restricting. A trial with barrows and gilts from the Hermitage Research Station which were fed up to 2·2 kg/head/day up to 50 kg and then 3·0 kg/head/day up to 85 kg liveweight with improvement in average daily gain and feed conversion ration and no major change in carcass parameters or factory grading indicated that farmers could increase their level of feeding.

The selection experiment at the Hermitage Research Station progressed through two generations of selection. Improvement in economic traits is being made. The degree of inbreeding remains very low. Boars from this experiment are in demand by the industry.

At the Central Boar Performance Test Station, 79 Large White and 35 Landrace boars were tested until the floods temporarily closed the station. Of these, 36 and 20 respectively were approved. Of the boars tested, 49 were sons of previously tested boars and 18 of these were approved. Eight sons of imported boars were tested and six of these were approved.

Experiments were undertaken by the Biochemical Laboratory to elucidate and quantify the residue potential of brood sows that had access to grain treated with the bunticide HCB before the product was prohibited as a seed dressing. Experimental sows passed HCB to their progeny during both gestation and lactation. The high residues present at weaning were diluted by subsequent growth but remained at or above recognised tolerance levels in baconers.

Salmonella groups E–C were isolated from an outbreak of salmonellosis on a Coomera piggery where over 50 pigs had died over a 6–month period. Group B salmonella, resistant to cloxacillin, were the cause of scouring in 3–month-old piglets in Toowoomba.

Erysipelas caused the loss of 16 store pigs introduced on a Charters Towers piggery, while cardiac erysipelas was confirmed in young pigs in the Biarra district. The disease was also confirmed in a couple of calves in the Maryborough Division.

Battey or atypical TB was diagnosed at meatworks in pigs originating from Landsborough, Gladstone, Moggill and Laidley. An intensive piggery at Laidley revealed an infection rate of 60% in 280 pigs slaughtered. Sanitation and husbandry were good and floor feeding was not practised. Meaningful results were not attained using mammalian and Battey tuberculin tests. Newly born pigs were housed with sows in pens containing sawdust and it is considered that this may have provided the primary source of infection. Its use in the future is to be discontinued. As well, a breeding management plan is being developed by which it is hoped the disease will be eliminated.

Seventy-five percent of foetuses in 13 litters on a Tolga piggery were mummified at birth. All sows involved were serologically negative for brucellosis, leptospirosis and erysipelas, but sera from these sows gave a high titre to Parvovirus. Professor R. Johnston, of the James Cook Veterinary School, suggested that Parvovirus invasion of the pregnant uterus in the presence of a fungal toxin may have been the cause of the problem.

Twenty-five pigs died and 20 were sick in a piggery at Daymar, and the post mortem symptoms were those of profuse subcutaneous and intramuscular haemorrhage. Similar losses in growers occurred in an Atherton piggery. The remaining animals in the age group were treated with vitamin K and no further losses occurred. The investigating officer stated that the feed had been stored considerably longer than was normally the practice and he thought the likely cause of the syndrome was fungal contamination of the feed. Other diseases of importance diagnosed included swine dysentery, oedema disease and *E. coli* scours.

Structural changes in the pig industry are being studied with financial assistance from the Australian Pig Industry Research Committee. Particular attention is being given to large-scale piggeries in order to complement a re-survey of this group contemplated by the Bureau of Agricultural Economics. Field interviewing commenced in March 1974, and data had been obtained from 42 enterprises up to the end of June. The break-up by piggery size was as follows: 79 to 90 sows 14, 100 to 144 sows 19, 150 to 199 sows 6, 200 and over 3.

A great deal of information has been obtained which will enable a better understanding of industry management practices and how these relate to profitability.

POULTRY

Methods of reducing heat stress in poultry assumed prime importance following the disastrous effects of heat wave conditions experienced in previous years. The proper installation of fogging systems and painting of roofs were methods widely used.

Observations on the quality of chickens produced at a leading hatchery in Queensland continued, and the relationship between chicken quality and hygiene assessments as indicated by fluff counts was further investigated. No clear-cut relationship was observed but this is thought to be due to the lack of objective methods for assessing chick quality. In conjunction with Pathology Branch, the programme of hygiene assessment of hatcheries based on fluff counts was continued. Unsatisfactory ratings were followed up at the hatchery level and recommendations made for improvement.

Egg pulp must be prepared hygienically. A Poultry Section officer examines an egg pulp manufacturing plant with the farm supervisor and explains hygiene requirements.

Poultry Section staff continued to investigate brooding area design and management using the automatic temperature recording unit, hot wire anemometer and multi gas detector.

Certain recommendations have been made by companies concerning restricted feeding methods for rearing pullet replacements. One of these methods was investigated in a flock by recording body weight at regular intervals, deaths and egg production. Deaths were not as high as the company had predicted. However, body weight during rearing parallelled company predictions.

It is intended to examine the performance of other flocks under different restriction regimes to obtain more field data on body weights and important economic factors such as egg number and size, feed use, and deaths.

A few producers considered spiders to be a problem through webs reducing ventilation, harbouring dust, soiling eggs and reducing the available light in the sheds. It was also stated that egg collectors were reluctant to collect eggs in heavily infested sheds. Since the banning of the use of dieldrin where livestock are involved, some farmers complained that spider populations were increasing. Observations were made in New South Wales by a drug company that when using Iodofen Phos at 4%, a residual insecticide for fly and mosquito control, there was a marked depopulation of spiders in the treated area. Trials on various farms yielded early results showing that this treatment was moderately successful.

Investigations were continued using light meters to test the efficiency of artificial lighting to various poultry sheds. Recommendations were made following these investigations to improve lighting techniques.

The branch engineer, working in conjunction with Poultry Section officers investigated shed design and equipment functions to the benefit of poultry producers.

Before the introduction of the Demand/Supply Management Scheme, a comprehensive survey was undertaken to study its likely effects on farm flock and production.

It was noted that one-third of Queensland layer replacement stock was purchased as started pullets. It is anticipated that fewer started pullets will be purchased and more 'on-farm' rearing of replacements will occur as has happened in West Australia where D.S.M. has been in operation for three years.

Replacement pullet rearing programmes adopted by growers will have an influence on their ability to maintain their quota numbers at a reasonable level. An extension programme highlights the necessity for forward planning of pullet replacement programmes to maintain hen quota numbers within the set limits as laid down under the Hen Quota Act.

Two accounting schemes are being conducted on a joint basis by the Poultry Section and Economic Services Branch.

The Pullet Rearing Scheme commenced in 1969 at the request of a number of producers who desired information on rearing costs as a means of assessing their own efficiency in rearing successive batches of chickens. These producers are able to compare their costs with the average of the costs of the other producers also rearing pullets. An overall improvement in efficiency has been observed.

The Layer Accounting Scheme also aims to improve the efficiency of egg producers. Co-operating producers supply information on egg sales, feed use, and deaths. Such reports allow producers to keep a check on the profitability of their laying enterprise and allow comparisons of individual results with the average of the group. To make interstate comparisons, a meeting of Poultry Section and Economic Services Branch officers was held with officers concerned with poultry accounting in New South Wales and Victoria.

The 1973 Poultry Information Exchange was organised under the auspices of the Poultry Advisory Board and planned and conducted by a joint D.P.I./Industry Committee.

This year's Exchange, held at Broadbeach International Hotel on 31 October and 1 November, was the fourth conducted since 1969. The Exchange was shortened to two days, and the change was a popular one. The attendance figure was 170—which was 40 more than the previous year. Among those attending were producers, production managers, servicemen, Egg Board representatives and members of universities and colleges of advanced education.

The symposium on planning to meet the future needs of the poultry industry in Queensland was one of the highlights of the Exchange. Speakers dealt with the problems that rapid urbanisation of near city areas are raising for the egg and poultry meat industries. Rapid escalation of land values has resulted in many existing farms becoming too valuable as real estate to be used for farming. As a result, new farms will have to be established farther away from the cities. Local authorities are taking a stronger line on pollution control measures. and poultry farms are now coming under closer scrutiny in this respect.

Another important topic considered was the fatty liver syndrome. Departmental research showed that many laying flocks were not using feed efficiently.

A Poultry Section staff workshop was conducted over four days from 30 October. The first two days' programme was run in conjunction with the Poultry Information Exchange at Broadbeach. The remaining two days were spent in Brisbane dealing with three major topics—extension, nutrition and economics.

The Egg Marketing Board Bulletin provided the main avenue for dissemination of poultry information to producers and the Poultry Advisory Board expressed strong support for the use of this medium for publication of extension material.

Two officers attended the 1974 Australasian Poultry Science Convention at Hobart and presented papers.

The Amendments to the Poultry Industry Acts which were passed in 1973 to meet changes in administration of the Acts did not cover a number of other sections of the Acts which required updating. It is proposed that a comprehensive amending bill will be presented to Parliament in the coming year.

A significant number of birds in commercial laying flocks in Queensland are excessively fat. Such birds have been shown to waste feed, lay fewer eggs (none of which are defective) and be more prone to death when subjected to stress than their leaner flock mates. Experiments at the Poultry Section, Animal Husbandary Research Farm, Rocklea, examined ways of reducing the tendency of these birds to obesity. These experiments examined two types of feed restriction, (i) limiting the amount of the amino acid, lysine, in the diet and (ii) physically limiting the birds' total feed intake. The latter procedure was shown to have advantages over the former and procedures involving denying the time birds have access to feed were developed which give predictable feed intake levels.

Restricting intake in the first 6 weeks of the birds' life was shown to offer no advantages; rather, age at lifting restriction proved to be of greater importance and there is strong evidence that restriction should be extended into the laying period. The ideal system of management may be to start the pullets on an adequate level of nitrition, apply a moderate restriction for the remainder of the birds' growing period to sexual maturity and then impose a mild restriction through the birds' laying life.

Data on the amino acid content of protein sources are important to the pig and poultry industries. Data are lacking on Australian feedstuffs. The amino acid content of five varieties of soybean grown at each of six localities was determined by the Biochemical Laboratory. The soybean varieties examined were: Wills, Semstar, Hill, Davis and Bragg. While the crude protein content of each variety grown at any one location was very similar, the crude protein of the varieties at different locations varied considerably. The average crude protein content of the varieties varied from 32·1 to 42·5% on a dry matter basis for full fat beans, and 42·5 to 52·8% on a dry matter basis for heat treated solvent extracted beans.

Only heat treated solvent extracted beans as fed to chickens was examined for amino acid content. From the results, location effects were highly significant when the amino acids were expressed on a percent of sample basis but tended to lose significance when expressed on a gm/16 gm N basis.

This means that for a given amino acid expressed on a gm/16 gm N basis over the above range of contents the result is fairly constant. For example, lysine ranged only from 5·88 to 6·45, threonine ranged from 3·67 to 4·08, and methionine 1·19 to 1·34.

Varietal effects were not highly significant.

Although Marek's disease is still the most important disease affecting poultry in Queensland, some encouraging vaccination trials are being carried out using turkey herpes virus, which gives cross immunity against this disease.

These was an increasing incidence of mycoplasmosis among broiler flocks of an *E. coli septicaemia* characterised by moist rales, pericarditis and perihepatitis. Many of these birds gave strong serological tests to *M. gallisepticum*. This organism was also associated with the loss of 150 eight-month-old birds, and sickness in another 300 in a Toowoomba flock. The impression has been formed that a greater incidence of mycoplasmosis occurs among birds raised in hot air breeding rooms where, for reasons of economy, the ventilation rate is reduced and the stocking rate increased during the first 2 to 3 weeks of life.

No iolations of *S. pullorum* were recorded during the year. This is a great advance over the situation which existed several years ago. However, there were a number of isolations of group *B. Salmonellas* from sick birds.

Officers of Economic Services Branch have been very much involved, together with officers of Pig and Poultry Branch, in the development and application of recording and accounting schemes for the industry. Discussions were held with officers of the Departments of Agriculture in New South Wales and Victoria to arrive at a common approach to poultry accounting and so facilitate wider comparison of flock performance. An adaptation of the N.S.W. computer system for analysing layer flocks is in readiness for implementation in Queensland in the near future.

A detailed study has been made of production costs associated with broiler production to identify improvements in cost and price factors and in technology—feed conversion and weight gains.

BEEKEEPING

An initial honey flora inventory was completed of the Cooktown region, and the information awaits compilation for publication. The area will develop for migratory beekeeping as roads continue to open.

An inventory of flora potential of coastal Central Queensland and hinterland continues. Arising from the survey, commercial beekeepers were able to work narrow-leaf ironbark (*Eucalyptus crebra*) in the Upper Burnett district, and about 3,000 colonies were moved to the area with significant production of choice honey.

Field days were organized at Beaudesert (attendance 207), Inala (212), Toowoomba (300), Maryborough (243) as well as Discussion Groups in Brisbane, Warwick, Toowoomba, Caboolture, Maryborough, Rockhampton and Atherton. An Annual Beekeeping School was conducted in conjunction with the Queensland Agricultural College, Lawes.

An artificially inseminated queenbee being introduced into a nucleus at Beaudesert by queenbreeder Mr. N. V. Rice (l) and Professor G. Woyke, of Poland (r).

Mechanical bee blower being tested in apiary at Yatala.

A new bee blower was assembled and field tested and was displayed at field days. This is designed to mechanise a presently unsatisfactory method of removing honey-combs from the beehive.

A Department apiary at Warwick is maintained for research (honeybee longevity, pollination) and extension and is being used for these purposes.

A new beekeeping field officer has been appointed and is currently receiving in-service training in Brisbane for ultimate employment on extension.

Serious outbreaks of American foulbrood (*Bacillus larvae* White) occurred on the Darling Downs. One hundred and twenty hives in two apiaries comprising 1 300 hives were destroyed by burning. A further 297 hives in 16 apiaries were also inspected.

Due to channel country flooding, yapunyah, *Eucalyptus ochrophloia,* in the Paroo district has produced much honey. This area has developed as a major beekeeping district.

A visit was made to Queensland by Professor G. Woyke, University of Warsaw, Poland, a honeybee geneticist, who demonstrated his improved technique of artificially inseminating queen honeybees.

Mr. C. Roff, Chief Adviser in Apiculture, was presented with life membership in the Amateur Beekeeping Society of South-eastern Queensland in recognition of his role as a founder and for continued service and support.

MEAT INSPECTION

Inspection of stock and poultry slaughtered for domestic consumption, both from the viewpoint of disease and to ensure that as high a standard of hygiene as possible is maintained during processing was, of course, the main activity of Slaughtering and Meat Inspection Branch. In addition, regular structure and hygiene inspections were undertaken at all premises licensed under the Meat Industry Act and the regulations made under this Act.

Grading and classification of carcasses was carried out at meatworks where full time inspection was provided. Within the realm of meat quality, the Branch promoted tender-stretched meat, investigations into beef carcass parameters and their influence on prices at Cannon Hill, carcass appraisals and bruising trials.

Disease recording at meatworks continued, with emphasis on tuberculosis and brucellosis. Monitoring of bovine lungs for bovine contagious pleuropneumonia continued. Trials took place to check results obtained from the Rose Bengal plate testing for brucellosis at meatworks against laboratory results.

Policing of franchise provisions of the Meat Industry Act in relation to abattoir areas revealed a number of breaches which were referred to the appropriate abattoir boards for their consideration.

The construction of the new Metropolitan Public Abattoir at Cannon Hill progressed satisfactorily, although delay in completion by the anticipated time, March, 1975, is expected, due to labour and material shortages.

Improvements are continually being undertaken at practically all abattoirs, dictated in most instances by overseas requirements.

Considerable industrial unrest occurred at many of the large export meatworks causing disruption and interference with normal operations. Slaughtering procedures have been generally satisfactory.

After the Meat Industry Regulations 1973 came into operation on 1 January, 1974, inspectors visited licensees of slaughter-houses in their respective areas to advise them concerning acceptable ways of complying with requirements. However, licensees are being advised that it is their responsibility to place proposals, as a planned programme of improvement, before the Queensland Meat Industry Authority for its consideration. If licensees consider that a certain requirement is unreasonable, impracticable or that special circumstances apply, they are being advised to include these in their proposal to the Authority. The Queensland Meat Industry Authority, as the licensing body, has the final decision. Licensees were required to submit a programme for the consideration of the Authority by 30 June, 1974.

A common sense application of new requirements is being undertaken, bearing in mind location in regard to providing an essential service, where every endeavour is being made to adapt existing facilities with the minimum of expenditure. However, a somewhat harder approach is being undertaken where unsatisfactory facilities exist in closely settled areas where there are readily available alternative slaughtering facilities of high standard.

Advisory plans for each class of slaughter-house and a small abattoir have been drawn up and these may be purchased from the Authority by anyone desiring to build new premises.

With the co-operation of the Department of Health and Local Authority health inspectors, further samples of water used in the dressing of carcasses at country slaughter-houses, poultry slaughter-houses and from some butchers' shops were submitted for microbiological analysis.

Commonwealth and State staff worked together harmoniously to inspect all meat processed at those export meatworks where State inspectors are located. Commonwealth inspectors undertook the inspection of meat for domestic consumption at abattoirs where no State officers are stationed.

In accordance with the provisions of amended legislation (Section 102 of the *Meat Industry Act* 1965–1973) action was taken regarding the certification of interstate premises supplying meat into Queensland.

Certification was issued, on application, to those premises which have an export registration with approval to send product to U.S.A. In all other instances, inspection has been requested. The Director carried out inspections in northern New South Wales, Sydney and Victoria, inspecting 23 premises.

Inspection revealed grossly unsatisfactory standards, in comparison with prescribed standards operative in Queensland —by reason of structural deficiencies, procedures for handling of edible product, and sanitation. Certification was refused to 15 premises, one of which was later certified.

The Queensland Meat Industry Authority, under provisions it is empowered with, gave consent to six of these premises to continue to send products into Queensland, subject to their compliance being expected by September.

It is considered that the action undertaken has proven to be fully justified.

Additionally inspection of introduced meats is required on entry into Queensland. This now includes prescribed meats (smallgoods, bacon, etc.) whereas previously only fresh (chilled or frozen) meat was subject to inspection. A fee is charged for inspection of prescribed meats—approximately $900 for the month of May.

The main emphasis in the field of butchers' shops and smallgoods establishments has been insistence on high standards of construction and equipment in new premises. Detailed plans are submitted for approval before construction commences. Excellent co-operation has been forthcoming and some very high standard premises have been constructed, mainly associated with supermarkets. As a result of competition from high standard newly constructed shops, the butcher in the old fashioned premises is finding it very hard to compete. This type of shop is gradually being eliminated.

The requirement in the new legislation that the use of sawdust be prohibited in butchers' shops aroused some controversy. A meeting was held with the Meat and Allied Trades' Federation to explain the reasons for this action. Only a small number of butchers raised objections, mainly on the grounds that the removal of sawdust would make the floor slippery and produce working hazards. Inquiries are being made into methods of floor preparation and treatment to overcome this objection. A survey disclosed, however, that over the State more than 80% of butchers no longer use sawdust. In premises where a hazard is considered to exist, the use of sawdust has been permitted until the licensee can overcome his problem.

Weight gain tests were carried out during the year at the larger poultry slaughtering establishments using spin chilling equipment. On one occasion the legal limit was exceeded and a warning letter issued. However, a repeat test recorded a satisfactory result.

Licensees of poultry slaughter-houses are required to submit a programme before 30 June, 1974, to the Queensland Meat Industry Authority towards the implementation of the new legislation. A common sense approach is used when inspectors discuss the requirements with licensees. Each case is considered individually and if special circumstances exist licensees are advised to include these when they submit their proposals to the Authority.

The number of licensed poultry slaughter-houses has now decreased to 80, a loss of 7.

During the latter months of 1973, a large number of operators at the Metropolitan Public Abattoir withdrew from the voluntary "blue ribbon" beef grading scheme. As a result, the percentage of carcasses offered for grading fell from nearly 100% to about 20%. Other centres where grading is conducted were not affected. Three of these operators requested that their carcasses be not classified.

This action was a great disappointment as it was felt that the grading and classification scheme was a protection for the consumer.

Since then the grading scheme has been reviewed, operators have been consulted concerning possible modifications to the scheme, and firm recommendations have now been made.

It has also been recommended that a voluntary scheme of classifying beef carcasses into different fatness categories be implemented on a voluntary basis.

A decision on these recommendations is awaited.

Branch officers have attended meetings and given talks on meat quality to consumer groups at Rockhampton, Gympie, Ipswich and Brisbane. Similar talks at field days for producers have been given at Roma, Oakey, Gatton, Emerald and Biloela. Meetings of butchers have been attended and addressed in Townsville, Mareeba, Rockhampton and Brisbane.

A mobile meat demonstration unit has been provided by the Australian Meat Board for meat promotion in Central Queensland. Branch officers are active on the committee which controls this and co-operated with local butchers in its use at the Rockhampton Carnival in June.

Officers noted an increase in the use of textured vegetable protein (T.V.P.) products as meat extenders in smallgoods. As yet it has not been possible to quantify this increase. It is apparently related to high meat prices, lower T.V.P. prices and greater availability of T.V.P. products.

During the year the Branch became increasingly active in tuberculosis and brucellosis eradication duties in meatworks throughout Queensland. For the first time TB/Brucellosis officers were appointed to meatworks to carry out collection of blood samples, disease specimens, trace affected cattle to properties of origin, generally up grade disease recording methods and test bloods using the Rose Bengal Plate Test when required.

Since the appointment of TB/Brucellosis officers to meatworks (in some cases not previously staffed by State officers) there has been a big improvement in samples coming forward for laboratory diagnosis. Information to enable traceback to the property of origin has also been much more reliable. This applies in particular to affected cattle ex saleyards.

Pig manure ponds, correctly built and managed, help to preserve the environment.

III. Dairy Research and Extension

The dairying industry is serviced in one way or another by most branches in all divisions of the Department.

The three branches of the Division of Dairying (Dairy Cattle Husbandry, Field Services, and Dairy Research) are concerned specifically with feeding and herd management, herd recording, artificial insemination, the hygienic production, handling and manufacture of milk and milk products, and utilization research. The Agriculture, Agricultural Chemical Laboratory, Entomology, Plant Pathology and Botany Branches are involved in pasture and fodder matters. The Veterinary Services and Pathology Branches cover animal health problems. Marketing Services, Economic Services, Standards, and Information and Extension Training Branches also have responsibilities to the dairying industry.

FIELD SERVICES

The dairy industry continues to use the services of Dairy Field Services Branch staff in the areas of dairy building, milking machines and equipment, milking methods, milk quality control, dairy cattle feeding and management, herd improvement, product processing and supervision of milk vending and licensing.

Farm visits numbering 17 896 were made during the year. Of these, 8 025 were to advise with improvements to buildings, equipment and bulk milk vat installations, to test milking machines, and in connection with general farm activities. A further 3 220 visits were made specifically in respect to quality control. As an indication of the growing number of requests from farmers for advice on feeding and herd management, 7 775 farm visits were made for this purpose. In addition, there were a large number of office and telephone contacts.

Specialists advisory staff undertook approximately 1 367 surveys/visits to processing plants.

At the request of farmers, 841 milking machines were examined for efficient operation, and faults notified for attention. Although this service has not been fully used by farmers in the past, field staff report an increasing number of requests since the start of the mastitis cell count programme.

Servicing the Dairy Pasture Subsidy Scheme continues to be an important aspect of officers' duties.

The supervision of milk distribution agencies, retail milk vendors and the control of shop vending licences placed a heavy commitment on field officers. This work, however, does ensure that satisfactory standards are maintained.

To accommodate changes in dairy farm density as a consequence of decreasing numbers, the branch offices at Beenleigh and Chinchilla were closed and the areas incorporated with adjacent centres.

In the conduct of extension programmes, close liaison and consultation is maintained with the industry through several dairy extension advisory committees and district committees. This liaison was strengthened during the year by co-opting representation from dairy companies and other interested bodies. The important role played by these committees is to highlight district problems and set priorities. Some committees are more active in this role than others.

Considerable time and effort was directed towards the planning and implementation of the mastitis cell count programme. This project is of major importance to the industry in view of the financial loss resulting from clinical and sub-clinical mastitis.

The monthly testing programme embraces 3 300 herds supplying 26 processing centres, with progressive results being returned to suppliers.

Overseas and interstate workers have reported several estimates of production loss due to sub-clinical mastitis. With the aim of establishing an estimate under Queensland conditions, a survey was conducted to compare average cell count of herd milk with actual production. This survey involved figures for 1 092 herds over the 1972–73 year. The results are shown:

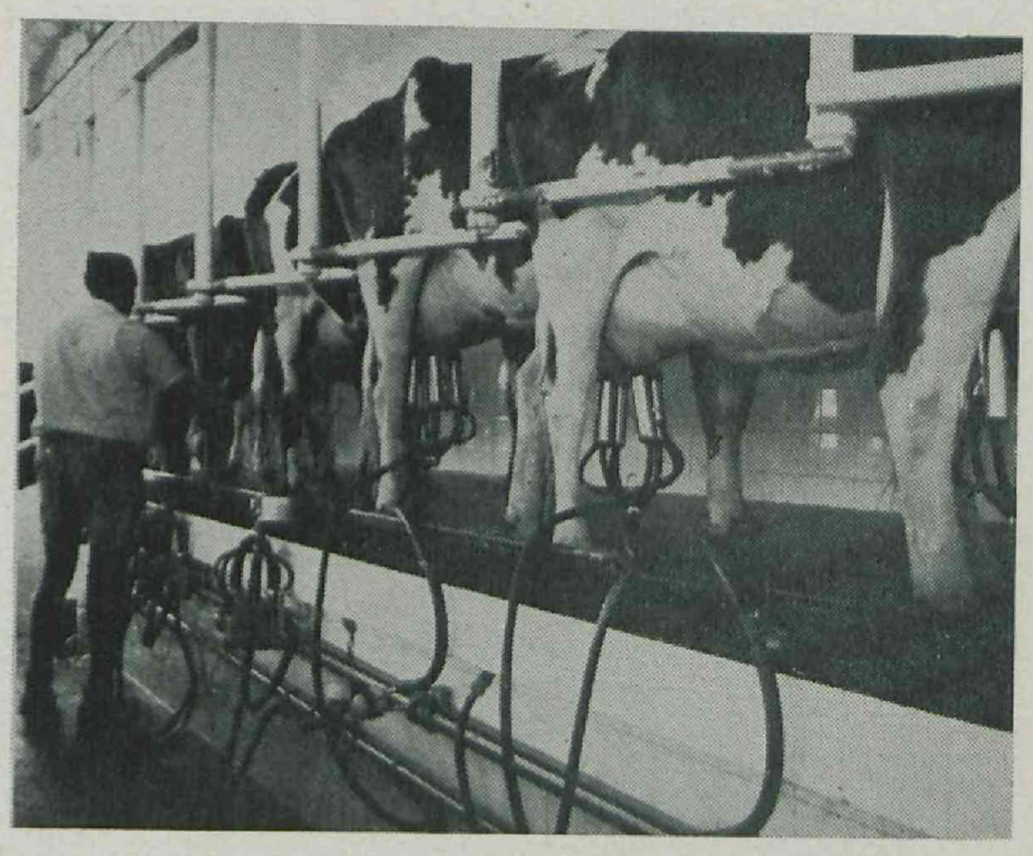
Percentage difference in production compared with the base < 10 figure is shown in brackets.

The production loss revealed is comparable with that found by other countries. A reduction of losses due to sub-clinical mastitis by even half would constitute a considerable saving to the industry.

In support of the extension programmes an investigation into the effectiveness, under commercial conditions, of recommended control practices is being undertaken. This investigation involves 11 herds in South-east Queensland.

In co-operation with officers of the Dairy Cattle Husbandry Branch, field officers increased their activity in A.I. and herd improvement. Officers were provided with up-to-date information on the bulls at the Wacol A.I. Centre and imported semen. Close contact is being maintained with district A.I. services and herd improvement is a prominent subject discussed during farm visits.

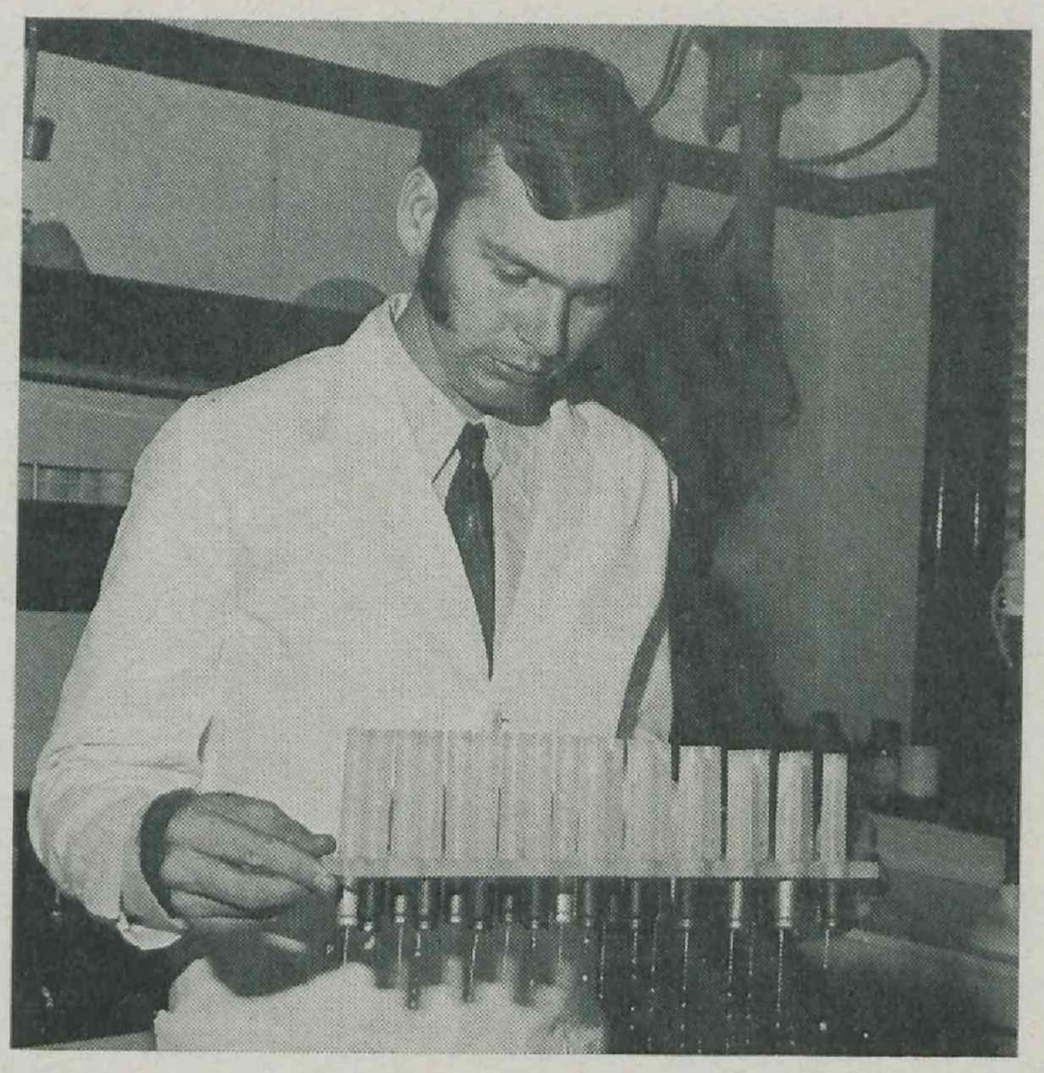
The main feature of the 1973–74 programme was a show exhibit incorporating background material with a display of A.I. progeny. By the end of the 1974 show circuit, this exhibit will have been displayed in the majority of dairying districts. Reports show that it created considerable interest and awareness resulting in a number of new members joining A.I. groups. Field staff also report that most dairy areas have an A.I. service. In the more densely populated areas, over 50% of milk producers use A.I. to some degree; however the overall State use is only about 10%.



Modern dairy buildings ensure top quality milk supplies to the public.

MILK PRODUCTION PER COW (kg)

Region	W.M.T. < 10	10–14	15–19	> 19
Herd Recording	2 975	2 818 (− 5·3%)	2 746 (− 7·6%)	..
Darling Downs	3 203	2 874 (−10·3%)	2 677 (−16·4%)	2 236 (−30·2%)
West Moreton	2 325	2 152 (− 7·4%)	1 987 (−14·6%)	2 013 (−13·4%)
State Base—Line Survey	2 295	2 175 (− 5·2%)	2 123 (− 7·4%)	2 238 (− 2·4%)
Wide Bay	1 762	1 788 (+ 1·3%)	1 607 (− 9·1%)	1 242 (−29·9%)



A cell count determination on milk to identify problems of mastitis in Queensland dairy herds.

