QUEENSLAND DEPARTMENT OF PRIMARY INDUSTRIES

ANNUAL REPORT 1985-86

QUEENSLAND DEPARTMENT OF PRIMARY INDUSTRIES

ANNUAL REPORT 1985-86

Presented to Parliament by Command

Hon. N. J. Turner, M.L.A.

As Minister for Primary Industries, I am pleased to provide this annual report, which highlights my Department's activities during 1985-86.

N J Turner.

(N. J. Turner)
Minister for Primary Industries

ISSN 0480-9696

72436—**A.5—1986**

THE YEAR REVIEWED

Rural production

In 1985-86 the gross value of the State's rural production was $3,110m, a decrease of 1.5% on the 1984-85 figure.

Low world commodity prices for many agricultural products were the main reason for the decline. At the end of 1985-86, the outlook was for low world prices to continue for many of the State's major agricultural exports.

Seasonal conditions

Much of the State was dry to drought-affected for lengthy periods and only north Queensland experienced anything like a normal wet season.

By September, 13 shires in the western half of the State had been declared drought-stricken.

In October, north Queensland had unseasonally heavy rains. Good rains also fell along the east coast, on the central highlands and on inland south Queensland.

In November widespread drought-breaking rains occurred throughout much of the State. Seven shires were removed from the drought-declared list. The other six drought-stricken shires (Barcoo, Blackall, Diamantina, Isisford, McKinlay and Richmond) missed most of this rain and, at the end of 1985-86, were still drought declared.

A lack of generalised rain characterised the first 6 months of 1986. In many areas, storm rains were patchy. Yet, properties in some of the grain-growing areas had their best-ever season, while properties only kilometres away had little or no rain. March and April were particularly dry, with only north Queensland receiving any reasonable falls.

In February, Cyclone Winifred struck the north Queensland coast and damaged crops, especially bananas and sugar cane. As the cyclone moved inland and turned into a rain depression, it brought much-needed rains to some of the northern inland areas and caused flooding in the Thomson, Barcoo and Bulloo river systems.

In March only six shires were declared drought-stricken, but, with the subsequent lack of rain, the list increased to 12 shires and one half shire. Three of these—Esk, Laidley and Beaudesert—were in the State's south-east corner.

An agricultural economist discusses the advantages of new self-cleaning 'dry cup' drinkers with a Harrisville broiler grower.

Although early winter crop-planting rains were received in many areas in May, follow-up rains were needed at the end of June.

Cyclone Winifred

Cyclone Winifred struck the north Queensland coast on 1 February 1986, causing severe wind damage to crops between Cairns and Cardwell and lesser damage on the Atherton Tableland and as far south as Ingham. Floods that followed the torrential rain further damaged crops and farm buildings along the Tully and Murray Rivers.

Total horticultural crop-production losses were estimated at $42.5m, but further costs were incurred in repairing damage to soil, trees and buildings on farms and in nurseries. Banana growers sustained heaviest losses. They will have a total lack of production until September 1986. Sugar-cane losses were estimated to exceed $40m.

Assistance schemes and subsidies

Drought-relief assistance for primary producers reflected the year's generally poor seasonal conditions. Expenditure on road-freight subsidies alone peaked at about $1m a month. Items of expenditure on subsidies and loans for drought and natural disasters were (at 31 May):

Rail freight subsidies	**$1,212,000**
Road freight subsidies	**$9,438,000**
Cost of agistment	**$27,000**
Hail insurance	**$243,000**
Drought relief loans	**$6,524,000**
Other natural disaster loans	**$14,345,000**

Assistance schemes for drought were the same as in 1984-85; that is, 50% freight subsidies on stock and fodder movements and low-interest carry-on and restocking loans.

The Granite Belt Hail Insurance Pilot Scheme was continued for another year with subsidies increased to a maximum of 5.425% of the total sum insured.

Hail storms throughout the state resulted in about 30 concessional interest loans being approved. The worst storms occurred at Mareeba in late October and in the Redland Shire-Logan City areas in early March.

DPI research

Up-to-date technical information is a vital component of extension work and agricultural production technology. The DPI's research and experimental development programmes generate such information.

In 1985-86 more than 400 research scientists and a similar number of technical officers were involved in R & D work. The DPI research budget totalled more than $40m and facilities included 25 research stations, 10 central laboratories in Brisbane and 10 country research centres.

Three of the research stations — at Longreach, Bundaberg and Roma—were still being established and will provide important new technical resources for primary industries in those areas.

Important research initiatives included: the expansion of investigations into food quality, particularly

meat, fish and fruit; expanded studies into coffee and tropical-fruit production; a move away from breed research to improved nutrition and carcass quality in beef cattle; cashmere goat investigations; and the search for more stable and profitable soil and field-crop management systems.

Use of tissue culture was increased to develop better techniques for propagation, pathogen elimination and plant improvement to benefit fruit, vegetable and ornamental crop industries.

Biotechnology involving recombinant DNA, DNA probes and other sophisticated techniques continued to be used in research to develop a more effective and safer tick-fever (*Babesia bovis*) vaccine and more specific tests for diagnosing bacterial and viral diseases of animals.

Trap yards using hay or other fodder lures to capture unmusterable cattle were developed and were used effectively by industry, particularly in more remote areas. The technique was being extended into an automatic cattle-management system for trapping and weaning cattle on extensive properties.

In response to consumer demands for more tender beef, a research programme began on ways to maintain high levels of muscle glycogen, an important determinant of tenderness. The programme was investigating the benefits of short-term supplementation with nutrients in the drinking water of cattle before trucking or while awaiting slaughter.

Food research

The analytical services of the DPI's new food research branch were further expanded to cover quality assessment and compositional analysis on a wider range of non-dairy foods. In addition to the seafoods incorporated into the branch's responsibilities in recent years, fruit and vegetable products, beverages, nuts, eggs and a greater range of meat products were introduced. Officers helped the wine industry develop a new light, dry table wine, Balandean Nouveau.

DPI facilities

The world's most modern laboratory for producing vaccines against bovine tick fever was commissioned at the Tick Fever Research Centre, Wacol. The laboratory supplies all of Australia's requirements for tick fever vaccine and is meeting an increasing overseas demand.

DPI officers at Bundaberg moved into the city's new government office building in April. Previously, some had been located in the nearby Court House building and some in rented accommodation elsewhere in the city. Besides the operational economy and efficiency of having all officers under one roof, officers now have better facilities and there is room for proposed further increases in staff members.

The new regional veterinary laboratories at Toowoomba and Rockhampton were under construction. They will provide diagnostic facilities for the livestock industries in south and central Queensland. The buildings were expected to be completed by the end of 1986.

Southedge Research Station, near Mareeba, was extended by 40 ha and an irrigation system was being installed to help an expansion in tropical fruits and coffee research.

On the Burdekin south bank, a new research site was provided by the Water Resources Commission. It is being developed to investigate problems associated with irrigating soils in the Burdekin River irrigation project area.

The area for a field research station at Roma was increased to 66 ha. Road and site works were completed to prepare for the erection of buildings.

At the new Bundaberg Research Station site, a residence was erected and the office-laboratory building was nearing completion. The station will be operating before the end of 1986.

The hatchery building was begun at the Bribie Island Aquaculture Centre, and salt and freshwater services were being developed. A caretaker's house was completed.

Horticultural research facilities were greatly enhanced at Bowen Horticultural Station, where a workshop, packing shed and plant houses were built.

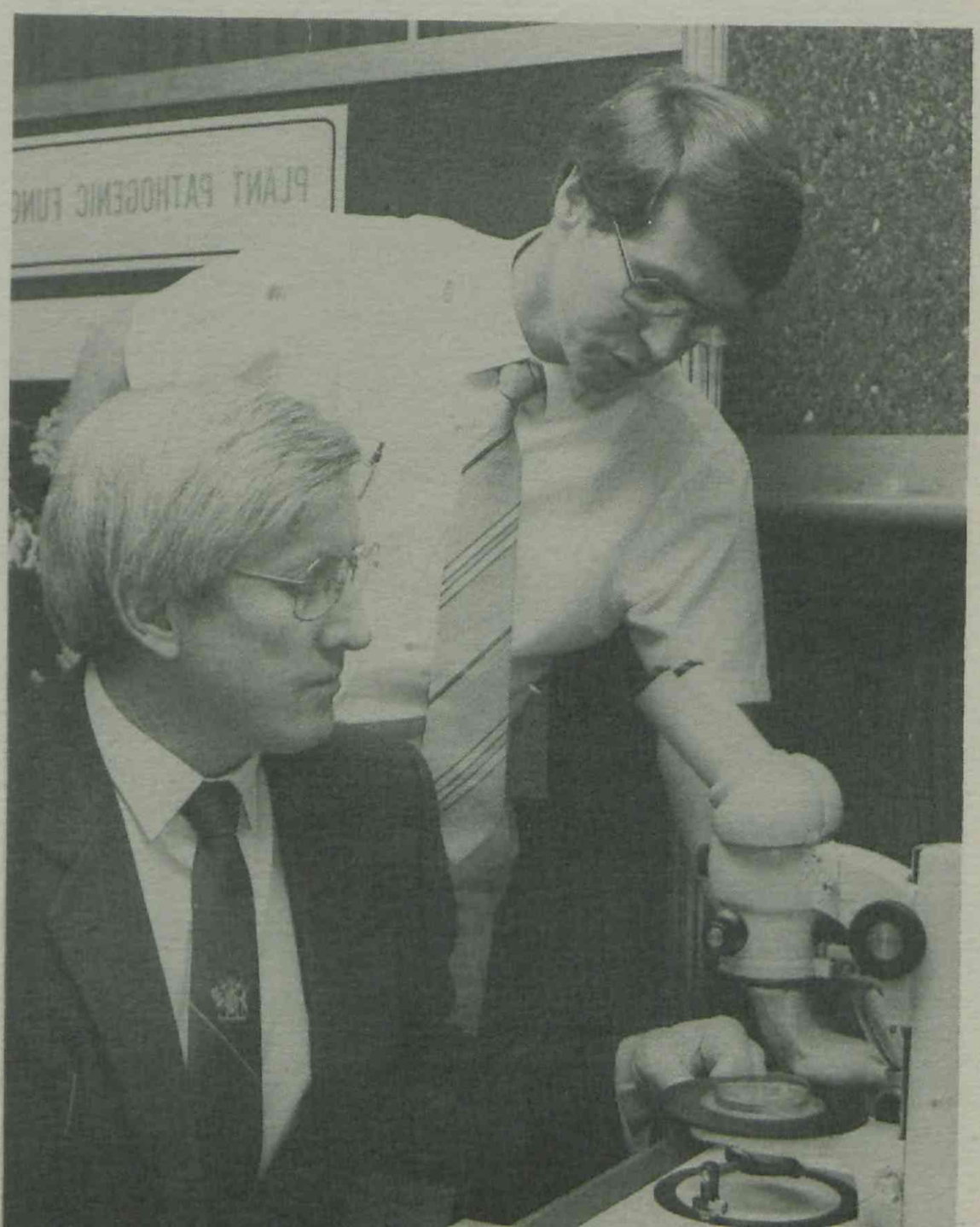
The design of the main office/laboratory building for the Arid Zone Research Institute, Longreach, was completed. Construction was expected to begin before the end of 1986.

Ancilliary buildings were added to facilities at Kairi, Maroochy, Southedge, Croxdale, Biloela, Redlands and Ayr research stations.

Extension activities

Primary producers were served by more than 150 extension projects, planned and delivered by DPI extension staff in groups operating on an industry basis in each DPI extension region.

Dr Ian Muirhead (left), assistant director, DPI's plant pathology branch, discusses an exhibit with the Minister for Primary Industries, Mr Neil Turner, at the Indooroopilly Agricultural Research Laboratories open day on 12 September. The microscope is focused on a dish that contains spores of the root-rot fungus, *Phytophthora*, which attacks avocados. The DPI branches located at Indooroopilly are: soil conservation services and research, land resources, agricultural chemistry, standards, entomology, plant pathology, and botany.



Priorities for these projects and other extension activities were set with the benefit of wide contact with producers, research workers and extension colleagues.

Extension services operated throughout the year in a climate of concern about market recession for grain industries. Catastrophically low returns to the sugar industry caused many traditional sugar producers to seek to diversify. Extension staff in the sugar areas were hard put to meet the demand for information for alternatives to sugar.

Extension staff helped producers establish and operate common interest groups relating to a wide range of fruit and vegetables.

These groups help communication not only between DPI staff and producers but also among producers themselves, and encourage united industry action on production and marketing problems.

The beef industry strongly supported the development of DPI projects in north Queensland to demonstrate practical research findings under commercial conditions.

DPI animal industry extension officers received training in pasture technology for the semi-arid pastoral regions of western Queensland. These officers now are adopting a whole-property approach to extension, and the programme is promoting practices to improve economic viability while maintaining or improving the pasture and land resource.

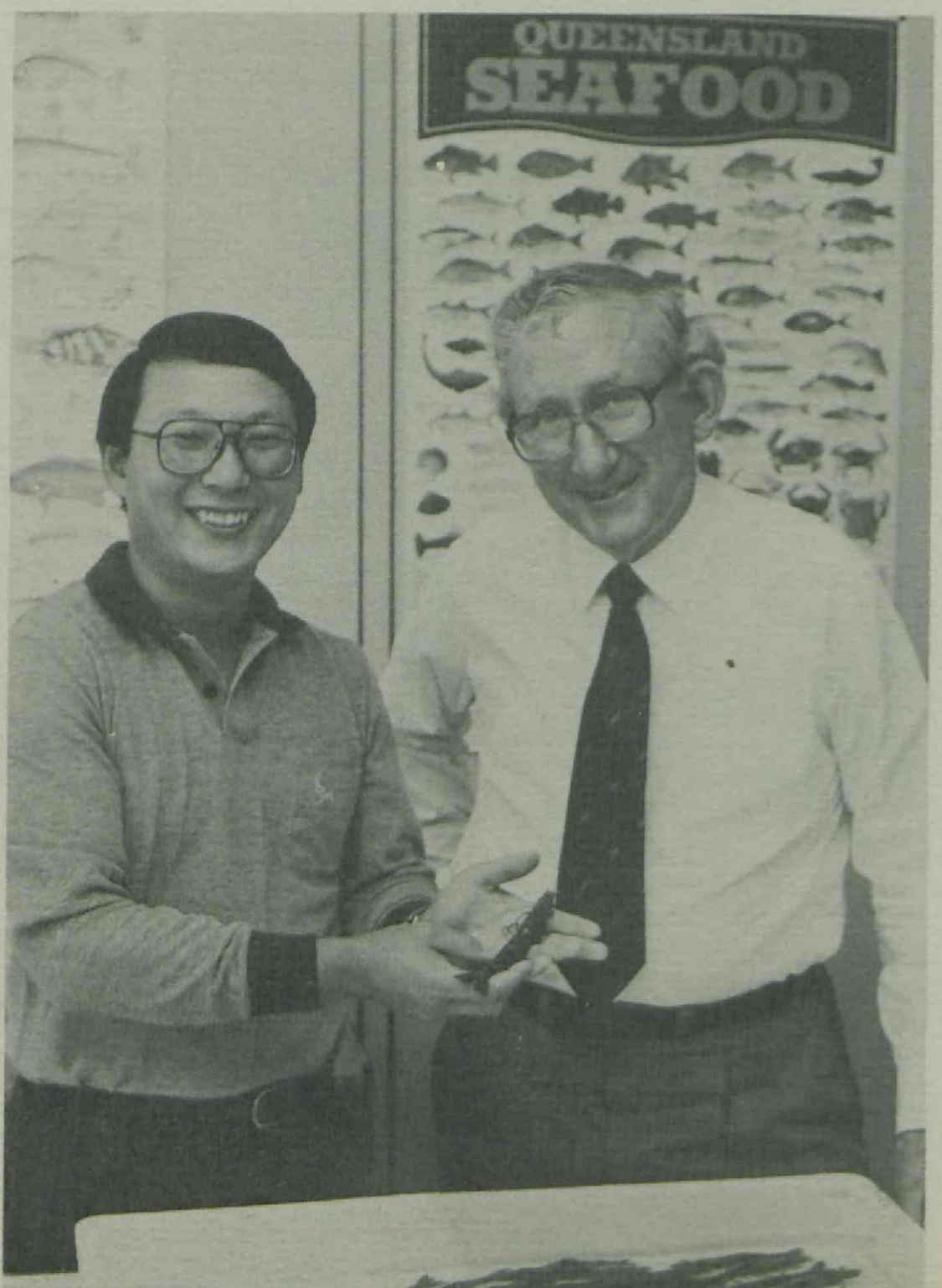
Conservation cropping continued as a major focus for extension effort, with more and more farmers appreciating the need for and practise of conservation cropping of the State's erodible farm land.

Extension services were actively seeking ways to deliver information more conveniently and efficiently. Newsletters designed for specific industries and produced in district offices were widely used to serve producers, particularly in pastoral and developing agricultural areas.

In the more closely-settled areas, extension staff used field days, Farm Notes and mass media to supplement farm and office visits. DPI officers studied the use of new technology, including computer-based information systems.

Extension staff sought to improve the relevance of their communication with farmers through the DPI's evaluation unit, which helps with research into the outcome of extension projects.

Tiger prawns were successfully reared to marketable size at the DPI's Southern Fisheries Research Centre, Deception Bay. DPI fisheries biologist, Mr Tadayoshi Hoshino, shows DPI director-general, Dr Graham Alexander, some of the first batch of prawns.



Conferences and field days

Officers delivered scientific papers at conferences held throughout Australia.

The DPI's Animal Research Institute, Yeerongpilly, conducted a symposium on applied immunology in animal science. Besides DPI scientists, distinguished scientists from the Queensland Institute of Medical Research, the Queensland Institute of Technology, the University of Queensland the the Prince Charles Hospital delivered papers.

At the International Conference on Animal Production in Arid Zones, Damascus, two techniques developed at the DPI's Toorak Research Station, Julia Creek, were adopted for use in other arid regions. The techniques are the propagation of shade trees to reduce heat stress on grazing sheep and the concept of water medication to provide supplements to stock.

Officers also participated in many field days organised by the DPI or industry organisations.

In cooperation with the Queensland Merino Stud Sheepbreeders' Association and the Maranoa Graziers' Association, the DPI conducted a series of field days and a seminar under the banner of Queensland Merino Week, with the theme of 'breeding sheep for the space age'.

These events were designed to promote the continued healthy development of an economically viable sheep industry. Some 800 producers attended.

The DPI's Maroochy Horticultural Research Station (Nambour) open day was attended by more than 2000 people, who were given the latest information on producing and marketing subtropical fruits. Displays, demonstrations and talks on 38 different subjects were presented, focusing on the theme of 'producing for profit'.

An open day at the DPI's Agricultural Research Laboratories, Indooroopilly, attracted an urban and rural audience of more than 2000 visitors. Displays covered a wide range of plant and soil research, including the latest scientific equipment and techniques used in combating plant disease and insect pests.

The DPI took a major role in a Brisbane conference on the rapidly expanding aquaculture industry. More than 1000 registrants, representing growers, scientists and hobby farmers, took part. Results of DPI research into this potentially significant industry were presented.

Computing facilities

The nucleus of the DPI's computing network, QDPINET, was established, with the VAX 11/750 and two Pyramid computers as hosts. Officers at Mineral House, Indooroopilly, Yeerongpilly and Toowoomba can use these computers to analyse research data statistically, simulate agricultural systems and develop on-line information systems.

A gateway to CSIRONET, the CSIRO network, allows staff at other regional centres besides Toowoomba to use the host computers on QDPINET. QDPINET operators also can access software and data bases maintained on CSIRONET by other groups. An AUSTPAC link provides access to QDPINET for users at smaller country centres. These centres are equipped with microcomputers, which are used locally for data and text processing and as terminals to the hosts on QDPINET.

A project management information system is being developed on the Yeerongpilly Pyramid computer to allow storage and retrieval of information on DPI projects and personnel. The system will help in administering of DPI research projects and meet the requirements of the National Database on Agricultural Research Projects, being developed by CSIRO.

Award for SORPACK

SORPACK, a computer-based sorghum crop management system, developed by DPI entomologists, won an agricultural software competition run by the national newspaper, *The Australian*. The management package, comprising a suite of computer programs, was tested by DPI extension and research staff at 10 locations throughout the State's sorghum-growing areas. Originally begun as an insect pest management system, the SORPACK program was expanded to include total crop management. Information on weeds, varieties, planting methods and rates and fertilisers was incorporated as well as on pest and disease management. The program aims to help farmers make crop management decisions by giving them rapid access to complex technical information in a readily usable form.

Lean meat promotion

The DPI continued to promote lean meat as part of a healthy diet. Late in the year the Minister for Primary Industries, Mr Neil Turner, launched a high-quality, entertaining film *Today's Menu*. Produced in collaboration with the National Heart Foundation, it portrays meat's proper place in a balanced human diet.

Meat inspection

The year 1985-86 was the first full year in which the rationalised meat-inspection system operated in Queensland export abattoirs. The system delegated a number of State initiatives and functions to the Commonwealth. Rationalisation arrangements were considered to have been very effective.

The DPI actively examined a proposition to give more responsibility to the meat industry in maintaining quality standards. In consultation with industry, DPI officers prepared codes of practice for constructing and equiping abattoirs, and for poultry processing techniques.

A wide-ranging review of butcher-shop inspection resulted in a system of shop accreditation, as a self-regulating concept, being actively explored with the trade.

Industry consultation

The DPI continued wide-ranging consultation with most industries to improve its programmes.

Of particular interest was consultation with beef industry representatives on a research and extension plan. In March, the consultative committee held one-day meetings with representatives from the beef industry's grazing, transport and processing sectors at Brisbane, Miles, Rockhampton and Charters Towers. The objective was to seek industry's advice on maximising the relevance of DPI research work, examining possible new methods of implementing extension programmes and improving the overall rapport with the industry's sectors.

Cattle tick control

Excellent progress was again made in eradicating cattle ticks from the Maxwelton Special Quarantine Area in north-west Queensland. The number of quarantined properties was reduced from 75 to 25, with a substantial reduction expected again in 1986-87.

Fencing both sides of the road/rail corridor between Cloncurry and Hughenden was completed. These fences prevent tick-infested stock straying southwards into the tick-free areas.

The new dipping facility at Helidon was officially opened. The dip has good road and railway branch access. It is strategically important in containing the spread of cattle ticks in south-east Queensland. The new facility will improve the necessary dipping of cattle moving from tick-infested areas in Queensland to markets, abattoirs or pastures in the tick-free areas of Queensland, or to New South Wales.

A working party was formed to review tick-control measures and animal-movement requirements and to improve procedures, while maintaining safeguards to prevent the spread of ticks. Its recommendations included a proposal to establish buffer zones between tick-infested and tick-free country.

Brucellosis and tuberculosis

Queensland maintained its steady progress in tuberculosis and brucellosis eradication. It is expected that the target dates of 1988, for freedom from brucellosis, and December 1989, for all herds to be at least 'provisionally clear' of tuberculosis, will be met.

The film crew shoots one of the scenes in the DPI's meat nutrition film, *Today's Menu*. Launched in May, the 15-minute film shows the place of meat in a balanced diet and explains some of the misconceptions about meat's nutritional value. The film was made with the National Heart Foundation's cooperation.

The Tuberculosis Provisionally Free Area was extended to include the shires of Diamantina and Winton, and those parts of the shires of Barcoo, Bulloo, Longreach and Quilpie west of the Western Dingo Barrier Fence.

Some concern was expressed within Queensland and interstate at the number of the State's supposedly TB-free herds that monitoring activities during 1985 showed to be infected. To eliminate the possibility of an escape of infection with movements of store cattle from these herds, all 'disease-free' herds considered to be at real risk from infected neighbours were reclassified as 'administratively provisionally clear'.

Such herds were still considered to be TB free, but a precautionary test was required on store cattle moving from them.

While this innovation was seen at the outset as cataclysmic by a section of producers, it gained acceptance, and praise, as it came to be seen in perspective.

In recognition of its effectiveness, New South Wales authorities continued to permit TB-free cattle to enter their State from Queensland without test.

Exotic diseases

A practical simulation exercise to control a vesicular disease outbreak in livestock was held in central Queensland. The exercise examined the problems likely to be encountered in an actual outbreak and the roles of personnel from the Police Department, State Emergency Service and Stock Routes and Rural Lands Protection Board in eradication procedures. Lines of communication between the field headquarters at Gladstone and the exotic diseases operation centre in the State Law Building, Brisbane, were tested.

A rabies control exercise was conducted in Toowoomba in May. The first of its type in Australia, the exercise successfully brought together a wider range of authorities, including local government, medical services and wildlife experts to focus on the special problems in a rabies outbreak.

Cattle-trade development

The number of cattle exported to the Japanese market increased dramatically. A total of 13 180 head of slaughter and feeder cattle were exported compared with 3973 head during 1984-85. A ship-board veterinary clinical service, in which DPI veterinary officers participated, was introduced to help maintain the health and welfare of the cattle during the voyages.

The New Zealand authorities agreed to permit the export of cattle, sheep, goats and deer to their country from Queensland and from other Australian states. The prospect is good for large contracts for fibre-goat exports from Queensland.

Soil conservation

Construction of soil conservation works was slightly below the 1984-85 level, although interest remained high. A reason for this was the actual or expected income fall at a time when erosion had not been widespread. However, the use of conservation farming techniques that reduce tillage and maintain plant material on the surface increased.

The increase was dramatic in the sugar industry. Some 70% of farmers in the Mackay district, for example, were practising trash retention.

Most were using a recently designed one-pass cultivator/fertiliser applicator. The central Queensland grain industry had significantly increased its use of herbicides in place of tillage.

Soil conservation works, nevertheless, were designed for 68 900 ha of cropping land. A record 9256 ha were treated with relatively inexpensive strip-cropping measures.

A National Soil Conservation Program project produced a computer data base on weeds in fallow situations. The data base was being expanded to provide better pest management advice to farmers.

Landholders had shown real interest in a number of coordinated catchment planning schemes in central and south Queensland. Most landholders involved were undertaking soil conservation work.

Activity in soil erosion control, by either works or management, was being maintained by increasing emphasis on extension. Part of this effort was devoted to ensuring that the coming generation understands the need for sensible land use and management. Education material, including field study resource kits, had been developed for use in primary and secondary schools.

Fisheries

Management programmes in the commercial fishery continued to stablise effort, and allocation of individual fishing rights associated with fishing vessels gave confidence for the future. In late 1985 favourable unit prices boosted returns from the major prawn and scallop fisheries, but, in the second half of the year, depressed yields in the prawn and barramundi fishery were expected to reduce the overall income.

Joint government development of controls in Torres Strait, under the Australian-Papua New Guinea Treaty, continued to stabilise effort in the prawn, mackerel and pearl fisheries. Arrangements were well advanced to introduce the Offshore Constitutional Settlement, transfering management of effort in offshore Queensland waters from Commonwealth to State control in all fisheries except the global tuna fishery.