The application, by farmers, of the concept of feed-year-planning is one of the most important objectives of field staff. Over the past year, mass media and individual farm contact were the main activities in this programme. With increased production per farm, producers have been quick to seek the assistance of branch officers. As a consequence, one region reports an overall increase in individual farm production ranging from 13 to 24%. The shortage and high cost of grain and supplementary feeds influenced producers to seek more advice on pasture management.

The use of molasses as an energy substitute for grain and grain by-products is rapidly gaining acceptance. This occurred to such an extent that demand could exceed available molasses production. Field officers were able to use the results from the several research centres to good advantage.

As a basis for more formal programme planning, regional husbandry officers prepared a situation statement and analyses for their region. In addition they undertook a number of detailed farm case studies to support the regional statement. This material will be used for further planning.

Whole farm development demonstrations provided an excellent avenue for group extension activities in a situation where well-documented records and achievements are available.

This is the fourth year of the programme. Although it was necessary to end some demonstrations, good progress was made with those remaining. A demonstration in the South Burnett region reported a 200% increase in production over the 4-year period. In other regions, increases ranging from 30 to 40% were reported.

This programme proved of considerable value for Departmental teams in developing an advisory approach on a 'whole farm' basis. An evaluation of this programme will be undertaken in 1974–75.

Branch officers were active in fostering farmer discussion groups. Further discussion groups were established in the West Moreton, Darling Downs, South Burnett and East Moreton regions. In addition, small groups were formed for specific purposes, mainly in respect to nutrition and mastitis programmes.

On the Atherton Tableland, branch officers played a major role in two farm management schools presented for local farmers.

Factory advisory staff presented a one-week school for factory operatives on 'Quality Control' in conjunction with the Queensland Division of the Australian Institute of Dairy Factory Managers and Secretaries.

Several short refresher courses were conducted for bulk milk tanker drivers.

Data collection for the protein payment evaluation investigation was completed at the end of June. While this will be analysed and a report made to the industry it will be continued in one region for a second year.

The monitoring and investigation programme related to variation in solids-not-fat and freezing point of milk continued. Financial support for this project was received from the Australian Dairy Produce Board. It is expected the project will go on for at least another year. Information subsequently obtained will be of considerable value for herd nutrition programmes.

The information collected from the survey of 276 participants in the Marginal Dairy Farm Re-construction Scheme was analysed and results published during the year. At the time of the survey (early 1972) major farmer needs were suitable finance for stock and development. A supplementary financial support programme was introduced by the Government and provided support in these areas. In all cases farmers were happy to be participating. A subsequent re-survey is planned in 1975.

Surveys were initiated to assist research groups and commercial processors in the development and manufacture of new forms of dairy foods. A total of 911 respondents comprising school children, factory workers and shoppers were provided with banana fruit milk; 212 households (representing 783 consumers) were given savoury butter spreads, and a high protein snack was tested by a small group of households. This work will be expanded in the coming year with some support from the Australian Dairy Produce Board.

Considerable assistance was provided to the Oakey United Co-operative Association in the commercial manufacture of a savoury butterfat spread.

Close liaison is maintained with the Dairy Research Laboratory in this development work.

During 1973, the overall levels of pesticide residues in dairy products continued to decline. The results listed are based on Commonwealth analyses:

PERCENTAGE OF SAMPLES FOUND TO CONTAIN PESTICIDE RESIDUES ABOVE TOLERANCE

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

The persistent high level of ethion residues is a cause for concern in view of the necessity for tick control on dairy cattle.

A survey of approximately 130 producers and 20 associated parties to assess the effectiveness of the various extension methods used to reduce the pesticide levels in dairy produce was undertaken in April–June, 1974. Results are being analysed.

A serious incidence of lipase induced flavour defects in cheese from four processing plants occurred during the year. Initial indications are aged milk arising from low seasonal production and prolonged storage in bulk as the causal factor. The steam frothing test is being used as a factory screening procedure.

Considerable time was spent by various officers on joint Dairy and Marketing Branch surveys on future factory production trends, and amalgamation possibilities. Several amalgamation proposals were prepared during the year and an extensive report was furnished to the Commonwealth Government on re-organisation of the industry in Queensland with particular reference to the Wide Bay, North Coast, South Burnett areas.

BREEDING

Bull proving was integrated into the Herd Recording section with an officer to co-ordinate the field work. The 1973 mating season was particularly encouraging. Following a concentrated effort to enlist new co-operators, cow nominations by the close of the season were the highest ever attained. For the first time, five bulls were used in each breed during both the 1973 and 1974 seasons. The inclusion of semen from overseas, A.I. proven sires, and breed society nominated sires, along with sons of proven sires has made bull proving attractive despite the subsidy of $20 a heifer being no longer offered to co-operators.

The largest number of cows offered was in the Friesian breed and the smallest in Jerseys. It is difficult, and will become more so, to obtain Jersey cows for bull proving as the decline in numbers continues with the change from butterfat to whole-milk production. Numbers of cows mated to sires in the 1973 proving teams were: Friesian 1 751; A.I.S., 1 510; Jersey, 1 306.

The test results of the bulls used in the 1969 proving teams, based on the contemporary comparison performance of their heifer progeny, are available and the proven sires from these groups were listed.

The procedure used by the New Zealand Dairy Board for the assessment of heifers for type and performance abnormalities was adopted. This involves assessment by the co-operating farmers of factors such as temperament and ease of milking. These assessments are expected to be more reliable than those based on limited observation by a visiting officer.

Eight A.I.S. bulls were purchased for use in bull proving teams during the next three years, six Friesian bulls were purchased for use in the 1975 proving team, and five Jersey bulls were purchased to be used in the 1975 and 1976 bull proving teams.

Contract matings were arranged for the three breeds.

Details of cows recorded under the Pure Bred, Group and Alternate Production Recording Schemes for the herd recording year completed in 1973 were:

—	No. of Herds	No. of Cows	Average Milk Yield/Cow (kg)	Average Butterfat Test (%)	Average Butterfat Yield/Cow (kg)	Average Lactation Period (days)
Pure Bred	154	5 131	3 361	4·1	139	..
Group	708	38 886	2 632	4·1	107	264
Alternate	39	2 137	2 137	4·3	93	254

Herds recorded under these schemes again decreased, but the number of cows increased by 2 335. Average milk and fat yield per cow increased by 38% and 35% respectively over last year's levels in the Group Recording Scheme. In the Pure Bred Scheme over the last five years the number of cows recorded increased by 21%, and average milk and fat yield per cow increased by 11% and 7% respectively.

Production recording of goats continued in cases where it was possible to record does in conjunction with dairy herds in the same localities. It was not possible to record goat herds in the suburbs of Brisbane because of staff shortage, the small number of does per herd and the increased cost of herd recording. During the year, 23 does completed lactations with average production of 763 kg milk, 3·3% fat and 25·5 kg fat in 277 days.

As forecast last year, centralized testing is now in use in Southern Queensland. Pilot schemes in Beaudesert and the South Coast were begun in spring 1973, and approximately 8 000 samples per month are now being tested. Milk samples are forwarded to Newstead from herds in the Boonah, Lowood, Brisbane and Dayboro districts.

Assistance in transporting samples was willingly given by Dairy Factory Co-operatives and Pauls Ice Cream and Milk Limited. This assistance is gratefully acknowledged. Collection and transport procedures were developed to ensure that milk samples reached the laboratory in good condition during the summer months.

Complete conversion to centralized testing is planned during the coming year.

This will be possible when the new milk testing laboratory at Wacol becomes operational late in 1974. The facilities at Newstead do not provide good working conditions, and effective capacity at this site will soon be reached.

There are 102 bulls at the Wacol A.I. Centre which is far in excess of the pen accommodation available for effective handling of mature bulls. Attention should be given to improving drainage in the existing yards.

In February, a new price structure for Wacol semen was put into effect. This provides for classification of sires on the basis of their proof status, and for Queensland prices to apply to sales within Australia. Appropriate quantity discounts are allowed. The new classifications provided for semen price increases which were impossible to avoid as a rise in costs of providing the services could no longer be contained. The price rises have been well accepted and the system of discounting applauded. The price of liquid nitrogen was also increased to 40c per kg.

Wacol semen is used on approximately 16% of Queensland dairy cows—10% being inseminated with dairy and 6% with beef semen. This represents 82% of the Queensland market for dairy semen. The Centre also supplies approximately 44% of the beef semen used in the State.

Dairy semen sales fell by 24%, and sales from Departmental bulls declined by 11%. However, sales from privately owned bulls at the Centre increased by 39%. Increased use of proven bulls of both the A.I.S. and Friesian breeds reflected increasing attention by dairy farmers to improving the quality of stock.

Total semen sales were 95 254; 131 600 doses of semen were processed in 0·5 ml straws. Production of semen in 0·25 ml straws was again delayed by unavailability of materials; 905 collections were made which yielded 97 200 doses of semen which went into storage. At the same time 13 000 doses of unlicensed semen from field collections were processed.

At the end of May, 93 Departmental bulls, four steers and nine privately owned bulls were at the Centre; 38 bulls were culled for various reasons. Poor semen quality led to culling of 16, and a further 13 were the low ranking sires in progeny tests.

It was proposed last year that collections should cease in summer to reduce operating costs, utilise staff more effectively, and avoid the effects of summer sterility. During the October to March period, 294 collections were processed and of these 28·9% had to be discarded after freezing. In the April–September period, 311 collections were processed, of which 22·5% were discarded after freezing.

It is now felt that a complete close down is not feasible as there is a commitment to work privately owned bulls every week, and bull proving teams have to be worked during the December–February period.

It is proposed that collections will be increased by working four days a week in winter and two or three in summer.

Increased emphasis was placed on imported Canadian semen, and several new breeds of which semen became available from Britain. Semen is held on consignment from five major organizations. The latest addition is a substantial stock from Victorian Artificial Breeders. Semen from this source will correct some shortage in availability of sires at Wacol.

Pressure on available space in the Centre for accommodation of privately owned bulls continued but towards the end of the year showed signs of weakening. Since the start of the scheme in 1971, 26 privately owned bulls have been located at the Centre for varying periods. Of these, only three have been consistently successful as semen donors.

Eight bulls have been completely unusable, ranging from completely sterile to poor quality semen. Four bulls never came into production and the remaining 11 have fluctuated from poor to average producers. Age of the bull affects semen quality and it is recommended that preference be given to bulls of five to six years and bulls of over eight years not be admitted to the Centre. In addition, an examination for reproductive soundness should be a requisite before entry to the Centre.

Accommodation charge for bulls is now $50 a month which will just cover costs for this service.

In excess of 1 000 visitors were conducted through the Centre during the year.

Fifty-seven inseminators were trained at the Centre this year.

A $25 fee is charged for the A.I. Certificate examination, and the Wacol Training Course fee is $175.

Semen Export Centre at Redlands is now fully operational with 19 bulls, seven of which are in the introductory area. The breeds represented are A.I.S., Red Sindhi, Sahiwal and A.M.Z. Interest has been shown from the United States, Fiji, South East Asia, New Zealand and Trinidad.

Export sales of semen from both the Wacol and Redlands Centres amounted to 9 546 doses consigned to five countries. The majority was produced at Wacol for Malaysia and New Zealand, but exports from Redlands to the U.S.A. were commenced. Substantial consignments from Redlands to the United States are expected during the first full year of operation in 1974–75.

A chromosomal study of bulls at the A.I. Centre, Wacol, commenced in September 1973. Chromosome spreads from 80 bulls have been prepared for photography and further studies. Bos taurus, Bos indicus and cross bred cattle are being studied.

An outbreak of ephemeral fever at the Centre during October and November 1973 provided an opportunity for intensive study of the effects of this disease on bull fertility and its transmissability in semen. The results are being analysed.

A field evaluation of the 0·25 ml mini-straw confirmed overseas findings of no significant difference in conception rate compared to an 0·5 dose of semen.

NUTRITION

An experiment was conducted at Kairi Research Station to evaluate the usefulness of autumn-applied nitrogen on a grass-legume pasture to boost growth and provide standover feed for the dry spring weeks.

To date there is no appreciable difference in legume content of pastures due to nitrogen fertilizer. Response of grass to nitrogen at four stocking rates varied with the legume content of pastures. Heavily grazed plots, with a low content of legume, were more nitrogen-deficient than lightly stocked plots.

Nitrogen increased milk yield of cows at the very high stocking rate by 1·7 kg/cow/day. There was no response in milk yield by cows at the low stocking rates. Returns in 1973 were of the order of $72 a ha. The experiment will be repeated to confirm these results.

An experiment was conducted to compare strip and continuous grazing of a grass-legume pasture during the winter period. Associated trials have indicated that milk production of cows is limited once pasture yield falls below approximately 1 500/kg/ha. At no time in this experiment did strip grazed cows produce more than those that were continuously grazed. Cows grazing in the two systems had similar dry matter intakes, but strip grazed cows appeared to consume a diet of relatively lower digestibility.

The Australian Friesian Sahiwal breed development project is conducted at both the Ayr and Kairi Research Stations. At Kairi, the best 12 A.F.S. cows are being compared with the best 12 cows from the Department's Friesian herd. The aim is to list the milk production potential of both breeds at a high standard of feeding and husbandry.

Lactation performance to May 1974 was:

—	Days in Milk	Milk (kg)	Fat (kg)	Total Solids (kg)	Per cent. Fat	Per cent. S.N.F.
A.F.S.	149	2 161	93·7	283·9	4·34	8·80
Friesian	155	3 049	111·3	363·3	3·65	8·27
A.F.S. as per cent. of Friesian	..	70·8	84·1	78·0	..	..

A.F.S. cows produced less milk than Friesians but with a higher fat and S.N.F. percentage.

Forty-five A.F.S. heifers were evaluated for tick resistance at Ayr Research Station before mating in January 1974. Five Friesian heifers were included in the lists for comparison. In three separate evaluations (July, September and November) 35% to 45% of the A.F.S. heifers were more tick resistant resistant than any of the Friesians and 75% to 85% were more resistant than the average of the Friesians. This indicates a useful range in resistance which will enable effective selection for this character in the A.F.S. breeding programme. These animals will be milked at Ayr and the correlation between tick resistance and milk production examined.

Four bulls were born to top ranking A.F.S. cows at Kairi and will form the basis of the first bull proving group.

In the calf multiple suckling trials, despite very adverse climatic conditions during the whole of the rearing period, deaths were kept below 4%, and the incidence of scours was low. The trial was designed to evaluate two multiple suckling systems as compared with once daily bucket feeding using a milk replacer.

Satisfactory calves may be reared by either bucket feeding or multiple suckling techniques. However, initial rearing costs are slightly higher for multiple suckled calves when costs are based on manufactured milk prices. Offsetting this is a reduction in labour and an improvement in calf health with slightly better growth rates.

From calf milk intake figures, it would appear that the suckled cows produce more milk because of the stimulus by the calves. It is possible, therefore, to have 5 calves suckling the cows—3 in the morning and 2 in the afternoon.

Research continued at Biloela into multiple suckling with the aim of providing dairy farmers with a profitable complementary enterprise.

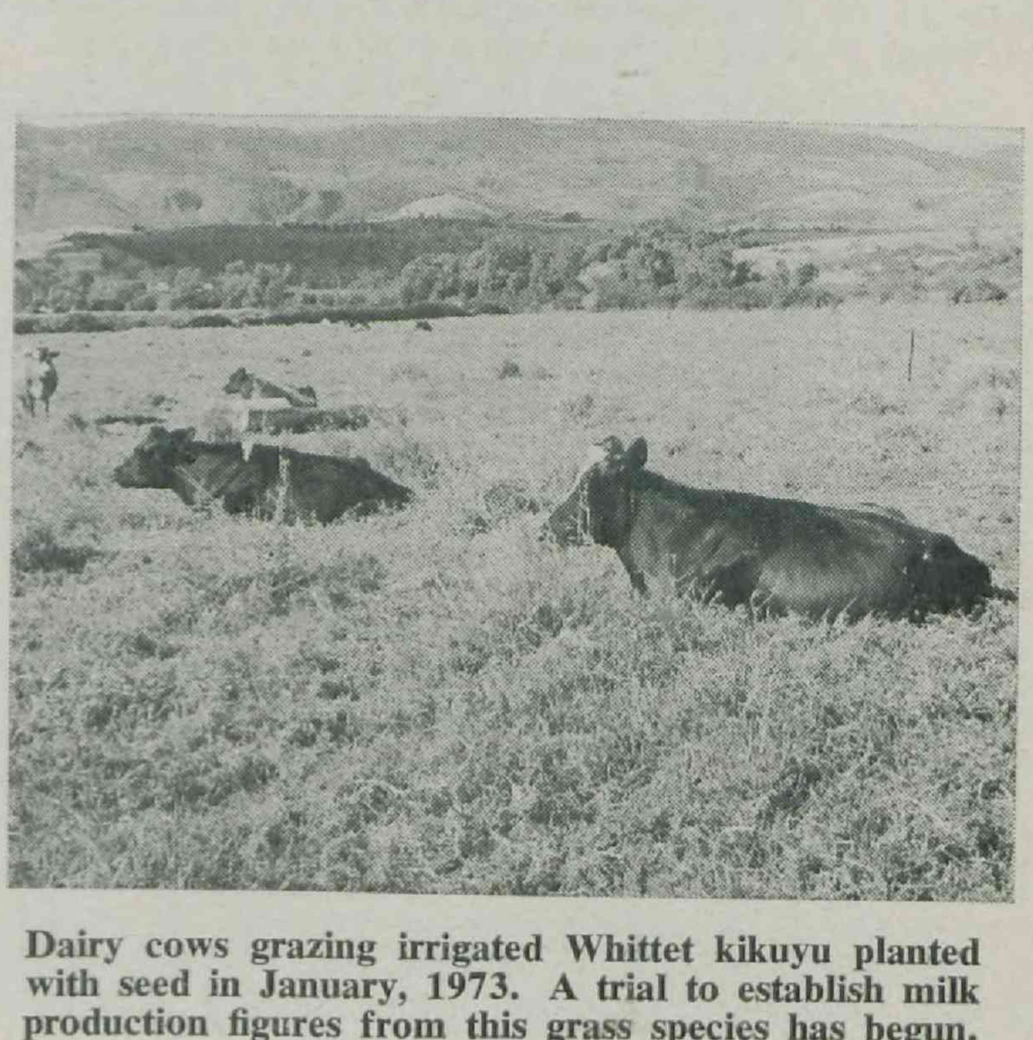
Up to 9 calves per lactation were reared very successfully in sequential free access suckling groups. It is intended next year to experiment with 14 calves per lactation at an earlier weaning age. Cows can be switched from suckling to machine milking and visa versa several times during lactation without detriment to their performance in either use.

This year vasectomised bulls were used to detect cows in oestrus and overcome apparent anoestrus problem associated with free suckling. Using this method, an 86% confirmed pregnancy rate was achieved from a 72–day insemination period. This appears to be an important breakthrough, but it requires testing under lower levels of nutrition than have been used in this experiment.

Calf performance was slightly better this year with an average gain of 0·88 kg/head/day. In addition, a stimulus to post suckling milk yield was noted from suckling early in lactation.

The research programme at Ayr is designed to overcome the problems for efficient dairy production of the marked seasonality of production, low percentage use, low digestibility and low intake of tropical pastures. Both pasture and animal investigations are undertaken. In the pasture field, emphasis is on evaluating the effect of N fertilizer on grass production under an irrigation regime. The major species under investigation is pangola grass. At Ayr this has shown yields up to 43 000kg/ha when cut at six weekly intervals and fertilized with 1 344 kg N/ha/year.

Irrigated pangola grass planted in December 1972 at Toogoolawah illustrating good establishment of this species in S.E. Queensland. Milk production figures from this species are being recorded.



Dairy cows grazing irrigated Whittet kikuyu planted with seed in January, 1973. A trial to establish milk production figures from this grass species has begun.

The most surprising feature of last year's grass production was the high level of winter production at the highest N fertilizer level.

The search for increased winter feed also includes sod seeding studies. Tropical crops, such as the grazing sorghums, and temperate species, such as rye and clover, are being planted in rotovated pangola grass.

Associated with the agronomic studies, digestibility observations are also undertaken.

Milk production from Jersey and Friesian cows grazing irrigated pangola grass fertilized with 672 kg N/ha, is currently in the fourth and final lactation. Results are consistent with previous observations that a high stocking rate and supplimentation are necessary to obtain high milk production from tropical pastures. Production of 24 486 kg milk and 932 kg fat a hectare was achieved. Most farmers would agree that this is remarkably good performance and it was obtained with a simple supplement equivalent to 3·8 kg molasses a head daily, (plus 1% urea and ½% mon-ammonium phosphate) put out once a week in the paddock in an open trough. The effect of the supplement is obvious at all stages of lactation.

A preliminary programme is underway feeding protected fat to male Sahiwal-Friesian and Jersey calves to ascertain the effect of the supplement in changing the composition of carcass fat and to examine the possibility of improving growth rates with this supplement.

Considerable emphasis is also placed on investigations with growing stock. The aim of this work is to provide a system of rearing that will ensure healthy replacement heifers capable of calving at the desired age.

From 1971 to 1974, three trials have been undertaken to study the influence of level of milk feeding, temperature of milk, weaning weight, and breed of animal on the rate and efficiency of preweaning growth of calves.

Results suggest that one could expect calves reared on milk fed at the rate of 10% of liveweight daily to approximately 60 kg to gain between 0·4 and 0·55 kg a day depending on the breed used. If weaning weight is higher, average daily gain will also be higher, e.g. Friesian and Friesian-Sahiwal calves reared to 91 kg in the 1972–73 trial gained an average of 0·71 kg a day.

The relationship between stocking rate (7.4, 9.8 and 12.4 heifers/ha), breed (Friesians v. Jersey in 1972, Sahiwal-Friesian v. Sahiwal-Jersey in 1973), and anthelmintic treatment was examined on an irrigated N fertilized pangola grass pasture. Annual growth rate a head was reduced significantly by increasing stocking rate, but there was no reduction in growth rate during spring and early summer. Anthelmintic treatment produced no response in either year. Friesians grew faster than Jersey heifers as could be expected but the difference between crossbred groups was not significant.

While no responses to anthelmintic were obtained in previous trials with female animals, massive responses occurred this year in a similar trial with male Jersey weaners as the test animals. Because of the variation in results to date this work will be expanded to define situations when drenching is and is not necessary, so that cost saving can be achieved by farmers.

Performance of dairy and crossbred calves for beef production in feedlot situations was studied using rations based on lucerne hay, grain and molasses. Results indicated that a commercial enterprise of this type would be highly economic at 1973 feed and cattle prices but only marginally so at present prices. Shifts in the prices of grain and/or cattle have large effects on the economics of such a venture. These studies are continuing with the emphasis on means of reducing costs.

The dairy beef trial at Millaroo is aimed at evaluating in terms of calf production two breeds of dairy cow, Jersey and Friesian, at two stocking rates with and without a molasses supplement, when grazing irrigated fertilized pangola pastures.

There was little difference between birth weights of calves regardless of month of calving or treatment of dam. However, Sahiwal cross Friesian calves were heavier than Sahiwal cross Jersey calves and males were heavier than females.

There was no effect of stocking rate or supplementation on growth rate but the effects of breed and sex were most marked.

Early calves born August–October were heavier at weaning than late calves born in January–March. Average weight gain ranged from 0·62 to 0·90 kg/head/day for all calves.

Cow performance was particularly influenced by the molasses supplement, stocking rate and breed. Weight loss post calving was influenced by date of calving, heaviest losses being observed in cows which calved late. By feeding a supplement and reducing the stocking rate, post calving weight loss was reduced. The major period of feed limitations at Millaroo was between April and August.

An apparent anoestrus problem occurred, the number of inseminations before weaning being unsatisfactory in the first year. After weaning, all cows began to exhibit oestrus, and conception rates were high with most animals conceiving 8 weeks after weaning despite their low body condition. In the following year, bulls were introduced to overcome the problem of oestrus detection. Subsequent calving dates indicate that conception occurred about the time the bulls were introduced but this cannot be reliably interpeted as resulting from improved oestrus detection or stimulation by the bulls as weaning also coincided with their introduction.

Results suggest that yearling beef production could be a viable enterprise in this situation if it were incorporated into a rice-irrigation farm. As rice production is geared to a May harvest, cattle could graze the stubble and irrigation banks so spelling the pangola pastures which cease growing between April and August.

In South-east Queensland, the main area of work has been the management and use of tropical pastures. Conclusions from an investigation into productivity, persistence and use of tropical grass-legume pasture were reported in the June and July, 1973 issues of the 'Queensland Agricultural Journal'. Application of these principles at the farm level to improve dairy cow nutrition is being tested on several farms in the Wide Bay, West Moreton and Burnett areas.

Trials commenced to measure milk production from kikuyu and pangola grass pastures under intensive management, including use of applied nitrogen and irrigation. The kikuyu area was stocked initially at 3·7 beasts per hectare. It is planned to raise the stocking rate to 5 milking cows a hectare when the pasture is fully established.

An investigation on two farms in the Beechmont area over the past two years has looked closely at feed intakes by dairy cows grazing kikuyu. Improvements in farm layout and pasture production were demonstrated and the effects discussed at meetings of the Beechmont Discussion Group.

The use of elemental nitrogen to greatly boost kikuyu production has revealed some gaps in knowledge regarding the relationship of soil nutrient level and nutrient uptake by the plant. A recently commenced project should overcome these deficiencies and permit greater opportunity to take advantage of the potential of kikuyu.

A pilot trial to investigate the incidence of hind-leg lameness in dairy cows started in Southern Queensland.

Molasses supplementation trials completed during the year showed no difference in production between control cows and those consuming 2 litres of molasses a cow a day. This is consistent with other evidence that per cow performance is not improved by supplementation at low grazing pressures.

In the field testing of Australian Milking Zebu cattle being conducted in collaboration with C.S.I.R.O., tick counts on cows in the Mundubbera area supported previous observations that A.M.Z. cattle carry only ⅛ of the number of ticks on British breed herd mates. A.M.Z. cows matched the fat production over the first 150 days of lactation of comparable Jersey and Friesian cross Guernsey cows in both the Mundubbera and Murgon areas.

In a dairy beef trial, carried out in the Nanango district, Sahiwal cross calves had greater liveweight gains up to the age of 6 months than Hereford cross calves.

A State-wide project to evaluate tropical pastures for dairy production was made possible by financial assistance from the Australian Dairy Research Committee. This work is initially concentrating on raingrown kikuyu pasture in three areas—Maleny Plateau, Eungella Plateau and Atherton Tableland—where this grass appears particularly valuable.

ECONOMICS

The importance of the wholemilk market to industry returns is exemplified to some extent by a comparison of return on capital for various groups. The Gympie group with only limited access to the wholemilk market showed the lowest return of any group in the State—minus 2 to 3%.

In looking at factors affecting profitability of manufacturing milk production in the Gympie district it seemed that highest profits occurred when feed and fertilizer inputs represented approximately 20% of gross returns. However, this must be regarded as a 'rule of thumb' measure at this stage.

Dairy demonstration farms in most districts continue to attract interest but one or two were closed down during the year. These farms provide both a practical basis for extension programmes and a means for the dairy farmer to assess at first hand the benefits of sound planning, budgeting and good husbandry.

Economic extension activities generally have been directed towards better business management of dairy enterprises. Specific problems or aspects looked at in particular districts include the impact of bulk handling in the Maryborough milk supply area and a multiple suckling trial at the Biloela Research Station.

A field study of the future profitability of dairying in the Callide Valley has been completed and the report will be finalised shortly.

Assistance is being provided to the Brisbane Milk Board to devise an index of the cost of production of milk.

The Marginal Dairy Farms Amalgamation Scheme has not been as widely used as it might have been, particularly in the Moreton region. This no doubt reflects the relatively high prices being paid for land suitable for urban development.

PRODUCTS RESEARCH

All of the research conducted in the Dairy Research Branch is applied, and aims to assist the dairying industry either in the improvement of product quality, the increase in processing efficiency or the development of new avenues for use of dairy products.

The following research projects are supported by funds from the Dairying Research Committee and involve problems which are Australia-wide in their application:

Design of a Statistically Based Sampling Programme for Dairy Products.—A system of sampling and analysis has been developed for the detection of coliform organisms in unsalted butter which will give predetermined levels of assurance of compliance with the rigid standards set down for butter exported to Japan. The laboratory and pilot plant stages of this work have been completed and the commercial application awaits the commencement of production in Victorian factories of the manufacture of unsalted coliform-free butter for Japan.

Cheese Ripening.—Accelerated cheese ripening by the addition of enzyme concentrates during manufacture has reached an interesting stage. A saving of 2 to 3 months maturing time appears to be possible. The industrial advantage of this research is the saving in interest and storage charges during cheese maturing.

Milk Lipase Activation.—By supplementing poor quality grazing with balanced concentrate ration, the degree of spontaneous lipolysis in the milk produced was significantly reduced. Removal of the supplement from the ration increased lipolysis to its former level. These findings have important influences on milk quality and dairy cattle husbandry.

Studies on Enzymes in Milk.—Preliminary studies commenced to assess changes in enzyme levels in milk in relation to mastitic infection, and the biochemical changes induced in milk constituents before pasteurisation.

Uses of Fractionated Milk Fat in Foods.—These activities are part of Australia-wide co-operative research at several organisations. It was demonstrated in the pilot plant that up to 30% fat replacement by hard melting point fraction (HMF) for cheddar cheese making does not induce loss of grade. However, further investigation is necessary to further reduce fat losses. 'Hard fraction' milk fat was also used successfully to produce whipping cream of excellent stability and a variety of other products including candles.

Research activities not supported by industry finance:

Butter/onion and Butter/garlic Mixtures.—At the request of the Oakey Co-operative Dairy Association, a commercial method for incorporation of onion or garlic flavours into butter was developed in the pilot plant. The composition of the resultant products precludes them from being regarded as butter or flavoured butter. They are quite spreadable and have had encouraging acceptance on the local market under the trade name 'Melt'.

Copper Content in Milk.—The investigation of copper in milk supplies to a factory producing large amounts of defective cheese revealed the incidence of exceptionally high copper content. Copper is a well-known factor in the deterioration of the flavour of milk and milk products. Investigations are continuing.

Cheddar Cheese Quality.—At the request of the Field Services Branch, it was demonstrated in the pilot plant, using milk from a factory producing large quantities of second quality cheese, that by using the factory maintained starter C6 and the factory's manufacturing methods the cheese produced graded 88 at one month and 86 at three months. This is similar to the grades received by the factory concerned. Using another portion of the same milk and starter C6 maintained here and our manufacturing methods, the cheese graded 92 at one month and 91 at three months. From these results it is concluded that problems at the factory are dominantly manufacturing, although an important milk quality problem also exists.

Butter/Sunflower Oil Blends.—A successful technique was developed in the pilot plant in co-operation with the Queensland Butter Marketing Board whereby up to 30% of the fat in butter was replaced by sunflower oil. The resultant products have excellent keeping quality and spreadability. The flavour of those products with up to 20% fat replacement compared very favourably with control butters and they appear to be a distinct commercial possibility.

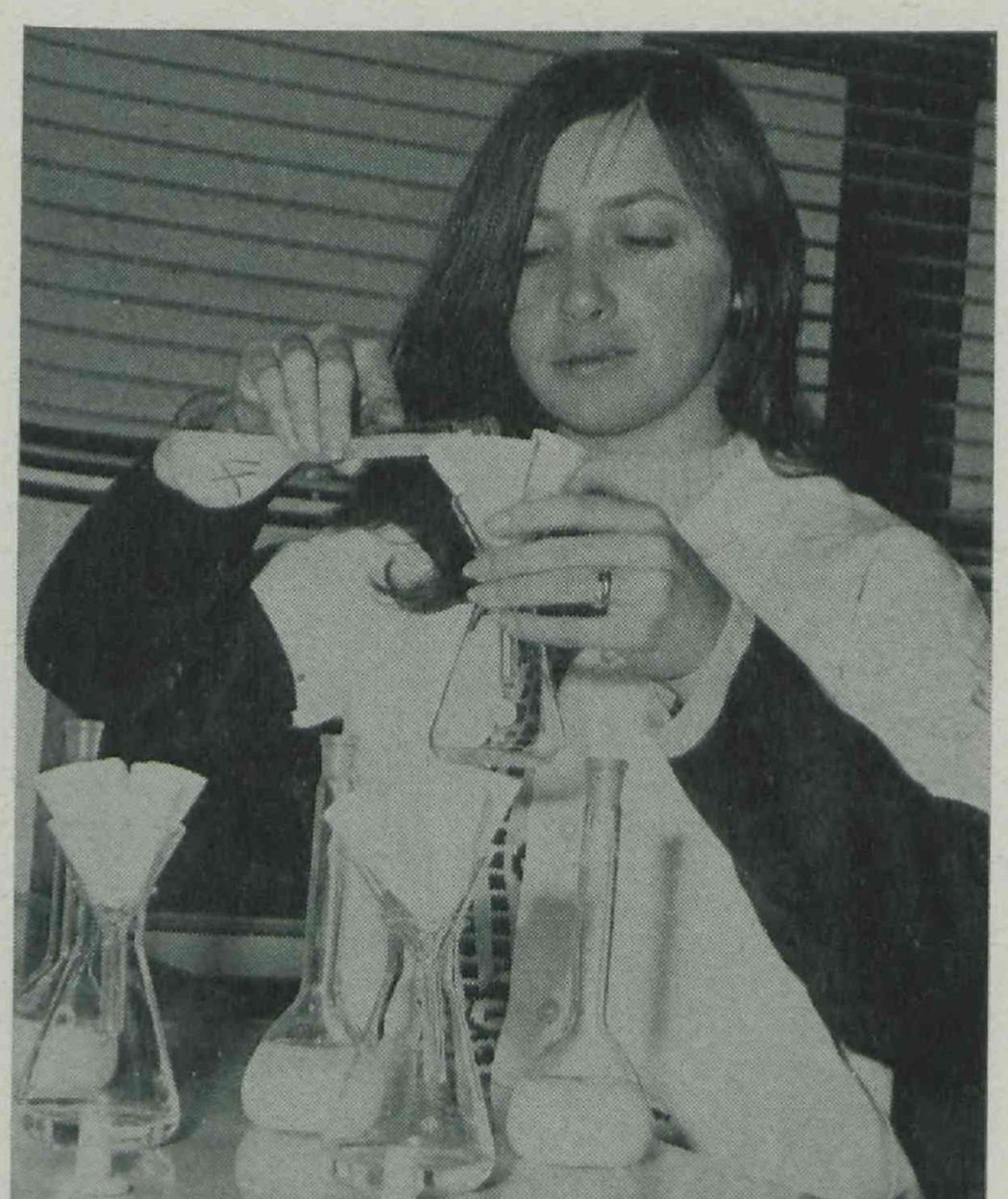
New Dairy Foods.—Several dairy-based new convenience foods were developed. Responsibility for stimulating industry acceptance of these foods was transferred to the Field Services Branch by an allocation to them of Dairy Research Committee funds for merchandising the products produced in Dairy Research Branch.

Excessive Iron Content of Casein.—Investigation of excessive iron content of casein produced at one factory revealed that the sulphuric acid used during manufacture was the main source of iron contamination.

Refrigeration Brines.—After analysing brines used in dairy factory refrigeration systems, advice has been given concerning their maintenance and strength.

Detergents and Sanitizers.—The chemical formulation and methods of use of detergents and sanitizers are kept under review. The Dairy Research Branch co-operates with the Standards Branch to ensure that unsuitable products are not registered for sale to dairy farmers.

Bottle Washing.—Experiments have continued with the washing of milk bottles experimentally soiled with bacteria, fungi and algae. Bacteriological contamination can be easily controlled, but the control of algal and fungal contamination requires further investigation. Acknowledgement is made of the supply of a small scale bottle washer by Queensland United Foods for this work.



Dairy Research Branch's laboratory quality control services assist the dairying industry to reduce losses and increase efficiency, and at the same time ensure that the consumer is provided with high quality dairy products.

DAIRY PASTURE SUBSIDY SCHEME

The downward trend in the rate of receipt of applications, apparent last year, continued into 1973–74. Total applications for the financial year numbered 1 824 compared with an average of 3 000 for the previous seven years of the scheme.

The fall-off was most marked in districts which made good use of the scheme in previous years. In North Queensland and Wide Bay, the year's applications were only 40% of the seven-year average. Both these regions previously showed the greatest activity. East Moreton dropped to 46% and other regions between 60 and 70% with West Moreton 76% of the average. On the Eastern Downs, the figure is 93% and Western Downs equal to the seven-year average.

Reasons advanced for the reduction in applications in 1972–73, i.e. good seasonal conditions and farm amalgamation, applied equally last year. In addition, the number of dairymen dropped by some 1 200 to about 5 300. This in itself could be responsible for a reduction of some 700 in the number of applications. The continued support from West Moreton, Eastern and Western Downs is interesting particularly on the Darling Downs where acceptance of the scheme was slow in the early years. It is considered that the improved seasonal conditions following a comparatively dry period were responsible for the sustained interest. Lucerne-based pastures were the main ones planted.

Farmers who have received the maximum subsidy of $2 000 numbered 136 and another five have been approved for payment at the commencement of the new financial year. Malanda district with 38 in this category is well ahead of any other district. Gympie East, Gympie West and Beaudesert follow with 10 each. Farms which reached maximum subsidy based on cow numbers were not recorded as the situation could change with the inclusion of more cows in the herd. Limitation due to size of farm is very rare.

Following are the number of applications received, areas approved for payment and claims paid since the scheme commenced in 1966: Applications approved 23 273; claims paid 18 937; area approved 127 890 ha; subsidy $3 805 476.

It is unlikely that in the scheme's form any increase in farmer participation can be expected in 1974–75. Requests were received from some areas for modifications. These include inclusion of forms of fodder conservation, application of maintenance fertilizer and increases in subsidy rates and maximum subsidy to compensate for increased costs of materials and land preparation.

These requests were evaluated by the Central Committee, and recommendations made to the Director-General particularly in the matter of increasing costs.

EXTENSION SERVICES

The long-term objective of the Dairy Field Services branch is to assist the dairy farmer to achieve maximum efficiency in the development of his resources. This applies not only to farm production but also to transport, processing and market development. A significant step was taken during the year with the launching of the Mastitis Cell Count Programme. The overall objective of this programme is the reduction of the incidence of clinical and sub clinical mastitis to a level where raw milk supplies to processing plants have a cell count below 500 000 per ml.

The main feature of this programme, to date, involves a monthly advice note to approximately 3 300 milk producers of the results of the Wisconsin Mastitis Tests carried out on herd milk. These tests are carried out by field staff at 26 milk factories. Individual producers receive progressive running average results together with a message indicating the likely herd situation. Industry acceptance of this programme has been most satisfactory. This phase of the programme is aimed at creating producer awareness of their herd situation and the effect of high cell count milk on production and quality. This approach has been supported by the use of mass media and group extension activities. Field staff are heavily committed to providing advice on farm control practices for mastitis.

Excellent co-operation has been received from other branches of the Department, industry organisations, factory management, private veterinary practitioners, the major veterinary drug companies, and retailers.

As a follow up to this initial phase, a programmed series of discussion material, entitled 'Project M', has been prepared. Field staff will incorporate this project in group extension activities during 1974–75.

A State wide base-line survey into farmer attitudes and knowledge related to mastitis was carried out at the commencement of the programme embracing 10% of all milk suppliers. It is too early to gauge any changes.

Making experimental cheese at D.P.I.'s Otto Madsen Dairy Research Laboratory at Hamilton (Brisbane).

IV. Pasture Research and Extension

The main responsibility for pasture research and development rests with Agriculture Branch, but branches such as Agricultural Chemical Laboratory, Beef Cattle Husbandry, Dairy Cattle Husbandry, Dairy Field Services, Sheep and Wool, Husbandry Research, Biochemical, Economic Services, Standards, Botany, Entomology and Plant Pathology have pasture production, management and evaluation projects of various types under way.

The main research centres are Parada Research Station, Walkamin Research Station, Kairi Research Station, South Johnstone Research Station, Millaroo Research Station, 'Swan's Lagoon' Cattle Field Research Station, Ayr Research Station, Biloela Research Station, Brigalow Research Station (Moura), 'Brian Pastures' Pasture Research Station (Gayndah), Coolum Research Station, Gatton Research Station, Queensland Wheat Research Institute (Toowoomba), Charleville Pastoral Laboratory, Animal Research Institute (Yeerongpilly) and various entomology and plant pathology field stations.

Extension work on pastures is conducted in all the main dairying and pastoral areas, primarily by Agriculture Branch officers.

The Dairy Pasture Subsidy Scheme (reported in section III of this report) is administered by a committee comprising representatives of various divisions and the Queensland Dairymen's State Council.

PASTURES SPECIES EVALUATION

The immediate needs for legumes for pasture improvement in the dry tropics, which cover the Peninsula, the Gulf and the hinterland behind the wet coast, are being met by the use of Townsville stylo. In the Peninsula alone, some 15 000 ha have now been sown.

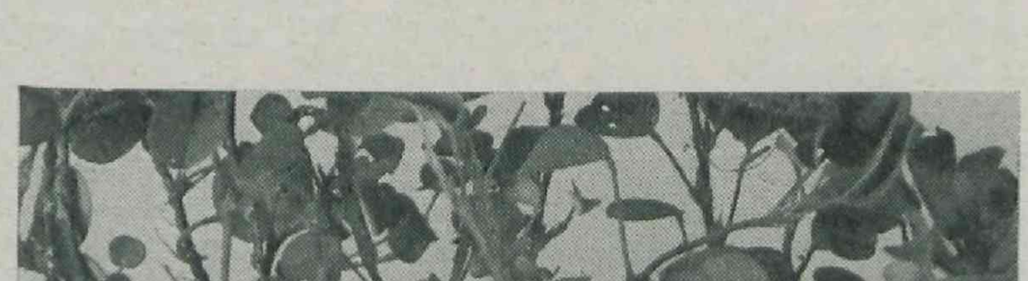
While the short-term effect is quite good, there are long-term disadvantages from sole reliance on this species. These include frequent weed invasion by species such as *Sida* sp. and *Hyptis suaveolens*, and some erosion problems. One approach to this problem has been to attempt to introduce perennial grasses such as *Urochloa mosambicensis* but this has not always been fully successful. It also leaves unexploited much of the high rainfall received during the short wet season.

Fortunately other stylo are showing considerable promise in varying sections of the dry tropics, and these appear likely to give more useful and resilient pastures than does Townsville stylo.

Stylosanthes hamata (CPI–38842) was released this year as Caribbean stylo cv. Verano as a result of co-operative testing which included this Department. It has reasonable ability to perennate and so can make use of early wet season rains. It has consistently grown further into the early dry season, which stretches the period when quality feed is available.

It also retains the free-seeding habit of Townsville stylo and so should be easy to establish on new areas. Verano is not a strong perennial but has some advantages of perenniality.

Co-operative experiments with producers are aimed at improving the efficiency of recovery of stylo.



The strongly stoloniferous legume, Hetero (cv. Johnstone) which grows well with pangola and signal grasses.

On the other hand, lines of *Stylosanthes scabra* and *S. viscosa* have shown strong perenniality and, once established, vigorous and useful growth. Both are somewhat shrubby species and appear likely to even further extend the period of availability of better quality forage. To date, *S. scabra* has not been noted as grazed during the growing season but is readily accepted after other species have ceased growth. It is a shrub which can reach 2 to 3 metres in 2 to 3 years in the absence of grazing. While leaves are dropped late in the dry season, very rapid regrowth is made with the first storms.

These species are showing considerable initial promise and will be much further tested over the next few years, but it appears likely that they will provide, for the dry tropics, far more useful and effective pasture legumes than Townsville stylo.

A major grazing trial is in progress at 'Tedlands' in the Mackay coastal area. Results from this trial which is using Kazungula setaria, Siratro and Schofield stylo, showed that at medium to light stocking rates, pastures planted initially with a high proportion of legume gave better liveweight gain than those with a low proportion of legume. However, it was clearly demonstrated that the main factor affecting legume content in a tropical pasture is stocking rate and that as the stocking pressure eases the legume proportion increases. On the high legume 0·8 ha/steer treatments, the

average daily liveweight gain was 0·6 kg/day during the 1972–73 grazing season. This was reasonable considering the adverse nature of the season with nine very dry months. During the wet period, steers on setaria plus 300 kg/ha N did poorly because it was too wet to apply the nitrogen on schedule.

Some disturbing features are arising from the trial and on some of the commercial pastures in the district on the poorly drained duplex soils. The major one of these is the steady decline in legume content which has been occurring especially at higher stocking rates, and it is likely that further studies will have to be directed to the problem of legume maintenance on these soils.

Within the central coastal forest country with 700 to 1 200 mm rainfall, essentially the spear grass region, Townsville stylo has wide application and most of the technology for its use is available. It is not, however, being widely adopted, for reasons not well understood.

It is also likely that the newer *Stylosanthes* species showing promise in North Queensland will have value in Central Queensland, and a start has been made to examine this collection in the Rockhampton area. In the first season, *S. hamata* cv. *Verana* and *S. subsericea* proved outstanding, and it seems from other observations Verano has a major role to play in the area. Work is now required to fit it into the Central Queensland context. Because of the different behaviour of Townsville stylo in Central and North Queensland, it is likely that other stylo species will also require different management techniques in the two areas. This arises in part from differences in climate and in part from differences in levels of intensity of land use.

Bothriochloa insculpta continued to impress as a possible species for the open downs country of the Central Highlands but has yet to be subjected, both during establishment and growth, to a series of dry seasons. These will really test its value.

Creeping blue grass (*Bothriochloa insculpta*) growing on the black soil of the open downs country of the Central Highlands.

Farther south, the Isis experimental site is an area of 80 ha representative of the drier northern Wallum of which there are some 350 000 ha north of Maryborough with a rainfall of about 1 100 mm and hard-setting, sandy loam, podsolic soils. Basic developmental information is now available for these areas and it is proposed to develop the Isis site accordingly; then to monitor the performance of pastures of Siratro, *Paspalum plicatulum*, Narok setaria and *Lotononis bainesii*, and the animals grazing them, to pinpoint deficiencies in the existing knowledge. The pastures were established, and grazing will commence in the coming season. Three stocking rates for growing animals and one for breeders will be used, and both growth and breeding performance will be monitored.

At 'Brian Pastures', the value of leucaena in improving winter performance of both weaners and growing stock continued to be apparent. Further improvement in the weaner performance from native pasture plus leucaena supplement was achieved by the further supplementation of peanut meal, however, indicating that leucaena was inadequate. As a result, altered systems of use are now to be considered.

At Brigalow Research Station, leucaena continued to show minor increases in animal performance over winter/early spring, and it is suspected that as the pastures on these soils age the effects of supplementary leucaena could be increased.

The search for suitable legumes for the brigalow areas has been unrewarding. Lucerne grows well for a year or two but lacks long-term persistence although it is of value for short-term rotations with cultivation. The persistence of existing cultivars such as Hunter River and Siro Peruvian is not influenced by such things as frequency of cutting, degree of competition both within and between species. Now it appears that disease infestation may be an overriding reason for poor lucerne persistence in Queensland. Both *Phytopthera* and *Colletotrichum* are widespread, and a recent survey suggests that they could be a major reason for rapid decline of a stand. There are however, some differences in the susceptibility of a range of cultivars to these diseases. So there are prospects that an intensive breeding programme could give better-persisting lucernes.

Sheep Pastures.—In the western arid lands, introduced species showing most promise of fulfilling a role of either higher energy production, land stability or specific seasonal production fall into the genera *Cenchrus, Schmidtia, Anthephora* and *Eragrostis*. Based on 15 months' growth in mulga plots, *Schmidtia* (7 700 and 5 500 kg/ha), *Eragrostis curvula* (5 300 kg/ha) *Anthephora pubescens* (4 000 kg/ha) outyielded the native mulga species *Aristida* (2 100 kg/ha), *Thyridolepis* (2 000 kg/ha), *Monachather* (1 400 kg/ha) and *Erogrostis eriopoda* (400 kg/ha). The potential of the introduced species is there but problems associated with establishment, nutrition and persistence have yet to be overcome. It is in this latter direction that continuing work will be guided, particularly species adaptability to various soil/climate situations.

As a group, legumes have been largely unsuccessful but two perennial *Stylosanthes* could have a place as good quality standover fodder.

Dactyloctenium giganteum is the only annual to show promise, and appears to be suited mainly to the light-textured soils. Work is continuing to assess the value of the litter from this species in promoting germination and establishment of preferred introduced perennials such as *Cenchrus ciliaris*.

Dairy Pastures.—At Cooroy and Mt. Mee, *Setaria anceps* cv. Narok proved the superior in terms of cold tolerance and fast, early spring regrowth. However, it is a very shy seeder, and the area planted was restricted because of seed shortage. This problem is being investigated in the pasture seed production programme recently initiated at Gympie. With the judicious use of nitrogen fertilizer, Narok is capable of producing large quantities of highly nutritious feed over the winter/early spring period, thus helping to fill a major feed gap. Its use is recommended over most of South-east Queensland either in raingrown or irrigated pastures.

In the 800–1 250 mm rainfall areas of South-east Queensland, the *Panicum* species are the most productive grasses. At sites in the West Moreton, *Panicum maximum* cv. Gatton and Petrie and strains Sabi and Q14734 were the most productive and persistent. At Upper Kandanga and the Middle Creek areas of Wide Bay, Petrie, Sabi and common guinea grass were the better grasses. Callide and Samford Rhodes grasses yielded well at a number of sites but legumes appear to be less compatible with them.

In the wetter regions of the Atherton Tableland, elephant grass gave outstanding yields both under raingrown and irrigated conditions. Pangola and kikuyu do well in this environment, kikuyu especially in the cooler months of the year.

Two recent releases of seeding kikuyu, *Pennisetum clandestinum* cv. Whittet and Breakwell, show promise in the Wide Bay region. At Gympie, when they were planted in March, very vigorous growth was made. However, mid-summer plantings at Cooroy, Belli, and Mt. Mee were slow to establish, were intolerant of weeds, and were unproductive for at least nine months after planting. Time of planting is obviously important. The necessity of high nitrogen applications for reasonable growth was established.

In the 1 250 mm and higher rainfall regions of South-east Queensland and Atherton Tableland, *Desmodium intortum* cv. Greenleaf continued to exhibit greatest adaptability to the wide range of soil types with good spring, summer and autumn production. However, at Cooroy an unreleased F_1 hybrid (*Desmodium intortum* x *D. sandwicence*) bred by Dr. K. McWhirter (Sydney University) consistently outyielded Greenleaf over a five-year period.

In the below 1 250 mm rainfall areas of West Moreton and Gympie, *Macroptilium atropurpurem* cv. Sirato was the superior legume. However, *Macrotyloma axillare* cv. Archer, *Glycine wightii* cv. Cooper and *Lotononis bainesii* cv. Miles also proved to be productive and persistent on a more restricted range of soil types.

Early investigations into *Trifolium semipilosum* cv. Safari at Cooroy, Gympie and Atherton indicated slow nodulation and susceptibility to Rugose Leaf Curl virus. However, after this initial, very slow establishment phase Safari was capable of high spring and summer production, and tolerated constant and close grazing. In this latter respect, Safari is fairly unique among the tropical legumes.

A weakness in the range of tropical species continues to be their inability to remain productive under extremes of wet and dry. Dry conditions may be overcome to some extent

with irrigation. However, perennial tropical pastures species are available for most environments and their productivity can be extended with improved nutrition. In environments where pastures are not as well suited (such as dry areas), a range of warm season forage crops is available.

Although climatic conditions in South-east Queensland and the Atherton Tableland strongly favour tropical and subtropical pasture species, there is still a requirement for pasture grasses, legumes and fodder crops that will provide feed in the cooler, drier months of the year. Both temperate and tropical species are being evaluated for the period April–November, under irrigation and raingrown conditions.

Intensive work has been in progress to evaluate various white and red clovers, including Safari and *Trifolium repens* cv. Haifa. Evaluation of Safari was mentioned in the tropical species section. It can be regarded as a tropical legume with good cool season production once properly established. In experiments conducted at Mt. Mee, Cooroy, Gympie, Coolum and Gatton Research Station, Ladino, Louisiana, Grasslands Huia and Haifa white clovers proved the most productive and persistent of a range of *Trifolium repens* strains.

Temperate grasses heavily fertilized with nitrogen all produced comparable yields from 3 200 to 3 750 kg o.d.m./ha during the cool season at Coolum Research Station. Ryegrasses tolerated severe flooding but were severely affected by rust at the onset of warm weather.

Of temperate grasses planted at Woodford in 1972, Wimmera ryegrass, Australian Phalaris and Demeter fescue regenerated in the second season. Without irrigation their production was low.

At Cooroy, an investigation into sowing rates of various ryegrasses indicated small yield increases above the 17 kg/ha sowing rate in the 1972 season (raingrowing conditions) and little difference in yield between the 22 and 45 kg/ha sowing rates in the 1973 season (irrigated conditions). Spring production of clover/ryegrass mixture was comparable with pure ryegrass + high nitrogen yields.

Over the last two years, investigations at Cooroy showed that production from field turnips, kale and mangels is comparable with oats but their usefulness is limited because of excessive disease and predator attacks.

Indications are that more reliance should be placed on tropical species that are capable of cool season production when correctly managed. Temperate legumes and grasses require much more moisture for production and persistence, particularly during warm periods, and frequently require re-introduction every two or three years.

Thus temperate pastures and crops should be used only to complement or supplement the warm season species during times of feed shortage or when they are deficient in quality. Much work is still required to integrate each feed source into viable farming systems.

Irrigated Pastures.—The major objective of irrigated pasture research is the provision of high-quality feed during autumn, winter and early spring. At this time feed from other sources is in short supply and very often of poor quality for high-producing dairy animals. Rainfall is low and usually unreliable, which accentuates this problem. Thus in many situations, dairying without irrigation becomes a hazardous enterprise.

Two types of pastures are being investigated. First an assessment of perennial grasses and legumes is being made for use in permanent irrigated pastures. In this series of experiments the basic feed source will be perennial, irrigated, mixed legume-grass pastures. Many of the irrigated pasture species currently used in the subtropics leave much to be desired. The second aspect of the work is the use of winter fodder crops and annual pastures. This involves varietal assessment, effects of variable seeding rates and nitrogen levels. The cost of annual resowing is offset, at least partly, by the provision of large amounts of high quality feed when it is most needed.

A more recent facet of irrigated pasture research is the irrigation of tropical pastures, particularly grasses, with the inclusion of white clover for cool-season production.

Mention has already been made of the slow start with Safari. However, after the first season, Safari is most impressive at Atherton and Evelyn in North Queensland where it outyielded *Trifolium repens* cv. Ladino and Louisiana.

Mention has also been made of Haifa. Under irrigation at Gatton and at Cooran it proved to be an outstanding legume, exhibiting some summer heat tolerance, and outyielding Ladino and Louisiana in the initial winter-spring period at Gatton.

In an experiment at Gatton to evaluate irrigation frequencies and temperate grasses, Sirocco phalaris outyielded annual and perennial ryegrasses in the first season. No differences were shown between the two irrigation frequencies.

A study of seeding rates and nitrogen rates for irrigated oats at Gatton showed that there is nothing to be gained by increasing the seeding rate above 90 kg/ha, while for medium rates of nitrogen little benefit can be expected above 45 kg/ha/ Nitrogen applications of 34 kgN/ha at planting and after each harvest achieved the most efficient use of applied nitrogen.

The most promising tropical species for supplementary irrigation are narok, kikuyu and elephant grass.

More research was undertaken on irrigated pastures than in any previous year. This indicated the upsurge in interest in irrigation by farmers whose production pattern is changing to one of market milk on a year-round basis. Legumes were selected that are of value for irrigated perennial pastures and these may withstand poorer summer irrigation frequencies. However, temperate grasses are inadequate in persistence and production and this remains the major limitation to the achievement of high-producing, perennial, irrigated pastures.

Seed Production Studies.—The seed production unit at Beerburrum concentrated on some 50 Stylosanthes species of the major collection held by C.S.I.R.O. at Townsville. These lines are being used in co-operative programmes throughout Northern Australia and results are more fully discussed at the beginning of this section. Up to 50 kg of seed of the best seeding lines were produced.

Work of the reproductive physiology unit was expanded with the transfer of one officer to Gympie at the beginning of 1973. Here he will undertake studies on grass seed production, previously a somewhat neglected field. The North Queensland work will remain mainly based on the legume seed crops.

With the stylo seed crops there is now a very detailed background of pattern of development, the causes of losses and their magnitudes, together with the effects of defoliation management on seed production. These details, while accumulated mainly on Cook stylo, can be extrapolated to Endeavour and Schofield. But they have not provided an easy single answer to the problems of increasing seed yield as they did with Siratro. They do, however, point to several possible lines of attack which will now be followed.

Three of these include defoliation management, choice of time of harvest and correct use of the harvester, and they will be subjects of grower education, using existing information. Two other lines of attack are to eliminate the risk of *Botrytis* damage by selection of a suitable fungicide pattern and removal of weeds, especially *Sida,* to reduce losses of seed during cleaning.

With Siratro, as a result of the revelation of the amount of intact seed lodged on the ground, commercial suction harvesting was expanded considerably and so the recovery of seed improved greatly. Some 25 tonnes of Siratro seed were suction-harvested in the last season, being one-third of total production.

PASTURE ESTABLISHMENT

Establishment of introduced pastures in some situations on brigalow soils remains a problem, especially on the heavy, flooded, clay soils. One possible means of improving the establishment of aerially sown seed looked at was pelleting with lime or phosphate. Results from one season over a number of plantings with buffel grass, green panic and rhodes grass, however, suggest no benefit.

At Charleville, studies continued on the factors affecting seedling establishment especially with native species, and considerably more information is now available. The life histories of 2 176 seedlings of native species growing on bare soil have been documented. Although data are still being processed, some results are:

Tillering occurred in 10% of the plants, of which 67% reached the flowering stage. The chances of a plant flowering if it wilted before reaching 30 days of age were only 1·5%. Of seedlings which tillered but failed to flower, 40% were victims of insect attacks; 50% of all seedlings died within 14 days of emergence, while 62% of the plants that flowered needed more than 120 days to reach that stage. A strong correlation was evident between tillering and reproductive success for plants growing on mulga soils in semi-arid S.W. Queensland. The first 30 days are most critical in a seedling's life, particularly the first 14. Seed germination after rain was mainly influenced by amount and duration of the fall. However, seedling survival is usually low and erratic (0–15%) an exception being after a very favourable rain in February 1973, when six months later seedling survival was still of the order of 30 to 40% and up to 68% for certain groups of plants.

Experiments on mechanical defoliation of seedlings indicated that if the plants are well supplied with water,

removal of leaf alone is unlikely to kill young seedlings. This is of importance in assessing the effect on seedlings of leaf-eating insects.

Information is indicating, first, characteristics of native species which regularly germinate and establish in mulga soils such as early tillering and flowering (the need to look for such characteristics in introduced species is obvious), and second, a management guide to encourage germination and establishment is becoming clearer (e.g. the importance of surface litter and timber cover and the times when seedlings require protection).

PASTURE NUTRITION

Fertilizer requirements for establishment have been fairly well fixed for most dairying districts, although situations exist where refinements are necessary, particularly with more intensive dairying. Present fertilizer recommendations, for maintenance even when reasonably adequate for the plant, may require modification to fit the high-producing grazing animal. Differences between species in nutrient requirements have to be assessed for the various environments.

In more recent investigations, emphasis has been placed on bag nitrogen as a means of supplying quick, reliable feed throughout the year. This practice is growing as a natural result of intensification of dairying following rising land prices and costs and the need for greater productivity per unit area. Experiments are being conducted at Atherton, Cooroy, Gympie and Southport where the effect of nitrogenous fertilizer on grass yield, legume establishment and on the persistence of legumes in mixed swards is being studied. Evidence suggests that strategic applications of fertilizer nitrogen on pure grass swards economically boost dry matter production at times of need but, when used on mixed swards, are detrimental to legume survival.

Experiments to investigate the residual effect of molybdenum are being continued throughout the region in co-operation with C.S.I.R.O. The residual effect of molybdenum in relation to soil type, legume species, method of application and molybdenum source is studied. Tinaroo glycine was the most responsive legume to the application of molybdenum while generally Miles lotononis and Cook stylosanthes failed to respond. Siratro responds at some sites but not at others. These experiments will run for three more years.

More precise recommendations geared to the needs of modern dairying based on wholly improved pastures are an economic necessity. An ever-increasing amount of data is being accumulated to allow better calibrations between nutrients extracted (from soil and plant) with soil type, plant and crop species. An efficient nutrient crop logging service subsidised by the fertilizer industry should be the ultimate goal.

Basic requirements for initial pasture establishment from virgin timber are now well known for all areas of the wet coast. Less, however, is known of requirements for re-establishment of degenerated pasture areas where weeds may be a serious problem, and of requirements for maintenance fertilizer to prevent degeneration of the pastures as they age. Two fertilizer grazing trials are being established as part of the attack on the latter problem, while fertility levels are to be monitored by soil and plant analyses on a wide range of situations in commercial pastures. No results are available from either study.

Chemical Laboratory Branch's activities in pasture nutrition are widely scattered over the State. At Millaroo, forms of nitrogen applied to irrigated pastures are being studied. Four different sources of nitrogen are being compared. It has been shown that on the soils used in the experiment, irrigation water rarely penetrates deeper than 20 cm and that very little applied nitrogen penetrates deeper than 4 cm. This study is continuing.

Also, at Millaroo, as a result of poor performance of pangola grass on the Station, an experiment has been set up to study the effect of soil pH on nitrification.

Monitoring changes in soil fertility beneath commercial pastures. An Agriculture Branch officer systematically sampling soil in the Ingham area; this pasture will be sampled annually to study the effectiveness of fertilizer and management practices.

An Agricultural Chemical Laboratory Branch officer examines a vigorous guinea grass-puero pasture in the Tully area. Changes in soil fertility are being studied by systematic annual sampling.

At South Johnstone, the Branch is collaborating with Agriculture Branch in studies on the maintenance requirements and best source of phosphorus and nitrogen in pastures. Pot experiments using granitic soils from the Cardwell and Johnstone Shires showed that stylo yields could be increased if deficiencies of copper and molybdenum were made up.

A pot experiment with soils from the Daintree–Cape Tribulation areas indicated that the application of superphosphate in the Cape Tribulation area and molybdenised superphosphate in the Daintree area should correct nutrient deficiencies.

In Brisbane, the response of three varieties of white clovers to fertilizer elements was studied.

Predictions from soil tests are only as accurate as their calibration in terms of plant response. In order to improve the interpretation of soil tests, six sites on grass/legume pastures were established in South-east Queensland. These are being used to relate the response to fertilizer needs predicted from analytical tests to the responses found in the field. One site was lost during the January floods but the others are yielding useful data.

LEGUME BACTERIOLOGY

The programme of sampling for quality testing of commercial inoculants on sale to farmers continued. Quality generally remained at a high level. During the year, 96 cultures for 15 different legume species were supplied by the Department for legumes for which no commercial inoculants are available. Field trials with inoculated soybeans indicated that the cultivars Hardee and Hampton nodulated poorly with the current soybean inoculant strain CB1809. Alternative

effective strains were selected for each of these cultivars. Tests with the newly released Highworth dolichos showed that the cultivar was readily nodulated by the cowpea inoculant strain CB756 thus obviating the need for a special inoculant.

DISEASES

There can be no doubt from survey work carried out that root and crown rot diseases, principally those caused by *Phytophthora megasperma* var. *sojae* and *Colletotrichum trifolii,* seriously limit lucerne persistence in Queensland. In field and glasshouse tests the cultivars Lahontan, Combined, ESI, BDSI and ECRSI showed high levels of resistance to *Phytophthora* root rot while the common cultivars Hunter River and Siro Peruvian were moderately susceptible. Siro Peruvian was highly susceptible to crown rot (*C. trifolii*); Hunter River was moderately susceptible but high levels of field resistance were detected in Lahontan, ESI, BDSI, ECRSI and Combined.

In North Queensland, anthracnose (*Colletotrichum gloeosporioides*) was severe on several species of Stylosanthes, particularly *S. mucronata*. *S. guyanensis* showed considerable resistance. Botrytis flower and stem blight was severe on *Stylosanthus* spp., particularly in seed crops and although the disease was controlled to some extent with foliar sprays of benomyl it may be necessary to restrict production of seed crops to drier areas. Foliar blight (*Rhizoctonia solani*) caused disastrous losses in siratro. Other legumes such as glycine were affected to a more limited extent.

NATIVE VEGETATION

To understand mulga community development, a number of exclosures from which domestic stock are excluded and 64 km of band transects open to grazing were established from the Charleville Pastoral Laboratory. These are used to measure shifts in the botanical composition of the pastures and to monitor changes in woody plant populations.

Data recording continued in the transects and exclosures. Although data from the latter have not yet been subjected to statistical analysis, it does appear that in many cases exclusion of stock has had little effect on shifts in botanical compositions. For instance, clay pans have not revegetated after eight years, preferred native species have been very slow to colonise bare areas and have not spread into sites infested with turkey bush (*Eremophila gilesii*). Such information is valuable in formulating revegetation strategies.