A sand crab tagging programme provided valuable information about the Moreton Bay sand crab fishery. A lottery to give fishermen an incentive to return tags resulted in a higher than usual return.

Mr Dave Mitchell, chairman, Queensland Fish Management Authority, and Ms Linda Campbell, secretary, *Queensland Country Life*, admire golden perch and barramundi on display at the first national freshwater aquaculture conference. Raising freshwater fish in captivity was one of the many topics discussed at the conference held in Brisbane on 27 and 28 April.

Aquaculture

The aquaculture of penaeid prawns and barramundi continued to develop, mainly in north Queensland, with marron growing becoming popular in south Queensland. The growing of prawns requires a signficant capital investment and the importation of overseas expertise.

Barramundi hatchery production advanced significantly, and much information about their reproduction was gained. Eggs were developed into fingerlings and a stocking trial at Tinaroo Dam was successful.

Fishing industry involvement

Industry bodies were actively involved with the DPI in setting priorities for research through the Research Advisory Committee.

Recreational fishery interests are making a valuable contribution to the management of sports fisheries through liaison provided by the Recreational Fishery Advisory Committee. The Queensland Fish Management Authority has become heavily involved in fish promotion through the Fish Promotion Advisory Committee. This committee has instituted a series of important industry awards which, together with other DPI initiatives, are seeking to focus attention on seafood quality.

Dairying

As in 1984-85, the year was marked by disagreement and indecision over new marketing arrangements for the Australian dairy industry. The Queensland dairy industry saw some of the proposals as threats to the orderly marketing system developed over many years.

After state dairy industry organisations failed to agree on a national marketing formula, the Commonwealth Government announced it would legislate for its own plan, the 'Kerin Plan'. This plan, which was to operate from 1 July 1986, was expected to have long-term structural influences on the dairy industry.

For the year ended 31 March 1986, Queensland factories received an estimated 605m L of milk, about 13m L (or 2%) less than for the year to 31 March 1985. The lower production was attributed to dry conditions in some south-east Queensland regions.

Artificial breeding

Semen production increased by an overall 71%, with 453 985 doses placed in storage. Production was lower in 1984-85 because of an electricity shortage in February. Gross income from artificial breeding activities exceeded $1.3m. Semen exports totalled 66 240 doses, an increase of 230% compared with the 1984-85 figure. Sahiwal and AFS were the main breeds sold.

A pig AI service using chilled semen was being developed through the cooperation of DPI pig and poultry branch officers, and Wacol AB Centre staff. Semen from top Queensland central tested boars is to be marketed through the existing AB Centre distribution system.

AFS semen sales continued to expand. In 1985, about 19 000 doses of AFS semen were exported to countries including the Philippines, Mexico, Indonesia, Venezuela and Zambia. An initial export of 20 AFS cows and heifers to a new dairy project being established in Malaysia was being arranged.

Pasture branch established

The pasture agronomy section of the DPI's agriculture branch was established as a new branch within the division of plant industry. Known as the pasture management branch, it has a staff of 85 stationed at 20 centres and is exclusively devoted to pasture research and development. Considerable emphasis will be placed on native pastures.

New crop varieties

Nine improved varieties and breeding lines were released from the DPI's field crop improvement programmes. New varieties of peanuts, rice and navy beans were released and were welcomed by growers. Four hybrid parental grain sorghum lines and one breeding line, all with a degree of resistance to sorghum midge, were released to the seed industry from programmes at Hermitage (near Warwick) and Biloela Research Stations.

Insecticide management

Intensive monitoring of synthetic pyrethroid resistance continued as an integral part of the evaluation of the insecticide management strategy for resistant *Heliothis armigera* in the Emerald district. Because it is a mixed-farming district, it has a wider range of *Heliothis*-susceptible crops. This allowed a longer sampling period for checking resistance levels. No significant differences occurred in percentage resistance between larvae occurring on crops of sunflower, maize and cotton and, up to the end of January, no significant change in overall resistance levels.

Before the end of January, the average resistance level was 6.5%. Spraying with synthetic pyrethroids began on 1 February and, by the middle of March, resistance levels had increased to 17.4%. Although expected, this increase was comparable to that experienced in the cotton-growing areas of the Namoi-Gwydir region in New South Wales. However, later testing indicated that, by the beginning of April, resistance levels were about 16% for Emerald and 44-45% for Namoi-Gwydir.

Papua New Guinea commodity board and PNG Department of Primary Industry staff attended a 10-day training course run by the Queensland Department of Primary Industries in Brisbane in May. The course involved the use of microcomputers in data collection and analysis. Skills acquired at the course are being used in economic surveys, statistical presentation and day-to-day administration in PNG.

Problems in rice and maize

Bacterial leaf blight of rice was recognised for the first time in Queensland at Arriga Flats near Mareeba in December 1984. The disease affected winter crops in 1985 and was widespread in the 1986 summer crop. It was not detected at Ingham or in the Burdekin district. Rice cultivars were being tested to determine whether any were resistant.

Symptoms of a new disease, downy mildew, were observed on maize on the Atherton Tableland and in the Lakeland Downs region of far north Queensland in April 1985. The identification could not be confirmed until January 1986, when spores of the downy mildew fungus were found on young plants. As a precaution to limit disease spread, legislation was enacted that required all seed produced in a defined Atherton Tableland Maize Quarantine Area to be treated with the systemic fungicide metalaxyl before movement to other areas of Australia. To protect young seedlings from the disease, growers in infested areas were advised to treat their seed with metalaxyl before sowing.

Visit to India

In late 1984, with the help of a $A13,500 grant from the International Bureau of Plant Genetic Resources, DPI pasture agronomist, Mr I. B. Staples, visited India to collect potential pasture legumes and grasses, especially plants likely to be suited to clay soil areas. His collection of 1121 plants (604 legumes, 496 grasses and 21 other plants) is being grown out for quarantine, seed increase, preliminary classification and ultimate field evaluation.

Overseas consultancies and training

During the year DPI officers undertook 35 short-term consultancies in 19 developing countries. Officers visited the Middle East, Africa, Asia, South-East Asia, the South Pacific and China. The consultancies were concerned with activities such as feasibility studies, technical advice on agricultural production problems and project reviews.

The DPI continued to get many requests to train personnel from developing countries. Training of overseas agricultural and livestock specialists through group and individual programmes is an important part of the DPI's overseas activities.

The DPI conducted an international course on tropical pasture management for participants from Argentina, the Philippines, Fiji, Papua New Guinea, Indonesia and Zambia.

Individual training programmes were provided in preserving stored cereals, tropical fruit production, meat inspection, pig production, plant pathology and agricultural extension.

The DPI organised more than 40 visits and study tours for senior executives from overseas countries. Among those from Africa were delegates to a Food Security Seminar organised by the Australian Development Assistance Bureau (ADAB) as part of an Australian aid project to strengthen the management of grain storage and marketing.

The DPI's relationship with agricultural bodies in China continued to grow. Further delegations from China visited Queensland to discuss pasture development and livestock production.

Overseas projects

Eight overseas research projects were being managed on behalf of the Australian Centre for International Agricultural Research (ACIAR). These projects involve pest control in grain storage, tick-borne diseases, control of fruit flies, post-harvest treatment of mangos, coconut crab biology, malignant catarrhal fever, and the economics of export tree crops. In undertaking these projects, DPI research staff were collaborating with researchers in Malaysia, Thailand, the Philippines, Indonesia, Sri Lanka, Papua New Guinea and Vanuatu.

On behalf of ADAB, the DPI was managing a technical cooperation project to strengthen the operations of the Institute for Control of Agrochemicals, Beijing, China. This project involves: training Chinese scientists, both in Queensland and in China; buying in Queensland and installing in China items of scientific equipment; and advising and guiding the Institute on the regulations and the procedures to control the use of agricultural chemicals.

The contacts and the relationships developed from these overseas activities will prove most valuable to Queensland industries.

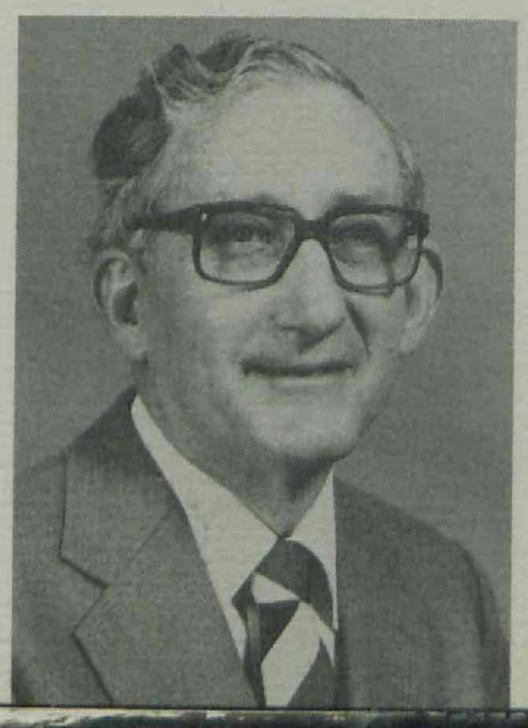
Unique agreement

A unique agreement was concluded between the DPI and the Guangdong Entomological Institute in Guangzhou, China. Entomologists at the Institute helped in the search for natural enemies of the key citrus pest, white louse scale (*Unaspis citri*) in southern Guangdong Province and on Hainan Island. Location of an effective parasite of this pest is vital for integrated pest management within the citrus industry in Queensland. The industry provided much-needed funds to finance the project.

Special employment schemes

The DPI again took part in the National Employment Strategy for Aboriginals (NESA) programme. Twenty-six trainees gained personal skill and work experience in a wide range of activities, from plant nursery work to mechanic's assistant and herd recording.

A total of 105 people were employed, under the Commonwealth Government's Community Employment Programme, in projects totalling $1.2m. The DPI's research stations branch gained $450,000 from the programme for projects involving major additions to buildings and other research-station facilities. The people employed under this scheme have gained valuable experience and some have been employed permanently.



G. I. Alexander
Director-General

FINANCE

Accounts re-structured

In line with a review of the DPI's administrative operations, its accounts branch was re-structured into three functional work sections: expenditure, revenue and supply.

The DPI's existing computerised accounting system was upgraded with more powerful networked personal computers. This enhancement was implemented as a pilot scheme for processing departmental accounting off mainframe.

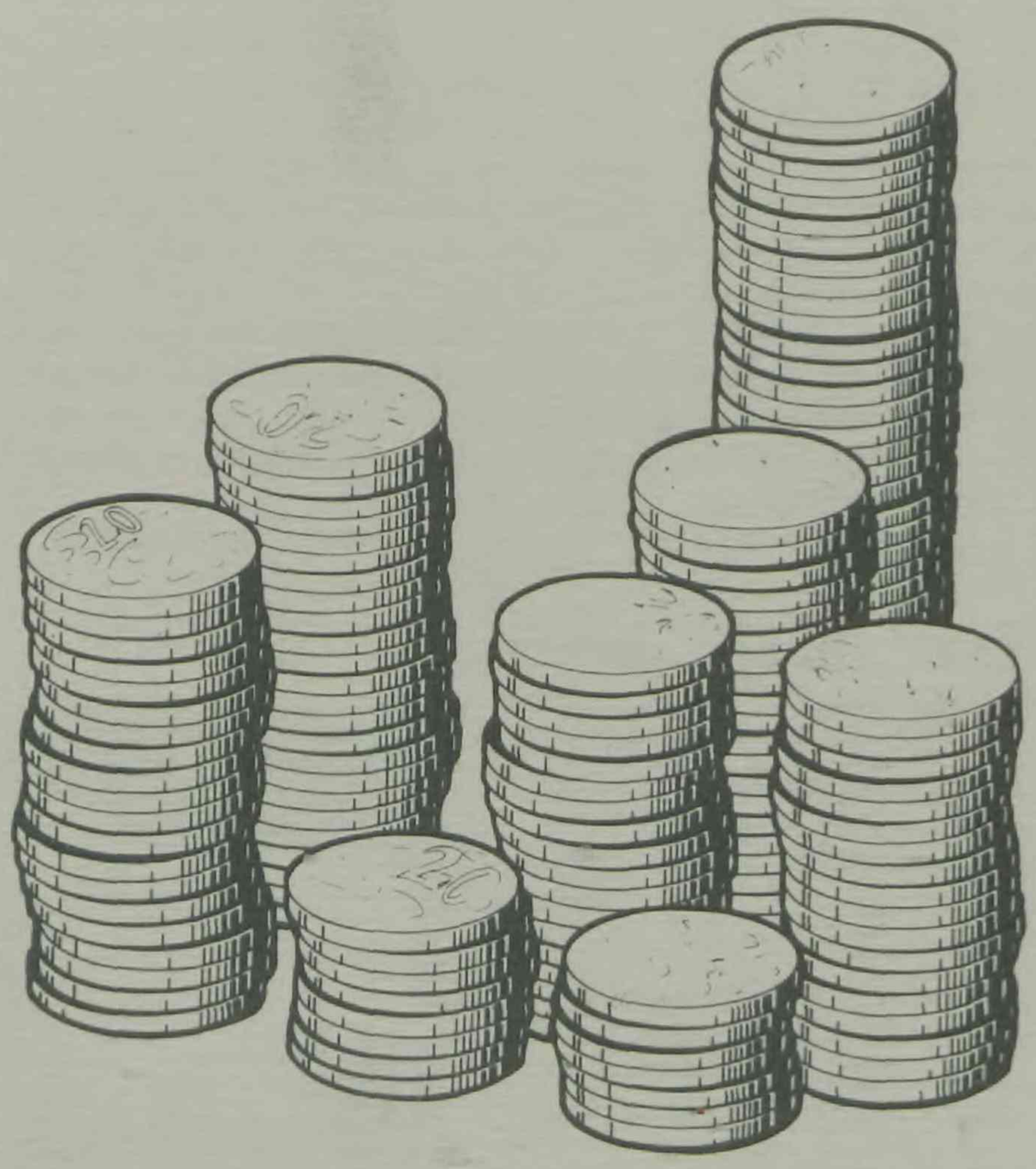
It means that routine accounting transactions are processed on DPI microcomputers rather than on a central public service mainframe computer. The result is a system with enhanced capabilities and a greater degree of compatability with other DPI systems under development. This enables the DPI's accounts branch to provide improved accounting information within the department.

Increased payments

Adverse seasonal conditions resulted in increased payments under the joint Commonwealth/State Disaster Assistance Scheme. Payments totalled $9,465,156, an increase of $6,287,282 over the 1984-85 figure.

Industry organisations financed some 170 research projects within the DPI's Special Standing Fund and some 145 projects through the Commonwealth Rural Industry Grants Fund.

Departmental expenditure from the various funds is shown on this page.



CONSOLIDATED REVENUE FUND

	1984-85	1985-86
	$	$
Department of Primary Industries		
Salaries	54 467 630	58 047 928
Contingencies	43 969 559	49 260 727
Payment authorised by special Act		
Grant in aid of the Banana Industry Fund	171 612	156 616
Total	**98 608 801**	**107 465 271**

Costs associated with Commonwealth-State Bovine Brucellosis and Tuberculosis Eradication Programme were:

	1984-85	1985-86
	$	$
Eradication	10 800 000	10 680 000
Compensation payments	8 100 000	9 428 000
Additional assistance	160 000	474 000
Total	**19 060 000**	**20 582 000**

TRUST AND SPECIAL FUNDS

	1984-85	1985-86
	$	$
Department of Primary Industries Special Standing Fund	10 039 368†	20 888 588*
Banana Industry Fund	336 004	334 493
Commonwealth Poultry Industry Assistance Fund	2 937 241	1 964 505
Commonwealth Quarantine and Export Inspectors Fund	4 407 116	4 922 600
Commonwealth Rural Industry Grants Fund	3 033 103	3 754 028
Fisheries Research Fund	286 172	375 041
Meat Inspection Account	3 766 982	3 331 107
Poultry Industry Fund	833 438	870 286
Stock Disease Compensation and Stock Improvement Fund	33 034	28 310
Sugar Cane Prices Fund	2 186 181	2 091 032
Swine Compensation Fund	3 033	Nil
Total	**27 861 672**	**38 559 989**

* Includes $9,465,156 on account of Disaster Assistance Scheme and $827,245 on account of the Queensland Fish Board.

† Includes $3,177,874 on account of Disaster Assistance Scheme and $868,646 on account of the Queensland Fish Board.

LOAN FUND

Expenditure of $959,974 was incurred through the Loan Fund to 30 June 1986.

PRIMARY INDUSTRIES OVERVIEW

Rural production values

The preliminary gross value of rural production in Queensland in 1985-86 was $3,110m, about 1.5% lower than in 1984-85. This decline was attributable mainly to lower international prices for a number of the grains, oilseeds and cotton.

Livestock slaughterings (and other disposals) were valued at $1,087m, up 4%. The value of cattle and calf slaughterings increased by 5.4% to $918m.

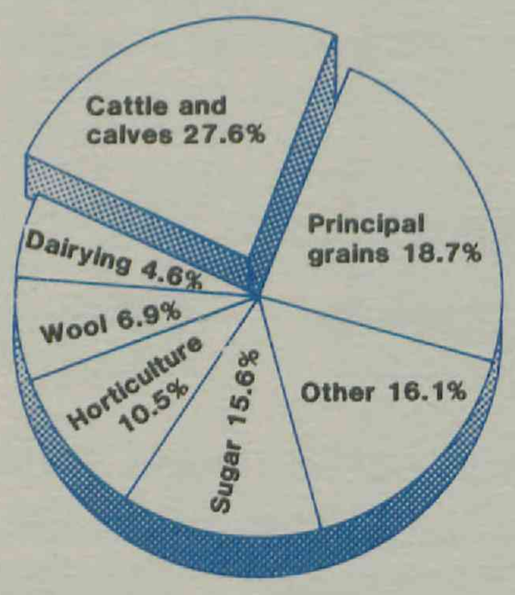
Poultry slaughterings were put at $68m or 13.3% more than last year's figure. Pig slaughterings decreased 1.7% to $90m.

The value of wool decreased by nearly 2% to $213m.

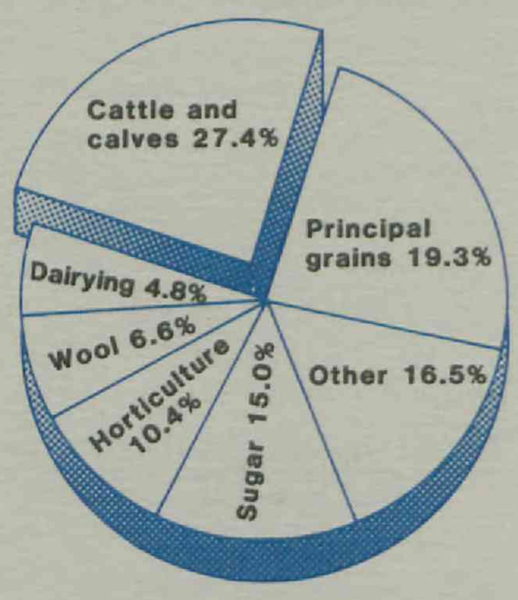
Horticultural production was valued at $339m, a 2.2% increase.

The value of cereal grains was expected to fall to $578m or about 2% down on the 1984-85 figure. The largest declines were expected in barley (down 5% to $96m) and maize (down 42% to $20m).

1984-85



1985-86



The beef industry

Beef cattle numbers in Queensland were estimated at 9.227m head at 31 March 1986, a modest increase on the 1985 figure of 9.051m. Dry conditions in several producing regions slowed the rebuilding of the cattle herd.

Average saleyard prices for cattle were slightly higher in 1985-86. Prices strengthened in the first 6 months, but eased in the second 6 months because of a weakening USA market and increased yardings brought about by worsening seasonal conditions. The gradual strengthening of the A$ relative to the US$ also had some downward effect on prices in the second half of the year.

The annual average price of bullocks (301 to 350 kg) at Cannon Hill increased by 6% to 175.5c/kg estimated dressed weight, while the price of cows (201 to 250 kg) increased by 4% to 160c/kg. The Queensland Cattle Market Index (Base 1981=100) averaged 141 compared with 135 in 1984-85.

In line with the higher yardings, cattle slaughterings increased, resulting in a rise of about 8% in beef and veal production.

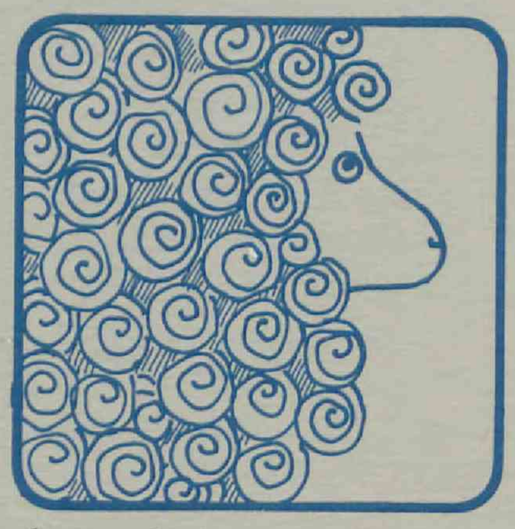
Beef and veal exports were also up on last year's levels, owing mainly to the increased supplies and generally favourable currency movements. Despite weaker prices, exports to the USA also increased markedly. However, the depreciation of A$ against the US$, particularly in the first half of the year, made returns to exporters of cow beef to the USA more attractive.

The FAS price for imported Australian boneless cow beef to the USA averaged 229c/kg compared with 232c/kg the previous year.

The development of a National Uniform Trading Language for objectively describing livestock was finalised by Aus-Meat, the Authority for Uniform Specification of Meat and Livestock. The Queensland Livestock Market Reporting Service began using the Aus-Meat language in early 1986.

With the establishment of Aus-Meat, the development of Australia's national electronic livestock marketing system—Computer Aided Livestock Marketing (CALM)—was nearing completion and was expected to be operating later in 1986. The Aus-Meat language will form the basis of sales by description and will be used by CALM for its electronic auction sales.

The wool industry



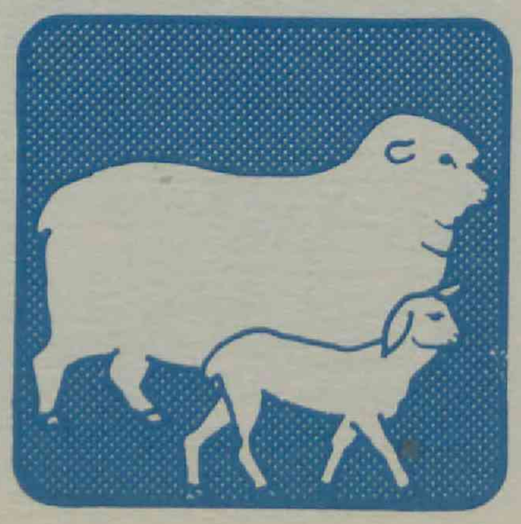
The Queensland sheep flock numbered 14.135m head at 30 March 1986, an increase of 100 000 head. The increase reflected higher-than-normal lambing percentages in south Queensland and a tendency for sheep to be held on properties despite prolonged dry conditions, particularly in north Queensland.

Queensland wool production was estimated at 68m kg, with a gross value of $210m.

Strong trade demand and reduced prices characterised the 1985-86 wool-selling season.

The floor price was set at 500c/kg clean, a 6% rise from the previous season. The market indicator opened the season at 549c/kg clean and closed the first half at a low 523c/kg clean. The Australian Wool Corporation was a net buyer in the first half, with stocks rising to 1.16m bales at 13 December 1985. By May, the Australian wool market had strengthened, in response to increased trade demand for most categories of wool. The market indicator rose to 556c/kg clean at the end of May 1986.

The sheep meat industry

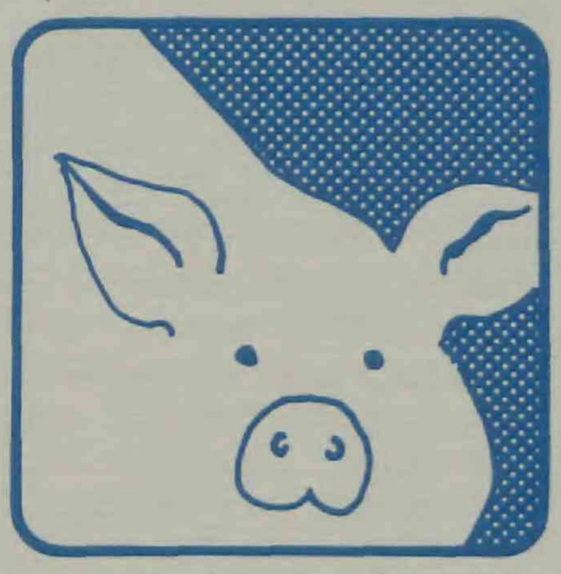


Sheep and lamb slaughterings were estimated at 1.34m, 3% down on 1984-85. Gross value of production was expected to increase by about 4% to $22m. This reflected a sustained firming of domestic lamb prices towards the end of 1985-86.

Saleyard prices of lambs firmed strongly in late 1985-86, because of decreased supplies in Queensland and increased exports of lamb products from southern states. At Dalby, Score 4 lambs sold to 165c/kg in May after selling at 80c/kg in March, 1986, but fell to 111c/kg in June.

Factors affecting the sheep-meat market during the year were: altered subsidy arrangements for the New Zealand sheep-meat industry; reduced income growth in the Middle East owing to depressed oil prices; and the re-entry of Australia into the Iranian sheep-meat market.

The pig industry



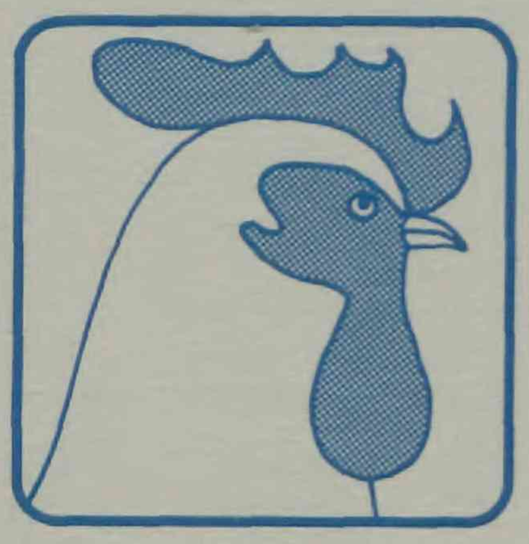
In 1985-86 pig slaughterings were expected to increase by about 5% to an estimated 1.013m head compared with 0.965m head in 1984-85. In line with this trend, pigmeat production was expected to increase by about 6.8% to an estimated 65 000 t compared with the 60 852 t produced in 1984-85.

Sow numbers increased modestly, a trend that slowed towards the end of 1985-86, owing to an uncertain grain supply and high interest rates.

Feed prices decreased for most of 1985-86. This was due to adequate supplies of grain being available to meet demand. Prices increased towards the end of the year when supplies of winter cereal grains were limited.

Pig prices at description sales fluctuated from about $2/kg in July-October up to an average of about $2.14/kg in November-February, before dropping to about $1.95/kg towards the end of 1985-86.

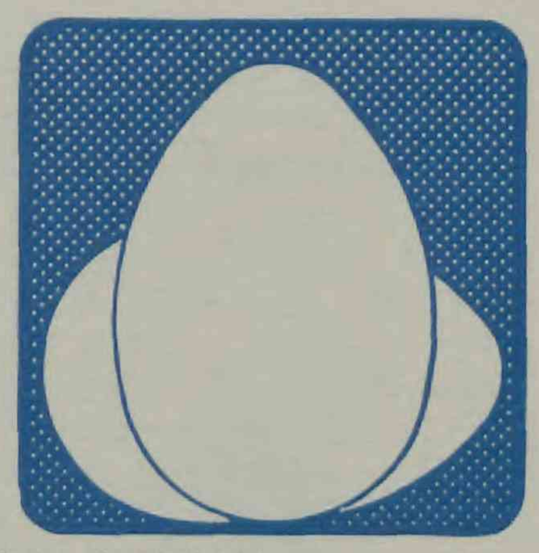
The poultry meat industry



Demand for chicken meat continued to grow and, in line with this trend, processors increased production. Meat chicken slaughterings were forecast to rise by 12.8% on 1984-85 levels to about 41m chickens, while chicken-meat production was expected to be 51 000 t, up 11.8%. Lower feed prices helped processors contain other cost increases and maintain the competitiveness of chicken meat.

After the regular 6-monthly review of indexed production costs, the Chicken Meat Industry Committee set the rates paid by processors to contracted growers for rearing chickens: 31.15c/bird for July to December 1985 and 31.9c/bird for January to June 1986. The average growing fee of 31.525c for the 1985-86 season was an increase of 3.7% on the average 1984-85 payment of 30.4c.

The egg industry



Egg production in Queensland was estimated to be 32.5m dozen, about 1.5% below 1984-85 production. Effective matching of egg supply with demand was achieved by improved production forecasting and applying the seasonal hen quota adjustment system.

South Queensland Egg Marketing Board egg sales were estimated to be similar to 1984-85 sales, while the Central Queensland Egg Marketing Board reported a sales reduction of about 2.5%.

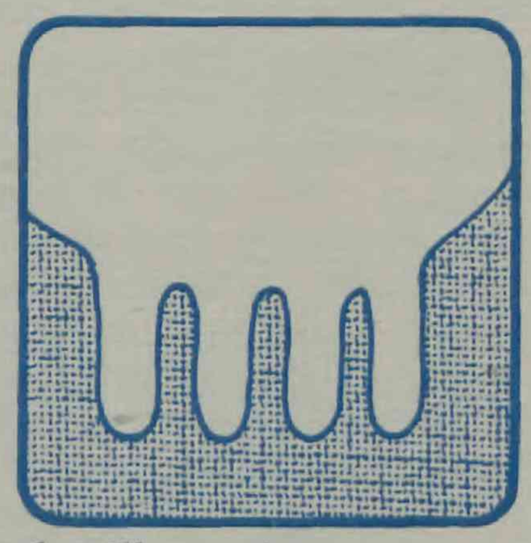
In April the South Queensland Egg Marketing Board instituted a new payment system for eggs. Under the new system, payments to individual producers closely reflect the degree to which the mixture of grade sizes supplied matches consumer demand for these sizes.

The Central Queensland Egg Marketing Board installed an egg pulp pasteurising plant, which began operating in April. Previously, egg pulp produced from surplus eggs had to be sent to Brisbane for treatment before it could be sold.

In north Queensland, Cyclone Winifred destroyed the largest egg farm in the region at Bingil Bay. This markedly affected egg supplies in the region, and a temporary quota adjustment was needed to meet market requirements.

Regulations made under the *Hen Quotas Act* were amended in November to permit, in certain circumstances, the transfer of hen quota without the attached land. A number of quota holders took advantage of this change to sell their quotas and leave the industry.

The dairy industry



Queensland wholemilk production was estimated at 594m L, 4% below the 1984-1985 production of 621m L. This decline reflected extended dry conditions throughout dairy-producing areas and depressed manufacturing milk prices for major processed milk products.

Sales of market milk, which include white, flavoured, UHT and low-fat milk, were expected to increase by 1.9% to about 285m L. Production estimates of manufactured dairy products indicated that butter production declined 25% and skim-milk powder by 30%, and that leviable cheese increased by 5% and non-leviable (specialty) cheese by 21%.

Average farm-gate returns to Queensland dairy farmers for all wholemilk supplied to factories remained stable. The average farm-gate price for market milk was about 39c/L and for manufacturing milk 11c/L, compared with returns of 37c/L and 11.4c/L respectively in 1984-85.

In late 1985-86 the Commonwealth Government was finalising legislative arrangements to introduce a new National Dairy Marketing Plan. This would mean the phasing out of equalisation arrangements for butter

and cheese and the ending of equalisation and pooling arrangements for other prescribed dairy products.

A levy on all butterfat produced in Australia would replace these measures.

It would raise revenue to support exports of dairy products to a level of 130% of their historic average export prices, except where the export price was less than 85% of the longer-term export price trend. Interim product levies would operate on butter and cheese to provide additional support to exports. The new marketing plan would aim to enable individual states to maintain responsibility for producing and supplying market milk.

The deer farming industry

Queensland's deer farming industry continued to expand. About 70 deer farms, with a total deer population of about 6000, were registered with the DPI. Venison production was still insufficient to meet local demand during the year.

The fishing industry

The fishing industry experienced a mixed year. In general, because of shortage of product and depressed prices, the season did not live up to initial expectations. The Commonwealth Government's February decision to allow primary producers a full rebate on diesel fuel purchases provided some offset to the product and price situation. Fuel is a particularly significant input cost to the otter trawl sector.

During Christmas-New Year, a 10-week trawl closure applied in north Queensland coastal waters. This followed the success of a similar closure one year earlier. The closures were designed to protect the fishery from over-exploitation and to allow the juvenile source to reach commercial size before capture. However, while north Queensland prawn catches were satisfactory in the first half of 1985, they were disappointing in 1986.

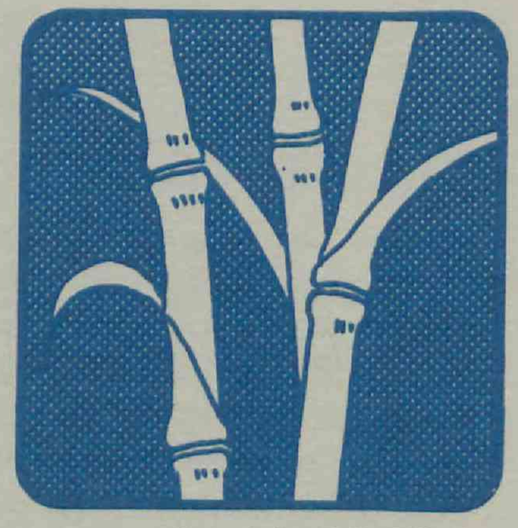
In south Queensland the lack of rainfall affected catches. Nutrients were lost, owing to lower run-off and discharge from coastal streams and rivers. In most areas, catch levels were average or below average.

Imported frozen fillets continued to supply a significant share of the local market. Exported product consisted mainly of prawns, scallops and mullet roe. Other potential export lines were being explored.

The DPI and the Queensland Fish Management Authority continued to develop fishery management programmes. A management programme for the south Queensland ocean-beach fishery was being implemented and a proposed line-fishery management programme was under discussion.

Interest in aquaculture increased significantly, with the DPI receiving more than 1000 inquiries. Several pilot farms were operating, with commercial production of fresh-water specie (such as marron) under way. Commercial production of salt-water specie (particularly penaeid prawns and barramundi) was expected to begin in 12 to 18 months. The DPI and the Fish Management Authority established guidelines to assess each aquaculture project before issuing a permit.

The sugar industry



Queensland's 1985 sugar crush was completed on 20 December when the last of the state's 23.00m t of cane was crushed. This was 3.8% below the 23.91m t crushed in 1984. The sugar content also decreased, with the average recorded c.c.s. of 13.69 compared with 13.72 in 1984.

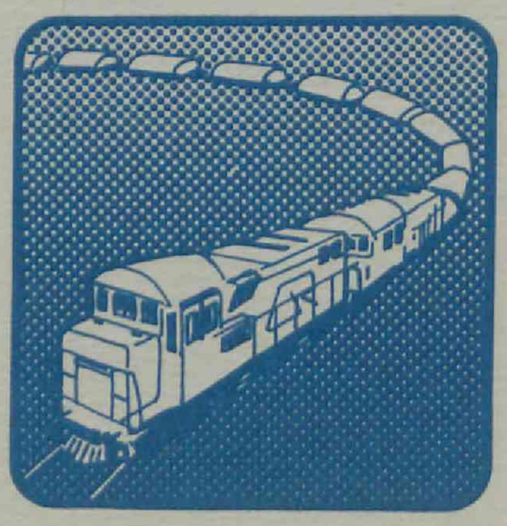
The production decline can be attributed to industrial disputes at sugar mills and persistent wet weather in some districts. Despite these factors, harvesting progressed satisfactorily, except for central districts where performance declined.

About 3.21m t of sugar was produced from the 1985 crop. On average, the tonnage of cane required to make one tonne 94 n t sugar in 1985 was 7.17.

After declining continuously since 1980, world sugar prices improved in the second half of 1985. From a low US 2.7c/lb in mid-1985, prices more than doubled to about 5.5c/lb later in the year. The price recovery resulted from a steady growth in world sugar consumption and a slight decrease in world sugar production. For 1985 the average market price was US 4.06c/lb compared with US 5.20c/lb in 1984. In 1986 the price continued to improve to an average of US 7.05c/lb in March and US 8.35c/lb in April.

The Commonwealth Government's assistance package to the sugar industry included a maximum of $54m for price support to maintain the No. 1 Pool price of $230/t for the 1985 season, $225/t for 1986 and $220/t for 1987, with a further $46m allocated for adjustment arrangements.

Grain handling



More than 3.86m t of grain was received by the Queensland Grain Handling Authority.

Capital works to enhance Queensland grain-exporting efficiency included improvements to the Gladstone and Mackay export terminals and the commissioning of a new facility at Fisherman Islands.

Grain storage capacity at the port of Gladstone was doubled to 80 000 t and the Gladstone Harbour Board commissioned a new 1200 t/hour ship-loading facility.

The new deep-water export terminal at Fisherman Islands was opened by the Premier, Sir Joh Bjelke-Petersen, in April. The terminal cost about $40m. It has a shiploading and intake capacity of 2200 t/hour and can load 60 000 dwt Panamax bulk vessels. Provision has been made to load 80 000 dwt vessels in the future.

The wheat industry

For the third successive year, Queensland produced an above-average wheat crop with 1.75m t being produced, the third largest crop on record. Australian crop quality was good. More than 80% was classified as ASW or better.

With continuing large Australian crops, record exports were again expected. More than 16m t were expected to be shipped out of Australia.

The guaranteed minimum price for ASW wheat was set at $149.87/t, compared with $145.35 in 1984-85. The GMPs for the premium categories were particularly pleasing, reflecting overseas production shortfalls of premium wheats.

The prospects for world markets remained depressed, with the USA exporting large quantities of subsidised wheat under its Export Enhancement and expanded Blended Credit Programs. While these subsidised sales were purportedly targeted at EEC-subsidised markets, the impact on world markets would be pervasive. Returns to growers could fall by as much as $A30/t and a Commonwealth Government underwriting payout could eventuate.

The barley industry

Queensland produced a record 830 000 t of barley compared with 704 000 t in 1984-85. Ideal growing conditions resulted in average yields of 2.22 t/ha compared with 2.14 t/ha in 1984-85.

The Barley Marketing Board received some 733 000 t compared with the previous season's 665 000 t. About 80% of the Board's intake was exported, with the remainder sold on the domestic market as malting barley and feed grain. The Middle East was again the Board's major market with Saudi Arabia, Kuwait and Iran the main destinations. Other important markets included Japan, China, Taiwan, Brazil and Peru.

The influences of higher world barley production and stocks, plus strong exporter competition for limited markets, caused a downward trend in barley prices. This was reflected in returns to growers.

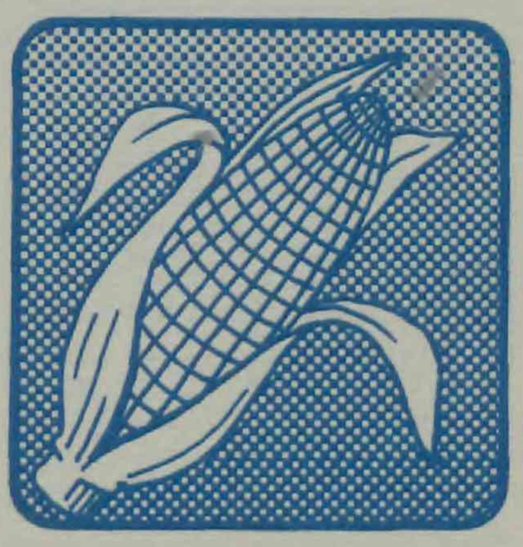
A first advance of $77/t was paid on all deliveries to the Board compared with $88/t for the previous pool. About 30% of the intake was paid under the cash option scheme whereby growers elect to accept a discounted cash payment in lieu of the normal pool payments spread over 12 to 15 months. Cash payments ranged from $84.50/t for malting grade to $80.05/t for feed grade. Last season's payments ranged from $103.91/t for malting grade to $97.45/t for feed grade. Growers delivering to the pool elected to cash out about 25% of the net pool tonnages. These cash-out payments ranged from $5.65/t for feed grade to $10.37/t for malting grade. The Board again expected to be able to finalise the year's pool within 12 months.

The grain sorghum industry

Favourable planting conditions in most areas resulted in an estimated 608 000 ha of grain sorghum being planted, 18% more than in 1984-85. During the growing season, dry conditions resulted in reduced yields and some areas being abandoned for grain. Nevertheless, production was estimated at 1.111m t, 7% more than in 1984-85.

Continuing high levels of world production of coarse grains and changes in USA export and support policies resulted in big reductions in world prices. The effects on grower returns were partly reduced by the declining value of the $A. However, average returns to growers were lower than in 1984-85.

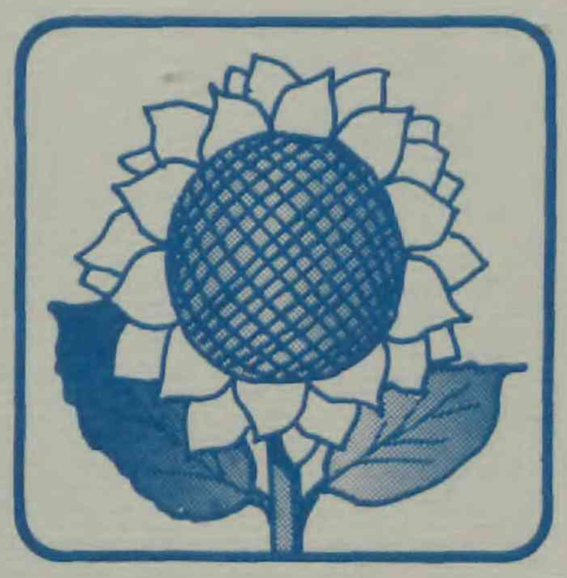
The maize industry



Maize production was expected to total 189 000 t, about 8% down on 1984-85 production. About 67 300 ha were planted, about 17% down on the 1984-85 planting.

Regionally, production was estimated at 21 000 t from north Queensland (29 000 t in 1984-85); 27 000 t from the north Downs (20 000 t); 26 000 t from the central Downs (26 000 t); and 115 000 t from other areas (130 000 t).

The oilseed industry



The area planted to **sunflower** in Queensland decreased, after 2 years of expansion. Plantings were estimated at 183 000 ha compared with 192 612 ha in 1984-85 and 141 254 ha in 1983-84.

As a result of dry growing conditions, sunflower seed production was expected to drop significantly to an estimated 117 000 t from the 157 942 t produced in 1984-85.

Sunflower seed prices fluctuated, but generally were well down on 1984-85 prices, owing to increased world production and large carryover supplies. Prices dropped from $270/t in July to $230/t in November, recovered to $260/t early in 1986 before falling again

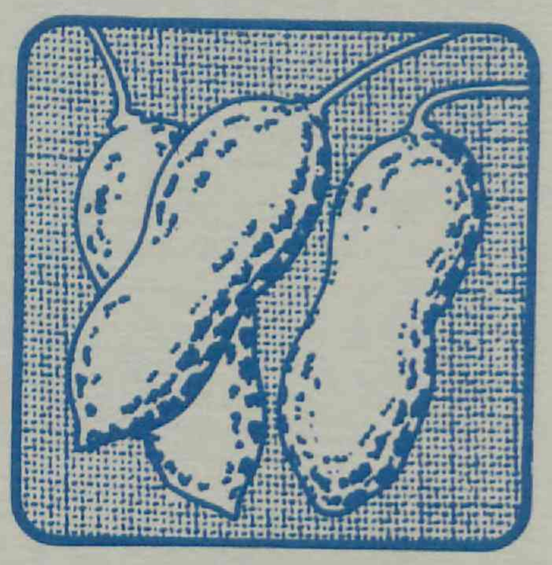
to end at about $200/t in May. In 1984-85 the average price ranged from a minimum of about $245/t up to a high of about $345/t.

Soybean plantings continued to expand. An estimated 39 100 ha were planted compared with 37 230 ha in 1983-84. Production was expected to decline to 51 800 t from the 1984-85 production of 63 663 t. This decline was due to dry conditions that caused reduced yields in almost all major producing areas.

Prices for soybeans dropped. Prices moved from about $295/t down to $230/t before improving to about $255/t in May. The 1984-85 range was $260 to $310/t.

Plantings of **safflower** seed increased to an estimated 26 000 ha compared with 20 974 ha in 1984-85. However, because of dry conditions, production was estimated at about 13 000 t compared with 18 230 t in 1984-85.

The peanut industry



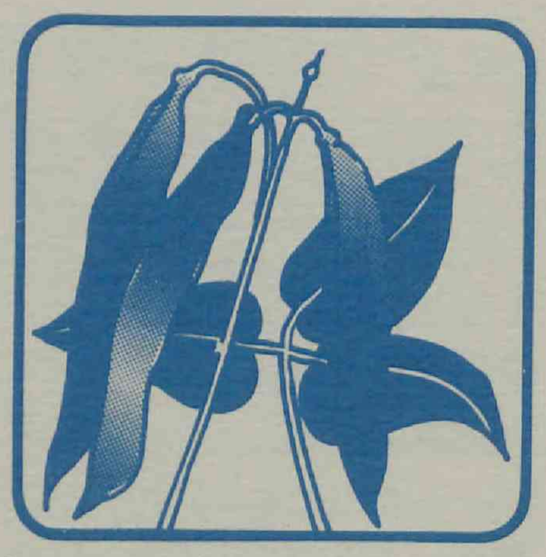
Peanut production was estimated at 41 100 t nut-in-shell from 29 200 ha, marginally above the 1984-85 crop of 40 981 t nut-in-shell from 29 145 ha. The 1985-86 season began with favourable growing conditions, but an extended dry period in south Queensland reduced crop yields in some areas. On the Atherton Tableland, a record peanut crop of about 14 000 t nut-in-shell was forecast.

The Peanut Marketing Board finalised the 1985 pool in May with an average pool return of 60c/kg before payment of individual upgrades (average 5.7c/kg). Suppliers of top-quality peanuts received payments of up to 67c/kg upon payment of individual upgrades. The Board made a General Reserve Fund deduction of 2.8c/kg from the 1985 pool to repay the 1973 Revolving Levy to growers and to provide funds for capital works.

The Board paid a first advance of 38c/kg for deliveries in respect of the 1986 pool. The final pool return was dependent upon the quality and quantity of the Queensland peanut crop and future movements in international peanut prices.

Surplus stock and depressed prices characterised the international peanut kernel market until May when dry planting conditions in the USA peanut-producing regions contributed to a temporary firming of international prices. This was a response to reduced supplies of kernels on the export market, owing to a partial USA withdrawal of surplus stocks. With countries such as China, South Africa and Argentina becoming net exporters of peanut kernels, the medium-term outlook was for an oversupplied international groundnut market.

The navy bean industry

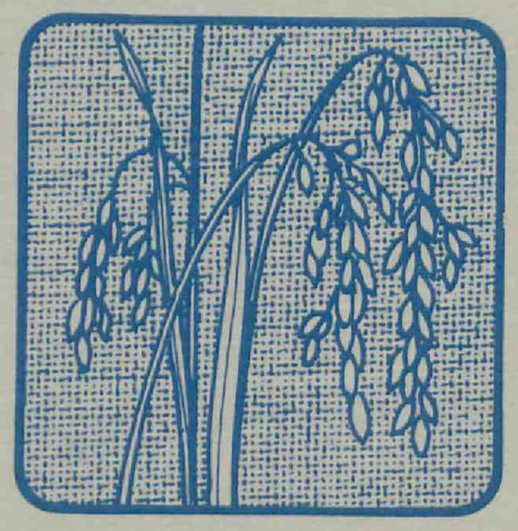


The navy bean industry had a successful 1985. More than 8500 ha were sown. Lack of moisture prevented some late plantings. Dry conditions in some districts reduced the yield potential; but, overall, the yield was above average, with an estimated clean-weight production of more than 7700 t.

The Navy Bean Marketing Board paid a first advance of 45c/kg on canning-grade beans and 65c/kg on approved seed. A residual payment of at least 22c was expected. At various times during the season, a cash-out option based on 17.5c/kg was also offered on canning-grade beans.

Plantings for 1986 were estimated at about 7500 ha. Dry conditions resulted in about 500 ha being abandoned. Yields were expected to be down, with some so low crop would not be harvested. Total yield was expected to be about 5000 t. The Navy Bean Marketing Board announced a first advance payment of 45c/kg for canning-grade beans from this crop.

The rice industry



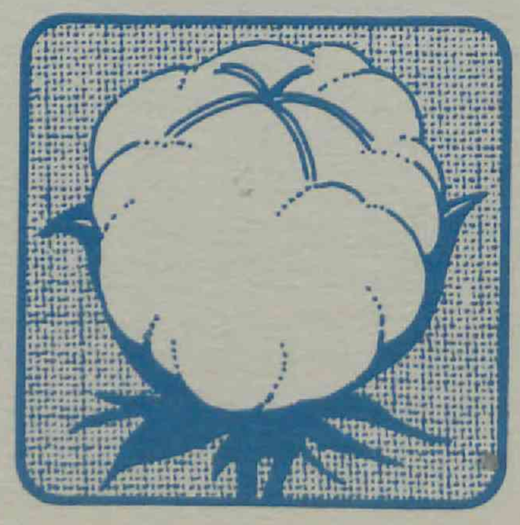
Production from the two 1985-86 rice harvests was expected to be about 13 900 t, about 30% below the 1984-85 figure.

The summer rice harvest was 5700 t, with the Burdekin district supplying 3600 t and Mareeba the balance. This harvest was well down on the usual production of about 10 000 t. The main causes were expected water shortages, the red-rice problem and low price expectations in the Burdekin area.

The winter harvest was expected to produce about 8200 t, with Mareeba supplying about 5500 t and the Burdekin about 2700 t. The incidence of bacterial leaf blight disease significantly lowered winter harvest yields from Mareeba.

Returns to growers improved to about $190/t. As a result, production for 1986-87 was expected to return to about the 1984-85 levels. Industry outlook was further lifted with the release of the new rice variety, Lemont, which was expected to reduce losses caused by lodging.

Cotton



Queensland ginned-lint cotton production declined to 200 000 bales, nearly 4000 bales less than the 1984-85 season's record output.

Summer hail storms severely damaged the crop, and, in several major cot-

ton-growing areas, bad harvest weather reduced both yields and quality. In general, however, the crop was of good to excellent quality, and, before adverse May weather caused a setback, yields were at record levels.

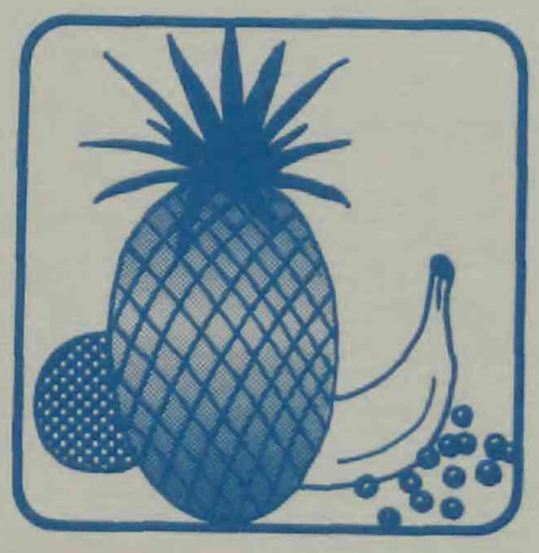
Plantings of new improved cotton varieties increased considerably. The most widely used strain, Delta Pine 90, gives good yield and lint percentage, and has excellent fibre strength. In addition to increased productivity, the new varieties enhance the marketability of Queensland cotton.

Extensive mechanisation of cotton-harvesting operations led to significant improvements in ginning facilities. A new cotton gin began operating at Cecil Plains on the Darling Downs. Elsewhere throughout the growing regions, existing ginning facilities had been enlarged to cope with increased production.

Significant changes occurred in the trade pattern. The export outlook for Queensland cotton deteriorated as USA cotton became more competitive under the market-oriented provisions of the US farm legislation. Trading in Queensland cotton decreased, with cotton prices falling by $100/bale by mid-May. Returns to growers were likely to decline to around $224/bale compared with $270/bale in 1984-85.

Expectations for 1986-87 were that Queensland cotton exports would continue to face strong competition from other cotton-producing countries, particularly the USA.

The fruit and vegetable industries



Heavy supplies of many produce lines continued to characterise Queensland's horticultural industries. The resultant pressure on prices gave greater emphasis to developing strategies to enhance the market penetration of various products.

Part of the reason for the continued heavy increase was the use of sugar-cane lands for horticultural production. For example, the gross value of horticultural production from the Bundaberg district (a major sugar-producing area) rose by 10% in 1985 to $65.6m.

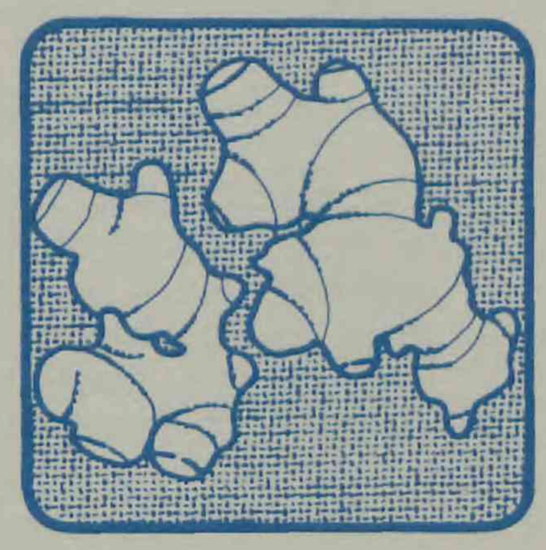
Natural disasters struck some of the State's major horticultural crops. Hail damage to the Granite Belt apple crop reduced returns to growers. In north Queensland, Cyclone Winifred destroyed a big part of the banana crop and extensively damaged mango, avocado and lychee plantings.