The soil moisture studies showed that not only does mulga tree density affect initial soil moisture absorption through interception of up to 13% of incoming rain but also the rate of depletion. More water is extracted from areas carrying 40 trees/ha and 3 500 trees/ha than from completely cleared areas and areas carrying 160 and 640 trees/ha. Moisture within this latter group is higher following rain and is also greater at the end of the drying phase.

Rangeland conditions and trend studies continued in the mulga and Mitchell grass communities. This is a follow-on to the work initiated by Professor Brian Roberts, from South Africa, during his year in Australia on an Australian Wool Corporation Research Fellowship. The importance of being able to accurately assess the present condition of the rangelands and to be able to recognise shifts or trends, whether these be instability, improvement or deterioration, is useful in ecologically based programmes of native pasture management. The work has consisted of the establishment and recording of 36 selected sites distributed over the major soil types in Central and South-west Queensland allowing the documentation of the floristics and basal cover in preserved samples of vegetation.

The thirty-six 0·8 km transects established by Professor Roberts in 1972 were re-recorded. These aim at the establishment of 'ecological benchmarks' for the study of condition and trend in semi-arid rangelands.

Recordings in 1973 showed that although small changes occurred in botanical composition there was no large-scale change in the species present at any site. The contribution of annuals had changed from 1972, reflecting changes in seasonal conditions.

FODDER CROPS

The highly opportunistic nature of successful forage and grain cropping in the under 500 mm average annual rainfall areas was again emphasised. During 1973, however, winter crops of oats and barley were grown on a water spreading site, in mulga country after a flood. The forage yields of both were similar at 2 000 kg/ha D.M. from a planting rate of 25 kg/ha and a row spacing of 30 cm. When planted at the same rate but in 15 cm rows the yield of oats dropped to 1 400 kg/ha D.M. Despite a low percentage of successful plantings since 1968, information is available on what crops, both summer and winter, can be grown, likely production levels and methods of cultivation and planting which will encourage establishment. For instance, in winter crops, barley has a slight yield advantage over oats when moisture is limiting. Taprooted crops such as safflower have not outyielded cereal crops. Preplanting cultivations influence the amount of moisture that can be stored in the soil.

PASTURE MANAGEMENT AND USE

The buffel grass grazing trial at Blackall has now been continuously stocked for 6 years at rates 5, 2·5 and 1·25 sheep/ha. The fourth treatment was maintained at 10 sheep/ha for the first 3 years and then subsequently stocked at 2·5 sheep/ha. Basal area of buffel grass in this treatment dropped from 4·10% in 1971 to 2·10% in 1972, improving to over 5% in 1973, illustrating the recuperative qualities of this species. One main point of interest is the ability of buffel grass to withstand continuous stocking through low rainfall years, at a rate of 2·5 sheep/ha. This compares with a district stocking rate on the native Mitchell grass/Flinders grass of approximately 0·7 sheep/ha. A further reflection of the favourable 1973 season is the dry matter forage yield of 5 000 kg/ha at 1·25 sheep/ha, this being the highest figure obtained to date.

Fleece weights were similar for the 1·25 and 2·5 sheep/ha treatments, being 4·97 and 4·83 kg respectively, while at 5 sheep/ha wool clip was 4·33 kg.

The Dairy Pasture Utilization and Management Programme (Dairy P.U.M.P.) was designed to investigate, by means of a survey, the effect of management by farmers on improved pastures. The survey is being conducted in all areas of the State where dairying is practised, and involves agrostologists and agricultural advisers serving in these areas.

Of the 183 farms surveyed, the largest number are larger than 200 ha. Less than 5% of the farms have a total acreage of less than 40 ha, although this varies between dairying regions. Of these farms, the highest proportion carry between 40 and 80 milking animals, and are in the 20–30 replacement animals category. Again, the proportion in the various categories changes within the various regions.

Data on the area of improved pastures on farms indicate that a surprisingly high proportion of the farms have over 20 ha of improved pasture available for grazing. The highest proportion of farms with smaller areas of improved pasture occur in the drier regions such as West Moreton, the Burnett and the Darling Downs.

Judged by a subjective rating of health there has been a gradual improvement in the survey pastures. Surveying officers rate each pasture within one of the categories—good, fair, poor. After three years, less than 30% of the pastures could be considered to have legumes which were fully supporting their companion grass. On the other hand, less than 20% could be considered poor.

The data on fertilizer application show a very disturbing result. Whereas the greater proportion of pastures had received fertilizer in the initial year (86%), in subsequent years the proportion of farmers applying superphosphate as a maintenance dressing was only 35 to 40%. This is a low proportion as the majority of the soils had low phosphate levels initially.

The largest variation of data within regions was demonstrated in that collected on species components of the pasture. For example, Greenleaf desmodium was planted in 68% of the pastures surveyed in North Queensland, but in only 4% of those in West Moreton. The data, however, show a pattern which closely follows the Departmental recommendations in the respective regions.

At present, definite trends are appearing from only some of the large quantity of data, indicating: Many pastures do not receive maintenance fertilizer; different patterns of grazing occur in different regions of the State; a large proportion of the pastures is still improving after three years, and, although some component species have been lost, there appears little danger of the majority of pastures becoming unproductive.

One of the most important side effects of this survey has been to make both farmers and Departmental officers look more closely at specific pastures and their management, and this in itself must lead to greater understanding of pastures and their requirements.

ECONOMICS

An economic assessment of the role of buffel grass in the Maranoa region has led to stimulated interest in the development of improved pastures. The assessment concluded that buffel grass development after a cropping phase was the most profitable development strategy.

Buffel grass has shown high productivity, drought resistance, ability to spread even on relatively poor soils. Some 14 000 ha of improved pasture planted in 1972–73 were mostly buffel grass which has provided the base for an increase in stocking capacity.

The use of kikuyu is to be the centre of a major co-ordinated extension programme on the Maleny plateau in the coming year.

V. Field Crop Research and Extension

Research and extension on field crops (i.e. crops except fruit, most vegetables and ginger) is a major responsibility of Agriculture Branch, but various other branches, including Agricultural Chemical Laboratory, Botany, Entomology, Plant Pathology, Economic Services, Marketing Services, Standards, Soil Conservation, Development Planning, Beef Cattle Husbandry, Sheep and Wool, Pig and Poultry, Husbandry Research, Biochemical, Biometry and Research Stations, are engaged to a lesser extent on various aspects of production and marketing.

Field crop research is conducted on research stations at Southedge, Walkamin, Kairi, South Johnstone, Millaroo, Biloela, Theodore, Gatton and Hermitage, and at numerous field investigation centres. Wheat research is centred at the Queensland Wheat Research Institute at Toowoomba, built and financially supported largely by the Queensland Wheat Research Committee and staffed mainly by the Department. Sugar cane production research and extension are conducted by the Bureau of Sugar Experiment Stations, which is controlled by the sugar industry.

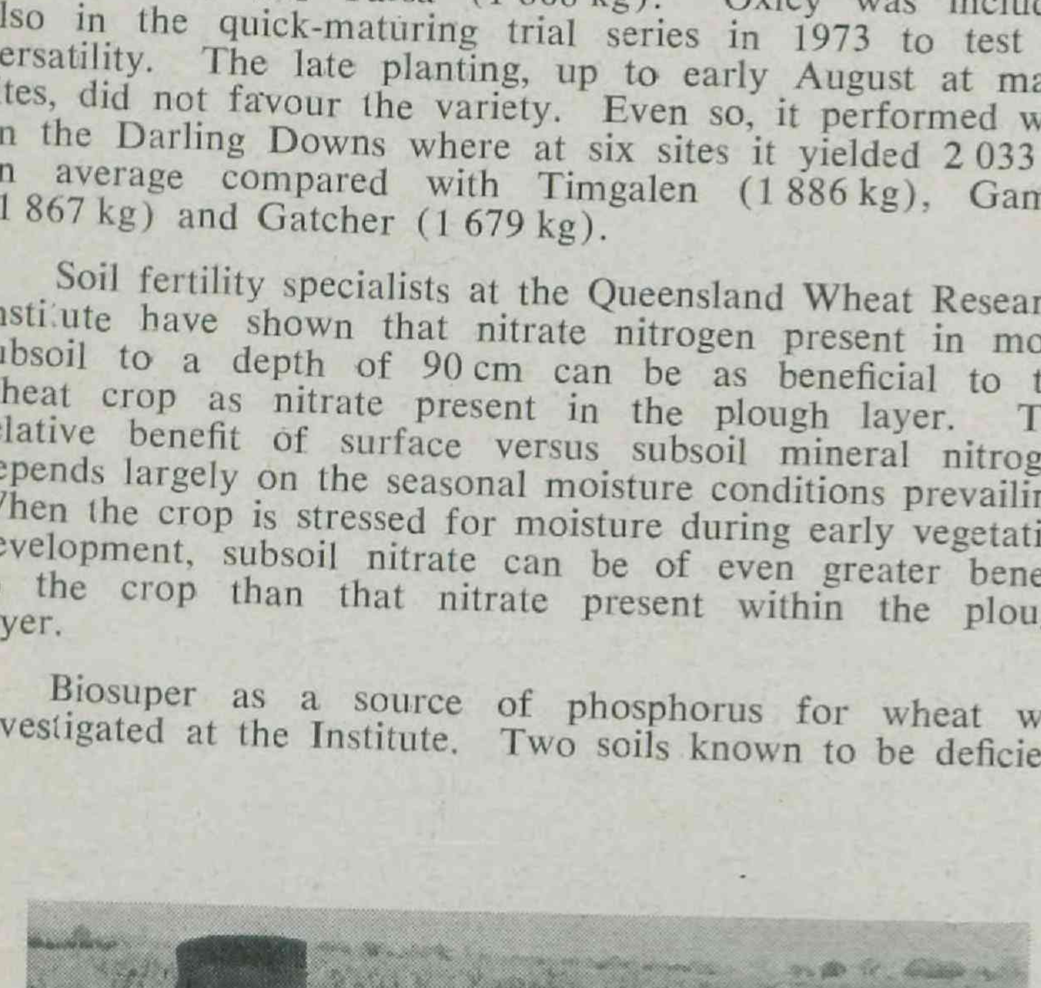
WHEAT

Oxley is the name given to the new wheat variety bred at the Queensland Wheat Research Institute, and released jointly by the University of Queensland and the Department. Oxley, a mid-season variety, has a high yield potential derived from one of its parents, a semi-dwarf wheat from Mexico. In addition, Oxley possesses good milling and baking characteristics and is resistant to all races of stem rust so far identified in Queensland and northern New South Wales. New races of rust are continually evolving, however, and the resistance may be effective for only a limited time.

Oxley was released after being thoroughly evaluated in the Department's varietal testing programme over the past two seasons. In the 1973 mid-season trial series, Oxley topped five of the six trials with an average yield over the six trials of 2 543 kg/ha. The best commercial variety in the series was Tarsa (1 868 kg). Oxley was included also in the quick-maturing trial series in 1973 to test its versatility. The late planting, up to early August at many sites, did not favour the variety. Even so, it performed well on the Darling Downs where at six sites it yielded 2 033 kg on average compared with Timgalen (1 886 kg), Gamut (1 867 kg) and Gatcher (1 679 kg).

Soil fertility specialists at the Queensland Wheat Research Institute have shown that nitrate nitrogen present in moist subsoil to a depth of 90 cm can be as beneficial to the wheat crop as nitrate present in the plough layer. The relative benefit of surface versus subsoil mineral nitrogen depends largely on the seasonal moisture conditions prevailing. When the crop is stressed for moisture during early vegetative development, subsoil nitrate can be of even greater benefit to the crop than that nitrate present within the plough layer.

Biosuper as a source of phosphorus for wheat was investigated at the Institute. Two soils known to be deficient in phosphorus were used in the tests and results, in the glasshouse and field, showed that biosuper is not a suitable phosphate fertilizer for wheat.



An Agriculture Branch officer is studying sesame varieties at D.P.I.'s Gatton Research Station.

The Department's agricultural engineers have designed a pilot commercial treatment plant for the drought hardening of wheat seed. Design criteria show that the treatment of seed wheat should cost approximately $1.90/t at present fuel prices. It is proposed that this pilot plant should be used to treat sufficient seed to allow large-scale field testing of the drought hardening technique. Considerable industry support is required for this project to be successful.

Despite favourable conditions, stem rust caused little overall loss mainly because growers sowed resistant cultivars. Some crops of Festiquay and Tarsa were adversely affected. Further changes in the stem rust pathogen (*Puccinia gramminis* f. sp. *tritici*) have enabled it to overcome the resistances in Tarsa and Gamut, which seriously reduces the resistant cultivars available for the 1974 season. Leaf rust (*P. recondita* f. sp. *tritici*) caused considerable loss, and no commercial cultivars resistant to all field strains of this fungus are available. However, there were further encouraging results in controlling the disease with the fungicide RH 124. Foliar pathogens, *Septoria nodorum* and *Pyrenophora tritici—repentis*, were conspicuous and were associated with yield losses in some areas.

The most severe outbreaks of head blight on record occurred in wheat, up to 70% 'deadheads' being recorded in some crops in the South Burnett. *Gibberella zeae*, the cause of crown rot, was the source of the outbreak. Studies are aimed at determining the heritability of resistance to crown rot—a necessary preliminary to a full-scale breeding programme against this disease.

Common root rot (*Cochliobolus sativus*) was widespread and severe particularly in a continuous wheat cropping sequence. Detailed ratings on a pasture rotation experiment are being conducted to investigate this effect. The provision of seed dressings as alternatives to mercury and HCB compounds still presents a problem because of the non-availability of liquid or slurry preparations. Meanwhile, detailed phytotoxicity tests are almost concluded to determine whether seed treated with alternative materials such as mancozeb will deteriorate with storage.

BARLEY

An active barley breeding programme is developing at Hermitage Research Station. The main aim of the programme will be the breeding of superior malting varieties. However, it is anticipated that high-yielding feed barley varieties will also emanate from the programme. In 1973, 50 varieties were grown in strain trials at Clifton, Dalby, Goondiwindi, Hermitage Research Station and Tara. These trials were designed to evaluate strains and varieties which may be used as parents in the plant breeding programme and to test selections from the breeding programme.

Eight barley varieties were evaluated at 19 sites throughout Southern and Central Queensland in the 1973 regional varietal testing programme. There have been 80 such trials in the past six years. Bussell (2 438 kg/ha) and Lara (2 412 kg) were the highest yielding varieties in the 1973 trials but cannot be recommended for commercial planting because of their inferior malting quality. The yield of Clipper, the commercial malting variety, was 2 247 kg.

The 1974 regional testing programme will include several selections from the Waite Institute programme which were grown in strain trials here and have considerable potential as feed grain varieties. The best of these selections outyielded Clipper in these trials by 19% over five years. Segregation of the three strains mentioned will not be difficult because they possess a distinctive grain colour. It is anticipated that one of the three selections will be released as a feed grain type in 1975.

The formerly resistant cultivar Clipper was severely affected by powdery mildew (*Erysiphe graminis*). It was still, however, the most resistant of eight cultivars examined in a field trial.

SORGHUM

The main aim of the sorghum breeding programme is to produce hybrids capable of yielding consistently well under the variable growing conditions in Queensland. Aspects of great importance which are receiving considerable research attention are resistance to lodging, to damaging diseases, to insect (midge) damage and to damage from insecticides used in sorghum production.

With regard to lodging resistance, certain high yielding, unreleased hybrids developed by the plant breeders lodged significantly less than the related commercial hybrids Texas 610 and NK212 at Biloela Research Station in the 1972–73 season. Alpha, the open-pollinated variety developed by the Department some 25 years ago continues to show the highest resistance to lodging. Alpha, although lower-yielding than the commercial hybrids, is still a very popular variety, particularly in Central Queensland where lodging is a severe problem. The small-seeded nature of Alpha is seen as a problem in certain export markets, and plant breeders are endeavouring to develop a large-seeded version of the variety.

The joint breeding-virology programme designed to produce sugar cane mosaic Virus (S.C.M.V.) resistant hybrids continues to impress. Since the release of four S.C.M.V. resistant lines QL1, QL2, QL3 and QL4 last year, requests for seed have come from many of the world's major sorghum breeding institutions. S.C.M.V. resistant progeny of the male parents of Texas 610, Texas 610SR and Q5161 (released earlier by the Department as a hybrid showing considerable resistance to lodging), are nearing the release stage. Hybrids based on them performed very well in the 1973–74 screening programme at Hermitage Research Station.

Lines reported resistant to midge in Georgia and Texas, U.S.A. are being investigated in Queensland with encouraging results. A co-operative project between plant breeders and entomologists is in progress at Biloela Research Station.

Some insecticides cause severe phytotoxicity in certain sorghums. Alpha, for example, is severely affected by monocrotophos, the main chemical used for control of locusts and sorghum head caterpillar. Breeding work is in progress to develop hybrids resistant to damage by certain insecticides.

The regional sorghum varietal testing programme is assuming greater importance to the industry because vigorous screening for resistance to important diseases is carried out annually on individual trials. Results of the screening strongly influence Departmental varietal recommendations for the various growing regions. It is significant that only hybrids entered in the testing programme are eligible to be included in Departmental recommendations.

Seedling blight (*Fusarium moniliforme*) caused losses in many areas often necessitating replanting. Leaf diseases were more serious than normal. Conclusions from preliminary investigations into stalk rot indicate that *F. moniliforme* is the dominant pathogen.

Rigorous screening of hybrids for reaction to sugar cane mosaic virus has shown that a few commercial releases of red stripe reactors are still being made. The companies concerned were informed.

MAIZE

The main objective of the Department's maize breeding programme based at Kairi Research Station is to breed maize hybrids which will yield well in the Atherton Tableland environment. Two Kairi hybrids QK217 and QK218 (grown commercially for the first time in the 1973–74 season) occupy almost all the area put to maize this season. However, these hybrids will be replaced in the near future by QK231 and QK232 which have better disease resistance. QK231 and QK232 outyielded QK217 by 30% in trials over the past three seasons. There is good evidence that hybrids now in the initial phases of testing will out-perform these hybrids. Maize acreage on the Tableland has declined but, if better hybrids can be brought forward, aggregate yields will be maintained. This is important as maize grain has a useful function in the economy of the area.

The Kairi hybrids have also performed well in other areas such as the Northern Territory, Papua-New Guinea and South-eastern Queensland. QK232 (6 988 kg/ha), KTW227 (6 850 kg), KTW221 (6 658 kg) and QK218 (6 656 kg) provided the highest yields overall in the mid and late maturing maize varietal trials conducted at Gatton Research Station and Kingaroy in 1972–73. The best of the locally grown commercial hybrids was Q1280 (6 345 kg). The Kairi hybrids, because of their extreme height and late maturity, are not suited to South Queensland production in their present form. However, the high yields produced give an indication of the breeding programme's potential.

As with the sorghum programme, the regional maize varietal testing programme has assumed greater importance to industry. Before hybrids can be considered for inclusion in Departmental recommendation lists for the various regions they have to be screened in the regional programme, and found to be acceptable for commercial production. The screening includes a vigorous evaluation of resistance of hybrids to important diseases.

Maydis leaf blight (*Drechslera maydis*) continues to severely affect hybrids based on Texas cytoplasm in South-east Queensland where race T of the fungus is completely dominant. However, normal cytoplasm hybrids which now dominate plantings have been free from the disease except in North Queensland. There, a change in race pattern of the pathogen, where race O has become dominant, has led to severe blighting of some hybrids containing normal cytoplasm.

Wet weather conditions led to severe outbreaks of common leaf blight (*Drechslera turcica*) in all areas of the State. Incidence followed the characteristic distribution pattern, being much more severe on early maturing hybrids. Other leaf diseases, including rust, were much more prevalent than usual.

Sugar cane mosaic virus, although widespread in southern parts of the state, has had a minimal effect because of the widespread use of resistant hybrids. Close scrutiny is being maintained on all new material being released so that full information is available on leaf spot and virus reactions.

Efforts to eradicate sugar cane mosaic virus from the Atherton Tablelands, where its occurrence has been restricted to the Innot Hot Springs area, was frustrated by the excessively wet season and the adjacent sorghum crops.

Detailed tests with sweet corn in the Lockyer Valley indicated that many new types will perform better than the currently grown commercial hybrids when sugar cane mosaic is a problem.

Stalk rot was obviously severe in all areas of the state. *Gibberella* stalk rots caused severe lodging in many crops in North Queensland. In South Queensland, earlier maturing hybrids were much more severely affected than late maturing types. At Kairi Station, fertilizer applications once again depressed *Diplodia* ear rot and *Marasmius* stalk rot.

SOYBEAN

The regional soybean varietal testing programme continued during the 1973–74 season with trials at 20 sites. Harvesting was delayed at many sites by wet weather, and results of many trials are not yet to hand. Results from completed trials gave best yields from Semmes (3 101 kg/ha) at St. George, from Bragg (4 027) at Gatton Research Station, from 70/39 (2 663) at Brookstead, and from HR1 (2 067) at Hermitage Research Station. The lines 70/39 and HR1 were produced by the Department's soybean breeding programme.

The breeding programme based at Hermitage Research Station aims at producing varieties suitable for Southern and Central Queensland with high yielding ability, resistance to leaf diseases and with the oil and protein contents required by the processing trade. The strain trials comprising early and late maturing lines are carried out at Gatton Research Station, Kingaroy, Brookstead and Hermitage Research Station, Kingaroy, Brookstead and Hermitage Research Station. The best lines from the strain trial series are then promoted to the State-wide regional varietal testing programme. To date one variety, Rhosa, imported from Rhodesia, and four lines from the breeding programme, 70/50, 70/39, HR1 and HR2, have been promoted to the regional testing programme. Rhosa has been discarded because of insufficient resistance to leaf disease.

Planting time x variety x plant arrangement trials under irrigation are being conducted at a number of sites in Southern and Central Queensland. Although all of these trials have not been completed, preliminary results indicate that maximum yields approaching 4 tonnes/ha are produced by plantings in November and/or December. There are, however, differences between varieties in their responses to planting time.

Investigations in North Queensland have been intensified and extended to the wet coastal area where the crop stood up well to the extremely wet conditions of the past season and showed promise of successful adaption. Yields in the Mareeba and Burdekin areas have exceeded 3·5 tonnes/ha in normal seasons.

Weed control in soybean was one of many demonstrations at a field day at the Gatton Research Station.

An investigation is underway at Hermitage Research Station to determine the levels at which green vegetable bug, *Nezara viridula,* infestations reach economic proportions and spray protection becomes necessary.

Further studies confirm that nitrogen fertilizers reduce nodulation levels and nodule size. Laterally placed nitrogen depressed nodular activity more than nitrogen placed in the centre of the beds used in irrigated crops in Central Queensland.

The phosphorus and sulphur nutrition of soybeans is under investigation at two areas on the Darling Downs. Results from these trials on two black earths are expected shortly.

Critical concentrations of phosphorus and potassium in soybeans were established in pot experiments. These will be checked in field trials in the coming season.

Four soybean experiments were established to relate the crop response to major fertilizer elements to soil tests and plant analyses.

Rust (*Phakopsora pachyrhiza*), which has occurred in humid areas such as Redland Bay and North Queensland, became much more widespread in the past season. There is no known resistance to this disease but spraying with Benlate assists in controlling it.

In previous seasons it has been restricted to coastal areas in South Queensland and the Atherton Tablelands. This year it occurred to a significant level in all areas except parts of the Darling Downs. In the South Burnett, it appeared to affect the yield of a small number of crops. Whether this spread is to be a permanent feature or related only to the excessively wet conditions this year is not yet known. A close watch will be kept on this disease in the coming season.

Charcoal rot (*Macrophomina phaseoli*) although widespread did not cause significant losses. The fungus *Sclerotinia sclerotiorum* in contrast, and no doubt as a result of the wet season, caused considerable foliage blighting.

SUNFLOWER

Varietal testing of sunflower continued during the 1973–74 season but wet weather conditions necessitated replanting or abandonment of several trials. An early-sown trial in the Kingaroy district produced a best yield of 1 618 kg/ha from the variety A20. On the Darling Downs, best yields were obtained from Stepniak (1 036 kg/ha), VNIIMK (997), A15 (978) and A20 (920).

The release from plant quarantine of small quantities of seed of cytoplasmic male sterile lines has permitted preliminary testing of hybrid lines in two trials at Gatton and Hermitage Research Stations. The trial at Hermitage is not completed but at Gatton four hybrid lines produced yields varying from 2 090 to 2 870 kg/ha compared with a yield of 1 720 kg/ha from the variety Peredovik 66. As plot size and degree of replication in this trial were limited, the results should be treated cautiously but the difference in yield between the hybrid lines and the open-pollinated variety suggests that increases in yield can be expected from the hybrid lines when they are more thoroughly tested next season. These hybrid lines are very uniform for height, flowering and maturity, and exhibit resistance to rust.

The main project in the sunflower research programme is the pilot study to examine the use of systems analysis. This project is designed to monitor inputs into the system, and to predict results. Inter-divisional and inter-branch co-operation has been at a very high level, and a number of feeder trials are being carried out to give added information. The systems analysis project is the first of its type to be conducted in Australia. A pollination trial is in progress to provide information on bee populations necessary to provide the level of pollination required to ensure maximum grain yield from sunflower.

Screening of sunflower lines for rust resistance was continued, and 10 lines showing generalised resistance were selected. These will be used in the breeding programme as parents for crossing with varieties with better agronomic characteristics.

Fertilizer trials showed that combined nitrogen and phosphorus fertilization promotes early plant development, early flowering and increased yields.

Sunflower trials during the wet season in the Burdekin Irrigation Area were not successful due to severe attacks of *Alternaria helianti* which reduced yields to only 100 kg/ha.

Rust (*Puccinia helianthi*) was generally present and caused yield losses. Evidence from detailed tests would indicate that levels of field resistance could well exist for this pathogen. Further work is contemplated this coming season. Head rot (*Rhizopus arrhizus*) was widespread and severe.

PEANUT

Varietal trials conducted in the South Burnett delineated five impressive lines of Virginia Bunch peanuts. The highest yield was 2 821 kg/ha (nut in shell) from P.M.B. Sel. VB69/2. Current trials compare these lines with two recent importations from North Carolina, NC-17 and Avoca II. Seven lines of Red Spanish peanuts produced good yields, the highest being 1 920 kg/ha (nut in shell) from RS4.

Growers inspecting peanut varieties at a crop field day at the Kingaroy Field Station.

Fertilizer placement trials in the South Burnett show that phosphorus fertilizer gives most satisfactory results when applied at planting, at seed level and 5 cm to the side of the seed.

In North Queensland, time of planting trials show December as the best month for planting. While *Cercospora* leaf spot incidence has been reduced by planting in June, it would be impossible to harvest crops from such plantings in most seasons because of wet conditions. Poor stands have been a feature of many crops in North Queensland and investigations have shown that these poor stands are due to defective planting machinery and not to poor quality seed.

Planting rate trials in North Queensland show that planting rates can be increased from the current practice of around 45 kg/ha to 90-100 kg/ha with the expectation of increasing yield by about 800 kg/ha. Average yields from 5 trials over 2 seasons were 2 630, 3 074, 3 376, 3 520 and 3 446 kg/ha from seeding rates of 44, 66, 88, 110 and 132 kg/ha respectively.

Leaf spot (*Cercospora* spp.) was very severe in North Queensland, and seasonal conditions made the use of the normal fungicidal control programme difficult. Rust (*Puccinia arachidis*) was again widespread in North Queensland, but its effect was difficult to determine because of the severe leaf spot. Trial work indicated, however, that at least two fungicides were effective against both diseases. Recommendations for control will be made before the next season.

In South Queensland, leaf spot was also worse than usual but widespread use of fungicides, particularly benomyl, kept adverse effects to a minimum. Peg, pod and stem rots (*Sclerotium rolfsii* and *Rhizoctonia solani*) were extremely severe because of the wet weather.

Peanut mottle virus is now well established in South-east Queensland, occurring in most crops. Experimental work is continuing to assess the effect of the virus on yield. This work was hampered this year by a 100% incidence in all crops sampled.

POTATO

The potato evaluation programme has been in progress for four years in co-operation with research workers in southern States. During this period, 205 varieties have been examined. For overall performance and for most purposes, the standard variety Sebago appears to be well suited to Queensland conditions. Currently 24 varieties are being tested in Stage I, 20 varieties in Stage II (second year of testing) and 11 varieties in Stage III (third year of testing). There are lines in the programme which can produce better yields than Sebago in particular situations while others are more suited to the canning trade.

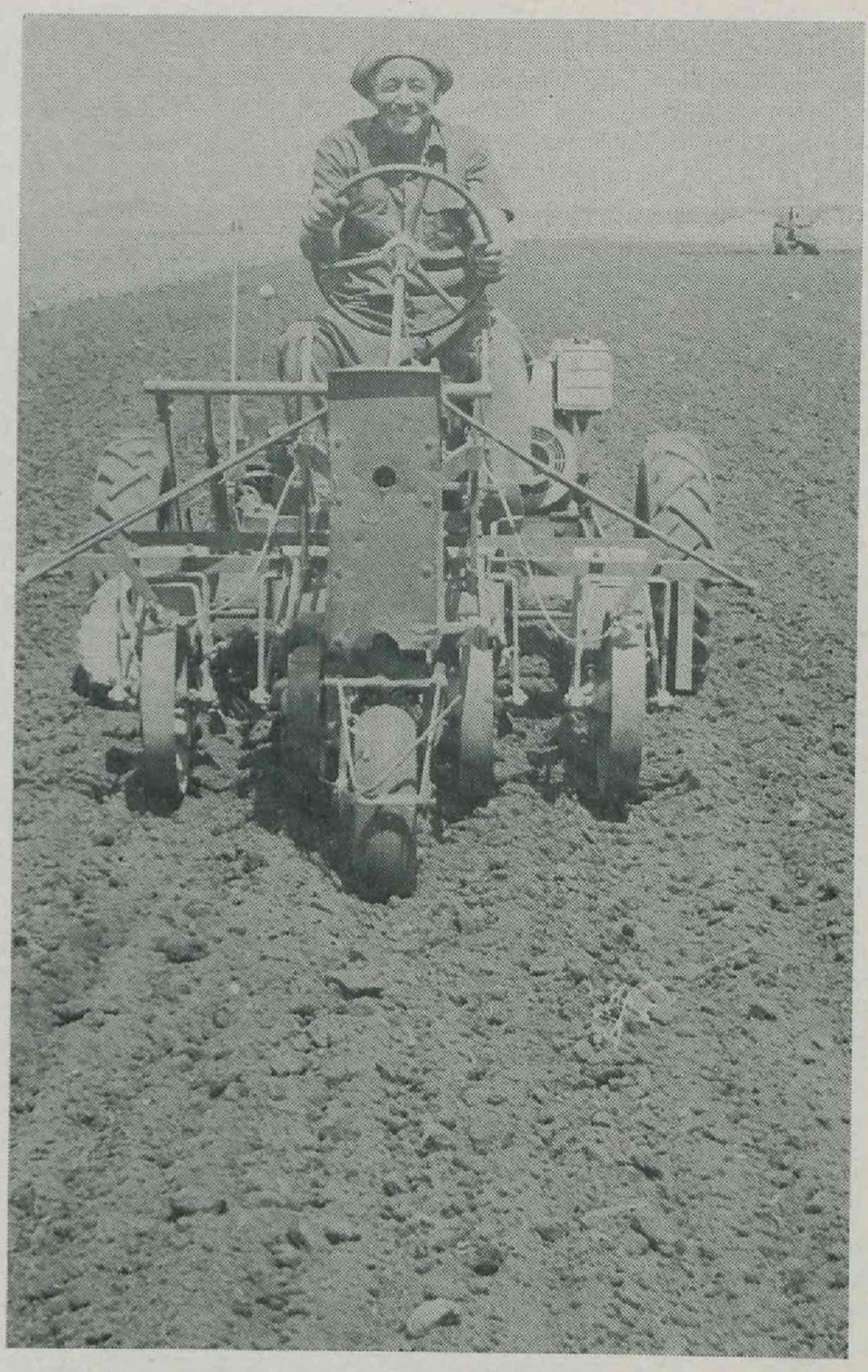
Disease-free seed of the cultivar Sebago was multiplied under glasshouse conditions and is now ready for field increase. An evaluation of this seed will be made in 1975 as part of a feasibility study for a seed scheme in Queensland.

Irrigation trials have confirmed that soil moisture should not be allowed to fall below the critical level of 70% available soil moisture at the time of tuber formation. Prior to this stage, the level of available soil moisture can fall to as low as 30% without detriment in the spring crop which is normally subject to low temperatures. In the autumn crop, which is exposed to comparatively higher temperatures, the available soil moisture must be kept at the higher level of 70% available soil moisture even in the period before tuber formation.

ONION

Population and spacing trials with the onion crop have produced yield increases of 25% by increasing the planting rates from 2·3 kg/ha to 4·5 kg/ha. Further increase in planting rate to 6·8 kg/ha gave an increase in yield of 50% of the yield at the 2·3 kg/ha planting rate. Yield was also increased by 8% in March plantings through a more even distribution of plants obtained by reducing the inter-row spacing (usually 30-35 cm). The higher density plantings were more severely affected by downy mildew (*Peronospora destructor*) but variation in inter-row spacing had no effect on the severity of the disease. In all cases, yield increase resulted from an increase in the number of pickler grade onions.

Trials were carried out to evaluate different seed sources of Early Lockyer Brown onions. In a trial with three planting dates between early March and mid-April, local strains of seed produced consistently higher yields in plantings made in March, and in the earliest planting yields were approximately double those obtained from seed from commercial sources. These trials are continuing and further yield improvement is being sought by making selections within these strains.



Mr. Cliff Ziebell plants onions at Mt. Tyson (Darling Downs).

TOBACCO

The Department's tobacco plant breeding programme based at Beerwah in South Queensland is designed to produce disease-resistant tobacco varieties. This programme is conducted in association with C.S.I.R.O., and new lines and introduced varieties are tested on a State-wide basis. The principal diseases concerned are blue mould (Strains 1 and 2) and black shank, and any new varieties released will possess at least field resistance to these diseases. Before 1972, Strain 2 of blue mould occurred only in South Queensland, but since then it has been recorded in North Queensland as well. A North American variety NC2326 performed well in field tests under South Queensland conditions and although susceptible to blue mould it is being released in South Queensland for the 1974–75 season.

New tobacco varieties are also being evaluated to assess their adaptability to varying cultural practices. This new field of investigation, commenced in 1972–73 at Southedge Tobacco Research Station, Mareeba, compares tobacco varieties planted early and late and grown under a range of plant spacings. Responses to time of planting in August or September differed appreciably. In 1973–74 the September plantings gave an overall 8% increase in yield of cured leaf, and increased gross returns/ha by over 18% compared with an August planting.

Tobacco growing under conventional practices has a high demand for labour particularly during harvesting and post-harvesting. To reduce labour costs, various operations are becoming more mechanised. The Department's role in this change is one of co-operating with other organizations in assessing, and advising on, the engineering, agronomic and economic implications of innovations. Engineering aspects being examined include methods of leaf conveyance for adaption to taxi-type harvesting machines, and modifications to conventional curing barns to achieve more uniform curing.

Crops in North Queensland of blue mould "resistant" cultivars such as Sirone were affected by a new strain for the second year in succession. Fungicidal control programmes had to be reintroduced. Detailed comparisons of all strains of *P. hyoscyami* occurring in Queensland are continuing. It is clear already that there are considerable differences in host range and in spore production capacity.

Black shank (*Phytophthora nicotianae* var. *nicotianae*) was successfully established in a disease nursery where intensive screening for resistance is being undertaken. Several resistant lines have been identified. In a field trial, some soil fumigants successfully controlled this disease. In glasshouse tests, the cultivars T.I. 1406 from the U.S.A. and Virgin-A-Mutant from Rhodesia showed resistance to potato virus Y, the cause of tobacco vein banding.

As indicated in the last annual report, the recommended chemicals together with the pest prediction service enabled a high level of control to be obtained. The level of budworm activity in the 1973–74 season was greatly reduced and this combined with the prolonged wet season limited testing of further chemicals.

Results confirmed the insecticide resistance work being carried out at Toowoomba which showed there was an indication of DDT resistance developing in *Heliothis armigera* (Hubner.) but none in *Heliothis punctigera* Wallengren.

Biological studies of, and chemical testing against, tobacco stem borer, *Scrobipalpa heliopa* (Lower) continued. It became obvious that control of this insect after infestation had occurred was very difficult to achieve. Under these circumstances, the destruction of residues and good farm hygiene assumes major importance in reducing subsequent infestations.

Studies on the economic injury levels of *Plusia argentifera* (Guenee) in tobacco continued. The problem is a complex one, particularly as the tobacco plant seems to have great flexibility in replacing damaged leaves.

NAVY BEAN

Varietal testing of navy beans was carried out in Central Queensland, the South Burnett and on the Darling Downs in 1973. In four trials in Central Queensland, the highest average yields were produced by Selection 51 (815 kg/ha), Selection 50 (739), Selection 46 (711) and Selections 52 and 53 (708). The standard varieties Gallaroy and Kerman produced average yields of 438 and 221 kg/ha respectively. On the Darling Downs, the best average yields from two trials were given by Selection 45 (1 637 kg/ha), Selection 37 (1 589), Selection 51 (1 557) and Selection 44 (1 512), while the standard variety Gallaroy produced a yield of 1 509 kg/ha. At Kingaroy, the best yields came from Selections 50, 41, 51 and 39 with 660, 647, 597 and 589 kg/ha respectively, while Gallaroy yielded 543 kg/ha.

Trials to study the effects of nodulation and nitrogen fertilizers on navy beans commenced in the South Burnett and on the Darling Downs.

Peanut mottle virus has caused widespread losses in navy bean crops in the South Burnett in recent years, and a breeding programme has been initiated to produce resistant lines. Crosses were made between resistant red kidney beans and several navy bean varieties, and the F_2 progeny were screened.

Rust (*Uromyces appendiculatis*) was severe in some crops. Fungicidal spray trials indicate that systemic fungicides such as oxycarboxin are superior to protective fungicides such as mancozeb in controlling rust of the foliage but inferior in controlling pod infection.

COTTON

An advanced strain test was grown at Biloela, Brookstead, Lockyer and St. George for the third year, covering the major cotton growing areas in Queensland. There were 25 entries, consisting of 16 introductions from the United States of America, a number of F_2 derived bulks from Deltapine Smoothleaf crosses, DSL 13 and A(57)1 (an African upland variety). DSL 13 was challenged only by one F_2—derived—bulk from DSL A(57)1 and by Deltapine 16. Other varieties such as Hancock yielded well sometimes but were not consistent.

DSL 13 was selected at Biloela from Deltapine Smoothleaf and is the commercial strain in Central Queensland. It yielded well in all trials showing superiority in yield and in stability of yield at levels ranging from 300 to 2 000 kg/ha. Deltapine 16, one of the popular varieties in southern United States cotton areas, is only slightly inferior to DSL 13 in overall average yield but appears to be more variable and less profitable.

The development of varieties with some degree of resistance to insects, especially *Heliothis* moth, is now considered a worthwhile objective. The most favoured approach is the incorporation, from a recently imported line, of a high gossypol content which produces some deaths in the insect larvae.

MISCELLANEOUS CROPS

Research on safflower is concentrated in Central Queensland, the main area of commercial production in the State. In varietal trials at Biloela Research Station and Emerald, no variety has significantly outyielded the current commercial variety Gila. At Biloela Research Station, the highest yield was 1 676 kg/ha from the variety UC-1 (Gila, 1 563 kg/ha) while at Emerald the highest yield was 2 398 kg/ha from the variety Gila.

Time of planting trials over two seasons show that best yields come from plantings in May and June with marked reductions in yield from later plantings.

Trials in the Burdekin area produced yields up to 1 700 kg/ha with Gila being among the top yielders.

Root rot (*Phytophthora drechsleri*) caused severe losses in crops in Central Queensland, especially where the land was poorly levelled for flood irrigation.

Irrigated trials on the Darling Downs to investigate lupin varieties, plant populations and planting times have shown that the *Lupinus albus* varieties, WB1 and WB2, are more suited to the soil conditions than the *Lupinus angustifolius* varieties, Unicrop and Uniharvest. The best time of planting is mid-April and populations of 400 000 plant/ha are more productive than lower plant populations. In these trials the variety WB2 produced the highest yield, 3 815 kg/ha with a protein content of 34%. In a trial planted at Biloela Research Station in April 1974, *Rhizoctonia* root rot severely affected the varieties Uniharvest and Unicrop but had only a slight effect on varieties WB1 and WB2.

Encouraging results have been obtained from preliminary experiments with sesame in Central Queensland, and work continued at Biloela Research Station. Preliminary studies also commenced at Hermitage and Gatton Research Stations. None of the three trials has yet been completed but studies using an autoheader at Gatton Research Station indicated that non-shattering varieties can be direct-harvested providing grain drying facilities are available.

In a mung bean planting rate x row trial at Roma, the highest yield of 545 kg/ha was obtained from a seeding rate of 9 kg/ha in a skip row pattern. A varietal trial is being conducted to find higher yielding varieties of this apparently hardy field crop.

Adzuki bean varieties are being grown at two sites on the Darling Downs to test the potential of this crop for the high value market that exists in Japan.

Pasmo disease (*Mycosphaerella linorum*) was present in all linseed crops examined on the Darling Downs. Investigations into effective seed treatments are underway.

Smut (*Tilletia barclayana*) incidence was surveyed in Burdekin and Ingham rice crops using samples of the 1973 summer crop delivered to the Home Hill mill. It was present in a large percentage of Burdekin crops but at an insignificant level. The incidence was very slight in Ingham farms. To date no grass hosts have been recorded in North Queensland.

Narrow brown leaf spot (*Cercospora oryzae*) and root rot (*Fusarium moniliforme*) were associated with severe seedling blight and lodging problems in ratoon crops in the Burdekin.

Stem rot (*Phytophthora vignae*) was very severe in the formerly resistant cowpea Caloona cultivar. New material incorporating an additional effective gene for resistance is now undergoing field testing.

Corn ear worm, *Heliothis sp.*, is the major pest limiting the production of sweet corn. In an attempt to find an effective means of controlling this pest an experiment was designed to examine the effect of spraying the silks only. Earlier work has shown that the majority of corn ear worm eggs are laid on the silks and silking lasts approximately 17 days.

In the experiment, the materials *Bacillus thuringiensis* (Dipel), 400 g/1 000 litres, DDT 0·1%, Chlordimeform 0·5% and methamidophos 0·1% were applied on a weekly and biweekly basis. After silking had finished no further sprays were applied. The mature cobs were then examined for corn ear worm damage.

It was found that this form of control significantly reduced the level of damage to cobs, when any of the chemicals were applied weekly, and if applied biweekly the level of control was improved by a further 50%.

It appears there are a number of chemicals available which, when they are applied to the silks, will reduce corn ear worm populations. The frequency of spraying during this period appears to be very important in reducing damage.

The results of this experiment clearly show that control measures are only required when silking occurs.

In the 1974–75 season, further experimentation will be carried out to determine the most effective chemicals and the optimum frequency of spraying.

IRRIGATION PROJECTS

At Emerald, irrigation frequency x plant population trials on grain sorghum showed that an irrigation at head initiation (about 3–4 weeks from planting), followed by one at early boot (6–7 weeks) and then at 10 to 12 day intervals until physiological maturity, should maximise yields from a September planting on the shallow cracking clays.

In a fertilizer trial on soybeans planted in beds, with nitrogen in the form of urea, it was found that the fertilizer moved much more freely when irrigation followed placement in dry soil that when the fertilizer was placed in moist soil with subsequent irrigation. There was also much greater fertilizer movement with lateral placement compared with central placement in dry soil followed by irrigation, while there was little difference in movement between fertilizer placed laterally or centrally into moist soil.

In the Lower Burdekin region, attention was given to finding alternative crops to rice. Varietal trials with soybeans during the wet season produced yields up to 3 760 and 2 650 kg/ha on levee and Barratta soils respectively while bulk areas on the flood plains produced yields up to 2 930 kg/ha. During the dry season, maize yields reached 4 210 and 5 420 kg/ha from early and late planted crops while sunflowers produced a reasonable yield of 1 500 kg/ha. In the Inglewood district, crusting and poor water penetration in the silty clay loams along the Macintyre Brook has been a long standing problem. Preliminary studies of furrow irrigation methods have indicated that the conventional 'V' furrow is the least efficient in achieving water penetration into the soil profile. A crop rotation trial aimed at improving the structure of these soils has been in progress for three seasons, and the three-year treatment phase has been completed. The assessment phase using soybeans and barley as indicator plants has commenced. Early indications are that the incorporated organic matter from the crop residues reduces the crusting problem and facilitates water infiltration. In these respects Rhodes grass is superior to lucerne. Soil physical and chemical assessments are also being made.

WEEDS AND WEED CONTROL

Wild hops (*Nicandra physaloides*) is a major weed problem in Atherton Tableland maize crops, and a recent trial has suggested that as few as 4·7 wild hops plants/sq. m. are capable of reducing maize grain yields by 30%. A further interesting point from this trial is that 4·7 wild hops plants/sq. m caused the same maize grain yield reduction as 37·3 wild hops plants/sq. m. Again, it was found in this trial that D.M. production/unit area of 4·7, 9·3, 18·6 and 37·3 wild hops plants/sq. m was not significantly different. Atrazine at 2·24 kg ai/ha as a pre-emergence spray gives good control of wild hops with a significant grain yield increase.

Two trials were carried out to determine the tolerance of grain sorghum cultivars to 2,4-D under Central Queensland conditions. When 2,4-D was applied at three rates (0·28. 0·56 and 1·12 kg a.e./ha) to the cultivar Alpha at six growth stages (0–2 secondary roots, 2–4 secondary roots, growing point differentiation, last leaf in whorl, shot blade and flowering), grain yields were reduced at all but the first two stages. In the second trial the tolerance of the grain sorghum cultivars Alpha, DeKalb E57, Q5161 and NK133 to 2,4-D applied to 0·56 kg a.e./ha at the growing point differentiation stage was examined. The yield of Q5161 only was significantly reduced while Alpha only suffered a significant increase in root lodging.

Bell-vine (*Ipomoea plebeia*), thornapple (*Datura* spp.) and Noogoora burr (*Xanthium pungens*) are three common weeds of the rapidly expanding soybean industry in South-east Queensland. Preliminary trials at Gatton Research Station have indicated that bell-vine can be controlled satisfactorily with a high degree of safety by post-emergence application of the herbicide Bentazon. In trials near Warwick, Bentazon also showed promise for the control of thornapple and Noogoora burr in soybeans. Further trials are planned to confirm these early findings.

A research programme has been devised to attempt to eradicate established swards of Johnson grass with repeated applications of translocated non-residual herbicides and to determine whether natural revegetation by more desirable species is possible or whether introduced grasses will compete with and suppress the expected subsequent germinations of Johnson grass seedlings. M.S.M.A. and glyphosate are being examined and to date glyphosate is more effective than M.S.M.A. in reducing rhizome regrowth, but Johnson grass re-infestation from seedlings is heavy. Establishment of introduced grasses has been minimal. The programme is continuing.

The herbicide triallate continues to give good wild oat control, and treated areas generally produce higher wheat yields than untreated areas. The wheat-wild oat competition trial is entering its fifth year. The results of the 1973 trial showed that wild oats reduced wheat yield more from a low wheat population than from a high wheat population. In the field, nitrogen fertilizers appear to break wild oat seed dormancy, and it is proposed to examine this phenomenon closely in pot studies.

A four-year trial to evaluate the herbicides treflan (0·84 kg a.i./ha), balan (1·4 a.i./ha), planavin (0·84 kg a.i./ha) and tillam (5·04 kg a.i./ha) for weed control in tobacco was completed, and most effective weed control was achieved by the chemicals in the above order. There was no herbicide build-up in the soil after four years' annual application at the above rates.

AGRICULTURAL ENGINEERING

The agricultural engineering group at Toowoomba comprising four agricultural engineers introduced some specialisation into its activities in order to provide a better service to rural industries, the specialities being farm buildings and structures, experimental machinery and farm mechanisation generally, grain drying and storage, ground spraying equipment, and examination of crop seeding and tillage machinery performance.

The peanut harvesting efficiency study indicated that overall harvesting losses can approximate 5% of the total yield. Increases in ground speed and in drum speed caused increased losses of good nut-in-shell and in loose kernels respectively.

The tobacco curing process is being studied in an experimental barn, and an assessment of the performance of a tobacco mechanical harvester is underway. A device for elevating tobacco leaves is being designed.

Efficient seed cleaning machinery was designed and fabricated for removal of stones, soil and broken grains from seed of pasture legumes, such as Siratro, and from commercial crop grains, such as navy beans. Existing experimental machinery was modified, and new machines were designed and built to meet the needs of experimental programmes involving crop seeding, soil sampling and sterilization and seed treatment.

A press wheel drill was designed, built and tested for planting winter cereal crops under conditions of declining seed bed soil moisture. Special narrow seeding tines fitted with wings to move away dry surface soil were devised, and proved successful. A detailed study of the press wheel principle in grain crop seeding is being planned and much of the equipment required was obtained.

The agricultural engineering group is hard pressed to meet the needs of the rural industries as well as the needs of the field research programmes. In addition, workshop space is already over-taxed and this situation was aggravated by the increasing needs of the soil conservation programme. The pay-off from an agricultural engineering service is high. It was estimated that at current production levels and prices navy bean growers should receive about $30 000 extra each year from sale of seed retrieved by the navy bean seed-cleaning equipment.

EXTENSION

The role of the extension worker continued to develop and broaden as the demand for technical advice to farmers, primary producer organizations and local authorities increased. This advice covered the whole range of problems in crop and pasture production, soil and farm management. The extension officer is more and more becoming an educator in rural communities.

Sown pastures continued to have an increasing impact on beef production, and extension emphasis is changing from one of establishment to one of management. Nevertheless, there are still some major establishment problems particularly on the heavy clay soils of the Darling Downs and the Central Highlands.

The area under soybeans continued to rise, and satisfactory yields were obtained despite the vagaries of the weather. Soybeans are now a well-established crop in many grain growing districts and extension officers have contributed much towards this diversification.

Considerable effort was put into property diversification. On the Darling Downs, traditionally the centre of wheat growing in the State, graingrowers have diversified into grain sorghum, sunflowers, millets and maize as well as soybeans. This diversification was accentuated by the run of poor winter seasons and an estimated 70% of the cropping land on the Downs is now under summer grain crops. On the western Downs and Maranoa, the area under crop has not only been reduced but considerable areas of grain sorghum and sunflowers are now produced. Extension officers had an important role in assisting property owners to diversify their operations.

Farm labour is becoming both more expensive and harder to obtain. All primary producers are relying more and more on machines, and extension officers are assisting farmers to mechanize their operations. In the tobacco industry, harvesting machines, bulk curing units and solid set irrigation are but a few of the innovations introduced recently.

In the grain growing areas, planting equipment with press wheels and moisture seeking tines were introduced to enable farmers to sow their crops over an extended period. In addition, cultivating equipment capable of working in crop stubbles was introduced enabling farmers to store moisture more efficiently.

Extension officers and seed producers continue to work closely so that the best varieties of grain sorghum and maize are recommended.

A number of planned extension activities were aimed at reducing pollution in agricultural situations and at assisting landowners to develop their properties along sound ecological lines.

A major extension effort was aimed at reducing the area of crops affected by weedicide spray drift on the Darling Downs. A significant reduction in the area of crops reported damaged by spray drift was achieved and in fact no crop damage was reported on the Southern Darling Downs around Warwick.

In this programme, wide row spacing of summer grain crops, particularly grain sorghum, was stressed. Weeds growing in these crops can be controlled mechanically or by tractor-mounted boom sprays. Spray drift is much less likely to occur when weedicides are applied by boom sprays.

Another programme emphasized the dangers of spraying with DDT crops likely to be grazed by livestock. Alternative chemicals are recommended when there is any likelihood of crops, crop residues and pastures being grazed by animals.

DDT has been replaced in all crop and pasture insect control recommendations except where no suitable replacement chemical is available. The remaining major usage area is the control of *Heliothis* species particularly on cotton.

Extension officers in the grain growing areas of Southern and Central Queensland were involved in a programme to control the locust plague which has ravaged these areas. They were involved in species identification, location of egg and hopper beds, chemical control recommendations and worked with shire locust control committees to co-ordinate control programmes.

The worst hit districts were the Central Highlands and the Dawson–Callide, and other agricultural extension activities in these districts had to be postponed because of the severity of the locust plague.

In the Burnett region, a 'low key' pasture development involves the introduction of the pasture legumes Townsville stylo and Siratro into native pastures. This approach, in which costs and clearing are kept to a minimum, resulted in a significant increase in pasture utilization, stocking rates and beef cattle turnoff. This approach already has wide acceptance among the graziers of the region and many are planning to develop increased areas in the future.

Examination of a wheat crop on the Darling Downs.

VI. Horticultural Research and Extension

The main responsibility for horticultural research and extension rests with Horticulture Branch, which is concerned with production, post-harvest handling and processing of fruits and vegetables. Cultural research is centred at five Horticultural Research Stations at Applethorpe (Granite Belt), Ormiston (Redlands), Nambour (Maroochy), Cairns (Kamerunga) and Bowen, supplemented by field trials in major producing districts. Post-harvest and processing research is carried out at the Sandy Trout Food Preservation Research Laboratory, Hamilton. Extension services are provided by the branch in all fruit and vegetable growing districts.

Liaison with industry is maintained through a number of horticultural advisory committees. Within the branch informal research/extension committees are responsible for the definition of problems in production and handling and assist in the co-ordination of research and extension activities. Horticultural advisory activities are now integrated on a regional basis under the new Extension Services Section.

Other branches of the Department involved in horticultural research and extension are Entomology and Plant Pathology Branches, which are concerned with pest and disease control, and Agriculture Branch, which handles the production side of some heavy vegetables—pumpkins, marrows, potatoes and onions.

Marketing Services, Economic Services and Standards Branches are concerned with such aspects of horticultural production as marketing, economic surveys, farm management accounting and seed certification.

DECIDUOUS FRUIT

The production of apples this season was about 30% below normal as a result of the mild winter which did not provide sufficient winter chilling and allowed blossoming to extend over a long period. Stone fruits were similarly affected, and the crop was the lightest for many years.

Increasing costs of production were the growers' main concern and the development of methods of reducing these was a major aim of the research programme. One way of reducing costs is to increase yields, and trials showed this can be achieved by close planting allied with irrigation. Close planting in itself leads to economies in harvesting, pruning and spraying as trees are shorter and in a hedgerow design.

Cropping in a close planting trial commenced this year although it is only three years since planting. The rootstock MM 106's performance has been outstanding. Compared with a district average for mature trees of 7·5 to 10 tonnes/ha, it gave an average yield of 21 tonnes/ha for Delicious and 30 tonnes/ha for Granny Smith under close planting conditions. The best treatments appear to be a 0·9 m inter-row spacing and a palmette training system.

A field irrigation trial in its fifth year produced its first good crop. Trickle irrigation applied four times a week gave better yields than other frequencies, and yields of up to 45 tonnes/ha for Delicious and 36 tonnes/ha for Granny Smith were recorded. The increases in yield resulted from an increase in the number of fruit rather than increases in individual fruit size.

The apple and peach improvement programme is now to the stage where early progenies are fruiting and assessments can be made. Fruit quality in many apple progenies is excellent and the prospects of producing a locally bred seedling apple with desired colour, maturity and quality characteristics for the Granite Belt look extremely good. Several promising peach progenies were produced. However, the performance of some early maturing varieties introduced in recent years is quite outstanding, and it appears that the desired improvements in peach production can be largely achieved with these types.

The combination of low rainfall and mild temperatures produced excellent quality wine grapes, and a good vintage is expected. Wine grapes under test at the Granite Belt Horticultural Research Station produced their first commercial crop, and samples were processed for wine at the Food Preservation Research Laboratory. The outstanding wine grape varities, Riesling, Cabernet Sauvignon, Shiraz and Semillon, which must play a large part in any commercial wine undertaking, all performed well. Sauvignon Blanc set poorly and does not seem to be suited to the district.

Despite a season favourable for apple scab (*Venturia inaequalis*), excellent control of this disease was generally obtained by growers. This was partly due to the use growers made of the warning service given by the Department, this being particularly beneficial in the early growth periods. In contrast, poor control was obtained with pear scab (*Venturia pirina*), and more emphasis will be given in the coming season to extension activities with this crop, particularly with regard to eradicant fungicides.

Dipping with a mixture of benomyl and dichloran again gave excellent control of brown rot (*Sclerotinia fructicola*) and transit rot of stone fruit, and this control measure is now being recommended to the industry. Tests to date with a large number of experimental fungicides have not yet revealed a single fungicide capable of giving control of both these diseases at a satisfactory level.

Following glasshouse studies which indicated that rye corn is an extremely good host of the root lesion nematodes (*Pratylenchus penetrans* and P. *coffeae*), it was shown that, under field conditions, the use of rye corn as a cover crop before replanting apple orchards caused a marked stunting of the trees. This is particularly important as rye corn is the most commonly grown cover crop in Stanthorpe apple orchards.

Virus indexing of 5 more heat-treated apple cultivars has given satisfactory results over a number of seasons. These will now be established in the mother tree block at the Granite Belt Horticultural Research Station.

Before the use of modern insecticides, phytophagous mites were not a serious problem owing to the controlling influence of predators. Since that time, however, these mites have become major pests with increasing resistance problems as their predators have been eliminated by insecticide sprays.

In the United States, a predator of tetranychid mites (*Typhlodromus occidentalis* (Nesbitts)) was found to have developed resistance to organophosphate insecticides. A number of mites of this resistant strain were imported into Australia by C.S.I.R.O. in 1972, and, in November 1973, Entomology Branch in Stanthorpe was supplied with enough of the resistant mites to colonise a number of trees. The O.P. resistant strain immediately commenced to breed and suppress populations of two spotted mite (*Tetranychus urticae* (Koch) on the colonised trees, while a build up of two-spotted mites occurred on the uncolonised trees. Applications of organophosphate insecticides were made during the observations with no detrimental effects on the predator populations.

Over four months, the predator spread and successfully controlled *T. urticae*. Populations of european red mite (*Pananychus ulmi* (Koch)) had increased by the end of this period and while *T. occidentalis* continued to feed on this species as well, reproduction of the predator stopped.

In the 1974–75 season, further observations will be made on the role that can be played by this predator. If it can adapt to the Stanthorpe conditions, it is possible there may be no need for miticide sprays, with resultant savings in cost of sprays alone.

PINEAPPLE

The growth regulator 'Maintain CF125' has shown considerable promise as an aid in the field multiplication of pineapple clones by greatly increasing slip production. The actual number of slips and location of these on the peduncle and fruit can be controlled by rate of application and time of application with respect to flowering. Size of slips can be controlled by regulation of the numbers produced. This technique may be useful to accelerate the multiplication rate of the Queensland Cayenne. This material has been selected over many years and is being multiplied for release to growers. Small quantities will be available in 1975 but with the use of 'Maintain', its incorporation into the industry could be greatly accelerated.

Boron sprays have been found to be effective in increasing ratoon yields and reducing the number of reject fruit on a site with a previous history of inter-fruitlet corking. It appears that on such soils, rates of 2·0 kg/ha as spray applications would be required to correct the deficiency.

Studies were made to determine optimum precooling and cool storage conditions for pineapples. Such techniques would have application for both interstate and overseas consignments. It was found that fruit should be cooled as quickly as possible after harvest. Fruit can be stored at between 7°C and 13°C, but if the fruit is ripe, the lower temperature should be used. The fruit is subject to chilling injury if the temperature drops below 7°C for too long.

In trials, sublethal infections by the base rot fungus (*Ceratocystis paradoxa*) caused a severe reduction in plant growth and yield. Partially drying (curing) or dipping tops in benomyl or captafol gave excellent control. Fruit from plants carrying sublethal infections averaged 1·29 kg while those plants from cured tops or tops treated with benomyl or captafol averaged 1·87 kg.

In preliminary investigations, mealybugs were shown to cause wilting of pineapples in Queensland. The symptoms produced were similar to those of isolated wilt, a disease of unknown etiology.

Captafol again gave excellent control of top rot and root rot cause by *Phytophthora cinnamomi*. The experimental systematic fungicide SN 41703 showed some promise. Acidification of pineapple soils with powdered sulphur gave good control, and work with sulphur and other acidifying agents is continuing.

In North Queensland, leaf spot (*Mycosphaerella musicola*) and speckle (*M. musae*) were particularly difficult to control because of the continual wet conditions. Only growers who were extremely conscientious with their spray programmes achieved a satisfactory level of control.

Screening trials with non-volatile nematicides to control the burrowing nematode (*Radopholus similis* (Cobb)), the causal organism of root rot, indicated that 'Nemacur' and 'Mocap' treatments significantly increase yield. High rates of application give better nematode control than the lower rates, but no further increases in yields.

BANANA

Banana production in North Queensland again showed considerable increases, while in South Queensland the areas being planted continued to decline. There is increasing use of road transport, particularly from the north, with almost one quarter of the crop being moved to market by this method.

Results from a series of nitrogen fertilizer trials showed that the retention of applied fertilizer nitrogen varied between soil types. The metamorphic soils of the North Queensland banana growing areas retain very little, while the Tully scrub soils have a high retention rate. This loss in the metamorphic soils is thought to be due to leaching by rainfall and this was confirmed to a certain extent by the leaching column trials now in progress. It appears that fertilizer management rather than amount is the important criterion in nutrition on these metamorphic soils.

Maturity bronzing, which is a continuing problem in North Queensland, has been noted in southern plantation and is thought to be increasing. It is considered to be most likely a problem of physiological origin. The severity of blemish and number of fingers affected has been directly associated with the increase in finger girth prior to harvest. The study of growth regulators for the possible control of the problem is continuing, but preliminary results are not promising.

A problem in marketing Queensland bananas in southern markets is that significant amounts of fruit are ripe on arrival. Variability in stages of maturity of individual hands packed in any one carton is one of the primary causes of the mixed ripe problem. Workers are continuing to study the variation that is found between individual bunches in a plantation and between individual hands on a bunch. The cause of this variability is thought to be due to the variation in microclimate (mainly temperature) through a plantation and up and down a bunch. This variation is possibly due to differences in exposure of the bunches.

The effect of ripening temperature on the shelf life and eating quality of bananas was investigated. The information obtained was used to prepare a guide for distribution to banana ripeners.

Eradication of neglected plants is a major problem and one which is increasing as more banana plantations are sold for re-development. These neglected areas present a serious disease threat to producing areas.

PAPAW

The papaw industry is slowly recovering from the series of severe epidemics which have, over recent years, caused disastrous plant losses. Fewer cases of dieback occurred but losses from waterlogging markedly reduced some plantings.

The nature of the dieback disorder is not known and exhaustive tests by Plant Pathology Branch over many years have failed to find an associated pathogen. A considerable and increasing amount of evidence now suggests that dieback is caused by a deficiency of calcium in the growing point.

Plants are grown in nutrient culture in a study of the dieback disorder of papaws.

To further test this hypothesis, plants were grown in nutrient culture under various degrees of calcium deficiency. The symptoms which developed showed many similarities to dieback in the field, but although the plants became very weak, the growing point did not die. A field trial is in progress also exploring the theory that dieback in papaws is caused by a calcium deficiency in the growing point. Treatments include forms of nitrogen, liming and calcium sprays.

CITRUS

A record citrus crop was produced last season. However, the good growing conditions which contributed to this crop also favoured the occurrence of diseases, and considerable losses occurred. The production of mandarins is continuing to increase with approximately one quarter of the crop being exported. The newly designed 9 kg export carton with waxed inner section performed very well, and protected the fruit from damage. However, the wet conditions under which they were packed led to the development of mould, stem end rot and centre rot. Delays in shipping some consignments aggravated these problems.

A large percentage of the trees were side trimmed and topped mechanically this year. This is becoming a fairly widely accepted practice as an alternative to hand pruning.

Field trials to determine the best citrus rootstock have been carried out over a long period. Rough lemon, which is the most common rootstock in Queensland, has been found to be superior in the early growth of the plant but in this, the fourteenth year of the trials, it was consistently outyielded. The margin ranged from 3 to 30%. The trials will be continued to determine if this trend is significant over the life of the tree.

As mandarin production is such a major part of the Queensland citrus industry, a programme to develop improved types is in progress. Several lines fruited for the first time this year. The most promising crosses were Imperial x Ellendale and Imperial x Wallent. Crosses of Imperial with Glen Retreat and Thorny produced generally small fruited hybrids and crosses of Imperial with Joppa and Jaffa oranges produced hybrids with too much orange character. Further crosses of Imperial with Wallent and Ellendale were made during the year and the seeds were planted.

Melanose (*Diaporthe citri*) and black spot (*Guignardia citricarpa*) were more severe than usual. This resulted from difficulties in timing the petal fall copper sprays, due to an extended flowering period following a mild winter. The wet summer also made conditions favourable for brown rot (*Phytophthora* spp.), and some growers suffered heavy losses.

Resistance to benzimidazole fungicides such as benomyl and thiabendazole, which are widely used as post-harvest treatments for citrus, was detected in two isolates of *Penicillium italicum*, the cause of blue mold. Both isolates were collected in the 1973 season at the Rocklea markets from decayed fruit which originated in the Burnett region. This is the first report of this problem in Australia, and is potentially important as replacement fungicides are currently unavailable.