The estimated gross value of production for horticultural crops was about $324m compared with $332m in 1984-85.

Fruit production was valued at $152m, down $7m on 1984-85, while the value of production of vegetables (including tomatoes) was estimated at $172m, just below the 1984-85 value of $173m.

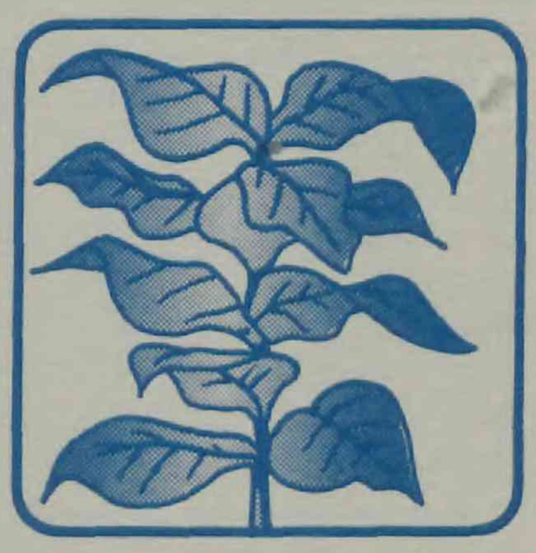
Import competition, particularly of processed products, continued to concern the horticultural industries. A big increase in the volume of frozen-pea imports led to the Industries Assistance Commission inquiry into the vegetable and vegetable product industries. The pineapple industry also continued to express concern about the levels and prices of imported canned pineapple. The Commonwealth Government decision to reduce the tariff on imported canned pineapple from developing countries, from 12.5% to 5% from 1 July 1986, added to the industry's problems.

The ginger industry



The Buderim Ginger Growers' Co-operative Association Limited's intake in the 1985 season was 3353 t, continuing a gradual increase in ginger production. The expected factory intake for the 1986 season was 3120 t, somewhat lower than expected because of dry weather. However, export sales values and, therefore, grower returns were expected to be buoyant because of the depreciation of the A$. Export sales of green ginger continued to show much potential. Green ginger sales on the domestic market were also estimated to be increasing by up to 20% each year.

The tobacco industry



Tobacco sales to the end of May accounted for 72.2% of the 1986 state marketing quota of 7.41m kg at an average price of 528.5c/kg, 4.5c/kg above the minimum average reserve price of 524c/kg. The total value of tobacco-leaf production for the 1986 selling season was expected to be about $39m.

Growers' 1986 quotas were set at about 1% less than their effective selling entitlements in 1985. However, quotas allocated for the 1987 season were about 4% up on the 1986 season, reflecting a significant reduction in manufacturers' stockholdings under the aims of the current stabilisation plan.

The tobacco industry continued to undergo significant restructuring through transfer of quota between regions. In particular, 41 571 kg of tobacco quota from NSW was transferred to north Queensland growers with the approval of both states' ministers. This compared with an interstate transfer of 390 000 kg in the previous year, the first year in which such transfers occurred.

ANIMAL INDUSTRY HIGHLIGHTS

The meat industry

In association with the Livestock and Meat Authority of Queensland, the DPI's veterinary public health branch continued to promote lean meat as part of a healthy diet. Late in the year the Minister for Primary Industries, Mr Neil Turner, launched a high-quality film, *Today's Menu*. Produced in collaboration with the National Heart Foundation, it is an entertaining and honest statement of meat's proper place in a balanced human diet.

The butchering sector, in general, expanded. Several new manufacturing premises began operating, and butcher shops continued to open in shopping centres at the expense of suburban-street shops.

The concept of selling meat direct over the counter into shopping malls seemed to have been well accepted and was extended to country areas, thus further permitting meat to be sold under conditions applicable to its competitors. Innovative selling ideas such as kebabs, stir-fry vegetables and marinates grew in popularity.

The abattoir sector had an uncertain year. Rumours of closures and rationalisation of killing capacity were prevalent. The Toowoomba Public Abattoir surrendered its export licence to concentrate on the local market.

The cattle industry

A high priority was placed on developing objective, competitive marketing systems. DPI staff coordinated training programmes in live-animal assessment and other aspects of marketing, concurrent with the development of computer-aided marketing (CALM) and a national trading language for livestock and meat. In conjunction with New England Livestock Computer Marketing (NELCM), officers of the Western Downs and Maranoa Beef Industry Group conducted schools at Goondiwindi and Roma.

Drought-mitigation extension was a major effort in many districts.

Molasses/urea-based feeds for cattle were being used increasingly. The number of producers who installed bulk-handling equipment, for both drought and more regular use, steadily increased. Equipment was being installed on properties in inland areas as well as on properties more adjacent to the coast.

The DPI continued to encourage regional development of research and extension programmes. A high priority was the re-establishment of beef industry groups with industry participation. Twelve groups were currently established throughout the State.

Thirteen video films had been produced. Subjects included: a series of six on the establishment and management of feedlots for different purposes; a series of three on building and management of electric fences; and single videos on pasture and cattle management in the wet tropics, phosphorus supplementation, protein supplements for breeder cattle, and breeder and weaner management in north Queensland.

Officers continued a vigorous extension programme to improve handling and transport procedures and facilities for marketing cattle. In conjunction with the Saleyards Boards Association of Queensland, officers conducted a 2-day live-in workshop at Dalby. A 2-day seminar was held in Townsville for meat processors, buyers and stockmen. As a result of these initiatives and industry's request for better liaison between all sectors on saleyard issues, the Queensland Saleyards Livestock Committee was formed in February 1986. It provides a forum to discuss and encourage improvement in cattle handling, stockmanship, selling procedures and facilities, transport facilities and market reporting at saleyards.

The control programme to reduce significantly the genetic pool of Pompe's disease in Queensland stud Brahman cattle reached the stage of stud proving. The efficiency of biochemical procedures used to identify carrier animals was being studied in a herd of disease carriers at the DPI's Rocklea husbandry research farm. Diagnosis of the disease depends on specific changes in the profile of blood enzymes.

A live attenuated vaccine to protect cattle against ephemeral fever came on to the market. DPI officers had helped efficacy test the vaccine in the field. Some 100 000 doses of the vaccine, to vaccinate 50 000 head of cattle, had been sold by 30 June. The disease used to occur in major outbreaks several years apart, spreading from north Queensland down the east coast of Australia. Now, it is ever-present in Queensland, particularly in the eastern coastal regions. The disease's sporadic nature renders susceptible all cattle over 6 months of age that have never had previous contact. With the vaccine, cattlemen now have a way to protect their herds.

More than 4000 samples of fat from cattle in Queensland were monitored for residues of 23 pesticides. Levels of pesticides below those permitted is a prerequisite for importations of meat by Australia's trading partners.

Forty-four instances of levels of pesticides in the meat of slaughtered animals, above 50% of the permitted level, were investigated. In each case DPI officers visited the offending property to investigate the source of the residues and to recommend precautions in using pesticides, in accordance with good husbandry and good agricultural practice.

For tick fever prevention, about 700 000 doses of the live attenuated vaccine prepared by the DPI were used in Queensland and 4820 doses were exported to Equador, South Yemen, Malaysia and China.

Beef cattle producers are keen to be trained in artificial insemination techniques. During 1985-86, the DPI ran successful AI training schools throughout central and south Queensland.

Stock poisoning

Dry conditions and management errors predisposed many poisoning outbreaks that cost industry at least $10m in mortalities, reduced production, treatment costs, control measures and reduced use of land because of toxic plants.

Lantana was the most frequently diagnosed plant poisoning of cattle. Predisposing factors in the 11 outbreaks included enforced overgrazing and recent introductions of drought-affected cattle to lantana-infested properties for agistment. Outbreaks of St George disease were investigated on drought-affected country near Longreach.

Careless disposal of sump oil and car batteries led to 15 outbreaks of lead poisoning. In eight instances of arsenic poisoning, the poison sources included old cattle dips, weed killers and old containers at rubbish dumps.

Failure to provide drinking water for working dogs engaged in husbandry procedures often had a sad aftermath. Dogs on 12 properties scattered throughout Queensland died from Lucijet (fenthion ethyl) poisoning. Other mortalities were caused by dieldrin, endosulphan, carbophenothion and parathion.

Brucellosis and tuberculosis

DPI remote-area staff became increasingly involved in planning management programmes to retain viability of TB-infected properties involved in the eradication scheme. Many inputs had been provided across a range of departmental disciplines.

Serological testing for brucellosis of about 1m sera obtained at slaughter and during field operations resulted in 1085 reactors. Consequently, herds classified as negative or free increased to 34 209. Only 43 herds (0.1%) remained infected.

Tuberculin testing of 858 158 cattle in 1596 herds (2025 reactors), and monitoring operations at meatworks that detected lesions of tuberculosis in 347 of 2 165 977 cattle slaughtered, reduced the number of properties infected with tuberculosis to 125. Active eradication programmes for tuberculosis were operating on the infected properties.

Work started on the building of the 200 km long Nicholson River Fence (estimated total cost $350,000), the first of the strategic fences to be erected in the Gulf of Carpentaria and Cape York Peninsula to help control and remove feral cattle infected with tuberculosis.

Enzootic bovine leucosis

Good progress was maintained in the voluntary accreditation scheme for enzootic bovine leucosis.

The collection and testing of more than 750 000 blood samples highlighted government and industry's big financial investment in the scheme.

Twenty-eight herds were accredited during the year, bringing the total to 53 since the scheme was launched in November 1983. More than 500 herds undertook testing towards accreditation.

Work continued on developing a vaccine to control this disease.

The sheep industry

Sale of fleece wools with the additional measurements of staple length and staple strength was introduced into the wool-selling system. Adoption of this practice nationally was low during 1985-1986, with only 6% of lots measured; but the Queensland adoption rate was much higher: 13.8% of lots representing 28.1% of bales sold.

A code of practice for clip preparation standards had been developed and endorsed by all sections of the wool industry. It was to operate from 1 July 1986.

Whole cottonseed was being used widely in south Queensland as a cheap and effective drought supplement. Problems were experienced with handling and feeding out: the seed does not flow freely through augers or silo chutes. The long-term storage characteristics of this fodder were being examined.

Officers in north-west Queensland investigated the use of paid advertising to promote DPI services. Producer response to their advertisements was being evaluated.

A survey was being conducted to determine producers' perceptions of (a) the incidence of the sheep body louse on their properties, (b) why they have a problem, and (c) the effectiveness of control measures. The information would be used in designing extension and research programmes.

The voluntary ovine brucellosis accreditation scheme for stud British- breed sheep continued. A similar scheme for stud Merino sheep was launched in cooperation with sheep industry organisations.

The pig industry

Staff were closely involved with the organisation and conduct of the 1985 Queensland Pig Fair at the Murgon showgrounds. The DPI stand offered information and advice on all aspects of pig raising. The role of computers in piggery management and the DPI's main services to the pig industry were emphasised.

A DPI research chemist investigates chemical attractancy as a control mechanism in the fight against the sheep blowfly (*Lucilia cuprina*). Bacterial extracts are being tested for potency as attractants for sheep blowflies using an olfactometer, at the DPI's Animal Research Institute, Yeerongpilly, Brisbane. This instrument is designed to allow the flies a random choice of flight path, influenced only by the degree of olfactory (sensory) attraction to the path.

DPI microcomputer programs help the beginner and the established pig farmer with husbandry, nutrition and piggery business management. The programs offer cash-flow budgets, profit modelling, production forecasts, and husbandry and financial performance assessment programs to help pig producers be more businesslike in managing their enterprises. Pig producers' applications for loan funds are often based on the data computed with these programs.

An AI service for the pig industry was launched by the DPI. Sires are drawn from top boars tested at the DPI's central performance test station. Boar semen collection, processing, packaging and transport procedures had been refined. Field results were encouraging: the first four litters to AI averaged 12 piglets. With initial guidance from DPI officers, users of the AI service will perform inseminations on their own pigs.

Biochemical differentiation between the meat of feral and domestic pigs may soon be possibly based on the discovery of differences in the enzyme, adenylate kinase. Potential overseas markets for the meat of the Australian wild pig as a true feral species could depend on a test being available for identifying differences between the two types.

The functional design and environmental control service for intensive animal buildings continued, with strong interest from producers and for DPI's pig and poultry buildings.

The poultry industry

Producer involvement in field investigations, surveys and research- development projects was being actively encouraged by DPI poultry extension staff. In north Queensland, egg producers were involved in planning and conducting egg-quality surveys and on-farm feed-density trials. Producers' ready acceptance of the findings and their willingness to adopt recommendations underlined the value of producer participation in the DPI's extension program.

Regulations made under the *Hen Quota Act* were amended in November to permit transfer of hen quota without the attached land in certain circumstances. A significant number of quota holders took advantage of this change to sell their quotas and leave the industry.

The revised Australian Code of Practice for Poultry Processing was the topic of discussion between Mr Jim Cramond, processing manager, Inghams Enterprises, and a DPI veterinary public health branch officer. The Code provides for increased industry involvement in self-regulation.

A survey of residues of the insecticide, dieldrin, in eggs from all south- east Queensland commercial laying flocks showed that the incidence of contamination was extremely low. The use of dieldrin is not permitted on livestock or in their housing, but its approved use as a soil treatment for ants and termites is thought to be a source of contamination. This view was supported by the data, which showed that eggs from free-range birds were more likely to contain traces of dieldrin than those from caged birds.

In south Queensland, the DPI's chicken-meat team did a series of on-farm studies, including: investigating sample weighing techniques used for predicting slaughter weight of meat chicken flocks; surveying lighting systems, ammonia levels and condensation problems in meat chicken sheds at night; assessing the suitability of different types of feeders for meat chickens; and studying temperature control in meat chicken sheds. A feature of these studies was the strong cooperation and support from meat chicken growers and processing companies.

DPI poultry section officers increased their expertise in the extension application of microcomputers. Helped by DPI economic services branch officers, they conducted workshops for producers on specific subjects, including diet formulation and checking, and analysis of farm records. This aspect of the poultry extension officer's role is expected to assume greater importance as more producers buy microcomputers for use in their farming operations.

Few serious poultry disease outbreaks were reported. The main problems were: respiratory diseases including infectious bronchitis (IB) and chronic respiratory disease (CRD), avian encephalomyelitis (AE) and Marek's disease. No infectious laryngotracheitis (ILT) outbreaks were reported, evidence of the continuing success of the extension campaign to control this disease.

Research in animal industries

Biometrical research contributed to the efficacy of analysis of reproductive data from grazing experiments. Experiments to improve reproductive efficiency in cattle and sheep are large in scale, cover several years and are expensive. The planning and design of such experiments dictate the form of analysis, the scope for interpretation and the practical use of results from the research projects.DPI biometricians reviewed these aspects and demonstrated the techniques of loglinear modelling for categorical data, comparing this method with the traditional analysis of variance method. The difficult area of model selection when the data is unbalanced was researched and guidelines given.

Good progress was made in developing laboratory tests for diagnosing animal diseases more accurately, rapidly and economically. The tests include enzyme-linked immunoassays (ELISA) for the diagnosis of infectious rhinotracheitis, ephemeral fever and botulism in cattle, melioidosis in sheep, goats and pigs, and infectious coryza in poultry. An ELISA was used for the first time in Queensland for the brucellosis testing of cattle in the eradication scheme. A DNA analysis test was developed to differentiate between strains of chlamydia, infectious agents that cause disease in commercial livestock, koalas, parrots and man.

Chemical analysis was also shown to be a useful method for rapidly identifying certain bacterial pathogens. Bacteria that cause infectious coryza in turkeys were distinguished from closely related species by slight differences in chemical structure. A similar approach was used for assessing the toxicity of poisonous plants for animals. Direct measurement of the toxin content in poisonous plants was shown to be a good guide to their relative toxicity in animals.

The clinical chemistry database was being used to map regions of potential mineral deficiencies in livestock. Incidence maps were being prepared as overlays of shire and regional maps to show relationships with pasture and soil types. The validity of the computer model was to be tested by analysis of tissues from animals sent to slaughter from reference properties. Based on this data, the cost effectiveness of mineral supplements was to be assessed.

A project at the DPI's Swan's Lagoon Research Station, Millaroo, aimed at increasing final liveweight or reducing age of turnoff, studied the likely carryover effects of weaner supplementation and the simultaneous use of a growth promotant. The results showed that responses to growth promotants depend upon the type of weaner supplement offered. With the combination of a growth promotant and a weaner supplement (for example, 500 g/day of protected protein), bullock weights can be increased by 55 kg at 3.5 years compared with untreated control animals.

Results from a major study at Swan's Lagoon Research Station showed that, to improve reproductive performance, manipulation of the *Bos indicus* content (half compared with three-quarter) or the utilisation of breeds other than the Brahman were not short-term solutions.The choice of *Bos indicus* breeds for commercial beef-cattle production in the dry tropics needs to be based on factors that include cow-and-calf survival and growth rates.

In the second cross, the half Brahman (50% *Bos indicus* content) would appear to be the most suited because of heavier cow liveweights, assuming no decline occurs in reproductive and growth performance in subsequent generations.

In studies to determine the productivity and economics of stylo pastures in the dry topics, it was becoming apparent that conditions during establishment markedly affected early performance. The emerging trend was that pasture yield, stocking rate and animal performance were superior where fertiliser was applied with the introduction of the legume.

In drought-affected cattle, the reduction in the flow of nutrients through the digestive tract may result in the production and absorption of harmful endotoxins. Bentonite may absorb these. Cattle that had been fed 1.5 kg sorghum grain/head/day and were in poor condition responded by gaining 18 kg in 3 weeks when provided with a 15% sugar, 7.5% urea and 49% bentonite block used in a spike feeding regime.

Molasses as a drought or production diet for cattle is a relatively inefficient source of energy because of the type of rumen fermentation pattern produced. Studies showed that adding the rumen modifier, avoparcin, improves the utilisation of molasses-based diets. Steers grew faster and consumed less molasses per unit of liveweight gain. Avoparcin also has the potential to improve the efficiency of other molasses-based supplements. This was being examined in the paddock.

The efficiency of utilisation of high mulga diets by cattle appears to be influenced by the mineral status of the diet. On the Charleville experimental reserve, the effects of feeding sulphur, phosphorus and non-protein nitrogen (as urea) through the drinking water on cattle performance were studied. The cattle were on a high mulga diet to simulate a drought, with the mulga cut three times a week. Supplementation substantially increased liveweight gains.

Further work was done on developing more suitable equipment for dispensing medicaments such as urea, phosphorus, salt, amino acids and drenches in the drinking water to improve the efficacy of production of beef.

Chemotherapy for cattle poisoned by *Bryophyllum tuberosum* ('Mother of Millions') was developed. The plant contains a cardiac glycoside that decreases heart function and causes scouring when eaten by cattle. The successful treatment regime counteracts both these effects and prevents the death of affected animals.

An intradermal test, developed to identify flystrike resistant sheep, showed that a positive correlation exists between a sheep's skin reaction to larval excretory products and the number of larvae that survive after a strike. This test was being further refined.

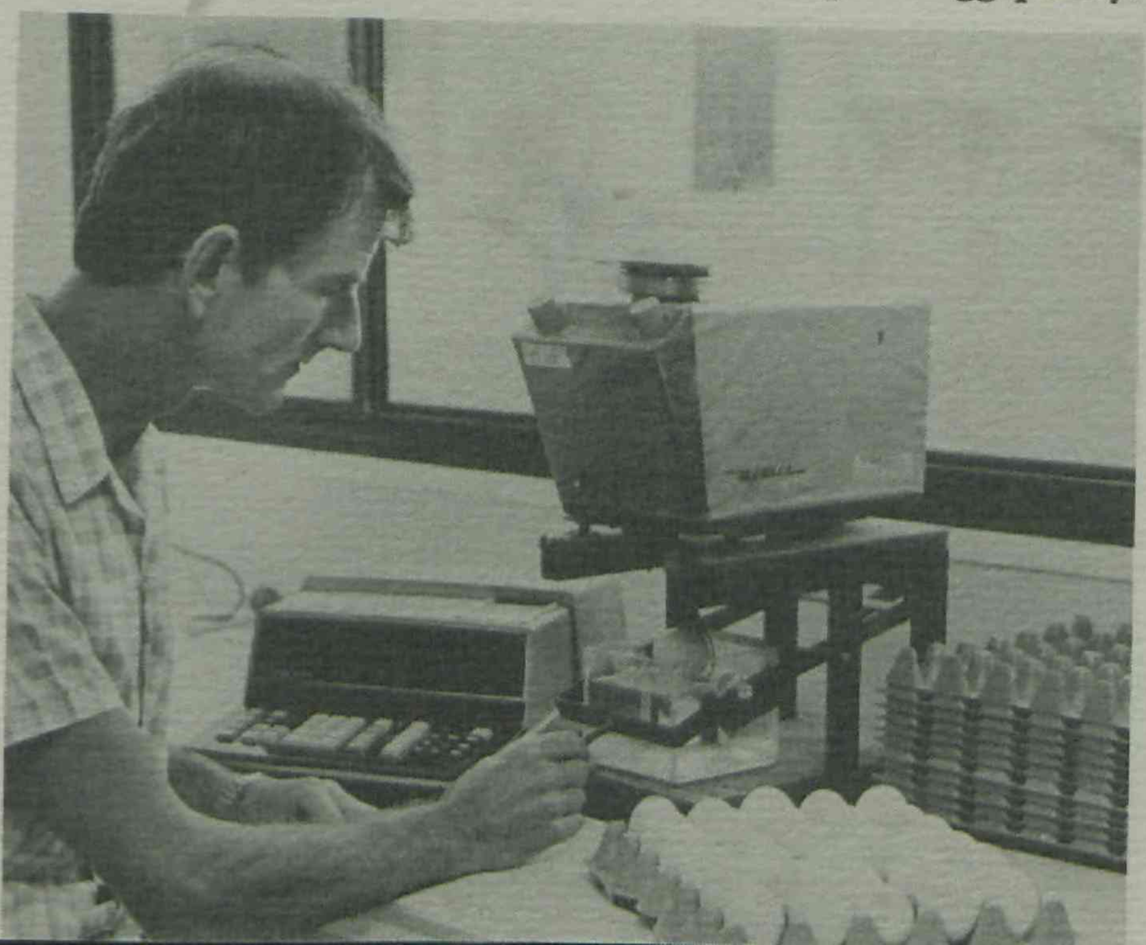
High antibody titres have been recorded in sheep immunised with a number of larval antigen preparations. The ability of these antibodies to protect sheep from flystrike was being evaluated.

Rubbish-tip strains of sheep blowfly (*Lucilia cuprina*) can initiate flystrike. After unfavourable seasonal conditions in the field, these could provide a nucleus population for buildup of numbers.

Studies into the pathological effects of flystrike showed that larval secretions with a molecular weight in excess of 500 000 Dalton units induce fever in sheep.

In blowfly-infested sheep, physiological changes occurring in or on the skin at the site of the flystrike indicated that at least part of the effect on the sheep can be represented by an inflammatory response model. 'Modifiers' were being tested to control the physiological environment of the strike site in a condition unfavourable for larval development.

A DPI poultry research officer checks the specific gravity of sample eggs to assess their shell quality. DPI pig and poultry branch scientists monitor the shell strength of eggs laid by trial chickens so that they can determine the effects of nutrition and breeding programmes designed to improve egg quality.



A study of the attractancy of chemical isolates for the sheep blowfly identified several low molecular-weight compounds as components common to high potency lures. In another approach to sheep blowfly attractants, the volatiles from flowers of several plant species that attract female blowflies were evaluated against reference attractants using a modified olfactometer.

Supplying polyethylene glycol to sheep consuming mulga increased feed intake, wool growth and liveweight change. These responses were further enhanced when a nitrogen-phosphorus-sulphur supplement was fed as well.

The use of teaser wethers in a prime-lamb producing flock before joining produced a more concentrated lambing pattern. Fifty percent of the lambs from the teased group were marketable in early June when prices were at a premium compared with 28% of the lambs in the unteased group.

The ability of goats to control coolibah, poplar box and sandalwood regrowth after pulling was being investigated in the Dirranbandi district. Six months after pulling, marked visual differences existed between stocked and unstocked areas.

At Biloela, the DPI's research piggery developed a small herd of pigs homozygous for the halothane gene. Investigations were testing the gene's effect on performance, meat quality and stress susceptibility of pigs reared in a warm environment.

Studies on the nutritive value and the effect of mycotoxins in weather- damaged and mouldy grain for pigs continued. Completed work included that done with covered smut (*Ustilago hordei*) of barley and mung beans infected with *Sclerotinia*.

Animal disease diagnosis

An on-line recording and retrieval system for veterinary diagnostic information was nearly completed. This system provides for interactive data entry and retrieval at the DPI's Animal Research Institute, Yeerongpilly, and produces regular reports for scientific and field staff on the diagnoses made. Results of the various pathology tests are reported, besides special reports for epidemiological or research purposes. The system uses the Yeerongpilly Pyramid 9OX computer and will greatly enchance the operation of the pathology laboratories.

The testing of chilled horse meat for trichinosis was implemented at the Animal Research Institute. Trichinosis, a disease in man and animals caused by a parasitic worm, is not known to occur in Australia. However, the testing was a condition imposed by France for retaining access to the French market.

Caprine retrovirus causes a chronic disease in goats. Good progress was made in developing an accurate diagnostic test for the infection. When fully developed, the test should ensure rapid and effective screening of goats destined for export.

Psitticosis became widely disseminated through Queensland pet shops after the arrival of infected sulphur-crested cockatoos from a dealer in Victoria. A recently developed commercial diagnostic kit based on a fluorescein-conjugated monoclonal antibody increased the efficiency of diagnosis. Diagnosis of the infection is more rapid than with traditional tests, and the risk of infection to laboratory personnel is minimised.

The development of aquaculture stimulated an increasing demand for a disease diagnostic service for fish, marrons and prawns. Unusual mortalities in imported aquarium fish were also investigated. An exotic viral disease was diagnosed in one consignment of gouramis.

Brands

Computerisation of brands through the Computer Operated Brands Recording and Acquisition (COBRA) project was virtually completed.

A project began in May to microfilm brands records from 1872 to the present day, to allow quick and accurate historical searches and researchers at the State Archives to use the original documents for compiling the early history of Queensland districts.

Brands staff attended the Cloncurry show and the North Queensland Rural Field Days in Townsville to demonstrate the COBRA system and answer brands enquiries.

Quarantine

Several initiatives to prevent the incursion of devastating exotic diseases, to permit the safe importation of overseas livestock species and to promote an increased awareness of animal quarantine activities in the general public were developed. They included:

- the compilation of a comprehensive report, on the adequacy of Torres Strait quarantine, to the Senate Standing Committee on National Resources;
- the completion of construction planning for the northern boundary fence of the livestock-free buffer zone on Cape York Peninsula;
- the development of a course to train and update part-time and interstate animal and plant quarantine officers;
- the visit of two Queensland quarantine veterinary officers to Canada and the United Kingdom to supervise pre-embarkation quarantine procedures for livestock being imported to Australia and to supervise quarantine requirements and the safety of the animals in transit;
- the participation of two senior quarantine officers in a national meeting of senior personnel whose work involves direct contact with the travelling public and with importers;
- the continued monitoring of potential pest-and-disease incursions into north Australia from the Torres Strait islands;
- the importation of cattle from north America through the Cocos Island Animal Quarantine Station;
- the Fifth Biennial Seminar on Quarantine in Cairns in May for all agencies involved in animal quarantine and the general public;
- exhibits on animal quarantine at shows in major cities and country towns;
- many talks on quarantine to members of nursing organisations and companion animal clubs; and
- a major display of extension information on quarantine for use at outpost quarantine offices and rural events.

DAIRY INDUSTRY HIGHLIGHTS

The 'Kerin Plan'

Disagreement and indecision over new marketing arrangements for the Australian dairy industry continued throughout 1985-86. The Queensland dairy industry saw some of the proposals as a threat to the orderly marketing system that had been developed over many years. After the dairy industry organisations from the various states failed to agree on a national marketing formula, the Commonwealth Government announced it would legislate for its own plan, the 'Kerin Plan'. This plan, which was to operate from 1 July 1986, was expected to have long-term structural influences on the dairy industry.

Queensland dairy industry

Milk production in Queensland declined by 2% to 605m L for the year ended 31 March. The decline was attributed to the dry conditions in some south-east Queensland regions. Of total milk receivals, 48.3% were bought for market milk compared with 46% for 1984-85.

Average price paid to producers for all milk received, including deferred pays was, 24.2c/L compared with 22.4c/L in 1984-85 and 22.3c/L in 1983-84. Gross average pay for market milk was 37.5c/L with a range of 32 to 39c/L. Price of milk delivered to Brisbane for use within the Brisbane Milk District rose from 38.75c/L to 42.18c/L.

Gross pay to Queensland producers for manufacture milk averaged $2.96/kg butterfat (11.85c/L) for the year ended 31 March. However, monthly rates paid by individual processors ranged from $1.75/kg butterfat (7c/L) to $3.25/kg (13c/L). Production of modified milks in Queensland increased by 16%, table cream by 5%, flavoured milk by 2.6% and pasteurised milk by 1.6%. Cheese production increased by 3%, but butter production declined by 29%, milk powder by 18% and casein by 33%.

Regulatory aspects

All dairy-produce premises and milk-transport vehicles throughout the State were registered. A total of 229 premises (excluding dairy farms) and 975 vehicles were inspected.

Grading of dairy produce continued, with most emphasis on butter and cheese quality. Local and interstate products were examined. A total of 2949 samples of bulk butter and 3431 samples of pats were graded. The mature and vintage cheeses assessment programme, which began last year at the Cheese Marketing Board's request, continued to provide a valuable guide to local cheese factories on the quality of their products. Generally, a high quality was observed in the samples examined.

The training of dairy factory employees was an important continuing programme. Training sessions dealing with factory hygiene, plant maintenance, promotion of milk sales and competency requirements for operatives were held at dairy factories in south Queensland. More than 125 employees attended. A video film, *Come Meet a Bulk Milk Grader*, was prepared to complement material presented in training sessions.

Energy

Practices that lead to energy conservation in food-processing plants were promoted. A highlight was a workshop that DPI officers and food-industry employees attended.

Improvement services

Demand for herd recording slackened. At 1 July 1985, 947 farmers were using the herd recording scheme: 302 in the farmer own sampling (FOS) scheme and 645 using departmental recorders. At the end of 1985-86, there were 907 members: 347 in the FOS scheme and 560 using departmental recorders.

A total of 73 881 cows completed lactations, in the 1984-85 recording year. Their average yield in 278 days was 3558 L of milk and 138 kg of butterfat, exceeding the 1983-84 yield and butterfat figures.

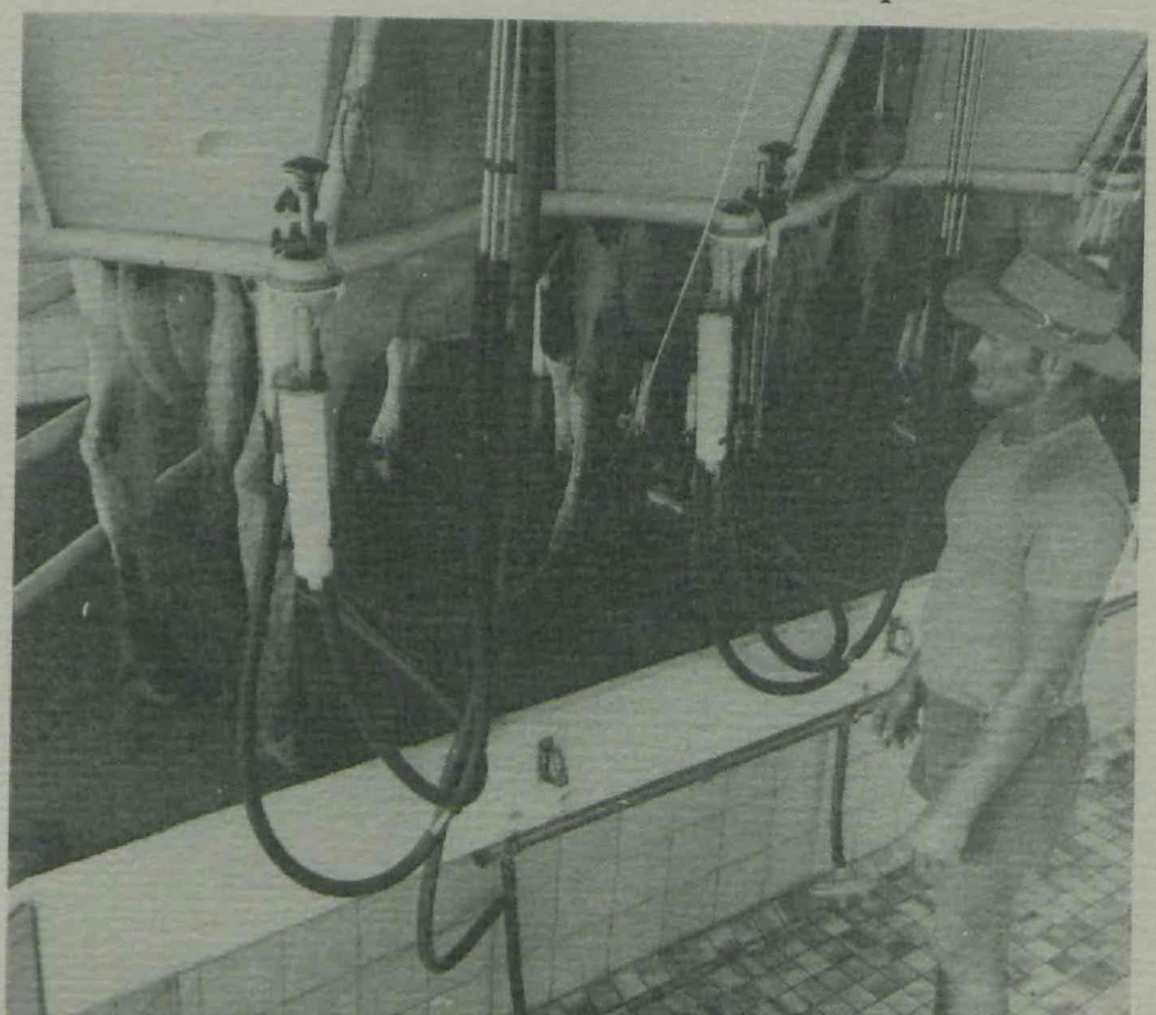
Seventy-eight percent of farmers using the herd recording scheme also used the bi-monthly cell counting service as an aid to mastitis control. Somatic cell counts were determined on more than 290 000 individual cow-milk samples. This is a drop of 6% over the previous year.

Genetic development

The 1985 Holstein-Friesian team of 24 bulls was mated to 22 135 cows in 347 Queensland herds. The bulls were used in two equal groups, with mating seasons from 1 January to 31 May, and from 1 June to 31 December. An additional two imported American sires (JOWAL and LINUS) were added to the 12 bulls used in the second half of the year. This was part of a collaborative proving effort involving the DPI, the NSW Department of Agriculture and the Holstein-Friesian Association of Australia (HFAA).

AFS semen sales continued to expand. In 1985, about 19 000 doses of AFS semen were exported to countries including the Philippines, Mexico, Indonesia, Venezuela and Zambia. The export of 20 AFS cows and heifers to a new dairy project being established in Malaysia was being arranged. This was the first export of AFS cattle to be arranged.

DPI dairy officers provide help to dairy farmers in design and construction of new dairy sheds. Since 1981, dairy farmers have built 146 herringbone bails, with DPI help.



Artificial breeding

Gross income from artificial breeding activities was $1,316,722. Increased business activity, particularly in custom collection of restricted and unrestricted semen together with a growth in semen exports, ensured a growing income.

Semen production for unrestricted use amounted to 453 985 doses, including 98 717 doses stored from privately owned bulls. This represents an overall 71% increase over 1984-85 production. Privately-owned semen storage increased by 118%. Production in 1984-85 was reduced, owing to power shortages in early 1985.

Processing of restricted (custom collected) semen increased by 21%, with 92 187 doses placed in storage. Favourable beef prices and further importations through Cocos Island resulted in strong beef-industry support of this service. Processing continued to have a seasonal peak, with more than 43% of semen being processed in the spring quarter.

A total of 255 627 doses of unrestricted semen were distributed through the DPI's Wacol AB Centre and its agents, compared with 230 616 doses in 1984-85; 214 991 doses (84%) were locally produced and 40 636 doses (16%) originated from other centres.

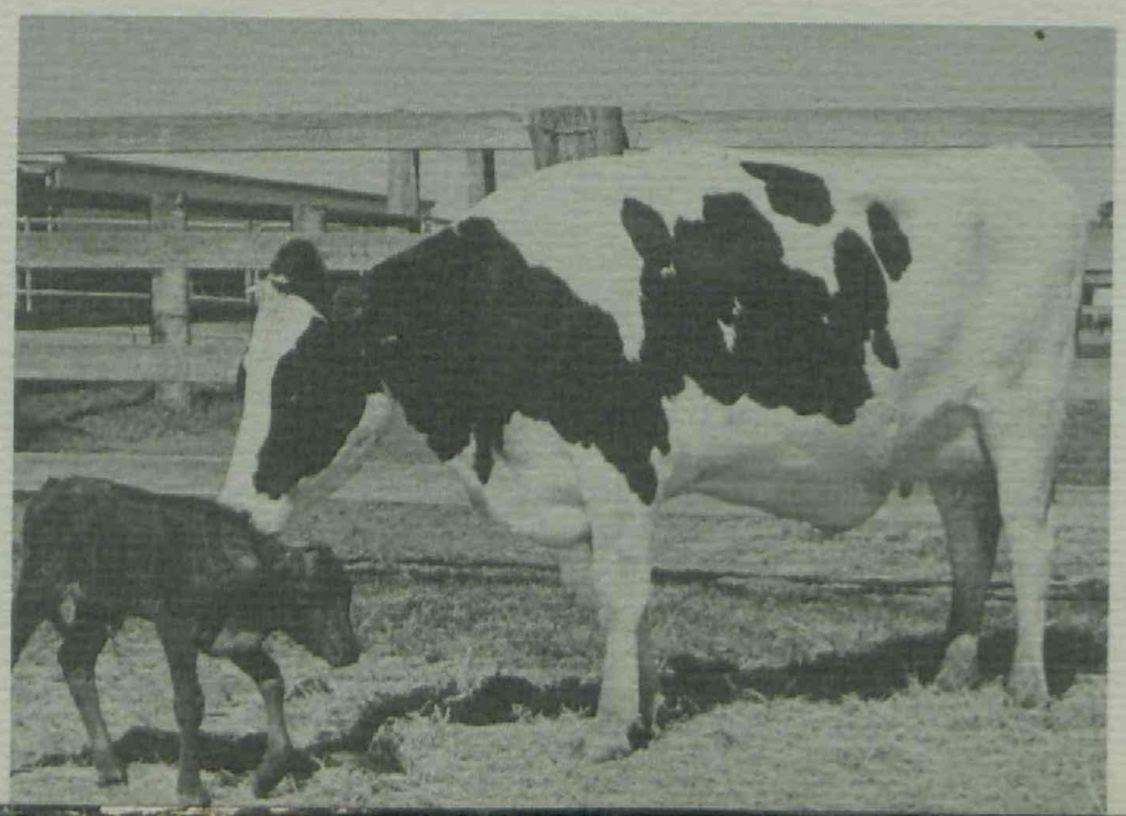
On-farm delivery of semen, nitrogen and equipment by Wacol's consignment agents continued to grow as the major method of servicing Queensland's clients. Twelve new interstate consignment agents in Victoria, New South Wales and West Australia were appointed.

Semen exports totalled 66 240 doses. Forty-seven percent of exports went to New Zealand, with other major demand from Indonesia, Philippines and Malaysia. Exports for the year increased by 230%. Sahiwal and AFS breeds were the main breeds sold.

Demand for inseminator training continued, with a total of 28 courses resulting in 260 people being trained. About 40% of these courses were for beef producers, reflecting the increased interest generated in artificial breeding by importations of North American beef cattle, particularly Brahmans and Poll Herefords.

Embryo transfer of elite cows for bull breeding continued to be well accepted, with good cooperation from stud breeders in the Holstein-Friesian and Illawarra breeds. A total of 131 pregnancies were produced from 39 flushes on 30 elite donor cows. Of the 260 embryos produced, 194 were transferred. The success rate of 68% ensures the AB Centre a high access rate to top elite cows.

After embryo transfer, this Australian Friesian Sahiwal calf was born to a Holstein-Friesian surrogate mother in the DPI herd at Mutdapilly Research Station, near Ipswich. Increasing interest overseas in the AFS dairy breed resulted in the sale of 20 AFS cows and heifers to Malaysia.



Pig AI

An AI service for the pig industry using chilled semen was being developed through cooperation of DPI pig and poultry officers and Wacol AB Centre staff. Semen from top Queensland central tested boars will be marketed through the existing AB Centre distribution system.

Accelerated cheese ripening was successfully achieved using elevated temperature storage of cheddar cheese. Three Queensland cheese factories had adopted, or were adopting, new maturing procedures. Storage at 13C instead of 8C reduces mature-cheese storage time from 6 to 4 months, significantly reducing storage costs. Factory and pilot-plant trials had evaluated the mutant starter process for accelerating cheese ripening. This process, when used in conjunction with elevated temperatures, has the potential to further reduce maturing times; for example, 2 months instead of 6 months.

Technology had been developed for new diagnostic field tests for mastitis. The tests can be used in conjunction with, or as an alternative to, cell-count monitoring and had been developed to the stage where they can be readily commercialised. The NAGase test, in particular, is rapidly gaining acceptance overseas as an alternative mastitis test, and a high-throughput laboratory procedure has already been commercialised in Finland.

Reverse osmosis was confirmed in a commercial factory situation as a suitable technology for concentrating milk before transport. The reconstituted product could not be distinguished from normal milk and was shown to be suitable for cheddar cheese manufacture, with some savings in starter and rennet requirements.

Specific flurogenic media were used to test for very low levels of Gram negative bacteria and for pseudomonads in freshly-pasteurised milk. The presence of these bacteria indicates milk with a short keeping quality.

A test that can detect very low levels of proteases in UHT milk was developed using isotope-labelled casein.This was cross-related with the time such a quantity of protease takes to gel the UHT milk. Monoclonal antibodies that also can detect low levels of these proteases were produced.

Dairy cattle research

Research station programmes at Mutdapilly (near Ipswich) and Kairi (Atherton Tableland) continued, with irrigated and dryland forage systems under study. Using pasture systems, milk production on both stations was well above district averages. In particular, Mutdapilly demonstrated that, even in harsh, dry environments and without irrigation, forage systems can be developed that maintain cattle throughout the year and support relatively high milk-production levels.

Legumes that withstand heavy grazing on hill paddocks under dryland conditions were being evaluated, using different levels of superphosphate. The legumes of interest are siratro—a reference species as it does not stand heavy stocking—lotononis, Bargoo jointvetch, safari clover and haifa clover.

Maize silage as a component in dairy feeding programmes was evaluated. Initial studies show that water, fertiliser and electricity are used efficiently when crops were used in dairy feeding programmes, particularly if the crops are stored as silage. Maize grown under irrigation at Harrisville produced 7 t DM/ML water and 100 kg DM/kg N, compared with pasture at 3 t DM/ML and 39 kg DM/kg N. The expected yields in the West Moreton range from 6.9 t/ha to 16.4 t/ha. With irrigation, yields are usually in the higher ranges.

Including maize silage in a farming programme increased milk output on three dairy farms by an average of 36%. It also showed that rainfall was more efficiently used when silage was used in the feeding system.

Providing tree shade to Holstein-Friesian cows during summer increased milk production at Kairi Research Station by about 1 L/cow/day.

Perennial clovers based on haifa clover, white clover and kikuyu allowed Holstein-Friesian cows to produce up to 5000 L milk/cow/year at Kairi Research Station. Various levels of nitrogen fertiliser from nil to 600 kg N/ha/year and stocking rates of 2.5, 3.75 and 5 cows/ha are being compared over 3 years to look at the optimum economic combination for these pastures. Over the last 2 years, this system supported equal production per cow and an equivalent stocking rate to a system of annually replanted pasture.

On-farm nutrition investigations were conducted on farms with different levels of production in the Rockhampton, Mt Larcom, Monto and Bundaberg areas to determine optimum fertiliser usage. Milk responses ranged between 3 and 6 L of extra milk per kilogram of urea. Responses were best where fertiliser was applied in two or three applications to good pasture (that is, high plant population of improved species such as callide rhodes or green panic) and lowest where fertiliser was applied to run-down improved pasture.

Artificial breeding of stock legislation

Forty-eight Certificates of Registration of premises and 236 Certificates of Competency were currently issued under artificial breeding legislation.This was an increase of one in the number of premises registered and 50 in the number of certificates of competency. Most of the increase in certificates was due to AI schools held in beef cattle areas.

Free advice to farmers is available from the DPI on all aspects of dairy-herd management. At 1 July 1985, 947 dairy farmers were using the herd-recording scheme.

On-farm computer programs, such as a farm accounting system (FARMACC) and a herd management system (HERMAN), are being used increasingly in dairy-herd management.

QUEENSLAND PRIMARY INDUSTRIES

1

Education for better soil use can get off to an early start using resource materials being developed by the DPI's soil conservation services branch for use in primary and secondary schools.

2

These fully-grown tiger prawns (*Penaeus esculentus*) were reared at the DPI's Southern Fisheries Research Centre, Deception Bay. They are one of the species being studied as prospects for aquaculture in Queensland.

3

Road trains at 'South Galway' station, near Windorah, loading bullocks bound for Yaraka railhead and destined for Rockhampton abattoirs. The DPI's beef cattle husbandry branch is emphasising research into cattle handling and transport design, so that meat quality can be improved through reducing the stress and bruising of animals during transport to market.

4

DPI research has shown that handling and transport stresses during consignment can reduce meat tenderness. It has also shown that cattle management during consignment and supplementation just before slaughter may help ensure that a more tender product is available to meet consumer demand.

5

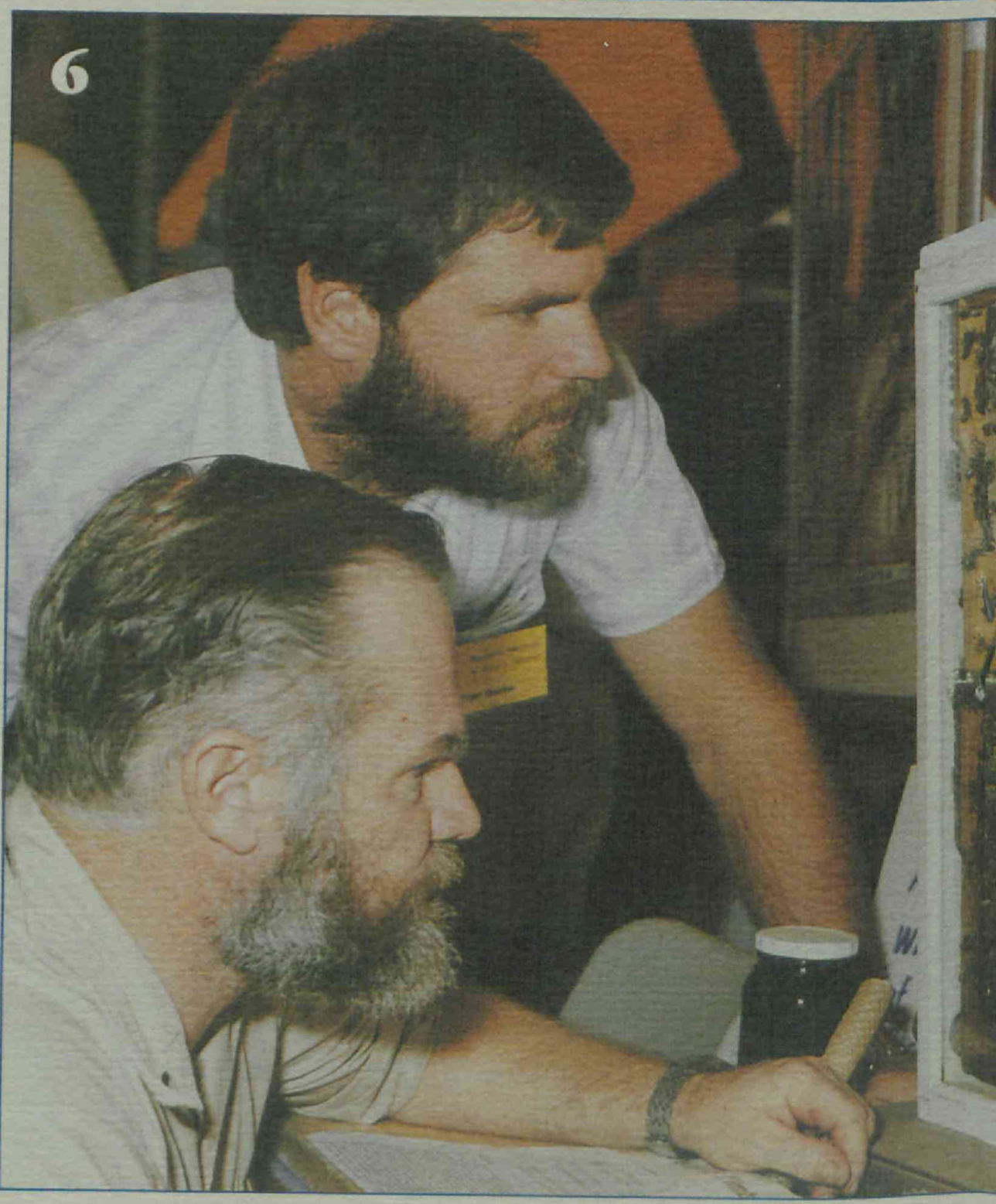
Below-average rains during the 1985-86 summer again resulted in drought in much of western Queensland. Beef cattle producers were forced to wean calves early to ensure the survival of their cows. Cattle were sold for slaughter earlier than planned, with abattoirs slaughtering maximum numbers.

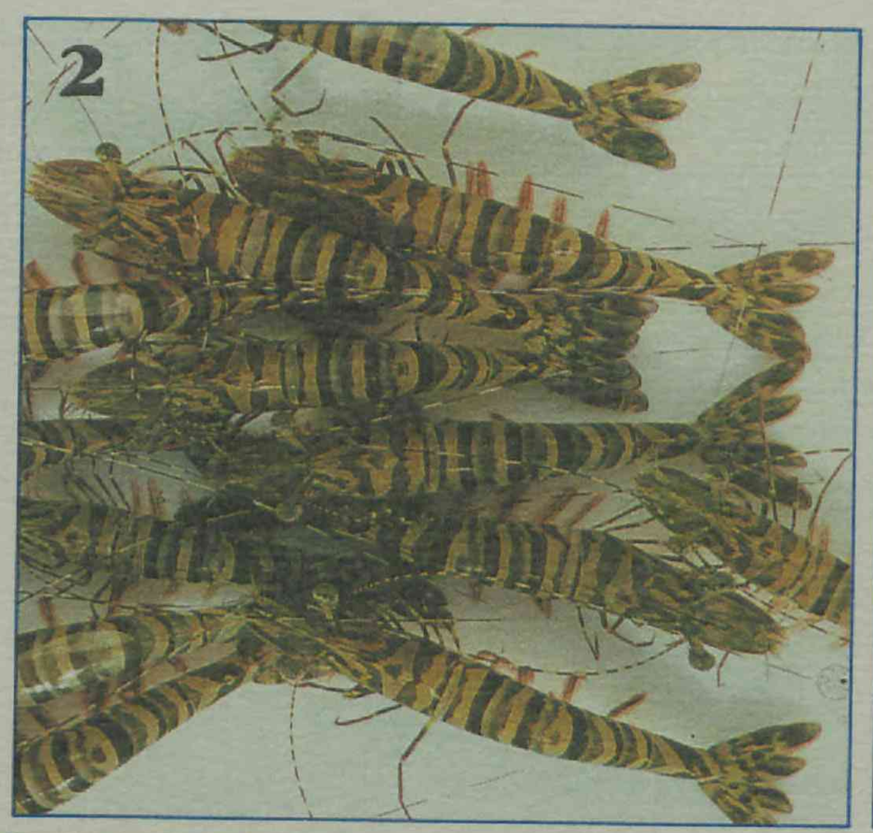
6

A commercial apiarist attending the North Queensland Field Days, in Townsville, watches the activity in a demonstration hive, while a DPI bee-keeping adviser (top) looks on. DPI advisers help bee-keepers identify signs of different brood diseases that can destroy young bees in their hives. Demonstration hives allow bee-keepers to see normal broods, so that comparisons can be made with their own hives.

7

Display boards in the DPI marquee at the North Queensland Field Days, Townsville, on 21 and 22 May provided visual impact and an opportunity for DPI officers to share technical information with producers and others involved in primary production. An estimated 8000 people visited the DPI marquee and viewed the displays of 10 DPI branches, the Lands Department Tropical Weeds Research Centre, and the Queensland Water Resources Commission. Altogether, 21 different DPI activities were presented.




2


3


4


5


7
FEEDING
CATTLE
DRY
WET
EARLY
DRY

PLANT INDUSTRY HIGHLIGHTS

Agriculture

The peanut variety McCubbin was released from the DPI's J. Bjelke-Petersen Research Station, Kingaroy, in late 1985. It is a Spanish type and, in 6 years of trials in south Queensland, produced 16% higher crop value per hectare than Red Spanish. It has higher edible kernel percentage and better potential shelf-life than Red Spanish and is acceptable to commercial processors.