With increased public interest in biological methods of control, experiments were undertaken from the Department's Nambour office to determine if such methods might be of value in controlling scale insects of citrus in Queensland.

As a first step, a survey of hymenopterous parasites was carried out in the citrus growing areas of southern Queensland to ascertain the extent of parasitism in scale pests. To date the parasites *Aphytis chrysompali* (Mercet) and *Comperiella bifasciata* have been reared from red scale in most areas of South Queensland, but their level of occurrence has been low. *Aphytis melinus*, however, is a more proficient parasite of red scale. This parasite was imported from South Australia and attempts are being made to multiply A. *melinus* on *Aspidotis hederae* at Nambour for eventual field testing for the control of red scale. *Aphytis melinus* was used with considerable success against red scale in the southern production areas in New South Wales, Victoria and South Australia.

In Queensland, the citrus scale problem is much more complex than in southern States where there is virtually only one scale involved. A range of parasites could be effective in suppressing scale populations, and this aspect is also under investigation. If the breeding and releasing of parasites reduces the level of scale pests, growers will be saved the expense of various spray programmes.

AVOCADO

The area being planted to avocadoes is increasing greatly, but as the result of a number of problems, particularly root rot, the number of producing trees is not increasing at anywhere near the same rate. Following the recent above-average rainfall, the heaviest tree losses to be known in the industry are being experienced.

A plant nutrition survey of 29 orchards in South-east Queensland was carried out in autumn. Leaf samples were collected and analysed as an index of the plant nutrient status. It was found that potassium and zinc deficiencies were the main nutritional disorders, but excess of nitrogen and chloride toxicity were also apparent in some orchards.

Root rot (*Phytophthora cinnamomi*) losses have been exceptionally high following the heavy rainfall. Survey work suggests that soil management practices, i.e. improving soil organic matter contents, increasing the cation exchange capacity, maintaining high base saturation and maintaining a favourable soil reaction, could go a long way to overcoming root rot losses. The Mexican type avocado rootstock Duke 6 was indexed for sunblotch and was found to be free. This rootstock has a limited resistance to root rot and could be of value when used in conjunction with soil management practices.

P. cinnamomi was detected in a number of avocado nurseries. More attention to nursery hygiene is urgently required.

Copper sprays applied from flowering until harvest on a 14, or 28 day schedule again gave good control of anthracnose (*Glomerella cingulata*), in Fuerte fruit.

STRAWBERRY

The 'pick your own' method of harvesting and marketing is gaining popularity among growers and its use is likely to increase with the high cost of labour for picking. There was a reduction in the plantings this season and this was attributed to problems of availability and costs of labour associated with the production of this labour intensive crop.

Earlisweet, the new variety bred at Redlands Horticultural Research Station, again showed great promise in recent trials. It was found to be superior to existing varieties for both early and total yield, disease resistance and bruise resistance, and had a slightly sweeter taste. Plants which were free of virus were placed in the Approved Strawberry Runner Scheme for multiplication and release to growers next season.

The bud nematode (*Aphelenchoides besseyi*) has become a most serious problem in strawberries. It was detected this season in the seed heads of a large number of grasses including green panic (*Panicum maximum* var. *trichoglume*) and elastic grass (*Eragrostis tenuifolia*). The significance of these grasses in the epidemiology of the disease in strawberries is currently being evaluated. Tests with nematicides also commenced.

MISCELLANEOUS

Macadamia.—A trial is in progress to determine if there is a difference in processing quality between nuts which have been ground harvested and nuts which have been harvested directly from the tree. If no differences in quality are found, it may be possible to develop a mechanical harvesting technique and eliminate the labour involved in ground harvesting.

A symptom involving twisting and bunching of young shoots has been reported from a number of orchards, particularly those on sandy soils. An observation trial indicated that the symptom is caused by copper deficiency which can be rapidly corrected with copper oxychloride sprays.

Ginger.—The variety of ginger imported from Fiji is being evaluated for the manufacture of confectionery and dehydrated products. The results have shown that there is little difference between it and the local variety. Chemical studies have also failed to show any differences and it is suspected that the two are closely related.

Mango.—The production of mangoes in the Bowen district is restricted to a short season, and production varies widely from year to year. Both producers and consumers would benefit from a longer, more reliable pattern of production. Investigations are being carried out at the Bowen Horticultural Research Station with a view to achieving this.

A plantation comprising 41 introduced varieties and 22 local selections was established on the station. Trials with growth regulator chemicals also commenced in an attempt to produce more uniform cropping.

Passionfruit.—The popular varieties Redlands Triangular and E–23 were developed at Redlands Horticultural Research Station many years ago. Attempts are being made to develop an improved type and a large population has been established for selection. Most lines produced a small first crop which allowed obviously unsuitable types to be eliminated.

The advantages of root rot resistance which can be obtained by grafting is only realised if resistant rootstocks are used. A number of rootstock lines which are being used by the industry were tested by Plant Pathology Branch and large variations in resistance were recorded. The most resistant lines have now been propagated and will be the nucleus of a reliable supply of rootstock material for the industry.

The control of Queensland fruit fly (*Dacus tryoni* (Frogg)) in passionfruit has been a problem for a number of years. The problem is characterised by early fall of fruit having hard, calloused areas. In an attempt to understand the problem, an experiment was designed to observe the flowering, fruiting and maturing patterns of passionfruit together with observations on fruit fly attack co-related with trapped fruit fly numbers.

It has been found that the winter crop can have up to 100% stung fruit even though fruit fly numbers are extremely low. In the spring, only 10% of the crop is stung and in late summer the stung fruit only reaches 50% even with large numbers of fruit flies being trapped.

These figures seem contradictory as the periods of major fly activity indicated by large trap catches do not coincide with the times when fruit fly stinging is most extensive. In the course of this work fruit flies were seen to sting fruit only one week old. When the time of stinging within a week of flowering was related to fruit fly numbers a strong correlation was found to exist. This information indicates that most damaging fruit fly stinging occurs within one week of flowering. This conclusion is also supported by the fact that examination of stings at a later stage has shown the formation of a calloused area around the sting, indicating that the stings occurred at an earlier stage.

Further work is to be carried out on the problem to confirm the finding outlined. Information of this nature will enable producers to time their fruit fly control sprays for maximum benefit.

VEGETABLES

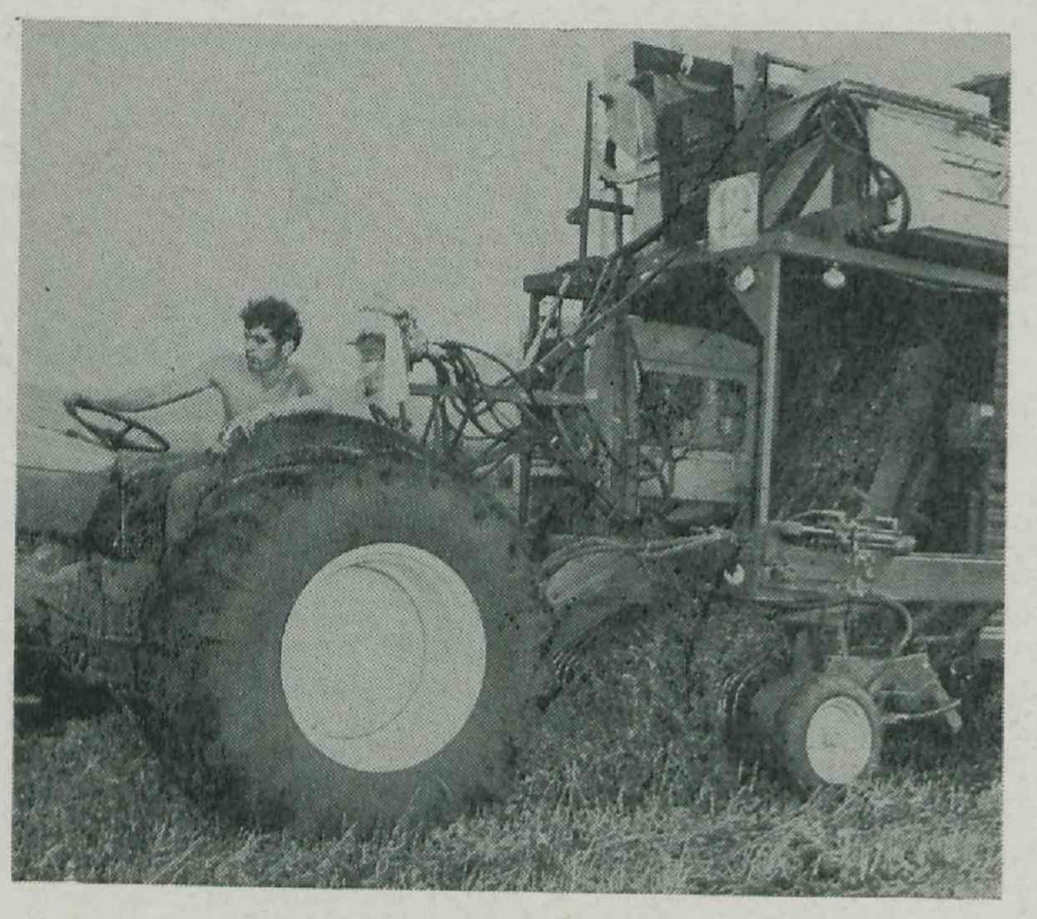
The excessively heavy rains and labour shortages presented serious problems to the producers of vegetable crops. There was a strong demand for vegetables which, in normal seasons, could easily be met as there is ample capacity for increased production in all established areas as well as potential new areas.

Tomatoes—A number of fresh tomato varieties, which have been introduced in recent years, have advantages for both producers and consumers. These include Floradel, Walter and Strobelee. Testing is continuing in an attempt to find improved types with particular reference to quality and disease resistance.

Fresh market varieties which have been developed for machine harvesting are also being tested. MH1, from Florida, has not performed well, Calmart and Pakmore from California produced good quick crops, but fruit colours unevenly and has a tough texture.

The lack of suitable varieties is probably the major factor limiting the production of tomatoes for processing. Many important commercial varieties have been imported and these are under test in potential producing areas.

Mechanical harvesting of processing tomatoes requires a concentrated fruit maturation period as fruit are harvested in a once-over operation. A trial was carried out in the Lockyer district to determine the effect of plant density on once-over harvest yields. The chemical "Ethrel", which was found to colour fruit otherwise green at harvest, was used in this trial. The potential yield of coloured fruit was greatest at 60 x 30 cm spacing where a yield of over 90 tonnes/ha was obtained.



One man can harvest a field of peas since the introduction of mechanical harvesting.

Bacterial wilt of tomatoes (*Pseudomonas solanacearum*) again caused significant losses in the hotter months of the year. Wilt caused by *Verticillium dahliae* on the other hand was more extensive than usual in the cooler months and surveys on its incidence and importance are in progress.

French Bean—Rates of nitrogen up to 140 kg N a hectare were found to be required for good yields of high quality beans where available soil nitrogen is low to medium. If applied correctly this rate does not affect disease incidence or promote excess vegetative growth.

Nitrogen is important throughout the life of the crop, but the bulk is absorbed after flowering and starvation here seriously reduces yields and quality. A basal dressing of 70 kg N per hectare will adequately supply the plants' requirements to flowering and further dressings are best supplied at that time.

Detailed nutritional studies showed that beans grew faster when at least part of their nitrogen was in ammonia form and this explains why crops often respond to applied nitrogen fertilizer even when soil levels are high.

Halo blight has become a serious disease of french beans in recent years with the increased use of tropical legume pasture species which also act as host for the disease. Sources of resistance have been obtained and breeding work is in progress to incorporate this resistance into our major processing and fresh market varieties.

Capsicum—The popularity of this vegetable has increased in recent years and studies have been made to improve its production. Improved varieties are being sought to overcome a range of disease problems. Northern Belle has proved an all round commercial variety in southern districts while Green Giant is the major variety in the Bowen area.

A trial investigating weed control found that Diphenamid gave good results. A new product, Devrinol, which is not yet registered, also gave good weed control with no crop damage.

Sweet corn—The demand for sweet corn is expanding on both fresh and processed markets. However, production has been severely limited by sugar cane mosaic virus. This virus attacks some common grass weeds including Johnson grass and as a result is very widely spread. Some varieties with resistance to this disease were introduced from Hawaii and preliminary tests in the Lockyer district were very promising.

Cucurbits—Watermelon mosaic virus continues to cause serious losses particularly in pumpkins and zucchinis. The type 1 strain has been found frequently in combination with the common type 2 strain. Many crops in the Ingham area had fruit so badly disfigured by the disease that no worthwhile harvest was obtained.

Field trials in both North Queensland and South Queensland again demonstrated the presence of resistance in powdery mildew to benomyl and related fungicides. At Bowen, the new fungicides 'Afugan', 'Imugan', 'Milcurb' and 'Triforine' were all effective.

The fruit spot of pumpkin, so serious last year in the Lockyer Valley, recurred this year but at a much reduced level. It was established that this disease is caused by the bacterium *Xanthomonas cucurbitae*, an organism not previously recorded in Queensland.

Cabbage—The insecticide, chlordimeform, used at 0·5% was found to be very effective against all cabbage pests except cabbage white butterfly (*Pieris rapae* (Lennsens)). With the addition of 'Dipel' at 200 g·100*l*, excellent control is obtained for all pests. One advantage in the use of chlordimeform is its relative cheapness in cost of chemical per hectare when compared with other chemicals.

However, there is a disadvantage in that the cabbages at maturity were found to have been bleached along the margin of the leaves, which could result in their rejection by consumers. Cabbages treated with chlordimeform were the only ones to suffer from this disfigurement.

The entomologist stationed at the Redlands Horticultural Research Station set out to find the reason for this condition.

A series of pot grown cabbages were treated with chlordimeform and methamidophos at 0·5 and 0·1% respectively by applying 1 litre per pot to the soil surface twice weekly.

The bleached condition was observed in the chlordimeform pots after 3 litres had been applied while the plants in the methamidophos treated pots appeared to be normal.

Analysis of the leaves from each group of treated plants using the HCl-diphenyl amino test indicated that the chlordimeform treated leaves had accumulated nitrates while those treated with methamidophos gave a negative reaction.

The nitrate accumulation in the treated plans is considered to be similar to molybdenum deficiency and the problems associated with chlordimeform may be overcome by applications of molybdenum.

Fresh Fruit Disinfestation Studies—Agreement has been reached between the Queensland and Victorian authorities for the trade fumigation of pumpkins and zucchinis, under plastic tents or in specially constructed fumigation chambers, with EDB at 24 g/m^3 and 12 g/m^3 respectively for 2 hours at 200° C for protection against *Austrodacus cucumis* (French)). In future, work will be done with the temperature at 15° C and on the possible use of methyl bromide as an alternative.

In the case of cucumbers, testing showed there are no larval survivors when fumigating with EDB at the rate of 12 g/m^3 for 2 hours at 20°C compared with over 20 000 for controls. This testing remains to be completed and further testing on cucumbers will be with EDB at 15°C and with methyl bromide.

It was found that a dosage of 43 g/m^3 of methyl bromide for 4 hours at 20°C against mature larvae of the Queensland fruit fly in avocadoes is very effective. The same level gave good kills of eggs compared with 18 000 survivors in the controls. The levels of non-volatile (inorganic) bromide found when using this level of fumigation varied between 50 and 70 p.p.m. which is less than the level of 75 p.p.m. laid down by the National Health and Medical Research Council.

Dip treatment using dimethoate against mature larvae in avocadoes was found to be unsatisfactory because of the high concentrations required. No further dipping work is contemplated.

In mangoes, a dosage of 24 g/m^3 of EDB for 2 hours at 20°C found to be effective against mature larvae of Queensland fruit fly in earlier experiments was confirmed by both dosage/mortality tests and by sequential tests to more than 30 000 survivors in the controls. However, dosage/mortality tests against 24 hours old eggs of the fruit fly in mangoes indicate that a higher dosage of 34·8 g/m^3 EDB for 2 hours at 20°C will be required. These results will be verified and the value of methyl bromide will also be investigated in future work with mangoes.

So far only initial dosage/morality time for EDB for 2 hours at 20°C has been undertaken for Queensland fruit fly.

From the progress made in the fumigation of commodities for protection against fruit flies, interstate trade will be greatly facilitated.

ORNAMENTALS

To 'say it with flowers' is becoming even more popular, thus increasing the demand for the relatively young floricultural industry. Gladioli, chrysanthemums, carnations and roses are the most popular types although many others including asters and lilies are also produced.

The production is limited by many severe diseases. Trials have demonstrated the benefits which can be obtained from hot benlate or TBZ treatment of gladiolus planting material. These results are being used by growers and a number have purchased the specialized equipment required. Many of the disease problems are aggravated by the use of infected planting material. Growers are being encouraged to use disease-free material and maintain it carefully to minimize re-infections.

A final inspection of cut flowers just before delivery to the florist.

As gladioli planting material is expensive, an investigation was made into the effects of corm size on flower size and quality and corm yields. The trial showed that corms larger than commercial grade 3 can be cut in half and in most cases still produce good quality flowers and corms.

Studies are being made in the use of native wattles for the re-vegetation of disturbed areas such as road-side embankments. Seed scarification and regular watering were found to be two of the most important factors. It was found that seed lying on the surface of the applied mulch readily germinated but soon died from drying out.

PACKAGING

The tight-fill system of fruit packing involves pouring fruit into the package which is then settled by vibration. This has been found in trials to reduce fruit damage during transport, and allows packing to be mechanised. Commercial demonstrations were carried out in the major citrus areas, and the system is being well received in the industry.

Bananas are inspected as they move along the conveyor belt of a demonstration tight-fill packaging line.

A portable packing line was built to demonstrate the application of tight-fill in the banana industry. Bananas can be cut in singles from a bunch into a water bath from which they are removed on a mesh conveyor. After spraying with fungicides, the fruit flows into the package until the desired weight is reached, and the package is then settled by vibration. The unit was demonstrated at field days and to a number of interested groups.

The paper shortage, together with rising fibreboard prices, has emphasised the need for an alternative package. An assessment of styrene boxes was made and commercial consignments were made from Bowen and Stanthorpe. The box performed well and will provide an alternative to fibreboard. The raw material supply of styrene is in short supply and this delayed commercial use.

The improvements in fruit and vegetable quality which are obtained from pre-cooling have been shown in trials. Investigations have continued into more efficient methods of pre-cooling. A tomato carton was developed for forced air cooling. The carton has a waxed dipped inner and ventilation holes are arranged to facilitate air flow. The carton will cool much quicker than the conventional carton and will give superior performance for pre-cooling and refrigerated transport for tomatoes.

Trials show that apple yields can be greatly increased if plants are closely spaced.

VII. Development Planning and Land Use

The Department has a continuing association with other Government departments in development planning projects and land-use studies. The Development Planning Branch plays a major role in co-ordinating the activities of the many branches involved in joint work and in addition undertakes various types of field work associated with land use and development.

The Agricultural Chemical Laboratory Branch carries out much independent as well as joint work by way of soil and water surveys. The Botany Branch has a particular interest in the destruction and control of trees and other woody plants as factors in land development. The Economic Services and Marketing Services Branches have an important role in studies of the economics of production and marketing.

DEVELOPMENTAL PLANNING

Brigalow Scheme.—The first phase of the Fitzroy Basin (Brigalow) Land Development Scheme, namely the allocation of new blocks and the preparation of the initial development programmes, is nearing completion. With the end of this phase the role of Development Planning Branch virtually ends as extension staff assume their responsibilities.

During the past year, ballots were held for 11 new blocks, with an aggregate exceeding 100 000 hectares; initial developmental recommendations were provided together with a property plan based on land classification appropriate to the early stages of development.

Generally, the blocks in the north-west corner of Area III are considerably larger than the more southerly blocks. The increased size is necessary because of the harsher climate with average rainfall down to approximately 550 mm and some problems of pasture establishment when conditions are less than ideal. The rather drier climate is reflected in the proportion of gidgee in the vegetation. The larger size necessarily entails somewhat higher developmental costs which could result in liquidity problems for settlers who have only the minimum equity requirement of $36 000.

The past season proved an outstanding one for grass establishment, and provided a good start for the new settlers.

Six new blocks were sold at auction, and prices were well maintained in comparison with past sales. The realized price was more than three times the upset price, which has been the pattern of recent years. Although some short-term uncertainty has crept into the beef market, and prices have fallen from the exceptionally high level of late 1973, this is probably balanced by the fact that only a few more blocks will be available and also that payment is extended over a total period of 10 years at a favourable rate of interest.

Broad-scale mapping of the region, based on C.E.S.G. funded activities, was completed during the year. When the final blocks are allocated in Area III, late in 1974, a total of 67 ballot blocks with an aggregate area in excess of 560 000 hectares will have been allocated to new settlers. Property plans and land unit descriptions were provided for each of these ballot blocks. During the same period, a total of 37 sale blocks, with an aggregate area of 283 000 hectares, were made available at public auction.

A major project by Economic Services Branch in the area was to look at the financial results of some of the settlers who had been in the area for about 2 to 3 years. The results indicated a 10·3% return on investment but this was a result of buoyant cattle prices and good seasonal conditions. There is some indication that the cash flow situation of these properties is fairly tight in the developmental stage. The average total investment was $228 000 and average stock number older than 1 year was 534 head for each of the nine farms exampled.

Attention has been given to medium-term development programmes, and a sample five-year programme was prepared.

In response to a request from the Brigalow Industry Consultative Committee, a report was prepared on methods of overcoming the water shortage problem during drought periods with particular emphasis on evaporation control methods.

Following an extensive literature review it is apparent that there are no completely satisfactory methods for economically reducing evaporation losses from small farm dams. Control measures such as shelter belts and floating barriers may have some ameliorating effects.

However, the most practical solution at this time involves the well-established principle of building larger and deeper dams where conditions permit, and integrating catchment and stock management so as to increase the efficiency of use of the water.

Western Arid Land Use Study.—This study now covers 35 million hectares of pastoral country in Western Queensland. The project comprises four study areas with the following common objectives: To describe, classify and map the land resources of the area following principles established in the first study area; to evaluate existing land use practices on the different land units recognised in the area; to relate the current usage to anticipated future use and provided appropriate land use recommendations.

The report and maps for Part 1 of the study are now complete, and will be published in the near future. This brings to a successful conclusion an integrated study based on 15 million hectares of land in the far south-west.

Reconnaissance work in Part 3 of the study, based on Charleville and Cunnamulla area, resulted in the establishment of a number of detailed recording sites for future analysis. Activity in this area is in abeyance due to staff changes.

The Development Planning Officer at Rockhampton was transferred to Blackall to commence field activities in Part 4 of the study.

Coastal Lowlands Technical and Land Use Study.—The Interdepartmental Study Committee met on four occasions during the year. Aspects under discussion included land values in the area and the fact that many would-be developers are of the opinion that land will be made available at freeholding rates comparable to the $2.00 an acre applicable to wallum block leases granted in 1964. Some economic evaluation emanating from current research work indicates that land at prices of the order of $30 an acre can be developed economically.

The Fauna Conservation Branch is undertaking a fauna survey of the coastal lowlands in order to present a more balanced approach in evaluating use of the region's natural resources. The survey involves collection and identification of species and interpretation of their distributions with respect to the land use mapping units.

The assistance of the Co-ordinator General's Department was sought in order to evolve a suitable methodology for conducting a recreation study of the region.

Granite-Traprock Study.—Field work for this Project is now virtually complete, and progress has been made in producing final drafts of maps and parts of the text. Maps to be produced include land systems, soils, vegetation, climatic subdivisions, landform, rainfall, temperature, and relative hail risk for the Granite Belt. Written contributions received from other branches include fauna, dairying, native and improved pastures, climate, agroclimatology (parts) and geomorphology. A contribution was also received from the Forestry Department. Land systems descriptions were upgraded by the addition of fauna information, climate descriptions and block diagram.

Eastern Downs Resources Mapping.—Work is now being undertaken on a key area mapping basis. This involves the collection and documentation of all resource information for a key area, from which extrapolative mapping can be undertaken at a later date by other Soil Conservation staff.

The Freestone Catchment (in Glengallan Shire) is based on Walloon sediments, and is considered to be a key area. The 8% slope line was transferred from topographic sheets to the aerial photos. Soils and land use information was collected for the areas of less than 8% slope. Collection of the land use information is well advanced for the major arable land units.

A comprehensive description was prepared of the Elphinstone and Talgai soil types including profile diagrams and a reference map indicating the location of all reference sites.

Northern Sheep Zone Study.—The northern sheep study is at the stage of experimentation with an integrated physical and financial model. The general aims of this phase are to increase understanding of the performance of the overall system, particularly in relation to weather variability, and to determine whether strategies exist which consistently enhance performance.

The sheep population is modelled by determining births, deaths, sales and purchases for each age and sex group. Age-specific factors are used to determine average wool production, deaths and lamb marketing percentage. Actual values are then determined using predictor equations based on model variables such as nutrition, liveweight and a parasite index. Historical data from local authorities were used to develop the equations. The parasite index, which is based on environmental stress as determined by rainfall and temperature, proved to be a statistically significant influence on productivity. Temperature was initially a significant factor but this only arose because of its correlation with rainfall. The analysis of local authority data suggested that the regional trends in productivity were only partly related to climate. The model which incorporated climatic differences did not account for a large part of the decrease in productivity of the three northern shires—Flinders, McKinlay and Richmond. The differences may be related to soil factors.

A high degree of flexibility has been retained in construction of the financial and management sub-model so that a wide range of alternative strategies can be evaluated. For example, the physical and financial consequences of altering decisions relating to flock composition, timing of sales and drought feeding can be evaluated.

Pastoral Ecosystems of the Arid Zones.—One meeting of the co-ordinating panel was held during the year, following correspondence on relevant aspects of activity. The functions of the panel were outlined in the last year's annual report.

Progress was made on the preparation of a map which will delineate the arid zone for the purpose of indicating what land system maps are available and also those currently in preparation. For future work, it was agreed that any land system map publication scale less than 1:250 000 is not suitable for application to range management, and that a uniform scale of 1:250 000 should be used for land system maps. In fact, there may be a difference between the compilation scale and the publication scale, in which case information on the compilation scale and the location of the material should appear in the accompanying text. The map showing the current status of mapping should be available by the end of June, 1974.

Each State has been requested to outline its needs for men and facilities to achieve 1:250 000 land system mapping by 1980.

Cape York Peninsula Study.—Investigations in the economic development of Cape York Peninsula and Gulf of Carpentaria regions are continuing. Within this broad framework, analysis and research have been directed towards assembling regional data as a basis for the land use study.

Property data have been collected from indirect sources rather than by survey in respect of the shires of Cook, Mareeba, Etheridge, Croydon and Carpentaria. This is being used to publish comparative information and generally outline the physical and economic resources of the area.

These five shires form a homogeneous agricultural unit characterised by the raising of cattle for beef in an 'open-range' grazing system within assumed uniform conditions such as climate, accessibility, distance from markets, etc.

Differing land systems would seem to explain major differences in levels of agricultural development within the whole region, and research is being directed at identifying and correlating areas of intensive use with specific land types. A regional development pattern will be constructed on this basis and the assumptions relaxed to provide an estimate of future agricultural usage.

Data collected for this study were used for other Departmental regional projects such as Shire Handbooks. Future involvement is envisaged in a study dealing with the profitability of Townsville stylo in the Cape York Peninsula.

The short-term aim of the Cape York and Carpentaria study is to contribute knowledge about an area which is largely undeveloped and about which relatively little is known.

In the longer term it is expected that the results of this project will aid in future investment decisions in the region both agriculturally and in the areas of transport and communications.

IRRIGATION

Burdekin River Extension (Based on Urannah Dam).—This Department and the Irrigation and Water Supply Commission published a report in 1971 on an extension of the Burdekin River Irrigation Project, which involved the proposed construction of Urannah Dam on the Broken River. The proposal envisaged development of riparian lands of the Bowen and Burdekin Rivers in addition to lands on the right bank of the lower Burdekin from Home Hill to the Elliott River.

At the time of the preparation of the report, the major production opportunities lay in rice, maize, grain sorghum and beef production from pangola grass pastures.

In the intervening period, marketing opportunities are such that two other relatively high value crops, namely sugarcane and soybean, can now reasonably be brought into consideration. This has necessitated some re-working of the data.

In addition, some irrigation benefit could be obtained in the relatively near future by the construction of the Clare Weir which would enable better use to be made of existing water and allow some broad-scale assessments of soil types and productivity on the right bank.

Mary River–Tinana Creek Study.—The Irrigation and Water Supply Commission provided information relating to the proposed diversion point on the Mary River, and grade line details relating to the possible water supply channels in the proposed irrigation area. This information will assist in identifyng the potentially commandable areas.

The assistance of specialist soils officers from the Bureau of Sugar Experiment Stations will be sought in a detailed study of the soils suitable for sugar-cane. Field work is planned to commence shortly.

Barker–Barambah Creek.—An irrigation feasibility study along Barambah Creek (from its junction with the Burnett River to within the vicinity of Ban Ban Springs) was undertaken. Some 80 hectares of suitable land were located while a further 720 hectares of restricted suitability land were also recognised.

Although significant areas of land appear to be topographically suitable, these were found to be recent, shallow, stony, basalt flows or impermeable soils on an old flood plain. It was noted that this section of Barambah Creek is well supplied with more or less permanent waterholes which are virtually not being used because of the unsuitability of land within close proximity.

There was also evidence of a number of private irrigation projects which have been attempted in the past but have resulted in failure. One such area on "Brian Pastures" Pasture Research Station was still being persevered with, but here even the management of simple grass-based irrigated pastures was proving to be difficult.

An economic reassessment of the proposed Barambah Creek project near Murgon was made in terms of a major feedlotting enterprise as well as the most profitable cropping possibilities. As much of the area is already highly productive, it seems that the benefits associated with development enterprises would be barely sufficient to offset the production losses in the area of inundation. Economically, the scheme appears marginal and considerations other than economic would need to be important issues to swing the pendulum in favour of the proposal.

Economic reassessments of proposed irrigation development on Three Moon Creek near Monto and in the Burdekin area have been commissioned in the light of cost changes and are in process.

Wallum.—Wallum development was again evaluated during the year. However, the evaluation was prepared when beef prices were near their peak and conservative estimates were used. These resulted in a very reasonable rate of return, but in the light of July, 1974 returns, the conservative estimates seem ridiculously high.

Maryborough Area.—A report titled "An economic model for the analysis of the multiple land use problem—specifically forest and beef production" was prepared to enable forest/beef trials to be evaluated. The main alternatives available to farmers in the Maryborough–Hervey Bay region are being valuated.

ENVIRONMENTAL STUDIES

Development Planning Branch officers undertook the liaison and co-ordinating roles for a number of inter-departmental environmental activities during the year.

Register of Australian Environment Investigations.—The Australian Environment Council is a central authority, located in Canberra, which maintains the Register of Australian Environment Investigations. On behalf of this Council, the Environmental Control Council of the Co-ordinator General's Department asked for the co-operation of the Department of Primary Industries in furnishing information on current environmental work. Development Planning Branch undertook co-ordination of this survey within the Department.

Environmental Control Data Bank.—The Environmental Control Council of the Co-ordinator General's Department initiated a survey of environmental work which is being undertaken in Queensland. In addition to recording Division of Land Utilisation environmental activities, Development Planning Branch co-ordinated reports from a number of divisions and branches with direct responsibilities in environmental activites.

The questionaire covered topics such as the organisation's environmental control activities, legislation relating to environmental control, committee representation, and publications on environmental topics. Information relating to the various environmental activities within this Department was forwarded to the Co-ordinator General's Department. A computerized data bank will be used for storage of the information. It is intended that this information will be updated annually for circulation to organisations with interest in environmental matters in Queensland.

Burdekin River Irrigation Project Extensions.—Representatives from the Irrigation and Water Supply Commission, Forestry Department, Local Government Department (Water Quality Council), Mines Department and the Department of Primary Industries attended a meeting on the environmental impact of the proposed Burdekin River Irrigation Project Extensions based on Urannah Dam and Clare Weir.

Development Planning Branch accepted the responsibility of reporting on aspects of land classification and current and potential land use, and undertook the co-ordination of reports prepared by specialist officers from the Agricultural Chemical Laboratory, Botany, Economic Services, Fauna Conservation, Fisheries, and Soil Conservation Branches.

The combined Departmental report contained information on the ecology of the area, land classification and land use, and social and economic impacts. It was concluded that any significant adverse effects are outweighed by the beneficial environmental aspects which will result from the project. The report was submitted for inclusion in the Irrigation and Water Supply Commission publication to be presented to Cabinet.