Four new hybrid parental lines and one breeding line, all with a degree of sorghum-midge resistance, were released from the grain-sorghum breeding programme at the DPI's Hermitage (near Warwick) and Biloela research stations.

The four parental lines are all females, with one having a high level of midge resistance and the other three having a moderate level. All four produce high-yielding hybrids and are superior to any other publicly available, midge-resistant female lines.

They are a major contribution towards the production of midge-resistant grain-sorghum hybrids. Growers who plant hybrids that incorporate this midge resistance will reduce their dependence on insecticides, with resultant economic and environmental advantage.

Lemont, a new rice variety for the north Queensland rice-growing areas, was released from the breeding programme at Ayr early in 1986. It is a semidwarf, long-grain variety developed at the Texas A & M University's agricultural research and extension centre at Beaumont, Texas. It matures about 2 weeks earlier than Starbonnet (currently the major variety) and, because of its short stature, is more resistant to lodging. This reduces yield losses, harvesting costs and loss of grain quality.

Revenue and Banker, two new navy-bean varieties, were released from Hermitage Research Station. Revenue has excellent canning quality and a yield advantage of about 12% over Kerman and Gallaroy, the major commercial varieties. It also has better resistance to bacterial blight and rust and is more tolerant of low zinc levels.

Banker is a high-yielding variety and, in 4 years of trials in south Queensland, yielded 12% higher than Actolac, 18% higher than Kerman and 25% higher than Gallaroy. It also has better resistance to bacterial blight and rust and is more tolerant of zinc deficiency. The canning quality of Banker is better than that of Actolac, but not as good as that of Revenue, Kerman and Gallaroy.

DPI extension agronomists using the Royal Agricultural Society of Queensland's weigh wagon to measure production from test strips on the Darling Downs.

An important statistical procedure was developed for selecting a group of plant accessions for further field testing. The technique selects a subset of varieties that have a high probability of being the best in the group. This selection procedure was initially applied in the barley-breeding programme. Adoption of this new technology will improve the efficiency of DPI plant-breeding programmes.

The development and extension of practices for reduced-tillage fallow management increased. An increasing number of farmers were involved in developing reduced-tillage fallow management. The use of equipment, acquired within the National Soil Conservation Program, significantly enhanced the development and demonstration of pesticide application, machinery utilisation and herbicide selection and use techniques. Highly successful field workshops were conducted with farmers, in conjunction with the Queensland Graingrowers Association.

Significant extension projects were conducted to develop improved irrigation and crop-nutrition techniques and practices, particularly on the Darling Downs and in the Burdekin River Irrigation Area.

Improvements in the technology of growing grain legumes resulted in these crops being grown in increasing areas. The advantages of utilising grain legumes in crop rotations to improve soil fertility and minimise pest-and-disease build up had been demonstrated in a wide range of environments.

The tea industry in north Queensland developed considerably. A total of 75 ha of new tea plantations were established and a survey to define suitable tea-growing areas in coastal and subcoastal north Queensland was in progress. An effective liaison had developed between DPI officers and tea growers and processors.

Pasture systems utilising leucaena tree legumes in central and south Queensland, ponded para grasses on coastal central and north Queensland and the shrubby stylos in dry inland northern and central areas increased beef productivity significantly.

Planters were being developed and optimised for leucaena and for sod seeding to improve pastures. Peanut planter metering mechanisms had been evaluated for damage to seed. A planting adaptor had been developed for chisel ploughs to allow low-cost entry into conservation cropping.

Drying research continued for peanuts and grains. Computer models had been used to study the performance of mixed-flow grain dryers. Low-cost solar air heaters incorporated into farm building roofs had been designed and computer optimised as sources of low-cost heat for drying.

Extension officers developed further computer applications to support farm decision making. Programs for use on-farm included whole-farm physical and financial analyses and fertiliser strategies. SORWEED, a decision-aid program for weed management in sorghum, was developed using modern Expert Systems software procedures. Increased development of decision-aid packages, using Expert Systems software, was to occur in 1986-87.

Investigations continued into energy use and conservation. Alternative fuels to oil, such as gas, solar or coal, were being studied for use in tobacco-curing barns. A solar air heater and rock heat store was being constructed to conserve energy in plant-breeding glasshouses.

Pasture management

In a major grazing trial on Stylosanthes at Springmount, west of Mareeba, legume content increased with increasing phosphorus application rate, while Stylosanthes ingested in the cattle's diet was in proportion to that on offer in the pasture. Liveweight performance over the 1985 dry season (April-October) of the most recent draft, for which data is available, ranged from a 35 kg loss on unfertilised pastures to a gain of 50 kg/head from pastures initially receiving 30 kg/ha of applied phosphorus.

A study of *Stylosanthes scabra* establishment at Biloela indicated competition for moisture to be the major cause of seedlings failing to establish, while heat-treated seed gave consistently superior establishment (24%) to scarified (depodded) seed (11%), which was superior to untreated seed (7%). These differences were consistent, although levels varied from various grassed or bare-soil seedbeds. Irrigation lifted the levels still further, but maintained the general differences between seed treatments.Mowing regularly or applying phosphorus had no effects on survival on grassed surfaces. Only seedlings establishing on bare-soil sites flowered and set seed in the first growing season.

Testing of winter-growing annual pasture legumes of temperate origins on the Darling Downs was revealing several of potential value. Several accessions of snail medic *(Medicago scutellata)* were proving superior to cv Robinson, the current commercial cultivar, while a range of serradella species and accessions were showing much promise for the duplex soils of the region. The genus *Ornithopus* could well provide new and more widely useful cultivars than the present Western Australian suite, cvv Pitman and Uniserra.

On the near north coast the *Lotus pedunculatus* cultivar, Grassland Maku, from New Zealand was showing much promise in moister and more humid sites and was being more widely tested. It had continued to perform well, even over the recent run of drier years.

Horticulture

Research and development work continued to develop efficient production and marketing techniques for Queensland's wide range of new and established horticultural crops. This information is communicated to producers through individual contacts, and, increasingly, through grower meetings, field days and publications.

Coffee growing was attracting increased interest in the Mareeba district and coastal cane areas, partly because of high prices. The DPI's research programme had identified the hybrid cultivars, Catuai and Catimor, and their common parent, Caturra, as the most promising, in yield and bush shape, of those tested. The mechanical-harvested yield of these cultivars and their yield consistency were yet to be tested. A series of DPI Farm Notes had been produced and meetings had been held to convey the available information on coffee growing in Queensland to interested growers.

The nursery industry was benefiting from an expanded extension service, made possible by the appointment of an extension specialist in ornamental crops. The expanded service includes a subscription newsletter that is distributed through the Nurserymen's Association and a booklet that lists the books and journals that nurserymen need as information sources. District extension officers' ability to advise their local nurserymen was improved by a 4-day workshop at which they were given additional training in solving nursery problems. The workshop also introduced them to an information base, established by the extension specialist, from which they can obtain specialised information on ornamental crops.

Avocado growers received much help in dealing with the steadily falling avocado prices resulting from heavy market supplies.

The DPI helped the Royal National Association to conduct its 'Producer of the Year' contest to find the best avocado grower. Improved avocado growing and marketing techniques were explained to growers at an RNA field day and at a series of seminars and farm walks conducted throughout the year. As a result, 28 Sunshine Coast growers and 12 Tamborine growers thinned overcrowded plantings to increase yields; an estimated 75 growers improved the shape of their fruit by treating previously unrecognised zinc and boron deficiencies; and 15 growers changed to bait sprays to control fruit fly.

The continued supply of healthy avocado plants was helped by 10 ANVAS nurseries being inspected for *Phytophthora* root rot and, subsequently, being accredited. Research showed that this fungus also adversely affects nutrient uptake.

Measurements of water loss from avocado leaves and flowers showed that the tree's water needs rise significantly when it flowers.

A lychee conference, organised by growers and DPI officers at Nambour, attracted 280 delegates from around Australia. A national lychee growers organisation was being formed. The conference focused on marketing aspects as a way to increase the profit from new fruit crops such as lychee, an aspect that DPI research and extension staff had emphasised for several years.

A series of field days was held during the year to encourage north Queensland growers to use DPI-developed techniques of post-harvest fruit dipping, plastic film wrapping and refrigeration. Research showed that increased rates of potassium applied after harvest can be used to prevent excessive vegetative flushes in autumn and, hence, increase flowering.

Banana maturity bronzing research showed that plants subjected to water stress for one month at bunch emergence developed significantly worse symptoms of

Queensland Herbage Plant Liaison Committee members, Dr Barry Walker, DPI, and Mr Dick Jones, CSIRO (standing left and right respectively), and Mr Ted Jeppesen, seed producer (sitting centre), with local senior pasture agronomist, Mr Bruce Cook (sitting left), inspect *Cassia rotundifolia* cv. Wynn in the pasture plant-evaluation and seed-increase nursery at the DPI's Gympie office.

this disorder than unstressed plants. In this glasshouse trial, water-stressed plants developed the symptoms at a much thinner finger diameter and their fruit had a reduced greenlife at harvest. Research on the water requirements of banana soils in north Queensland allowed their general irrigation requirements to be calculated for different seasons and irrigation methods. By monitoring soil-moisture status with devices such as tensiometers, preciser measurements of the water requirement on individual farms can be achieved.

Tomato breeding lines were developed with resistance to the race of Fusarium wilt fungus that is causing problems at Bowen. The best lines available so far in the programme produced significantly more fruit than standard lines in infested soil and developed wilt symptoms later in their life. Their fruit is not as firm as current commercial cultivars. A new fresh-market tomato cultivar, Redlander, was produced that has the same wilt-resistance qualities as Redlands Summertaste, but is cheaper to grow because it is not a hybrid cultivar. It also has a more compact bush shape and the fruit are easier to pick.

Tomato production studies showed that solarisation, a system of heating the soil for 2 months using heat from the sun trapped under a clear plastic mulch, can be a practical way of controlling *Verticillium* wilt. Solarisation of infested soil gave a 74% increase in yield, and most weeds were controlled as well. Leaving the plastic mulch on the beds during the growth of the crop gave a 35% increase in yield compared with removing it. All beds were trickle irrigated.

Pineapple breeding, aimed at developing a better fresh-market pineapple, produced plants with larger fruit size and larger, flatter eyes than the Queen cultivar, while still retaining the good internal quality and slice characteristics of Queen fruit. The plants selected were all smooth-leafed. Separate selection work within the cayenne processing type identified 12 elite families of new clones. They all showed excellent fruit and plant characteristics, and yield testing had begun.

Citrus exports to Japan were pioneered by the Queensland industry using DPI-developed techniques to improve packaging, containerisation, refrigeration, insect fumigation and aeration. Other states had adopted these techniques to achieve the high quality out-turns that this market demands.

An extension officer demonstrates tip defoliation to stimulate fruiting buds on custard apples, at the DPI's Maroochy Horticultural Research Station, Nambour.

Postharvest handling of mangos was being studied in a major research project with Malaysian and Thai research organisations. Preliminary results indicated that rind blemishes due to sap burn could be reduced by: harvesting only fully mature fruit (which have a smaller flow of less injurious sap), harvesting early in the morning, cooling the fruit after harvest, and applying dry powders to the fruit to absorb the sap. Taste panel tests found that the total solids content of the flesh is a satisfactory indicator of fruit maturity. Research was continuing on expanding the mango-market season. This includes work on the storage performance of individual cultivars, the effect of irradiation on fruit physiology and the use of rind coatings to prolong storage. Field trials were testing the performance of several new mango cultivars.

The capsicum cultivar, Redlands Sweet Sue, was released to industry to replace the long, yellow-fruited Hungarian Yellow. Redlands Sweet Sue is partially resistant to bacterial leaf spot and potato virus Y, diseases which limit capsicum production in south-east Queensland. Exceptional yields of good quality fruit were obtained in several commercial plantings.

A sweet corn cultivar, Golden Early, that matures several days earlier than Rosella 425 (the industry standard) was identified. It is suitable for early-season processing and for filling production gaps caused by rain at sowing. The cultivar, Jubilee, produced exceptional yields early in the season and has excellent quality for both whole cob or kernel production. It is not suitable for mid- or late-season sowing.

The dormancy of grapes grown in a subtropical environment was broken by spraying them with a stabilised, commercial-grade solution of hydrogen cyanamide. The flowering and maturity time were both advanced by an average of 18 days for all cultivars tested. As a result of the treatment, increased bud-break was recorded for both the two-bud spurs and other dormant buds on the arms. On the non-treated vines, bud-break occurred mainly at the terminal positions of the arms, making selection and pruning of spurs difficult. No detrimental effects or phytotoxicities were recorded at the concentration used.

Entomology

Use of silver reflective mulches, together with insecticide sprays of demeton-s-methyl and albarol, resulted in a 90% increase in yield of marketable zucchini fruit in trials in north Queensland. The method prevents aphids from transmitting watermelon mosaic virus. North Queensland zucchini and rockmelon growers had adopted the method with outstanding success.

Entomologists in north Queensland devised monitoring techniques for brown planthopper to refine insecticide spraying programmes for rice crops in the Burdekin and Ingham districts. They used yellow pan traps to attract winged hoppers migrating into the crops from outside, while they examined the rice plants for wingless hoppers. Earlier studies had shown that a population level of two hoppers per tiller required treatment with insecticides to prevent economic loss of yield. Information on pest numbers derived from the monitoring service enabled farmers to apply timely control measures before damage and crop losses occurred.

Low doses of a commercially-produced virus gave good control of infestations of the corn earworm *(Heliothis armigera)* on sorghum in trials at Gatton. The virus treatments were applied to coincide with peak hatching of the larvae, which concentrated their feeding in the sorghum head. Previous studies had found that hatching usually occurred when almost all the florets of the sorghum head were flowering. This information enabled accurate timing for applying the virus. The young larvae fed almost exclusively on the contaminated pollen sacs, which ensured a high level of infection. At this early stage of development, they were extremely susceptible to the virus.

After about 5 to 7 days, infected larvae died, liberating millions of virus particles to provide a new source of infection. Other larvae became infected through feeding on the re-contaminated head or through cannibalistic feeding on infected larvae. Almost the whole larval population was lethally infected as a result of this secondary spread of the virus.

The success of the virus treatments, which was due to the combination of all these factors, demonstrated the potential of the virus to provide cheap effective control of *Heliothis* in a suitable crop. The virus, which attacked only *Heliothis*, had no direct harmful effects on other beneficial natural enemies in the crop. It is quite harmless to human beings.

Trials of a sex attractant for avocado flushworm *(Homona spargotis)* in north Queensland showed the pheromone to be a valuable tool for monitoring egglaying cycles. Monitoring programmes enabled more accurate timing of insecticide applications, which, together with new insecticide recommendations, significantly reduced crop losses. The flushworm, a serious pest of avocados in north Queensland, attacked the young growing tips and also damaged the rind of fruit, reducing its market appeal. The caterpillars built shelters by webbing leaves together or webbing leaves to the fruit and feeding within. The shelters gave them some protection from contact insecticides. DPI entomologists had to devise specialised insecticide combinations to control the pest.

Ecological studies examining the influence of insects on flowering of field- grown hibiscus plants confirmed that the primary cause of bud drop was a small black beetle *(Macroura concolor)*, which invaded the opening bud to feed and lay eggs. During spring and summer, when beetle numbers were high, hardly any flowers were produced despite an abundance of buds. Such loss of flowers reduced the value of hibiscus as an ornamental plant and caused a serious problem for commercial nurseries.

In the studies, some branches were enclosed in cages to exclude the beetles, while some were left exposed. Branches that were caged produced flowers immediately, but uncaged branches produced no flowers. This showed that poor flowering was not due to water stress but to insect attack. Buds fell from the plant prematurely when invaded by more than 15 beetles per bud, but, when beetle numbers were reduced below 10 to 15 per bud by using insecticides, prolific flowering occurred.

However, use of insecticides produced a secondary problem. Twospotted mites that had been controlled previously by natural enemies became a problem as the insecticides killed not only the beetles but also the beneficial predators. Future studies were being planned to modify the spray schedules and to control twospotted mite with predatory mites that are resistant to certain insecticides.

At least 40% of spray costs for macadamias was saved in trials in the North Moreton district through integrated pest management (IPM), with no loss of yield or nut quality. In some instances yields and quality from the managed orchards were better than those from orchards relying on schedule spraying. In pest-monitoring studies the number of spray applications of six orchards averaged about five, which was half the number applied on orchards using a calendar spray programme. The management strategy involved: developing quick, efficient monitoring systems for key pests; determining action levels; and applying appropriate insecticides only as necessary to prevent economic damage.

Plant pathology

Boil smut was sporadic in its occurrence, with only one heavy infestation reported. The disease was still confined to south-east Queensland.

Head smut affected some Darling Downs sorghum cultivars that were previously resistant to the disease. Glasshouse studies showed that two distinct races of head smut were now in south Queensland.

Stripe rust appeared in the southern border region in August 1985 and spread throughout south Queensland on crops of the susceptible wheat cultivars, Flinders and King. However, levels of the disease remained low with little if any effect on yields.

Stem rust was not a problem in wheat, barley, triticale and rye during 1985. Plantings of susceptible wheat cultivars, Oxley and Cook, and triticale cultivars, Coorong and Satu, were much reduced. The amount of over-summering rust at the start of the winter was low and environmental conditions were unfavourable for disease development.

Phytophthora stem rot had spread to all soybean-growing areas of south Queensland, but had not been detected in central or north Queensland. In recent years, the disease's severity had decreased due to the development of cultivars resistant to the two races of the fungus that occur in Queensland.

Cylindrocladium black rot caused serious losses in peanuts, particularly in north Queensland. A disease nursery was being established to test the resistance of progeny from the peanut-breeding programme.

Bacterial canker, a serious exotic disease of citrus, was found on Thursday Island in May 1984. An eradication programme destroyed all trees with symptoms. The disease was not found on citrus on other

A DPI experimentalist takes soil temperature records from an onion white-rot trial at Lawes.

Torres Strait islands or on Cape York Peninsula. Regular surveys were to be carried out to ensure that the disease does not become established on mainland Australia.

Panama disease of Cavendish bananas continued to spread in south-east Queensland. Banana cultivars resistant to the disease overseas had been introduced and were being tested under local conditions.

Botany

The second of the three-volume *Flora of South-eastern Queensland* was published in April. It contains descriptions and guides to identifying 1347 species of plants. Many of them are illustrated. The *Flora* now covers a total of 2629 species. The second volume includes species of such important families as Myrtaceae, the family of eucalypts and tea-trees, and Asteraceae, the daisy family.

The account of the mangrove vegetation of Moreton Bay was published as a Queensland Botany Bulletin. Ten detailed maps show the mangrove communities of Moreton Bay. The publication resulted from studies undertaken for the Commonwealth Government as part of the planning for the new Brisbane International Airport, now being built.It provides basic data for managing a resource of extreme importance to the fishing industry.

The vegetation survey of Queensland continued. Maps and explanatory books covering south central and south western Queensland were issued and work continued on preparing maps for central western and far northern Queensland. The objective is to map and describe Queensland's plant communities. Maps are published at a scale of 1:1 000 000, and nine maps will be needed to cover the whole of the State. A book accompanies each map and provides detailed descriptions of the communities mapped, commentary on the floristics (the plant species occurring in the area) and plant lists. These are supported by chapters on climate, geology, geomorphology, soils and land use, including comments on management and land degradation.

DPI botanists identified 12 250 plant specimens for primary producers, consultants, DPI officers, other state and Commonwealth bodies, and the general public. Advice on poisonous properties, weed potential and control, and natural distribution were supplied for most of them.

As the result of taxonomic research, officers described one new genus and 24 new species, and made 33 new combinations for mainly Queensland plants. Botany branch officers contributed significantly to the accounts of four plant families published in the *Flora of Australia*. All state herbaria support the *Flora of Australia*, which is coordinated by a Commonwealth Government agency.

Curation of the collection of about 400 000 plant specimens continued. About 99% of all the native-plant specimens had been mounted and 92% of all collections. The herbarium data-storage system (HERBRECS) was kept up to date. Information contained in the herbarium archives, which date from the last century, was available to researchers. Archival material was sorted and indexed.

Much progress was made on the project to identify Queensland's rare and threatened plants. This is the first attempt to document systematically the conservation status of about 6300 species of vascular plants (ferns, conifers and seed plants) making up the indigenous flora of Queensland. The objective is to produce a checklist of rare or threatened species for publication in 1986. The list currently contained more than 800 species. For each species there is a summary of the conservation status, geographical distribution and representation in nature conservation reserves.

Food research

An investigation began to determine pre-treatment requirements and optimum operating conditions for concentrating pineapple juice by reverse osmosis. This has the potential to reduce production costs and improve the quality of fruit-juice concentrates. Initial experiments showed that clarification of pineapple juice before concentration is unnecessary. This greatly enhances the feasibility of applying reverse osmosis in the Queensland pineapple-processing industry.

Optimum pasteurisation conditions, packaging requirements and shelf life were being determined for 'bag-in-box' aseptically-packaged mango puree. The development of aseptic packaging technology will help expand markets for Queensland's rapidly-increasing mango production. Varying pasteurisation conditions over a broad range (80C with 15 sec hold to 95C with 60 sec hold) had little or no effect on the flavour, colour and consistency of aseptically-packaged puree. However, separation of insoluble solids in drinks formulated from these purees increased with increasing temperature and time of pasteurisation.

The quality and stability of new peanut varieties bred at the DPI's J. Bjelke-Petersen Research Station, Kingaroy, were being assessed. Assessments carried out on freshly-harvested roasted nuts indicated that the quality of the new Spanish variety H54 was superior to that of the current industry standard variety, Red Spanish, and at least equal to that of White Spanish. The new Virginia variety, Shulamit, was found to be superior in appearance but inferior in flavour to the current industry standard, Virginia Bunch. Further quality evaluations were to be carried out after 6 months' storage of raw and roasted nuts.

White wines produced from the Granite-Belt wine-grape cultivar trial improved in quality in the 1985 season, after a poor-quality 1984 crop. The three cultivars most preferred by taste panelists were Emerald Riesling, Gewurztraminar and Colombard, all of which are floral aromatic styles.

An investigation to evaluate the sensory and chemical quality of Cabernet Sauvignon wines, produced by extended maceration techniques, began. This work was expected to result in quality improvement and superior handling techniques in the Granite-Belt wine industry.

The light, dry-red table wine, Balandean Nouveau, was introduced to Queensland by all Granite-Belt wine producers during the summer and was considered to be well positioned in the red-wine market. The DPI's food research branch played an important part in this development. It helped plan the project, supplied resource material and gave analytical and advisory support to the participating wineries.

An investigation began to develop an accelerated storage test that predicts the shelf life of roasted macadamia nuts. Such a test would help to overcome rancidity problems in the industry by enabling kernels with short life to be identified and marketed rapidly.

LAND MANAGEMENT HIGHLIGHTS

Erosion incidence

Extreme soil losses occurred in some parts of the State, despite a generally dry year without widespread erosion.

The worst losses occurred, during heavy summer storms, on bare, sloping land on the Wet Tropical Coast and in the Mackay district. Cyclone Winifred caused flood-erosion problems on the Wet Tropical Coast and severely damaged granitic tobacco-growing soils in the Mareeba Shire. Severe rill and sheet erosion resulted from isolated storms at Kingaroy and Gayndah.

Soil losses of up to 800 t/ha were measured on unprotected saturated soils after storms at Mackay in November; and some cultivated land under ratoon cane at Innisfail lost 400 t/ha. At Cairns, paddocks left bare of trash after harvest lost 80 to 100 t/ha, while adjacent land, protected by trash from cane harvested green, showed negligible erosion.

Little damage occurred in extensive grain-cropping areas. However, isolated storms caused poorly maintained soil-conservation structures to fail in parts of the Central Highlands.

Adoption of measures

DPI soil conservation officers designed and surveyed soil-conservation measures (contour banks, waterways, and strip cropping layouts) on 68 900 ha of cropping land. This was slightly below the 71 000 ha installed in 1984- 85, even though a record level of implementation was achieved in central Queensland. Cane farmers experiencing financial hardship were reluctant to invest in costly soil-conservation works.

Grain farmers in some districts might also have been deterred by actual or anticipated fall in income. Suitable conditions for construction of works and strong cooperation in group scheme areas partly offset the influence of poor economic conditions on implementation figures. A record 9256 ha of strip-cropping measures were adopted. These are relatively inexpensive to install.

Adoption of conservation-cropping measures increased significantly in cane-growing districts, with 30% of cane in the Douglas and Mulgrave shires harvested green and with 70% of farmers in the Mackay district practising trash retention. Minimum tillage, involving one pass with a recently- designed cultivator and fertiliser applicator, had been adopted by 50% of Mackay growers, according to a survey.

The use of tined implements had increased greatly during the last 3 years in extensive croplands. This permits better surface retention of stubble during cultivation. In central Queensland 3 years ago, use of knockdown herbicides for fallow weed control was insignificant. In 1985 knockdown herbicides were used on more than 50 000 ha.

Community involvement

Landholders had responded well to planning activities in catchment schemes in extensive cropping areas of central and south Queensland. Eighty percent of landholders in group schemes in central Queensland were undertaking soil-conservation work. Large waterways were built in the Kioma-Boogara group project in Waggamba Shire.

Community action was taken to resolve runoff coordination problems on the Wet Tropical Coast, the Atherton Tableland and the Darling Downs. Funds were approved for a landholder-requested project, in the Mackeys Creek catchment near Cairns, to achieve soil-erosion control and runoff coordination. Four major runoff coordination issues were resolved in the Atherton Shire, mainly through shire council action and mutual agreements between landholders. The Northern Downs Advisory Group Committee formed a subcommittee to develop a floodplain management policy for the northern Downs.

Community concern for land management was shown in the Gatton district, through the formation of the Lockyer Watershed Management Association, and on the southern Downs, through establishment of gully-control demonstrations of soil-conservation officers in cooperation with the Inglewood Land Management Committee.

A total of 3578 landholders requested soil-conservation service, 310 of these implementing soil-conservation measures for the first time. These figures were slightly below the 1984-85 figures of 3700 and 390. Economic hardship in some rural industries and, perhaps, absence of recent erosion caused farmer requests to decline in some districts. However, nearly all farmers in the Binjour Plateau met to discuss ways to achieve greater erosion control on contoured land. During severe storms, they had seen severe rill and sheet erosion on their peanut land.

Extension

Conservation cropping, improved standards of soil-conservation structures and better use of soil resources were given increased attention in planned activities to encourage adoption of soil conservation. Distribution of the colour booklet, *Soil Conservation: Caring for Queensland*, and a soil-conservation competition conducted jointly with *Queensland Country Life* helped to increase rural and urban awareness and appreciation of the advantages of well-planned soil-conservation farming practices.