Denison Creek Dam.—Representatives from the Irrigation and Water Supply Commission, Forestry, Mines and the Department of Primary Industries attended a meeting on the possible environmental effects of a storage at the Denison Creek 20·8 miles dam site.

Development Planning Branch accepted the responsibility of reporting on land classification and current and potential land use, and undertook the co-ordination of specialist reports from Botany, Fauna Conservation and Fisheries Branches.

A submission setting out the area's ecology, land classification and land use was forwarded to the Irrigation and Water Supply Commission for collating with other Departmental reports. It was concluded that the proposal did not pose any significant adverse effects on the environment.

Tallebudgera Creek.—The Secretary, Main Roads Department, requested the specialist assistance of the Department of Primary Industries in formulating an environmental impact statement for the Gold Coast freeway crossing of Tallebudgera Creek.

Two alternatives were to be considered, others having been eliminated due to a variety of engineering, economic and social problems. Representatives from Botany, Fauna and Fisheries Branches subsequently evaluated the situations and submitted reports to Development Planning for collation.

The Tallebudgera Creek complex comprising the Fisheries Habitat Reserve, David Fleay's Fauna Sanctuary and the public open space is a valuable public asset in terms of its recreational and aesthetic appeal. It has considerable scientific interest in being the last remnant of a relatively undisturbed estuarine ecosystem on the Gold Coast.

The preservation of this complex is not merely concerned with small area intensive developments such as freeways, but also with large area extensive land use practices over the whole of the Tallebudgera Creek catchment. Precautions can be taken to minimize the effects of freeway construction but there are no controls over land use. In the light of this, it is suggested that the choice of the recommended route would have insignificant effects on the environment but that some degree of deterioration must be expected as a consequence of urban development of the surrounding area.

Weather Modification.—The C.S.I.R.O. Division of Cloud Physics was visited to obtain information on the current status of work in this field. Their work is increasingly centred on detailed studies of cloud structure and dynamics and the distribution of atmospheric particles, this being a necessary background to full understanding of the variability of weather processes so that the impact of weather modification efforts can be more accurately determined.

Burdekin Re-Appraisal.—The Department was associated with officers of the Co-ordinator General's Department, Irrigation and Water Supply Commission and State Electricity Authority in planning and arranging for the execution of a number of study proposals for which joint State-Commonwealth funding was arranged.

SOIL CONSERVATION

The predominance of relatively low intensity, protracted rainfall this year resulted in most erosion occurring in the middle and lower reaches of streams and rivers. Severe erosion of stream banks, and of areas adjacent to streams, occurred in all regions, but particularly in the coastal areas. Rainfall up to 750 mm a day resulted in major flooding and severe erosion of cultivated lands within the flooded areas.

The excessive rainfall in the Near North Coast region, with the cultivation of very steep land for horticultural crops, combined to keep soil erosion at a most unacceptable level in this area. Soil losses are often dramatic; soil removed between rows of pineapples can be deep.

Some remarkable photographic evidence of raindrop splash erosion was obtained on farms in the Nambour/Gympie districts, and it is suspected that raindrop impact is the major cause of erosion in these steep, horticultural lands.

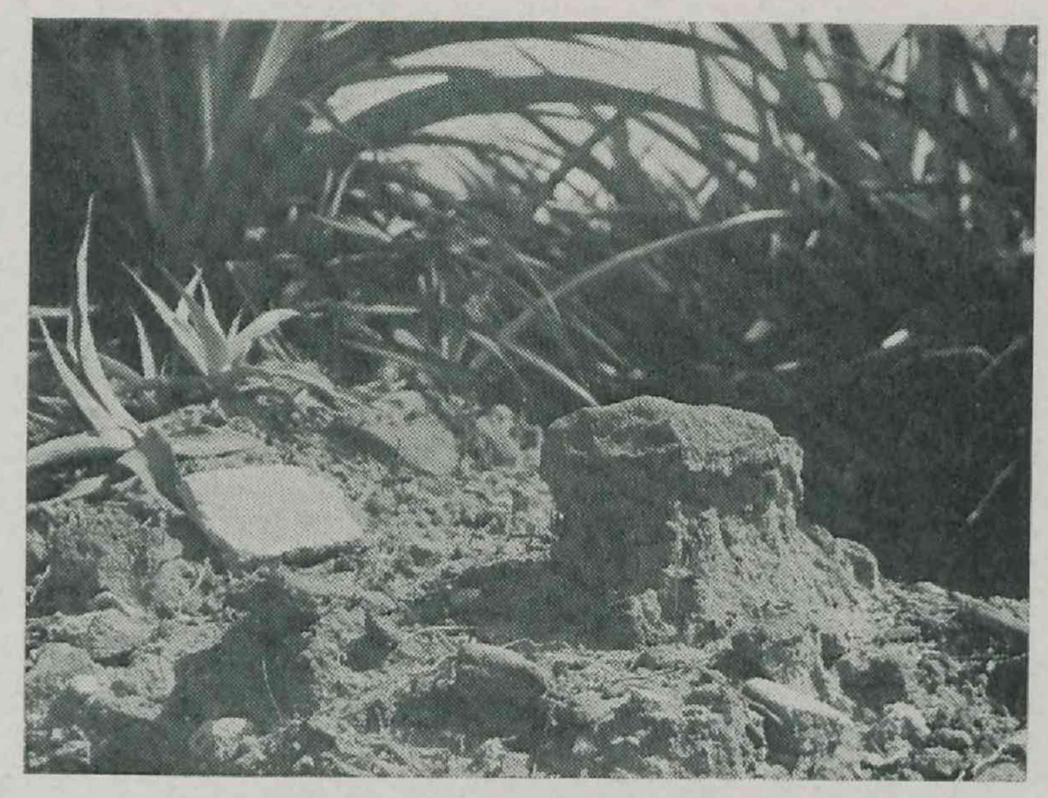
A few high intensity storms occurred in most districts, and resulted in moderate to severe erosion depending on the nature and condition of the soil surface cover at the time of the rainfall. Examples of higher intensity storms include 57 mm in 15 min. and 75 mm in 45 min. on the Darling Downs.

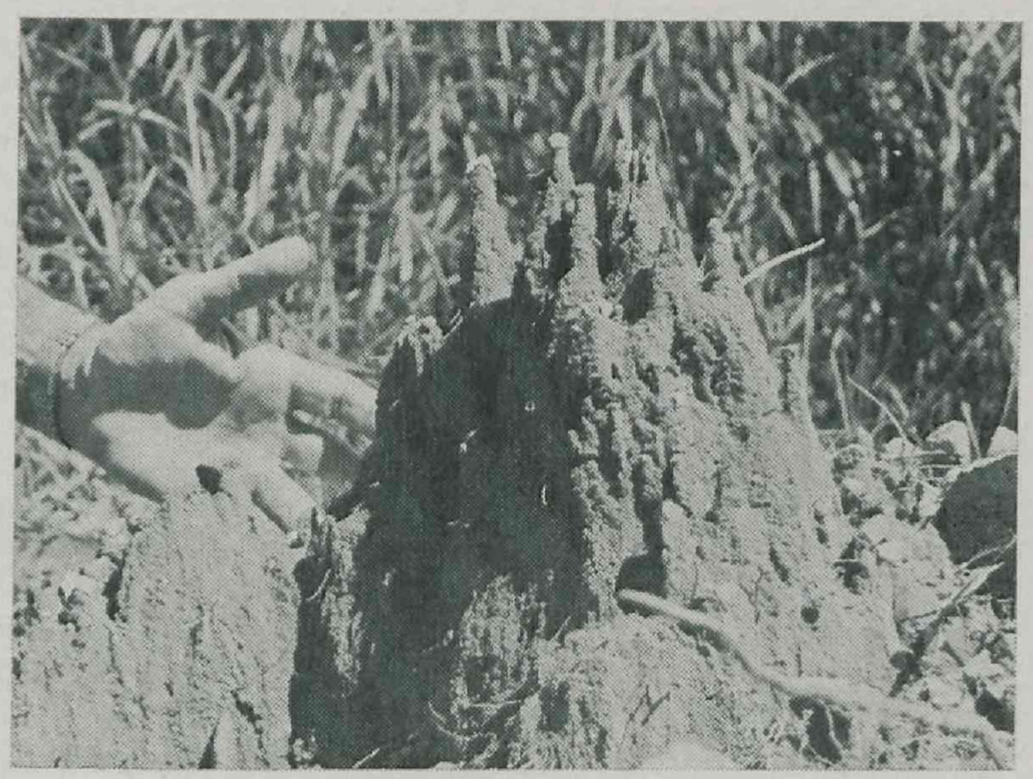
The worst erosion of cultivated lands in the State occurred in a 161 km strip from 48 km south of Emerald to Clermont in the Central Highlands. The damage rivalled that suffered by the Darling Downs in 1972. In the Central Highlands the rainfall was more intense, and was interspersed between sufficient dry period to enable the land to be cultivated between rains. In many other parts of the State the continuous rainfall prevented the use of cultivation implements, and surface cover of weeds and/or crop helped to prevent serious erosion when the heavier storms were received.

The wet conditions throughout the year prevented most wind erosion. However, moderate to severe wind erosion was reported on some belah soils on the Darling Downs, and also in the tobacco areas around Bundaberg where the District Extension Committee has reported its concern with this problem.

The weather pattern was conducive to good crop and pasture growth. However, although most rural incomes would have been satisfactory to good, the excessively wet conditions at both harvesting and planting periods substantially reduced returns in some cases.

Concrete waterways are a feature of pineapple farm drainage in the Nambour area.





Earth columns indicate that erosion was caused by falling raindrop—not surface flow.

Gully in a pineapple farm at Nambour.

Harvesting of 1973 wheat crops in the Central Highlands was hampered by the wet conditions; the 1974 planting, which was expected to be an all-time record because of plentiful subsoil moisture, will be reduced because of shortage of seed. Considerable areas will be diverted to safflower production.

The trend towards increased cropping with sunflower, safflower and soybean (the latter becoming established as a profitable crop in most regions) has problems from a conservation viewpoint because these crops do not produce a good stubble cover. Some spectacular erosion occurred in the Mareeba–Dimbulah tobacco area where sloping granite soils were planted to soybeans and peanuts.

Considerable progress was made with the investigation into, and demonstration of, stubble retention and management procedures. In spite of the abnormally wet year, there were opportunities to demonstrate the advantages of the press wheel drill in extending the planting time after rain on coarse-textured soils. Interest that has developed among farmers and machinery firms is encouraging.

The inability of many farmers to get on to the land, because of the excessive wet, highlighted the importance of trash clearance in secondary tillage and planting machinery. In many cases, failure to plant sorghum, for example, could have been avoided if the right machinery had been available to allow planting into standing wheat stubble.

The need for stubble retention and management is assuming greater importance in the Near South West region because of difficulties associated with contour cultivation under a large-scale farming system. Cultivation and planting machines up to 14 or 15 metres wide are causing decreased interest in cultivation of irregularly-shaped contour bays. Farmers argue that the 10 to 15% increase in time required to farm a paddock on the contour is uneconomical. Reports indicate that leaving an irregular width grass strip—occupying up to 25% of the paddock—is not popular, so the alternative is to provide parallel layouts and/or embark on a comprehensive stubble retention and management programme.

Interest in carrying out soil conservation programmes varies throughout the State. However, in general it reached a fairly low ebb last year. This is in part due to the exceptional rainfall which significantly reduced the opportunity for carrying out soil conservation work. It was influenced by reaction to Commonwealth rural policy, and by the wait-and-see attitude that followed the introduction of subsidies in association with the use of the legislative provisions of the Soil Conservation Act.

While there was a drop in interest from the point of view of application of soil conservation measures, there was considerable interest by landholders within the areas of soil erosion hazard. This applies both on the Downs and in the Isis district. Recent reports indicate that an initial farmer reaction against the programme has now turned to considerable interest and support by most farmers.

Project Areas.—In the Boonyouin No. 1 project area, the grassed chute general benefit work performed satisfactorily, but a waterway is proving difficult to stabilize. The private benefit waterways constructed during the year are grassing up well.

Similar problems occur with the general benefit waterway in Haly Creek No. 1 project area, but slashing of the grass helped to improve the spread of the Rhodes grass. Private benefit works on one farm are proving difficult to manage because of a change in share farmers operating the property.

Areas of Soil Erosion Hazard.—The only additional area declared during the year was the Isis area of soil erosion hazard. This area comprises 56 680 hectares of land in the Isis district. It was the subject of a land use study by an inter-departmental committee in 1971.

As a result of a recent Cabinet decision, a further six shires on the Darling Downs will be declared areas of soil erosion hazard in the near future. These are the Shire of Glengallen, Rosalie, Wambo, Chinchilla, Millmerran and Crows Nest.

A procedure was adopted by the Division of Land Utilisation for the preparation of resource data for use as a basis for land use and soil conservation planning in areas of soil erosion hazard. Basic resource data and detailed key area mapping are to be undertaken by the Soil Conservation research staff with assistance from Development Planning Officers. Extrapolative mapping (or resources data collection suitable for farm planning purposes extrapolated from the key area mapping) and farm planning are to be undertaken by the Field Services Section of the Soil Conservation Branch.

On the Darling Downs, areas of soil erosion hazard resource data which include soil type, land slope and soil depth are being mapped in advance and are stockpiled for use in project planning. Priority areas for mapping are based on the programmed project plan areas in each of the declared Shires, and in those to be declared in the near future. A total of 27 100 hectares were mapped bringing the progressive total area mapped since October 1972 to 65 700 hectares. Of this total, data relating to 43 700 hectares of land have been, or are being, used in the 1973–74 project plan programme.

Extrapolative mapping continued on a tentative basis in advance of key area mapping in the Wambo Shire. Some 27 000 hectares of land have been mapped in this area.

Extrapolative mapping and farm planning are to be carried out as one operation whenever possible, and this has been the recent practice on the Darling Downs. However, some further stockpiling of resource data will be necessary to ensure continuity in the project plan programme.

Eight project plans have been completed in areas of soil erosion hazard on the Darling Downs during the year. These comprise part or the whole of 138 farms, the total area of which is 13 950 hectares. The total estimated cost on-farm works is $269 799, an average of $1 954 a landholder. However, there is a substantial range in costs per farm from $70 to $12 400.

On the basis of estimated costs for the individual properties, the total estimated subsidy payments will be $79 618. This is an average of only $577 a farm even though the maximum subsidy payable is $1 000 a farm. However, some of the landholders with small costs have only part of their property in one project area and may have larger costs in another one.

The inspection period for four of the eight advertised project plans expired. Objections were considered and are being reported upon prior to gazettal of the approved project plan.

At the end of May, a further 7 project plans totalling 9 500 hectares were in an advanced stage of preparation.

Implementation of the land use changes adopted by the Government as a result of the Isis land use study are being carried out under the direction of the Irrigation and Water Supply Commission. The Commission is being advised by the local Isis Land Use Advisory Committee. Plans for establishment of new blocks on a sound conservation basis are being prepared by soil conservation staff at Bundaberg and Childers with assistance from Head Office. The first 24 landholders to have their sugar cane assignments substituted to the new area were able to make a start on their new blocks early in 1974.

Delays inevitably occur in preparation of a project plan, such as awaiting the completion of the 3-month inspection period, and in the processing of objections and final approval of the plan. A recent Cabinet decision recognised these problems and approved the institution of a provisional project plan approach in an attempt to speed up the application of soil conservation programmes in the field.

A provisional project plan may be prepared for a single property, part of a project plan area or even a whole project plan area. The essential criteria for such a plan are the non-contentious nature of the proposals and a written agreement to this effect by the landholders concerned. Such a plan can be approved by the Soil Conservation Authority, and an order issued on the landholder to carry out the works. The landholder would then be eligible for financial assistance in the form of subsidy and loans available for approved soil conservation works.

Preparation of maps and plans was one of the major bottlenecks in the areas of soil erosion hazard programmes this year. Many techniques were investigated to speed up the process.

In spite of the problems, good progress was made in developing techniques for coping with the enormous mapping programme associated with the areas of soil erosion hazard.

The land subdivision boom was evident within areas of soil erosion hazard. Subdivision layouts are normally not based on conservation principles, and often pose a threat to the stability of land within declared areas. These problems were recognized early in the year. Through consultation with surveyors, shire councils and developers, a procedure was established which will prevent subdivision from prejudicing the future implementation of project plans.

Excellent co-operation was received from Cambooya and Jondaryan Shires on the Downs. So far, approximately 2 500 hectares of land have been investigated, and the application of conservation principles has in most cases led to subtantial changes in the original proposals.

Reports from the Dalby/Jandowae area indicate that farm amalgamation is a more important force than subdivision. In one catchment, 21 farm houses are now empty, only four remaining occupied.

Disscussions with the Department of Lands over the lease conditions on the Medway holding were fruitful, and probably represent a major break-through for soil conservation principles. For the first time, lease conditions have direct reference to soil conservation, and place restrictions on grazing management. A large area is to be destocked for up to 10 years if this is required by the Soil Conservation Authority.

Meanwhile the 80 ha enclosure has proved most interesting. With the bounteous season ground cover has been exceptional. Permanent transects were established in both grazed and ungrazed areas. Beginning at 3% basal cover in both areas, this has increased to 5% in the grazed area following the good season, and 15% in the ungrazed exclosure. Absence of new seedlings in the grazed area is significant.

Species evaluation began on bare areas, and will continue with sowings at about 2-monthly intervals until October.

There were no applications for soil conservation loan assistance during the year. This is thought to be due to the high interest rate imposed ($8\frac{5}{8}\%$), and to the Agricultural Bank's requirement of first mortgage.

Forty-three landholders are making use of this facility. Approvals during the year totalled $713, while advances totalling $120 were cancelled. The amount of effective approvals is now $64 478, while the sum of payments made in the nine years since the scheme commenced is $58 948.

The first project plans are still awaiting the settling of objections, and no work has yet commenced on structures eligible for subsidy.

One claim for subsidy on modifications made to farm machinery to enable full stubble retention practices to be adopted has been approved and paid. Seven others are in course of approval.

Services to Landholders.—A free service is provided to landholders who wish to adopt or continue soil conservation programmes. This includes farm planning, marking out areas for contour banking and contour working, the preparation of land capability and land use plans, surveys for parallel contour bank systems, marking of contour guidelines for pasture furrowing and pasture ripping, and assistance with the planning of property development or re-development.

During the year, 3 317 requests for assistance were received, and 3 387 property visits made to assist with the development of soil conservation programmes; 282 landholders commenced contour farming programmes for the first time, bringing the cumulative total of co-operators to 8 229, which is 21·5% of the total number of rural holdings in the area of the Branch's operation.

The assessment of the intensity of use which a particular piece of land is able to sustain without deterioration is of paramount importance in planning the development and use of land, and forms the basis of soil conservation planning. Landholders are coming to appreciate the value of this information in planning development and improving the efficiency of operation of their properties, and 31 new plans were prepared covering an area of 41 523 hectares.

Under the area of soil erosion hazard programme, the entire area will be planned in this manner and a maximum intensity of land use specified for each land type, which landholders will not be permitted to exceed.

The area protected by contour farming was increased by 25 945 hectares during the year. This brings to 576 368 hectares the total area of the State's vulnerable cultivation land which is protected in this way, and represents about 30% of the area needing such treatment.

The Engineering Section concentrated its work in the Downs Region, where project planning by the branch was commenced in October, 1973.

The section established and maintained formal communication with all engineering authorities in the area, and negotiated agreements for the establishment of all necessary cross-drainage structures within the project plan areas. The structures are all in accordance with the drainage network designed by the branch.

Topographic survey work preceded this work, and supplied detailed and well-presented documentation of all necessary cross-drainage points. The topographic survey work also provided large-scale maps of particular problem areas within the project plans, where close detail of topography was required by the planning teams.

The machinery from the Dalby office operated regularly throughout the year and the demonstration and on-farm use was greatly increased by the acquisition of a truck with mounted crane. A trailer is also to be acquired.

Areas around Dalby, and extending to Jandowae, Miles, Wandoan, Roma, Goondiwindi and St. George made use of our equipment. The demonstrations have pointed up both good and indifferent features of the machines, and the farming community has reflected our own interest by acquiring and/or modifying similar equipment of their own. Formal trials of tillage and cropping patterns are established at Muckadilla and Drillham. The demonstration and trial work of this unit is to be continued in the coming year, and stepped up by the introduction of further equipment for demonstration purposes.

The machinery operated from Toowoomba concentrated on the Eastern Downs, and successful crop establishment by suitable machinery was well proven. The machinery has been demonstrated in Glengallen, Allora, Clifton, Cambooya, Jondaryan and Pittsworth Shires.

Following decisions by the Queensland Machinery Evaluation Committee and a direct grant of $23 000 from the State Government, the Toowoomba unit will be expanded.

Work in 1974–75 will be essentially practical, and designed to illustrate that stubble retention can be achieved together with commercial establishment.

To encourage stubble retention and management practices, the Queensland Government approved the allocation of a 50% subsidy, up to $500 a farm, for suitable tillage and planting equipment. This subsidy is to be part of the maximum subsidy of $1 000 a farm which will be paid on a $1 for $1 basis for on-farm soil conservation measures applied in accordance with an approved project plan.

A visit was made to the major agricultural equipment manufacturers in South Australia, Victoria and New South Wales to alert these organizations to the growing demand for suitable equipment and to assist their development programmes with expertise gained by the department under Queensland agricultural conditions.

A total of 6 100 ha of low gradient country was contour plotted in Formartin-Bowenville, Jondaryan, Wyreema and Mt. Irving areas. This is part of a continuing programme of survey work for future use in erosion prone areas.

Soil Erosion Control on the Darling Downs.—A partial economic analysis was initiated to determine the short-term effects of statutory provisions regarding land use on the Darling Downs. The objective of the introduction of the statutory provisions was to prevent or reduce soil erosion.

Basically, the statutory provisions will reduce the area of cultivatable land. The effects on farm income of a loss in cultivation land were determined for the various types of farm enterprise combinations common to the Darling Downs.

Where a cash grain enterprise competed with a beef cattle enterprise, a substitution of beef for grain reduced farm income to an appreciable extent under current price relationships. The existence of a complementary relationship between grain and beef was apparent under certain circumstances.

Where a feeding system based on fodder crops was replaced by one based largely on improved permanent pasture for beef and dairy enterprises, preliminary analysis indicated the farmer could well be better off. However, the situation was not clear cut, there is not general agreement, and differences exist from farm to farm and area to area. It appears more work needs to be done in this area, particularly to overcome the gaps that exist in the technical framework.

Where grain production is replaced by a dairy cow enterprise, it appears in many cases that farm income would be reduced in the short term. This is based on current price relationships.

It should be appreciated that the results of the analysis only apply to the short-term situation. As such they are dependent on current price relationships. However, it is felt that conclusions reached will hold for quite a few years yet.

The introduction of the statutory provisions in a favourable period for primary industries has been fortunate because the capacity was there to absorb any relative short-term ill effects on farm income.

Other Activities.—Detailed maps were made of two areas (key areas) to the west of Allora. One area is on Walloon coal measures, the other on the Marburg sandstones. The area is being studied and mapped to provide the necessary information for officers to do farm planning on similar types of country.

To date, 10 000 hectares of Walloon coal measures (Elphinstone Area), and 6 000 hectares of the Marburg sandstones have been mapped at the soil series level. Reference sites were established and sampled for analysis by the Agricultural Chemical Laboratories Branch.

Farmer interviews were carried out on the process of the survey to confirm that the mapped soil series were also recognised by farmers. Land use information was also collected during the interviews.

To provide additional information for the soils, a series of field and laboratory measurements were made. These included water entry, moisture storage and soluble salt measurements.

Attempts were made to establish soil profile features which will assist other soil surveyors and farm planners to recognise key horizons. In the Elphinstone clay linear gilgai complex for example, water entry is limited to the upper dark grey to black surface layer. Water storage is restricted to 10 cm in this soil series.

To enable farm planning to proceed more rapidly, Soil Conservation Branch's research section assisted the field services staff in mapping within 7 000 hectares of the Budgee catchment and 5 100 hectares of the Steele Rudd catchment.

A report was prepared on the hazards arising from the clearing of steep land on the Eastern Downs.

Colour Photography.—Colour aerial photography is to be obtained for parts of the Eastern Downs. Arrangements were made with Survey Office to incorporate the colour photography in the State aerial photography programme for 1973–74. Soil series mapping of cleared and cultivated areas will be simplified by the use of these colour photographs.

Information has been received from Forestry Department, Co-ordinator General's Department and Botany and Fauna Branches of this Department on the suitability of Moreton region land for native and plantation forests, outdoor recreation, flora reserves and fauna habitats respectively. This, together with sections provided by conservation officers on agricultural capability of land, form the bulk of a report which describes the classification used by each contributing body, how it was applied to the region, a statement of their findings, and a map showing areas having different suitabilities.

An inter-departmental study group was set up by the Department of Local Government of which Soil Conservation Branch is a member. This group was to document resource information, hazards and possible management solutions for the North Pine dam catchment. In addition, an assessment of outdoor recreation capability was made.

A report is in preparation on the pollution hazards arising from rural industries. A data bank being compiled by the Branch is also being used to establish potential for urban development, outdoor recreation and flood hazard.

SOIL STUDIES

A fertility study of the Highworth clays of the Callide–Dawson valleys was completed by officers of the Agricultural Chemical Laboratory Branch. Reports covering the soil chemical properties and the nutrition of the gilgaied clays of the Highworth land system are to be published shortly.

The Mayvale land system was studied in some depth. A report on the soil morphology, soil chemical properties, vegetation and land use was compiled. A soil association map was produced for this report, and the report and map will be published shortly.

FARM MANAGEMENT ACCOUNTING SERVICE

The service continued to operate satisfactorily using both the monthly mail-in recording scheme and the annual print out service. Over 200 summaries for the 1972–73 year were prepared. The monthly mail-in scheme is valuable to those producers who have limited records or who require the regular quarterly cash flow reports which incorporate comparison of actual results with budget estimates. The annual print-out service is designed to meet the need of those who already have a good recording system but who require the annual statement of their financial performance.

Membership is now limited to those who will usefully contribute to the data store for extension and research purposes. The service provides a source of continuous on-farm recorded data which is particularly valuable to economists in their extension and research activities.

A seminar, organized by the Bureau of Sugar Experiment Stations in July, considered the three computerised accounting services available in Queensland by the Bureau of Sugar Experiment Stations, Queensland Institute of Technology and this Department together with other systems proposed by the University of New England and the Queensland Grain Growers Association. All systems were based on the use of the ACCRA code. At this seminar a working group was established to examine the concept of a universal computer program for farm management accounting and to reach agreement in recommending standard report formats. The working group comprised representatives of each of the above organizations together with the ACCRA Secretariat and the Australian Society of Accountants.

The working group presented its report to a second seminar in November. As a result it was agreed that the Department of Primary Industries, the ACCRA Secretariat and the Bureau of Sugar Experiment Stations should work closely with International Computers Limited to modify the B.S.E.S. computer programmes to meet the working group's recommendations.

Work is continuing in this project and the first stage of the conversion is being system tested. This stage will produce transaction listings, a cash flow report and a trial balance. It is intended that the revised B.S.E.S. system would be made available for use by any interested party. The control of the program would be vested in representatives of the Bureau of Sugar Experiment Stations, the ACCRA Secretariat and this Department.

NATURE CONSERVATION

Maintenance of some environmental standards is a responsibility of several Departmental branches. Fauna and flora conservation depends on sound soil conservation, fishery and botanical (agronomic) practices, and clearly reflects balanced development. The Fauna Conservation Branch thus concentrates more on conservation aspects than consequent exploitative interest.

The *Fauna Conservation Act* 1974 has been successfully promoted; "*The Native Plants Protection Act of* 1930" is now the subject of revision. The important continental initiatives taken are being extended through the newly established Council of Nature Conservation Ministers (CONCOM).

Facilities to discharge the responsibilities involved in these Acts have been developed concurrently. The North Queensland Fauna Centre at Pallarenda, Townsville, is now well advanced; a similar centre at Hermitage, via Warwick, has been planned, and the first steps for suitable headquarters in Brisbane have been taken. Some field stations are in action at major fauna areas e.g. Central Queensland Field Station (Emerald) and Closed Forest Field Station (Mt. Spec).

Departmental officers erecting Fauna Reserve notices on the 4 325 ha Cooloola Fauna Reserve. This area is to be retained free of human interference.

The primary function of the biological staff has been to undertake inventories. Fauna surveys were completed, or are in the process of being completed, at 11 areas; these provide the most comprehensive lists yet prepared for this most diversely endowed State. Apart from confirming the survey techniques, results in 1973–74 have included data on such notable species as the bridled nail-tailed wallaby (*Onychogalea frenata* (Gould)), last seen 37 years ago. A check-list of the mammals and birds of the State was compiled for the first time this year, and appropriate statistical data entered in the *Queensland Year Book*. The reptile situation, foreshadowed for consideration under the new legislation, is likewise now being considered.

Surveys indicate that complex taxonomic problems need early consideration, and appropriate studies on many of the rodent species were completed this year.

In addition to threatened species, initial specific attention is devoted to those groups confronting man, whether as pests or producers. A long-term study of the problem of collisions between aircraft and birds (at Townsville) was completed in 1974 and the results are being applied. The relationships between native and introduced species are included, and the distribution of red deer (*Cervcus elaphus* (L.)) and fallow deer (*C. dama* L.) was reviewed.

The more intensively exploited resources—kangaroos, waterfowl (wild ducks), aviary birds, and crocodiles—continued to receive attention at the species and industrial levels.

No evidence of excessive use was detected. On the contrary, such common species as have attracted this perennial harvesting and are permitted to be taken e.g. grey kangaroo (*Macropus giganteus* Shaw) and black duck (*Anas superciliosa* Gmelin), provide evidence of increasing abundance. Climatic conditions during 1973–74 disadvantaged harvesters and also should ultimately favour population expansion.

Licences and permits, royalties, fauna dealers, zoos and avairies involve technical and administrative processes which are steadily being refined. The hobby of aviculture and the difficult related matters of dealers and of aviaries are receiving special attention at present, while appropriate encouragement of honorary protectors is a complementary subject now being reviewed. Other extension is to be developed with the recent appointment of a Branch Assistant Director.

Application of zoological information is otherwise most pertinent in land use planning. Fauna sanctuaries, as a lesser level of fauna protection from earlier legislation, continue to be declared; increasing revision of these areas this year included the largest fauna sanctuary, Atherton Tableland/North Queensland coast (1 310 175 ha), designated in 1938. Fauna reserves provide direct control over a comparatively few selected 'reservoirs' of fauna and its habitat throughout Queensland; some further areas, notably islands on the Great Barrier Reef, were selected and are being processed. The *Fauna Conservation Act* 1974 provides for an intermediate habitat category, the Fauna Refuge, where multi-purpose land use can proceed provided that it does not adversely affect fauna. This is generally in areas devoted to primary industry, and studies of tolerance are important and are being developed.

This year investigations of sand and of limestone mining, agriculture and shipping (oil spillage) were reported on, and studies relating to forestry were commenced.

A major stage in the long-term planning of urban development in relation to fauna—at the 3 240 ha Town Common within the City of Townsville—was completed and is being published as a book, while a land assessment reference programme for the Moreton district continues to be refined.

Studying mangroves before mapping of the ecology.

VIII. Special Field and Laboratory Services

The Department operates a number of services ancillary to its crop, livestock and commodity research, extension and regulatory services. Some of these are recorded elsewhere in this report. This section deals with stored products, various diagnostic services, and agricultural engineering.

STORED PRODUCTS

Insect infestation in stored grains and related products was the highest for a decade and reflected the increasing importance of resistance to maldison. This, in turn clearly indicated the need for alternative insecticides to replace maldison and, indeed, the need for a more determined approach to hygiene, both on farms and in central storages.

Preliminary studies of alternative grain protectants, under bulk storage conditions, were conducted by the Indooroopilly Entomology Laboratory. These established that chlorpyrifos methyl (formerly Dowco 214) and pirimiphos methyl gave satisfactory control of both susceptible and resistant strains of rice weevil (*Sitophilus oryzae*), lesser grain borer (*Rhyzopertha dominica*), rust red flour beetle (*Tribolium castaneum*) and tropical warehouse moth (*Ephestia cautella*). These promising insecticides, together with an unnamed compound from Ciba Geigy, fenitrothion, and the standard maldison, are being subjected to a further test in silos at Malu, on the Darling Downs.

Over an extended period, records have been made of the activity of insect pests in typical farm facilities. These studies have revealed that isolated facilities can harbour active infestations of major pests even two years after last use. This emphasises the importance of farm hygiene in the reduction of farm infestation, and the contribution this makes to infestation in central storages.