Use of conservation-cropping demonstration sites that enable farmers to observe differences in growth, yield and, sometimes, soil loss for crops grown by

The Minister for Primary Industries, Mr Neil Turner (left), presented strip-cropping innovator, Mr Hector Tod, with the 1985 McKell Medal, at the Fourth Australian Soil Conservation Conference, Maroochydore. The medal is an Australia-wide award for achievement in soil conservation.

different methods was expanded. The opportunity to compare zero- tilled and stubble-mulched practices with conventional farming methods under local conditions was used well by many farmers. Conservation cropping was also featured in field days and farm walks, and in a series of leaflets on machinery suitable for conservation cropping. Conservation-cropping methods used by the winner of the *Queensland Country Life* soil-conservation competition were widely publicised.

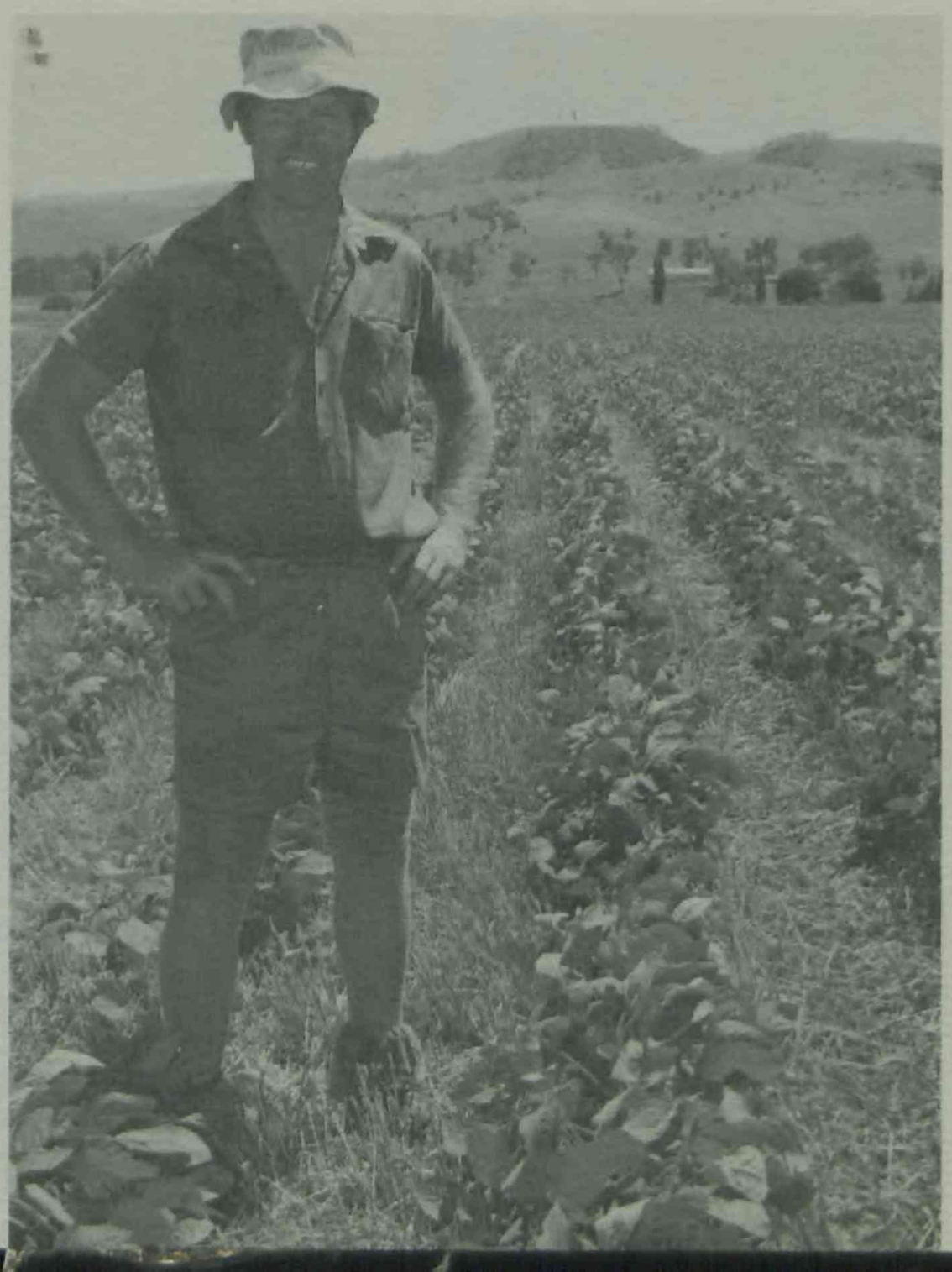
Four videos and a booklet on contour-bank construction methods were prepared to help efforts to improve the standard of soil-conservation structures.

The videos show correct construction and maintenance methods for different types of structures. Videos on waterway construction and maintenance were produced and distributed through the commercial distributor Aglink.

Extension of land-management practices to achieve the best use of soil resources in the Roma district was augmented by a video, *Land a Winner*. The video, which focuses on how to select land suitable for cultivation, was used successfully at several farmer meetings. Education on best use of soil resources also occurred through informal landholder discussion groups, the Lockyer Watershed Management Association and the Inglewood Land Management Committee.

Foundations were laid for improved understanding of the soil resource through education kits for primary and secondary school students. The kits include a soils activity booklet on soil erosion and conservation for primary schools, and resource kits for field studies on the eastern Darling Downs, on the Atherton Tableland and in the Gatton area.

Zero-tilled soybeans planted into barley stubble were one feature of Mr Rod Petersen's approach to farming at Tannymorel that impressed judges of the *Queensland Country Life* 1985 Soil Conservation competition.



Enhanced services

The success of the approach used in group scheme areas funded by the National Soil Conservation Program was shown by farmers' high interest and action in schemes, in broadacre grain-growing areas, to undertake soil-conservation measures.

A new project began for the horticulture industry, in the Gympie-Nambour districts, to develop and demonstrate layouts for pineapple, banana, papaw and bean-growing enterprises.

Funding from the national program also helped produce educational materials to increase community understanding of the soil resource and the importance of its conservation.

Technical achievements

During the last 3 years, efficiency of farm planning and design of soil-conservation layouts had been increased through: the introduction of electronic distance-measuring equipment for topographic data collection; computer-plotting of contour maps; and the development of computer programs to design runoff-control structures. Development of computer methods of analysing land-suitability data and preparing land-management recommendations also began. These initiatives allow new approaches to be developed in the use of farm planning for whole-farm management.

DPI agricultural engineers had developed and field tested a second header cutter bar to reduce stubble length, the cause of most trash handling problems in conservation cropping implements.

A wide high-speed multi-wheeled boom spray had been developed to overcome problems in boom stability and height control over rough ground, including traversable contour banks.

Green-cane harvesting, use of a minimum tillage fertiliser applicator developed for one-pass tillage in caneland, and use by some growers of chemicals for cane stool eradication are significant technical achievements towards soil conservation in cane areas. Economic advantages of green-cane harvesting and use of the minimum-tillage equipment make these techniques attractive for more profitable production.

Methods of achieving stable crop-production systems were drawn together at the Fourth Australian Soil Conservation Conference hosted by the DPI in October. At the conference Hector Tod, an innovator of strip cropping and conservation-tillage methods in Queensland, was awarded the McKell Medal, a national award for notable achievement in soil conservation.

Soil cover

Studies throughout the State continued on the effect of soil cover on runoff and soil-loss areas. The studies are being done on the Central Highlands, in the Dawson-Callide, on the Darling Downs and in the Maranoa, and in potential development areas of the Atherton Tableland. Experiments range in size from large catchment areas to small plots. An additional study, using National Soil Conservation Program funds, began on the solodic soils in central Queensland to assess the effects of tillage and soil cover on soil loss and crop production using wheat and sorghum in instrumented contour bays. Zero-tillage, reduced-tillage and full-tillage treatments were being studied.

Damage to soils occurs not only under cultivation but also in pastoral areas. Exploratory research in pasture situations began in the semi-arid tropics and in western areas of the State.

Models developed from information obtained from these and other experimental areas are valuable tools for integrating complex interactions and identifying knowledge gaps. A model, PERFECT (productivity erosion runoff functions to evaluate conservation techniques), was developed and was being evaluated alongside others including CREAMS (chemicals, runoff and erosion from agricultural management systems) for use in runoff prediction.

Methodology and equipment for measuring factors involved in runoff and water use are constantly being improved. A telephone link between equipment at a field catchment site and the DPI's Toowoomba computer was installed to relay measurements automatically.

Agronomy

With funding from the National Soil Conservation Program, sites were established at Murgon, Drillham and Millmerran to study the relationship between erosion and plant productivity. Soil was removed from field plots in 12 depth increments to 20 cm, which corresponds to 2000 t/ha of lost soil and is equivalent to 10 to 20 years of soil removal from bare soil by summer storms. Wheat and sorghum yields declined at all sites, owing to exposure of unfavourable subsoils. One site had saline subsoil; the other subsoils lacked nutrient levels needed for optimum plant growth. This work will be linked to studies of natural erosion so that the cost of soil loss can be realistically estimated for grain-growing soils.

Cooperative work with private industry developed an attachment for a chisel plough to make it perform better in a planting operation under reduced-tillage conditions. A converter reduces the tine width and provides easy interchange of a spear point or a 'Concorde'-shaped duckfoot. Shields keep soil away from the seed trench long enough to allow placement of seed in moist soil without dry soil mixing in the seed zone. The modifications allow quick, easy, secure fitting and trouble-free operation and are long lasting.

Research consistently showed that, when they adopt conservation tillage, farmers can be confident that they will maintain or improve yields without increasing inputs to uneconomic levels.

Soil physics

Lack of water is the greatest limitation for Queensland's dryland farmers. Efficient rainfall use is therefore most important. While runoff is being measured, infiltration into the soil also needs to be studied. Because the impact of raindrops can severely damage the surface structure of soils and reduce water penetration, a rotating-disc rainfall simulator was used to study rainfall infiltration under varying cover levels and for a range of soils with different moisture contents. Data from these experiments was being used to develop models to predict infiltration in the field and to become part of the runoff and soil-loss models such as PERFECT. The results correlated satisfactorily with data obtained from instrumented contour bays.

Methods of measuring the resistance of soil aggregates to breakdown by rainfall impact were studied to enable the soils prone to crusting to be identified and the effects of management practices on soil structure to be measured. Studies concentrated on: reliability of measurement; stability of samples when being transported to the laboratory; and development of laboratory equipment.

Rainfall simulator work showed that neither surface samples nor the type of simulator affected size distribution of aggregate in the surface or in sediment. Samples of the soil surface under rain gave a good measure of the soil material that was initially entrained by runoff, but sediment in runoff did not.

Salinity

The incidence of dryland salting continued to increase and more observations of salting in irrigation areas were reported.

Workshops were held to provide DPI officers and officers of other departments with the principles of landscape salting processes, soil and water salinity, salinity measurement, data interpretation and report procedures. Feedback on these officers' experiences was also sought. Proceedings of each workshop were provided. They covered principles and processes and contributions from workshop regions.

Anticipation of salinity problems in the developing Burdekin River Irrigation Area resulted in a new project to examine hydrosalinity processes and drainage reclamation strategies. Instrumentation was installed to measure water-table response under irrigation in relation to known groundwater transmission restrictions at break of slope and at occurrences of upslope dykes. Water-table response will be related to changes in groundwater salinity and secondary salinisation of surface soils.

Land resources

Sugar industry land-use studies continued, with substantial progress being achieved in the Plane Creek, Ingham, Tully-Cardwell and Innisfail studies.

The Plane Creek sugar-cane land suitability study was completed and a draft report prepared. A map showing land suitability for growing sugar-cane was prepared and printed, and much progress was made in preparing the soils map. The study indicates some 50 000 ha are suitable for sugar-cane growing and that adequate unassigned suitable lands exist to allow for any foreseeable expansion in the Plane Creek Mill area.

Field work for the 170 000 ha of the Ingham sugar-cane land suitability study (Herbert River Lowlands) was completed and report preparation begun.

The cooperative study with the CSIRO in the Tully-Cardwell region in the Wet Tropical Coast reached the stage where all field work, including soil mapping, had been completed for the 115 000 ha under investigation. The region extends from the Cardwell Range north to the Tully River and includes sugar lands, large areas of grazing lands based on tropical pastures and extensive banana-growing lands. The study indicated significant areas suitable for expansion of arable agriculture.

Soil mapping of the Innisfail canelands, 127 000 ha extending from the Tully River to the North Johnstone River, was completed by the CSIRO some time

ago. Mapping, in terms of land suitability for sugarcane and other land uses, was underway. The Pin Gin landscape, some 25% of the area, was mapped into areas suitable for cultivation, horticultural tree crops, pastoral and non-agricultural uses.

The high-intensity soil survey designed to provide soils information to help farm subdivision and overall layout of the irrigation scheme in the Burdekin River Irrigation Area continued. Further progress was made with the Leichhardt, Mulgrave, Northcote, West Inkerman and Haughton-Horseshoe Lagoon sections.

Report preparation was well advanced for the 9700 ha of the Leichhardt section, and drafting of the soils map at a scale of 1:25 000 was nearing completion. About 80% (7760 ha) was classified as suitable for sugar-cane growing. Soil survey and land-suitability assessment was completed for the Mulgrave section (8460 ha) and report preparation begun. Land suitability data for the Mulgrave and Leichhardt Downs (southern) surveys were used as a basis to prepare farm-design layouts for farm development in these areas. DPI officers worked with QWRC staff to assess these designs, both independently and as members of the recently established Farm Inspection Committee.

Soil survey continued in the West Inkerman section, with a further 350 ha being completed, and in the Northcote section, with some 400 ha being completed. A preliminary reconnaissance survey completed for the Haughton- Horseshoe Lagoon section indicated some 10 500 ha of potentially irrigable land.

The programme of land-resource survey to provide information and guidelines on areas suitable for development and on their management requirements continued in the Wide Bay-Burnett region. Map and report preparation began for the 820 000 ha of the Central Burnett region, and field work for the Wide Bay-Southern Port Curtis region overview study was completed.

Low-to-medium intensity soil surveys continued. All reference areas for the South Burnett Red Soils Study and for some 50% of the alluvia of the Lower Lockyer Creek were completed.

Funding was made available under the National Soil Conservation Program to enhance programmes to map the soils and determine land-management requirements for the Roma 1:100 000 map sheet. Some 300 sites had been described and 25 soil types identified. Funding continued under the National Soil Conservation Program for land-assessment and land-management projects in central Queensland and the Dry Tropics. Some 16 000 ha covering 35 soil types have now been mapped as part of the central Queensland project based on the Kilcummin 1:100 000 map sheet. The initial phase of the Dry Tropics project involves an overview study of the lands in the Mareeba-Herberton region. Field work was well advanced. On completion of the overview, priority areas will be identified for detailed soil assessment at 1:100 000 scale.

High-intensity soil surveys were undertaken or finalised for DPI research stations. These include sites at Bundaberg, Wellcamp, Brigalow, Roma, South Johnstone, Utchee Creek and Biloela. Data from the surveys are used in developing and planning research activities on the various stations.

Eroding drainage lines, such as this one in the Kioma catchment, Waggamba Shire, threaten continued cultivation of large areas of extensive cropland.

Evaluation and planning

Evaluation and planning for potential irrigation developments and shire planning continued. Investigation of irrigation potential downstream of the proposed Cave Hill Dam site at Cloncurry indicated some 2200 ha with limited potential for cropping, although an economic assessment is essential to complete the evaluation. A 1:50 000 soil survey and assessment of land suitability for irrigation of an area upstream of Ceratodus on the Burnett River was finalised. A decision was later made to construct a weir at this site.

Land upstream of Teddington Weir, on Tinana Creek at Maryborough, was evaluated for irrigation potential, as part of a possible expansion of the Mary-Tinana irrigation scheme. Additional on-farm property evaluations to refine the land-suitability classification were being done in the Isis-Childers district to help the QWRC design the irrigation scheme.

Local authorities continued to request land-resource data to help identify valuable agricultural land as an aid to shire planning. Projects were completed for Taroom, Hervey Bay, Woongarra and Herberton shires. Demand from local authorities and the Local Government Department continued for land-suitability assessments on land subject to re-zoning applications for subdivision.

Subsequent to the programme of identifying potential tea-growing lands in the Cardwell Shire, a programme was developed to identify all lands with tea-growing potential in the Wet Tropical Coast. Preliminary familiarisation had begun, and planning for the major field programme was well advanced.

The land management field manual programme was continuing. On a district basis, it provides: a suitable resource base for farm planning; specifications for runoff control structures; the limitations and management of the soil resource; and suitable conservation management systems. The manual for Wandoan District was released and presented to local DPI officers, farmers and industry representatives. Manuals for Roma, South East Downs and Goondiwindi were in final form, while the manuals for Dawson-Callide, Atherton-Mareeba, Central Burnett, Oakey-Pittsworth and Miles were being prepared.

Salinity investigations continued to be a high priority. Community awareness of salting was increasing, reflected in increased requests for specialised help. Detailed support was given to DPI officers in the Oakey, Clifton, Theodore, Lockyer Valley, Kalbar, Roma, Rockhampton, Mackay and Clermont areas to help plan

preventative measures with property owners.

Further salinity workshops were held at Toowoomba and Ayr. They are a way of presenting current research data, applying research to regional situations, documenting local salinity data and improving liaison for more effective action against salting.

Funding was obtained under the National Soil Conservation Program for a programme to determine relationships between grazing-management strategies and soil loss and runoff, pasture condition and productivity of the mulga lands in south-west Queensland. Planning was well advanced, with initial site selection, soil sampling and rainfall simulator measurements completed.

A joint study with the Lands Department to assess the extent of land degradation on Paroo Resource Region properties in the far south-west was completed. Land condition was recorded in terms of ground cover, surface sheeting, perennial grass cover, unpalatable woody shrub cover, mulga cover and pasture biomass. Evaluation of these data was underway.

Data storage and retrieval for resource survey and mapping remained a priority. The WARIS software was provided to interstate organisations, and negotiations were in progress to provide software to overseas organisations. Computer-assisted drafting was further evaluated, with the land suitability map being completed and printed for Plane Creek using the Intergraph system. Evaluation of additional systems was underway, and the State Government Computer Centre was to determine the most appropriate work station for DPI use.

A land resource mapping catalogue was compiled and published, with the help of an officer employed under the Community Employment Programme. The catalogue provides a complete reference to all land-resource maps compiled and published by the DPI.

The staff interchange between a drafting section staff member and an officer of the Department of Scientific and Industrial Research in New Zealand ended in November. A report documenting the benefits of the interchange and the implications for the DPI was nearing completion.

Agricultural chemistry

New soil tests for phosphorus and potassium were investigated on 70 soybean fertiliser trials in south-east and central Queensland, covering a wide diversity of soils. The tests, based on a dilute calcium chloride extraction, proved superior to previous soil-analysis methods. The work has identified soil levels of phosphorus and potassium required to produce maximum soybean yields. Furthermore, the phosphorus test gives an estimate of the rate of superphosphate required on different soils to produce maximum yields.

A soils data bank was established for storage and retrieval of soil descriptions and soil chemical analysis data. Information on 150 soil profiles from the Burdekin River Irrigation Area were coded and stored on computer disk. This information was analysed and the results published. They summarise the salinity characteristics of Burdekin soils. A bulletin summarising fertility for the Burdekin was being prepared.

Acid horticultural soils collected from various parts of Queensland were chemically analysed to characterise their fertility. In general, the soils have a limited ability to hold plant nutrients. Proper fertiliser management is, therefore, critical to maintain their fertility. Using chemical characteristics, soils were categorised into groups based on management strategies such as liming and organic matter build-up through green manure crops.

A water data base was developed to enable chemical analyses of water samples to be stored on computer disk. Sorting of these analyses by shire enabled the chemical 'finger prints' of bore waters from different shires to be obtained. It was also possible to produce maps of the state based on water-quality criteria such as salinity and sodicity.

A potting-mix analysis service was set up to help horticultural advisers diagnose disorders in ornamental plants for the nursery industry. Both chemical and physical characteristics are measured. The most common disorder is high salinity caused by over-fertilisation.

Insecticide residue measurements on fruit and vegetables are important in obtaining registration of new treatments. Tomatoes, capsicums, mangos and avocados were analysed for residues of dimethoate, an organophosphate insecticide. Residues of fenthion, another organophosphate insecticide, were also determined in tomatoes, mangos and avocados as part of the same programme. This work has enabled interstate trading of these commodities.

Methoprene residues on stored wheat were determined at intervals during 9 months' silo storage. Methoprene applied at 1 mg/kg (nominal) remained virtually unchanged during storage. Analysis of the milled fractions showed that the highest proportion of residue (47%) remained in the pollard and that almost all of the residue in the flour was lost on baking.

Pollen from insecticide-treated rape was analysed for residue at 0, 1, 2, 3 and 4 days after application. This work, in conjunction with the Queensland Agricultural College, is helping in a study of the chronic toxicity to bees of selected organophosphate insecticides. Methamidophos, monocrotophos and dimethoate have been found in pollen at levels that have been shown to effect bee reproduction in feeding trials. Results will be used to develop management procedures for beekeepers to minimise bee deaths from pesticides.

Gossypol and tannin levels in commercial and experimental cotton varieties were monitored during cotton-boll development. High levels of these compounds in the plant tissue increase the plant's resistance to insect attack. Selected lines may be involved in plant-breeding programmes when biological assessment has been fully investigated. By increasing the plant's natural defences to insect attack, dependence on pesticide usage should be reduced.

Chemical changes in stored peanuts were measured to determine differences among varieties and to see whether specific components were useful indicators of storage stability. Some variations were found among varieties, with the largest difference being in the oleic/linoleic acid ratio, the factor reported to be the most important in controlling stability. Ratios ranged from 1.5 (Virginia type) to 1 (Spanish type). Any new variety must have storage characteristics at least equal to current commercial varieties.

FISHERIES HIGHLIGHTS

Prawn research

Research on the biology, abundance and movements of commercial prawn species in Torres Strait began and surveys took place using the new research vessel *Lumaigul*. Commercial samples were also bought. The numbers, distribution and migrations of juvenile prawns in seagrass nursery beds were studied, using a specially designed beam-trawl. Many juvenile prawns, some as small as 4 mm, were collected and seasonal changes in their abundance observed. Changes in the species composition and abundance of commercial-sized prawns were also documented.

Commercial prawn numbers were monitored during the 1985-86 east-coast prawn-trawling closure. Monthly samples of prawn stocks were taken near Townsville and Cairns and in fishing grounds north of Cairns. Data collected were computer analysed and the results distributed before the start of fishing. This helped fishermen in planning fishing strategies for the start of the season.

Fishery landings, between Lucinda and Bowen, of red spot king prawns and blue leg king prawns were down on catches recorded in 1983-84. Log-book data showed that the area worked by trawlers in 1985 was much smaller than that worked during 1983-84. Preliminary analysis of bycatch in the king-prawn fishery indicated that trawling in near-reef waters produces a bycatch similar to open sand and mud areas rather than a true reef fauna.

Increasing evidence shows that red spot king prawns use reef lagoons as nursery areas and do not have the typical estuary-offshore life cycle of most prawns. The reproductive cycle of both red-spot and blue-leg king-prawn populations was monitored.

Thirteen seagrass species were identified in coastal seagrass beds that form juvenile prawn nursery grounds between Cape York and Cairns. The seagrass species composition and total biomass appear to be influenced by the salinity and turbidity changes associated with the summer monsoon season. Annual variablity in the size of the adult prawn stocks is probably partly related to annual changes in the extent of seagrass beds. Trawl samples of prawns living in seagrass beds included many red-spot king-prawn juveniles. Previously, juveniles had not been found north of Cairns.

An inspector (left) with the DPI's fisheries management branch speaks to a participant in a survey of non-commercial fishermen in the Gulf of Carpentaria. The photo was taken on the bank of the Norman River near Karumba.

Crab research

Coconut crabs represent a valuable resource in Pacific islands, where they are threatened by uncontrolled commercial harvesting. A joint study with the University of Queensland (funded by the Australian Centre for International Agricultural Research) on the growth and biology of these crabs was carried out in Vanuatu. Movements were monitored using freeze-brand identification marks. The feeding behaviour of captive juvenile and adult crabs was studied and their growth measured. In a major breakthrough, coconut crab larvae were successfully reared. These advances will allow the improved management of this species in many island countries and may lay the basis for farming them.

The sand crab research programme was boosted by a tag lottery to provide an incentive for fishermen to return tags. Prizes totalled $6,000 worth of gold bullion. The higher returns of tags, particularly from recreational fishermen, demonstrated that the lottery was an important innovation for fish tagging studies. Biological investigations of female crabs revealed that virtually all newly-moulted females had been impregnated. When considered with their high fecundity and population size, the resources appear to be remarkably healthy. The information gained from the sand-crab tagging work and the other aspects of sand-crab research will be used to help manage this important fishery.

Boondall wetlands study

Investigations began in the Boondall wetlands on the effects of modifying this mangrove-lined waterway, which forms a nursery area for commercial fish and prawn species. More than 70 species of fish and crustaceans were identified from beam-trawl catches, including significant numbers of juvenile greasyback prawns, mullet, bream, whiting and flathead. The work was continuing.

Barramundi breeding

Significant advances in hatchery production of barramundi and in knowledge of reproduction in wild stocks were made. Field sampling of adult fish and planktonic egg and larval stages at Weipa provided detailed information on the relationship between spawning and lunar-tidal cycles and demonstrated the existence of localised spawning grounds.

Successful hormone-induced spawnings of wild fish held in estuarine net cages and of captive fish in tanks at the DPI's Northern Fisheries Research Centre, Cairns, yielded fertile eggs for hatchery rearing. Fertile eggs were also obtained by stripping ripe fish at spawning grounds. Two-week-old larvae were transferred from saltwater tanks in Cairns to freshwater fry ponds at the DPI's Walkamin Research Centre, Atherton Tableland, and grew rapidly to fingerling size. Some fingerlings were used for feeding and growth trials, using formulated pellet diets.

Tinaroo Dam trial stocking

More than 14 000 fingerlings were used in a trial stocking of Tinaroo Dam in December. In May netting trials revealed big numbers of good-sized barramundi (30 to 37 cm, 400 to 660 g), indicating that the trial stocking had been remarkably successful.

Gear technology

A video camera recorded the behaviour of prawns and fish in a new experimental tow tank as they tried to avoid being captured by an advancing trawl net. Prawns of different species were found to jump differently, and many trawl nets may not have the optimum design to catch certain species. In addition, trawls towed too quickly did not give the prawns enough time to react and often passed over the animals before they could jump into the mouth of the net. Analysis of the results and provision of video tapes to the fishing industry were expected to lead to more efficient nets and better net handling.

Gillnet fisheries

Preliminary findings of a collaborative research study by DPI fisheries research branch officers in Cairns and CSIRO biochemical geneticists in Brisbane showed that Queensland's multi-million-dollar barramundi gillnet fishery is based on at least five different varieties of the fish. Field surveys showed that all varieties differ from one another in growth, breeding and life span. The researchers identified two barramundi types in the Gulf of Carpentaria and three others along the east coast. This information can help to manage the State's barramundi resources more effectively.