Control of the residual pest infestation is an integral part of any clean-up programme. Preliminary studies of fabric treatments which are applied to buildings to control these residual infestations established that chlorpyrifos was superior to currently recommended materials, some 10 months after treatment. A further examination of this material is required to determine its potential as a control of resistant insect pests.

Growers are being supplied with useful brochures on the identification and control of the major pests of stored grain, and on methods of hygiene designed to prevent infestation.

DIAGNOSTIC AND IDENTIFICATION SERVICES

In the course of diagnostic work, the Pathology laboratory at Yeerongpilly and the Animal Health Station, Townsville, examined over 12 000 batches of specimens.

Some of the more unusual diagnoses are briefly mentioned.

Horses in the Central Queensland buffel grass area and in other places where improved pastures are grazed have been affected with what used to be known as bran disease (*Osteodystrophia fibrosa*). Mineral is lost from the bones and they become enlarged and soft. This is very noticeable in the head. Growing or lactating animals are first affected.

There is a lot of experimental work to be done in the laboratory and in the field (to confirm why the mineral is lost), and also on prevention and treatment.

In the Rocklea cattle, after the floods, there were two cases of meliodiosis. This is a well-known infection of animals and soil in tropical countries and North Queensland but not elsewhere. Unfortunately we are unlikely to find out how the infection occurred.

Deaths in pigs from mercury poisoning gave an example of the danger of feeding to animals seed grains that have been treated.

A strain of infectious bronchitis virus was recovered from a flock of poultry where vaccine apparently broke down. This strain differs serologically from some others and will need to be added to the vaccine if break down continues.

In sheep, after the floods in Western Queensland, considerable losses were attributed to sand fly worry.

On the research side much effort has gone into work on ticks and tick fever of cattle. One objective, that is not an easy one, is to culture the organisms in synthetic media. This is being attempted because there are undesirable features in producing the vaccine in calves i.e. other infections being transmitted from the calves, problems with red blood cell sensitivity, and sometimes severe reactions. However, work in conjunction with Veterinary Services Branch has produced evidence of the need for vaccination. Unvaccinated control animals were lost and others became sick. Work on cattle ticks and tick fever is assisted by a grant from the Australian Meat Research Committee.

Humpy-back in sheep continues to be a problem in flocks during the summer, particularly when mustering for shearing. Some outbreaks were investigated, and microscopic lesions were found in the spinal cord and in muscles of the hind limbs. Investigations into the cause are continuing.

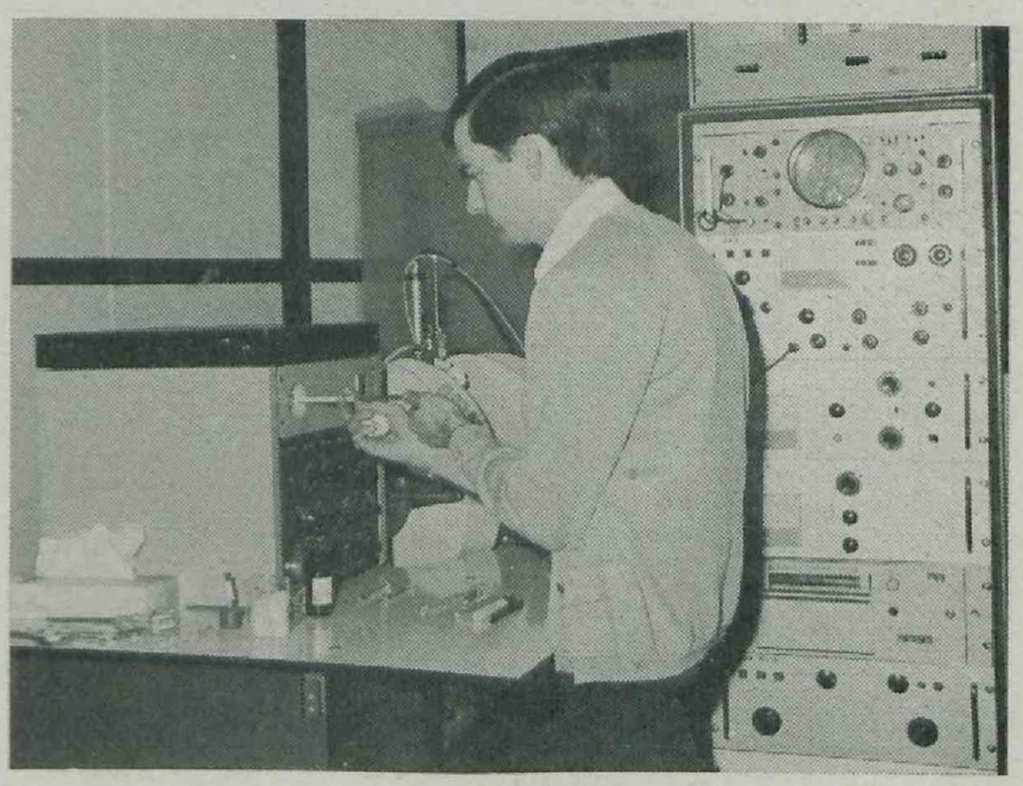
With the introduction of the poultry industry regulation that requires bacteriological standards for liquid egg products, Pathology Branch has become responsible for these tests. Associated with this, one school for producers was run in which the object was to help with the improvement of the quality of the product; another is being arranged.

A computer system was introduced to record information on diagnostic samples handled by the Branch. It was programmed to yield a variety of information, and will have increasing usefulness as data accumulate.

Service analyses are presently undertaken by Biochemistry Branch on behalf of the Division of Animal Industry, and Dairy Cattle Husbandry, Fauna, and Fisheries Branches. The 5% annual increase in the number of services evident over the last few years did not occur. The disruption of Departmental experimental programmes due to the January flooding was the main cause of this decline. A hiatus in the laboratory function resulted from the flooding of plant located in the basement of the new laboratories at Yeerongpilly.

Analysis of pesticide residues requires special skills for successful work to be accomplished, and the Agricultural Chemical Laboratory is fortunate in having several officers with training and expertise in this field. The numbers of samples analysed for herbicide residues, particularly 2,4–D and 2,4,5–T, remains high as there appears to be no diminution in number of complaints of damage alleged to be caused by herbicide spraying.

For the measurement of residues of bromide fumigants in fruit and vegetables, new methods of analysis were evolved using X-ray fluorescence spectometry. Because the Navy Bean Marketing Board uses tetrachlorethylene to remove dirt from navy beans, tests were carried out to determine the



Identification of pesticide residues by gas chromatography/mass spectrometry.

levels of the chemical remaining in the beans after the washing process. It was found that significant amounts of this chemical remained 21 days after washing.

Other chemical work dealt with residues of various pesticides in soils and plants, Vitamin A in stock foods, pentosans in wheat and flour, testing of coating materials for laboratory benches, regulatory analysis of fertilizers, stock-foods, pesticides and veterinary medicines, oil seeds for oil content and oil constituents, waters for irrigation and stock.

The plant pathology herbarium contains many valuable plant disease specimens dating from late last century, and work on the cataloguing and repacketing of this material was continued. In addition, many new collections were added. The herbarium now contains more than 10 000 collections, representing primary plant parasitic microfungi of all groups. This material is important in the routine identification and research functions of the Branch, and taxonomic work associated with the correct naming of these collections is adding to knowledge of the fungal pathogens of Queensland crops, trees, native plants and weed species.

The culture collection of plant pathogens continues to be used as a source of reference, research, or teaching material.

Over 2 500 inquiries on plant diseases were handled, and advice on control was given in all cases.

The specialist virology group carried out diagnosis of over 400 plant specimens. Many of these were able to be checked quickly with the electron microscope which has proved invaluable for making a rapid determination of the presence or absence of rod-shaped viruses such as peanut mottle virus or sugar-cane mosaic virus. This instrument has also enabled diagnosis to be made of the difficult group of diseases caused by mycoplasma. For instance, this year mycoplasma-like bodies were found associated with autumn wilt disease in potatoes for the first time. Plants in quarantine suspected of being virus-infected are routinely checked with the electron microscope.

The specialist nematologists examined over 500 soil and plant specimens and gave advice to farmers and Departmental personnel. The specialist bacteriologist made 53 separate diagnoses involving isolation and identification of the casual organism. One specialist mycologist on the staff made 15 identifications of the toadstool (*Psilocybe cubensis*) for the Police Department. Numerous identifications of poisonous fungi were made for Departmental officers and private persons.

Some 1 800 accession records of diseases caused by fungal pathogens were incorporated in the disease record system.

The insect identification service of Entomology Branch identified 3 500 insect specimens for field staff, other branches, quarantine authorities, farmers and members of the public. One of the many important identifications made of insects was that of Khapra beetle (*Trogoderma granarium* Everts.) intercepted by Plant Quarantine from the hold of a ship. This important grain pest is not found in Australia, but overseas is considered one of the most serious problems of grain storage.

Early recognition of the insect enabled timely precautions to be taken that prevented its becoming established in Australia. Had Khapra beetle succeeded in becoming established in Australia the grain export trade would have been placed in jeopardy.

Botany Branch was able to maintain an efficient plant identification and advisory service; 14 500 plant specimens were identified, and 143 rumen samples examined for the presence of poisonous plants. The Police Department required identification of *Cannibis* material and subsequent court testimony. Work was carried out on 256 criminal cases, involving 26 court appearances.

Determination of sulphur in plants and soils by X-ray fluorescent spectrometry.

IX. Agricultural Standards

The Department is concerned in many ways with the maintenance of standards of primary produce, both raw and manufactured, intended for local consumption or export. It is also concerned with standards of certain agricultural requirements, mainly agricultural chemicals, and with standards of usage of certain materials. Where standards have statutory force, the Department polices them in appropriate cases as an agent of the Commonwealth Government.

The Standards Branch is the branch most involved in regulatory control of standards, though Dairy Field Services Branch and Dairy research Branch have prime responsibility for standards control of dairy produce, and Slaughtering and Meat Inspection Branch for meat and meat products.

AGRICULTURAL CHEMICAL CONTROL

A function of Standards Branch is concerned with the activities of The Agricultural Requirements Board which assumes responsibility for ensuring that only effective agricultural chemicals are offered for sale.

During the year, applications for registration, re-registration or further registration of 4 262 agricultural requirements were received. This represents a decrease of 58 when compared with last year. In addition, approval was granted for the supply of 85 special mixtures of fertilizers and one special mixture containing a pest destroyer.

The Agricultural Requirements Board, at 19 meetings, considered claims made by manufacturers regarding efficacy of 1 587 preparations for which application for registration or re-registration had been made.

The aims of the board were carried out with a high degree of success through its deliberations on claims to be made for new agricultural chemicals, meticulous scrutiny of labels, and constant review of uses for agricultural chemicals.

The work of the board was not increased to any marked degree by the aim to introduce the metric system because of the adoption of a set of guidelines which the agricultural chemical industry is using in the conversion of measures on labels of its products.

Board policy is to phase out chlorinated hydrocarbon insecticides and other persistent chemicals from situations where suitable substitute chemicals can be used. Some alternatives may not be as biologically effective but they do not possess a long-lasting effect on the environment. Manufacturers of agricultural chemicals are co-operating in encouraging the use of these chemicals rather than persistent ones including noted chlorinated hydrocarbon insecticides.

The Agricultural Chemicals Distribution Control Board constituted under this Act met three times during the year. Among the items discussed were submissions from fruit and vegetable grower organizations in the Near North Coast and a grain grower organization on the Darling Downs alleging damage to crops in these areas as a result of the use of herbicides. Recommendations for two hazardous areas resulted. Recommendations for Hazardous Area No. 1 and Hazardous Area No. 2 have been gazetted.

The board introduced a permit system into exis'ing controls over the use of certain agricultural chemicals in specified areas of Queensland. Permits are required for the spraying of chemicals whose use contains an element of risk and for which less hazardous alternatives do not exist.

A total of 144 permits, covering 9 560 acres, were issued to licenced commercial operators in Hazardous Area No. 1 while 3 applications for permits involving about 640 acres were refused. In respect of Hazardous Area No. 2, 11 permits were issued for the spraying of 2,4,5-T butyl ester onto roads, river banks and land beneath power lines and forestry reserves.

During the year, 33 notifications of complaint on damage or injury to plants or stock were received. Investigations on behalf of the board were completed in respect of 28 notifications, and statements subsequently issued.

Nine of these notifications were lodged in respect of alleged damage to garden plants, shrubs, garden fruit and vegetable crops grown in densely cultivated areas of sugar-cane. These allegations, although involving plantings of minor economic importance, point to the need for special care by agricultural pilots when spraying weeds in sugar-cane.

Fifty examinations to qualify for commercial operator's licences, involving 85 candidates, were held in 14 centres during the year. In addition, eight pilots were examined for pilot chemical rating licences in four centres. These, and earlier examinations, resulted: 85 unrestricted commercial operator's licences issued; 150 restricted commercial operator's licences issued; 866 commercial operator's licences renewed; 7 pilot chemical rating licences issued; 44 pilot chemical rating licences renewed.

Several field trials, in conjunction with the Biological Section of the Lands Department, involved the addition of thickening agents and foams to spray mixtures. This included early morning operations using water, thickening agent and 2,4-D from an aircraft at a Forestry Department airstrip at Beerwah. This work could not have been undertaken without the co-operation of the Lands Department, Forestry Department and a member of the Queensland agricultural aviation industry.

Treatment of many horticultural crops and cotton with 2,4-D continued at the Redlands Horticultural Research Station. The symptoms of abnormal growth were photographed and described, and it is anticipated that the result of this work will be of value to inspecting officers who are called on to visit complaint areas and comment on plants with abnormal growth.

DAIRY PRODUCTS

There was an overall increase in services provided to industry for quality control purposes, and, where service results were promptly used, product quality remained high.

The quality of the raw milk remained satisfactory on the basis of current acceptability tests (e.g. methylene blue and thermoduric plate count and % fat content). Some seasonal deficiencies in solids-not-fat and freezing point were detected.

The quality of pasteurised milk in bottles, cartons and sachets was, in general, satisfactory. However, at some factories, on some occasions, the presence of coliform organisms indicated post-pasteurisation contamination. Pasteurised milk in cans was, in general, of poorer quality than that in other containers.

The increasing trend of factory intake towards milk rather than cream resulted in diversification, with such factories producing milk powders and casein as well as butter and/or table cream.

Because of the marked decline in butter production at Queensland factories and the corresponding decrease in Queensland butters being received at the Butter Marketing Board, the Butter Improvement Service was reorganized so that it is based on samples collected by field officers at country factories and analysed either in the appropriate regional laboratory or in Brisbane.

Analytical results indicate that the variation in butter quality from factory to factory throughout the State is greater than that within factory variations. Some factories consistently produce an excellent product whereas the butter at some other factories is much poorer in quality.

To satisfy local consumption, Queensland imports large amounts of butter, mainly from Victorian factories. In general, this butter is of good quality.

As a considerable quantity of cheddar cheese grades below choice quality, Dairy Research Branch assists the industry by providing a cheese quality improvement service, trouble shooting surveys when required, and technical advisory services which include starter propagation and rotation, bacteriophage control, manufacturing techniques and cheese composition.

Three factories manufacture edible casein, and samples are analysed sporadically to assist in upgrading product quality.

Monitoring of dairy products for the presence of insecticide residues continued during the year. A total of 331 samples were examined with approximately 3·2% samples containing above-tolerance levels for DDT and its metabolites.

SEEDS AND GRAIN

During the year, 12 134 seed samples were tested. The number of samples handled at Toowoomba was 1 884.

Grass seed samples, chiefly *Panicum maximum*, were responsible for the major component of the work in both centres, thus maintaining the normally high work load associated with grass seed testing. The maintenance of a component of about 25% in respect of inspectors' samples is interesting to note in both areas.

In the field of seed certification, there was a substantial drop in certified seed compared with previous years. This decline, particularly in hybrid sorghum, hybrid maize and beans, was attributable in the main to several unavoidable causes e.g. difficulties experienced by certified sorghum growers in securing the necessary isolation, and adverse effects upon stored bean seed caused by high humidity. In the case of hybrid maize, a reduction in the acreage planted to parental seed was primarily responsible.

In grain inspection, a considerable amount of work was carried out at the Pinkenba grain terminal. As previously, problems occurred from time to time with insect infestations and weed seed content, and comments were made from time to time on standards of farm hygiene that could be improved in both these areas.

A sizable programme of inspections of agricultural requirements was carried out in all districts serviced by Standards Branch inspectors. The number of samples submitted for analysis in the metropolitan area was 1 295.

Work was carried out on a number of projects including continuous investigations into germination and dormancy of subtropical forage grass cultivars, and into the impermeable seedcoat condition in a number of subtropical forage legume cultivars. This work led to the preparation of four scientific papers for presentation at the 1974 I.S.T.A. Congress in Warsaw, and publication in the "Journal of Seed Science and Technology". Other work investigated the causes of differences between the results of analyses of samples of bean seeds before and after transport from Queensland to Tasmania. Sundry data were collected on germination characteristics of various species for other Branches and outside organizations.

FRUIT AND VEGETABLE INSPECTIONS

Inspection services were maintained at market and retail levels in all existing areas. Routine matters continue to exact a major demand on time and manpower, as testified by the following examples of activity taken from the metropolitan area:

—	1972–73	1973–74
	Packages	Packages
Brisbane market condemnations ..	31 860	35 684
Fruit regraded	38 502	20 687
Fruit reconditioned	12 385	13 271
Vegetables regraded	5 948	15 754
Vegetables reconditioned	2 275	6 811
	Bags	Bags
Potatoes, onions and pumpkins inspected	1 520 284	1 193 856
Potatoes, onions and pumpkins found faulty	47 900	38 285
Potatoes, onions and pumpkins lost as waste	16 889	11 958

A less publicised activity associated with the fruit and vegetable inspection service is that of maturity testing. During the year, 420 samples of fruit were analysed.

The supervision of EDB fumigation of citrus fruit was carried out at the C.O.D. rooms at Clapham, Brisbane Cool Store at Eagle Farm, and recently at The Golden Mile Orchard, Mundubbera. This is a very time-consuming duty, and at times required the full time of an inspector for many days during the period when Queensland fruit was being prepared for forwarding to the Melbourne market.

FARM PRODUCE AGENTS

There are 53 farm produce agents licensed in Queensland, 44 in Brisbane and the remainder in major country centres. Inspections carried out under *"The Farm Produce Agents Act of* 1964" showed that agents generally met their objectives in the operation of trust accounts, including preparation and audit of books of accounts, as well as possession of adequate fidelity bonds.

A review of the security provisions of the Act has been held in abeyance pending the return of the Registrar from an official visit overseas.

Payments of amounts totalling $12 957 was made by way of compensation to the 83 unpaid grower principals from the security ($12 000) held by farm produce agent, E.G.P. Fruit Vegetable and Produce Supplies Pty. Ltd. (in liquidation) and the unidentifiable trust money ($957) recovered from the Receiver/Manager for the secured debtor. Payment was effected at the rate of 35·7c in the $.

A variety of planktonic animals in a sample of coastal water taken by the research vessel 'Kalinda' north of Cape Moreton.

X. Fisheries

Research, extension and regulatory matters relating to fisheries and marine life are the responsibility of the Fisheries Branch of this Department, though field enforcement is carried out by the Small Craft Control Branch of the Department of Harbours and Marine. The research activities of Fisheries Branch are being re-organised along two main streams, one dealing with specific fisheries resources and the other with the general aquatic environment. The maintenance of the quality of the latter is, naturally, vital to the continued viability of the former. There is, of course, a certain degree of overlap between these two activity streams. Research teams are based at Deception Bay (prawn biology and estuarine ecology investigations), Brisbane (fish diseases, minor investigations and extension), Mourilyan Harbour (Crown of Thorns starfish research), Walkamin (freshwater fish studies) and Cairns (Torres Straits resource surveys).

FISHERIES RESEARCH

In July, 1973, Cabinet approved an in-depth survey to establish more fully the extent of commercial fishery resources in the Torres Strait area. Subsequently, the appointment of scientific, technical, and clerical staff was made and headquarters established in Cairns. The survey is concentrating on prawns, lobsters, and mackerel—three important commercial species.

The objectives of the prawn survey are to define suitable areas for trawling, determine the nature and distribution of bottom sediments, collect data concerning the physico-chemical environment, and identify the types of associated marine life. This information will be of value to fishermen searching for new prawning grounds and to future research workers who may engage in prawn research.

Three cruises have been made, each of about three weeks' duration covering an area of 8 000 square kilometres. The navigational features of much of this area are not well defined on charts, and an area of 3 300 square kilometres was found to be unworkable because of the rough nature and shallowness of the bottom.

The objectives of the lobster survey are to identify species present, define their distribution, estimate magnitude of stocks, and recommend an appropriate basis for management measures.

Four cruises, each of about three weeks, have so far been made covering an area of 5 700 square kilometres in a grid pattern. Three thousand nine hundred and twenty-six (3 926) lobsters were taken, and were of four species. The majority of these (3 868) were *panulirus orantus*.

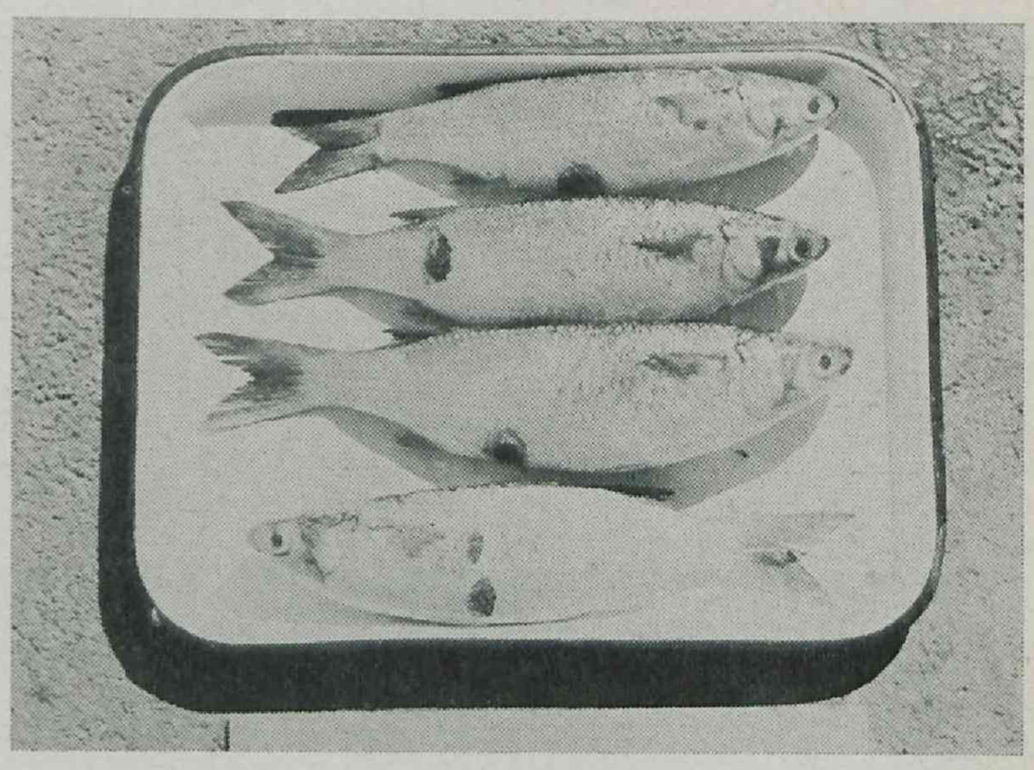
Studies in freshwater fisheries biology is continuing at Walkamin Research Station, where studies include life histories, behaviour, and environmental requirements of various freshwater fish. Hydrological data on a number of North Queensland freshwater impoundments were compiled.

Six ponds were constructed and propagation of several smaller species is being attempted.

Crown of Thorns Investigation.—The research team based at Mourilyan Harbour has been monitoring crown of thorns starfish populations in the general region between Townsville and the Whitsunday Islands, and has continued studies of coral recolonisation and regrowth on previously attacked reefs between Green Island and Townsville. Recovery of the faster-growing corals such as Acropora has been impressive, and after seven years, has progressed sufficiently on Green Island to justify the return of glass-bottomed boat activities in areas previously devastated by the starfish.

The so-called 'Bundaberg Fish Disease', characterised by the presence of external lesions or ulcers, continues to affect fish stocks in rivers and estuaries of Southern Queensland. A high incidence of a pathogenic myxosporidian parasite has been observed in sea mullet and bream. Encysted spores of this protozoan have been found in organs and tissues of affected fish. It is believed that high intensity of infection by the parasite causes weakening of the fish, through metabolic disturbances, resulting in the formation of lesions. The presence of fungi and bacteria in the lesions is thought to be a secondary infection.

The East Coast Prawn Research Programme (a joint project involving this Department and the C.S.I.R.O. Division of Fisheries and Oceanography) was directed during the year



External lesions on these mullet are symptoms of the Bundaberg Fish Disease.

along the following principal lines of study: The water chemistry of Moreton Bay; migrations of king prawn post-larvae into Moreton Bay; the biology of adult king prawns in offshore water above the continental shelf; growth of juvenile king prawns in aquaria; development of a new type of benthos sampler using artificial sea-grass.

During the latter part of 1973, an echo-sounder survey was made of the continental shelf between Noosa Heads and Indian Head. This area was largely unknown to trawlermen, because of extensive areas of rough bottom. The survey established the main patterns of distribution of trawlable and untrawlable ground, and following the survey, over 40 000 kilograms of king prawns were taken from the region. Charts showing the trawlable areas were prepared for sale to fishermen.

Fish Spoilage.—A research project by Dairy Research Branch is supported by funds from the Australian Fishing Industry Research Trust Account. The object is to develop control measures to improve the eating quality of fish available to South-eastern Queensland consumers.

To assess the factors responsible for post-harvest deterioration of fish quality, the following aspects were examined:—

- Fish received at the Metropolitan Fish Market and at various retail outlets were surveyed bacteriologically.
- The characteristic biochemical reactions of those bacterial isolates capable of producing the odours characteristic of spoiling fish were determined.
- Gas chromatography with particular reference to sulphydral compounds was used to assess the contribution of these isolates to fish spoilage.

Bacteria of the genus *Pseudomonas* are the principal fish spoilage bacteria. Lack of hygiene and temperature control during harvest and transport appear to be the dominant factors in fish spoilage.

ESTUARINE ECOLOGY

The Brisbane Airport environmental study has been virtually completed. The fisheries of Serpentine Creek were investigated with a view to assessing the importance of the area to amateur and professional fishing. During the course of the studies several thousand bream, whiting, and flathead were tagged in Serpentine Creek.

A study of estaurine habitats along the Queensland Coast commenced with a survey of Tin Can Bay and the southern portion of Sandy Straits. Efforts were made to gauge the importance of the area to present and potential fisheries. The information gained will serve as a basis for future habitat reserve selection and for the development of a more firmly established estaurine conservation policy.

Fifteen legislative actions were taken during the year connected with fishing in various parts of the State.

The number of honorary fishing inspectors was increased by 14, being limited to certain areas. Honorary inspectors fulfil a special need in the more remote areas of Queensland.

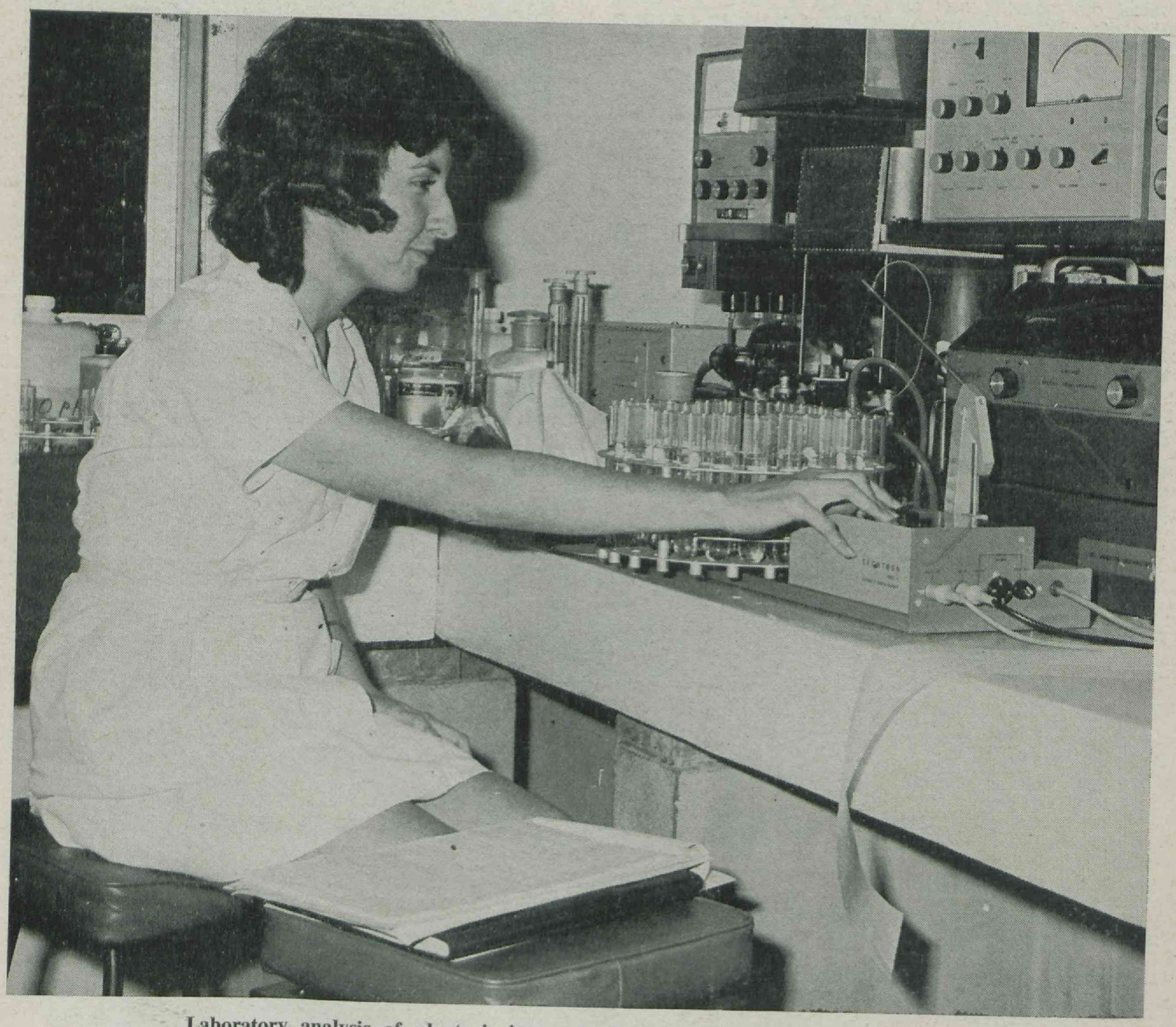
Licenses were issued under the *Fisheries Act*, 1957–1972, giving State totals for the years as follows:

Description of Licenses	Number	Value (Dollars)
Master Fisherman's License ..	2 504	25 040
Employee Fisherman's License ..	2 354	4 708
Commercial Fishing Vessel License ..	3 623	18 115
Oyster Bank License	315	6 300
Oysterman's License	232	464
Oyster Boat License	107	535
Coral License	22	230
Shellgrit License	20	200
Fish Trap Permit	42	252
Total Fees	..	55 844

In recent years it has become impossible to produce accurate fisheries production figures in time for inclusion in the annual report. This is because the sources of such information are not under the control of Fisheries Branch, and moreover the heaviest landings of the more important products such as prawns and mullet take place within the last few months of the financial year. To maintain a continuous record for year to year comparative purposes, production figures from the previous season (i.e. 1972–73) are published hereunder.

The return to operators from commercial fishing in 1972–73 was approximately $12 112 232. During that year live-weight production of the major individual fisheries products was as follows: finned fish 5 424 tonnes, valued at $3 237 564; prawns 6 892 tonnes, valued at $7 364 381; crabs 382 tonnes, valued at $398 751; rock lobsters 120 tonnes, valued at $169 018; bay lobsters 54 tonnes, valued at $52 617; scallops 4 082 tonnes, valued at $850 000; squid 98 tonnes, valued at $39 901.

Amateur Fishing.—Heavy to flood rains severely curtailed amateur fishing activities in estuaries and bays throughout the State during the summer months. However, excellent catches of spanish mackerel were made off the Southern Queensland coast over the Christmas period, and the 1974 winter run of tailor was particularly good. At least two world game fishing records were broken in the Cairns region during the year, the most spectacular being a black marlin of 553·4 kilograms taken on 36·3 kilogram breaking-strain line. An international marlin tournament held at Cairns in October, 1973, attracted teams from the U.S.A., New Zealand, South Africa and Hawaii, as well as a large number of Australian participants.



Laboratory analysis of plants is important in determining fertilizer requirements.

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