A comprehensive study of the Queensland east-coast commercial gillnet fishery was completed. A final report discussed aspects of the fishery's management in detail and offered recommendations for minor changes to the current fishery management plan.

Ciguatera research

Ciguatera fish poisoning is a problem affecting the marketing of reef fish and mackerel. The causative algae *(Gambierdiscus toxicus)* were isolated and grown in mass culture in the laboratory. Factors affecting the production of ciguatoxin were studied to explain ciguatera outbreaks. The role of reef disturbance has been of special interest. A programme to develop a way to detect toxic fish began. It is using toxin obtained from toxic fish taken from Gove and Hervey Bay. A new poke stick test developed in Hawaii demonstrated that a simple test for ciguatera may be feasible.

Aquaculture

This primary industry expanded to cover culture of penaeid prawns, barramundi, freshwater fish, marron and other freshwater crayfish *(Macrobrachium* and *Cherax)*. Well-attended aquaculture workshops, seminars and displays were held at seven coastal centres. The highlight was a 2-day Aquafarm '86 Conference in Brisbane, organised in conjunction with *Queensland Country Life*. More than 900 people attended each day.

Hatchery rearing of the brown tiger prawn *(Penaeus esculentus)* was studied. Postlarvae seeded into small nursery tanks grew to a marketable 15 g size in 6 months. This growth rate is slow when compared with *Penaeus monodon*, which is the widely-farmed species in South-East Asia. Brown tiger prawns, however, may be more suitable for farming on drier sections of the Queensland coastline, as they have lower freshwater requirements.

A disease screening technique for cultured penaeid prawn species was set up to protect this industry. Future programmes will extend to other species now being cultured.

A survey of marron farmers in south-east Queensland showed a wide range in financial investment in the industry. Generally, the large investors were the more successful. An industry liaison group was formed and was preparing a booklet detailing management guidelines for successful marron farming.

Aquarium fishery

Collecting marine aquarium fishes from coral reef areas and breeding freshwater native fish for sale to local and overseas markets, particularly the USA, are a growing industry. An industry management group was established to advise on new permit conditions that were being implemented for all operators in the fishery.

Scallops

The scallop surveillance programme continued and obtained compliance of the 150 boats in the fishery with the new 85 mm shell size regulation. Owing to excellent industry cooperation, most samples were in the under 1% small scallop category. The higher unit price for these better-quality scallops was expected to yield $15m in 1986.

Bacteriological analyses of freshly-shucked scallops produced a wide range of organism counts, reflecting poor handling practices. Recommendations were being made on improved scallop-handling practices.

Research showed that irradiation extends scallop shelf life. Scallops irradiated with a 3 kGy dose remained acceptable to taste panelists for up to 5 weeks compared with 2 weeks for non-irradiated scallops.

Oysters

A major review of the industry was completed and industry liaison arrangements were introduced. The spread of Pacific oysters *(Crassostrea gigas)* in local waters and their effect on stocks and markets were being monitored.

DPI fisheries biologists evaluate the colour reaction caused by testing a toxic barracuda with a new poke stick test developed in Hawaii for testing for ciguatoxin. This test is the forerunner of a simple test that the public may use to detect ciguateric fish.

Environmental protection

Investigations were made into more than 40 projects that affect tidal areas, and assessment advice was given on 11 environmental impact studies. Alternate strategies were frequently provided where the extent of proposed degradation could not be justified.

Nine new Fisheries Purpose Reserves were gazetted in the Proserpine and Hervey Bay regions. Others were still in progress. Studies began in the Gulf of Carpentaria.

The artificial habitats of Gold and Sunshine Coast canals were studied to determine the types and abundance of fish species present. Canal design, substrate type and age were found to influence the species composition. Many commercial and recreationally important fish species were found in the canals, while some prawns, and sand and mud crabs were also recorded.

Angling club data

Results of analyses of angling-club data voluntarily supplied by clubs in the Mackay and Bundaberg districts showed that catch rates had declined, but average size had remained stable, suggesting fish stocks were not being threatened.

Tunnel net demonstration

After public debate against commercial fishing operations in Tin Can Bay and Sandy Strait, DPI fisheries officers, together with local commercial fishermen, held a tunnel-net demonstration in Tin Can Bay. Special guests included the Minister for Primary Industries, the Minister for Education, local members of Parliament and businessmen. The demonstration showed how fish are harvested in a tunnel net and dispelled many of the concerns about this type of fishing operation.

Ocean beach fishery review

DPI fisheries officers reviewed management measures in the ocean beach net fishery from Fraser Island to Coolangatta. The review, together with discussions with fishermen, served to formulate new management options for this fishery. The options were introduced.

The R.V. *Lumaigul*, a 12.5 metre fibreglass vessel commissioned in November by the DPI, served as a sea-going laboratory for DPI fisheries research branch officers as they studied the behaviour patterns of commercially important prawn species in the Great Northeast Channel of the Torres Strait. The *Lumaigul*, with a range of 400 nautical miles, operated out of Thursday Island after being officially named by the Minister for Primary Industries at a ceremony on the Brisbane River. 'Lumaigul' is the Torres Strait Islander word for 'investigator ship'.

Inland fisheries

The DPI's fisheries management branch began an advisory service to local bodies wishing to stock inland water storages for recreational fishing. The service included a prestocking survey of dams to ascertain existing fish species and their population, and subsequent advice for re-stocking and improved survival of introduced fish. The Glenlyon, Boondooma and Leslie dams had been surveyed and the local bodies advised.

Gulf recreational fishing survey

The Gulf of Carpentaria fishery logbook programme showed that the total catch by commercial fishermen had remained relatively stable since 1981 at 600 t of whole fish annually, but that the quantity of barramundi taken from the Gulf by recreational fishermen was unknown. A programme to estimate the quantity of barramundi and other fish taken by non-commercial fishermen in the Gulf began in 1986.

Tuna

Detailed studies of auction markets in Japan were made to investigate ways to improve the returns from Queensland's resources of yellowfin and bigeye tuna. The new information obtained from direct observation of auctions has led to reliable specifications being developed for high-quality export product. Market studies in Japan, aimed at assessing the market potential for other Queensland seafood species, were continuing.

Longline fishing gear was developed and evaluated in cooperation with commercial fisherman in both south and north Queensland waters.

Seafood quality improvement

A research programme began to increase financial returns to the fishing industry by improving product quality. State-wide surveys of retailers and wholesalers were conducted to assess handling and storage procedures and to develop quality standards.

Samples collected during the survey were acceptable when bought, but the bacteriological results suggested that many were close to the limit of their storage life.

The study found that there are many practical, inexpensive ways by which retailers and wholesalers can improve the quality of product supplied to consumers.

Otter trawl fishing cost model

This project, based on actual operational costs for a range of different fishing vessels from different fishing areas, seeks to develop a computer model of the costs of trawling operations. Nineteen fishermen in southeast Queensland were participating in the study, which will extend progressively to all trawl fisheries in the State.

MARKETING AND ECONOMICS HIGHLIGHTS

Mango marketing

Because of looming mango-production increases, DPI marketing officers began a project to help develop a domestic and exporting marketing plan for the industry. In 1985-86, the study focused on market research in Sydney and Melbourne and has included consumer, retailer and wholesaler surveys. As part of the initiative, two marketing officers visited New Zealand to study its horticultural market systems.

IAC vegetables inquiry

A submission and evidence presented to the IAC inquiry into vegetables and vegetable products requested that the Commonwealth Government help overcome factors limiting vegetable exporting from Queensland; help the frozen-pea industry; and reinstate the quarantine embargo for potatoes.

The IAC was asked: to consider and report on the implications and effects of abolishing all such schemes as the present Tasmanian Freight Equalisation Scheme and the proposed Tasmanian Freight Compensation Scheme; to recommend how a deficiency in anti-dumping arrangements could be overcome to safeguard the fresh-produce industry against injury from unfair international trading practices; and to examine the issues raised by the current approach to anti-dumping complaints lodged by growers' organisations that have no tacit support from processors.

The IAC was also asked to recommend prompt government action to introduce plant variety rights (PVR) legislation for horticultural industries and to note that, with the introduction of a PVR scheme, plant breeding needs to expand.

The IAC report was released in May and recommended that imports of unprocessed vegetables be dutiable at minimum rates, while imports of processed vegetables be dutiable at a general rate of 10%. Other recommendations included: the introduction of a PVR scheme; an increase in government funding for vegetable research; a review of the export inspection system; and the ending of prohibition on the importation of potatoes under the Second Schedule of the Customs Regulations and associated quota on imports from New Zealand.

Wheat industry review

DPI marketing officers contributed significantly to the Queensland Wheat Marketing Review Committee's report that was presented to the Minister for Primary Industries on 30 June 1985. The report was the subject of extensive discussions with the grain industry, the State Wheat Board and the Australian Wheat Board. As a result, significant improvements were made to the wheat-marketing system, particularly in communication, research, grower payments and domestic marketing.

Trade section

The DPI's trade section was involved in successful trade promotions.

In Brunei, at an exhibition in August 1985, a DPI display highlighted Queensland's tropical-agriculture expertise.

The theme, 'Queensland - world leader in tropical agriculture' was used in the DPI's display at AgChina 85 in Beijing in November. Eleven Queensland companies, under the Enterprise Queensland banner, attended this exhibition. A major success, it resulted in agreements and letters of intent being signed with Chinese organisations.

Four Queensland companies, through the DPI's support and efforts, participated in the Australian Fair in the Daimaru department store in Hong Kong in August 1985.

In London, the DPI's trade development officer, had a significant input into the marketing strategies of statutory marketing organisations and arranged contacts for organisations wishing to expand or open new markets in Europe.

The trade section was heavily involved with irradiation as a means of disinfestation and of improving and extending the shelf life of horticultural products, seafood and flowers.

Chickpea potential

In response to a Queensland Graingrowers Association request, the DPI's division of marketing prepared a report on the Queensland chickpea industry. The report confirmed that, because of the uncertain prospects for major winter cereal grains, chickpea production had the potential for further expansion. Possible export markets were identified, but a cautious approach to industry expansion was recommended as these markets needed further development.

Risk-management policies

With some marketing boards becoming more involved in exporting and more exposed to the associated foreign-exchange risks, DPI marketing officers helped the boards to develop and document appropriate foreign exchange risk-management policies.

Agricultural co-operatives

The DPI's assistant director of marketing services, who is also registrar of Primary Producers' Co-operatives, was a member of the working party on agricultural co-operatives established by the Standing Committee on Agriculture in 1985.

Research shows that leucaena, a shrub legume, has widespread commercial application in tropical and subtropical regions. DPI agricultural economists have studied its role as a fodder crop in beef-cattle production.

The working party, which included representatives from New South Wales and South Australia, undertook a major study of Australian agricultural co-operatives under terms of reference laid down by Standing Committee.

A report was to be presented to Standing Committee in July 1986.

Review of Act

The *Farm Produce Marketing Act* 1964-1982 was reviewed. It provides the framework for dealings between fruit and vegetable growers and the 150 farm-produce commercial sellers, throughout the State, who act as wholesalers of that produce.

During the Act's 2 years of operation, it became obvious that the different types of transactions between grower and wholesaler needed clarification. An amendment had been proposed and the opportunity was being taken to streamline certain procedures relating to the licensing and record keeping of wholesalers.

Legislation

The *Primary Producers' Organisation and Marketing Act* and various other Acts that deal with the operation of statutory authorities were amended to bring these bodies' superannuation policies into line with State Government policies in this area.

The *Queensland Grain Handling Act* was amended in 1986. The major amendments enable the Authority: to offer a 'warehousing' service to growers to store non-statutory grains and to handle approved commodities other than grain.

Agricultural standards

The first full year of operation of the *Agricultural Standards Act* 1952-1981 was 1986. The Act replaced the yearly registration fee with a 3-year renewal fee. File identification, renewal applications, renewal notices and lists of registered products are now produced by computer for all categories of products. Registration data provide an important base to the crop protection management system (CPMS) that the DPI's division of plant industry is developing.

Regional agricultural economists are involved in assessing the economics of newer intensive livestock industries, including mohair production.

Amendments to the *Agricultural Standards Regulations* 1984, which took effect in December, require labelling of seed for sowing and for stock foods. The level of compliance with labelling seed for sowing, in spite of wide publicity given to the requirements, was disappointing. Most offences related to seed of non-proprietary seed lines and to lucerne and legume seed produced and packed in southern states, where declared species differ from those in Queensland. All lines of seed varieties produced by major seed companies with specialised production facilities complied. Stock-food manufacturers, generally, were slow to comply with the new requirements.

Seed analysis

The number of samples of seed analysed decreased by about 24% compared with the average for the previous 5 years. The decrease was due to the discontinuation of bird-seed analysis in May 1985 and an increase in the activities of private and commercial seed-testing laboratories.

The 3134 ha of crop certified for seed production in 1985-86 and the 523 t of seed produced were the highest on record. These increases were due to increased plantings and/or yields of hybrid maize, French beans, approved oats, and pasture seed. Callide rhodes grass accounted for almost 70 t of the 87 t of pasture seed produced and Samford rhodes a further 14 t. A certification scheme was established for hybrid sunflower seed, to help develop export markets in countries requiring OECD certification.

The DPI's agricultural standards branch hosted the 1986 International Seed Testing Association (ISTA) Congress and Symposium in Brisbane.

Agricultural standards branch, through the Australian Seed Committee (ASC), helped to establish an external training course for seed analysts at the Queensland Agricultural College. Staff helped develop the syllabus for the course to be available for the 1986 spring semester.

The number of commercial operator's licences and pilot chemical rating licences issued under the *Agricultural Chemicals Distribution Control Act* 1966-1983 continued to increase. During 1986, 1970 licences were issued or renewed compared with 1566 five years ago. Cotton and sunflower crops on the Darling Downs and in the Emerald Irrigation Area, and horticultural crops in the northern sugar-cane growing districts were again major sources of complaints about damage from spray drift. 'Operation spray safe', which the aerial spraying industry proposed to promote the safe use of agricultural chemicals, was drawing attention to spray-drift problems and to reducing the incidence of damage to susceptible crops.

Financial management seminars

Almost 2000 primary producers attended financial management seminars held at eight south and central Queensland centres. DPI regional agricultural economists organised the seminars to help producers in financially managing their properties. Many producers were continuing to have problems servicing their debts, because of high interest rates and low commodity prices. A major seminar topic was alternative ways to finance producers' increased indebtedness.

PNG export tree crop study

The DPI's economic services branch, in collaboration with the Papua New Guinea Department of Primary Industry, is doing a 3-year study of the PNG coffee, cocoa and copra industries. The Australian Centre for International Agricultural Research (ACIAR) is funding the study. Its objectives include developing a suitable low-cost, sustainable method of obtaining agronomic and economic information for the largeholder and smallholder/village sectors of each industry.

Fifty coffee plantations were surveyed to gather economic data. To demonstrate alternative survey methods, informed persons techniques were used to collect similar data for coffee and cocoa/copra largeholder sectors. The experience and skills that the DPI economists acquire in this project will substantially benefit studies of Queensland primary industries.

Alternative crops

A study to determine the profitability of alternative horticultural crops in the Bundaberg area revealed that large farm sizes were needed for financial viability. The report addressed concerns that subdivision of existing sugar farms for horticultural cropping could cause fragmentation of farming units, which would lead to long-term land-use problems. Findings from this study and from similar studies in other cane-growing areas were providing helpful advice for cane growers on the profitability of alternative crops.

Service to intensive industries

DPI agricultural economists gave substantial help to producers in the intensive livestock industries. The effect of vertical integration in broiler processing was examined. A submission to the Prices Surveillance Authority recommended that day-old chickens and parent genetic stock be subjected to price surveillance.

Economists continued to develop computerised management aids, such as least-cost diet programs for pig and poultry producers, and to provide a management recording and accounting service. Training in the use of specially developed computer software was provided for both farmers and DPI officers.

Conservation cropping

As part of an on-going research programme into cost structures of Queensland farms, DPI economists in broadacre cropping centres did economic comparisons of conventional and reduced tillage methods. Information collected from farmers indicated that reduced tillage produced substantial savings in their labour time. The longer-term impact of these changes in cultivation methods, including the economic effects of reduced soil loss, taxation effects and the changes in farmers' levels of machinery investment, were being investigated.

Saleable publications

Publications continued to be an important avenue of advice to primary producers. Producers wanting to improve management, to understand more about taxation and to be well-informed on current sources and terms of rural credit were particularly well-catered-for. Officers revised the financial part of the *Farm Management Handbook* and the booklet, *Farm Taxation* to include amendments and proposed changes to the *Income Tax Assessment Act*.

Because of major changes caused by financial deregulation, such as entry of many new banks and new forms of lending including foreign currency loans, the booklet, *Rural Credit in Queensland,* was revised to improve its relevance to primary producers.

Economics of tea production

DPI economists and agronomists prepared a report on the economics of small-scale tea growing in far north Queensland. The research examined 20 and 40 ha tea enterprises for the Atherton Tableland and coastal areas. The study showed that tea growing would be profitable, but it might take up to 30 years to recover invested funds, depending on tea prices and farm size.

IAC insurance inquiry

The DPI's economic services branch presented a submission to the IAC, recommending that the Commonwealth provide financial help for implementing the Queensland Graingrowers Association pilot scheme to evaluate long-term viability of self-funding multi-risk crop insurance. The submission commented on production risks and income instability facing Queensland farmers, the types and problems of insurance for agriculture; a review of available insurance schemes in Queensland and overseas; details of the QGGA multi-risk crop-insurance scheme; and the role of government in insurance schemes.

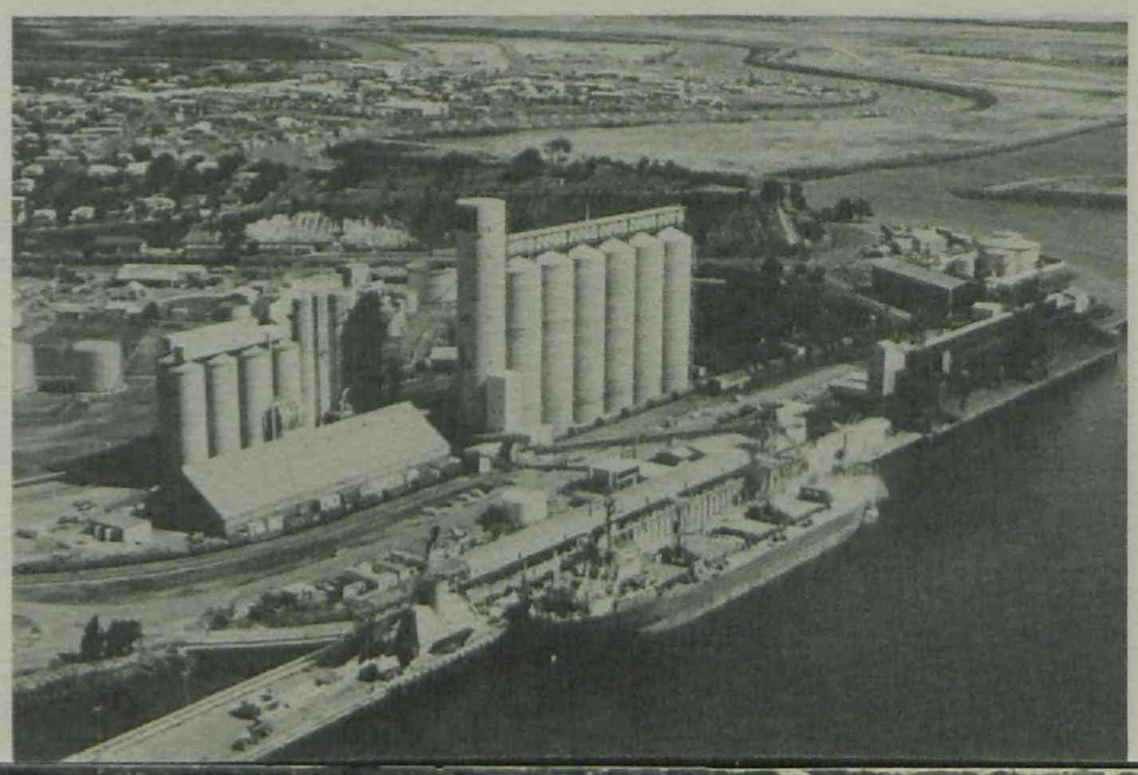
Farmer computer training

As part of an on-going commitment to rural training, DPI agricultural economists conducted schools and courses on computer use for primary producers. Among these were a 5-day course at the Burdekin Rural Education Centre and shorter courses and computing demonstrations held as part of financial-management workshops in regional centres.

BTB financial advice

A team of DPI agricultural economists based in Townsville, Mareeba and western Queensland gave financial advice to graziers affected by the brucellosis and tuberculosis eradication campaign. Economic models of beef enterprises for major producing areas were spin-off benefits of this work. The models will be used to help analyse likely economic effects of DPI research and extension programmes on beef properties.

The Port of Gladstone grain terminal is serving the export needs of an expanding central Queensland grain industry. In 1985-86 about 870 000 t of grain were shipped from Gladstone. The port is designed to cope with a projected 1.5m t throughput by 1990.



LEGISLATION

New Acts

During the year the Minister for Primary Industries introduced seven Bills into Parliament.

The six that became Acts are noted below.

- *Canned Fruits Marketing Act Amendment Act* 1985 extended the existing canned-fruits marketing arrangements in Queensland for a further three years. The objective is to stabilise the canned deciduous fruits industry by minimising market disruptions and severe price discounting. This has a positive flow-on to Queensland's canned pineapple industry. The Act also provided for greater flexibility and cost savings in product insurance.
- *Milk Supply Act Amendment Acts* 1985 and 1986 provided for a system of market-milk entitlement negotiability within processor groups in a prescribed area to allow producers to buy and sell entitlement at prevailing market prices. The Act also enabled for the Milk Entitlements Committee to maintain distribution pools for market milk by continuing acquisition of market milk growth and by applying a forfeiture in the form of a transfer assessment on milk entitlement transactions where an entitlement was transferred away from the land and registered dairy premises.
- *City of Brisbane Market Act and Other Acts Amendment Act* 1985 amended various Acts to ensure that superannuation schemes that operate for the benefit of staff of primary industry statutory authorities were uniformly accountable.
- *Tobacco Industry Protection Act Amendment Act* 1985 increased penalties under the Act to ensure that farmers comply with pest-and-disease control measures. Recent non-compliance with such measures had resulted in a serious disease, blue mould, having the potential to become resistant to existing fungicide. Penalties under the Act had not been effective deterrents.
- *Stock Act Amendment Act* 1986 was mainly concerned with furthering the bovine brucellosis and tuberculosis eradication campaign. It gives the Minister the authority to enter into agreements with owners of infected properties to carry out eradication programmes and the power to require internal fencing to be repaired or erected for disease eradication. General disease control measures were strengthened: by enabling the Minister to prohibit, immediately, by Notification, the introduction of infected or suspected stock or animal products from another state or territory; by expanding the notifiable disease provisions to include suspected diseases; and by widening the implied disease-free warranty conditions to provide an enhanced remedy for buyers of diseased stock.
- *Queensland Grain Handling Act Amendment Act* 1986 enables the Queensland Grain Handling Authority to offer a 'warehousing' service to growers to store grains that have no marketing board. It gives the Authority power to handle commodities other than grain, as approved by the Governor-in-Council.

Field days featuring conservation cropping machinery and reduced tillage methods were well attended as farmers become increasingly interested in the advantages of the new approaches. Here a senior agronomist in the DPI's soil conservation research branch explains aspects of his work involving tillage and cover effects on runoff, soil loss and crop production on solodic soils, during a field day at Brigalow Research Station, Theodore, on 19 March.

Soil Conservation Bill

The Soil Conservation Bill that was introduced into Parliament during the 1986 autumn session is designed to control soil erosion. It will help land owners, who are primarily responsible for mitigating soil erosion, to implement soil-conservation measures.

The Bill was expected to pass all stages during the 1986 budget session of Parliament. Upon royal assent of the Bill, the existing *Soil Conservation Act* 1965-1980 will be repealed.

Repeal proposed

After a review of DPI legislation during the year, it was proposed to repeal these obselete Acts in 1987:

- *Diseases in Stock Acts and Another Act Amendment Act of* 1944;
- *Diseases in Stock Acts and Other Acts Amendment Act of* 1940; and
- *Queensland Meat Inspection Agreement Act of* 1932.

Acts transferred

With the establishment of the Queensland Industry Development Corporation, the Acts below were transferred to the Premier and Treasurer for his administration:

- *Agricultural Bank (Loans) Act* 1959-1981;
- *Co-ordination of Rural Advances and Agricultural Bank Act* 1938-1982;
- *Farmers' Assistance Act* 1967-1980; and
- *Rural Adjustment Agreement Act* 1977.

ACTS AND REGULATIONS

The DPI administers 72 Acts of Parliament and 75 sets of Regulations, dealing with subject matter that ranges from artificial breeding of livestock to the wine industry.

All of these Acts and Regulations are within the Minister for Primary Industries' responsibility.

Acts

Agricultural Chemicals Distribution Control Act 1966-1983
Agricultural Standards Act 1952-1981
Apiaries Act 1982
Artificial Breeding of Stock Act 1979
The Banana Industry Protection Acts, 1929-1937
Brands Act 1915-1979
Brands Act & Another Act Amendment Act 1974
Brands Act & Another Act Amendment Act 1932
Brands Act & Diseases in Stock Act Amendment Act of 1941
Bread Industry Committee Act 1979
Brisbane Milk Board Extension Act 1977
Canned Fruits Marketing Act 1981-1985
Chicken Meat Industry Committee Act 1976
City of Brisbane Market Act 1960-1985
The Cotton Industry Acts 1923-1926
Dairy Produce Act 1978-1979
Dairy Produce Acts & Other Acts Amendment Act of 1934
Dairy Products Stabilisation Act Repeal Act 1981
Deer Farming Act 1985
Diseases in Plants Act 1929-1972
Drought Relief to Primary Producers Acts 1940-1961
Exotic Diseases in Animals Act 1981
Farm Produce Marketing Act 1964-1982
Filled Milk Act 1958-1982
Fisheries Act 1976-1984
Fishing Industry Organization and Marketing Act 1982-1985
Fruit and Vegetables Act 1947-1972
Fruit Marketing Organisation Act 1923-1985
Grain Research Foundation Act 1976
Hen Quotas Act 1973-1985
Liens on Crops of Sugar Cane Act 1931-1981
Local Sugar Cane Prices Board Confirmation Act of 1915
Margarine Act 1958-1982
Margarine Acts & Another Act Amendment Act 1974
Meat Industry Act 1965-1984
Milk Supply Act 1977-1986
The Peanut Industry Protection and Preservation Acts 1939-1965
Plague Grasshoppers Extermination Act 1937-1971
Poultry Industry Act 1946-1984
Primary Producers' Co-operative Associations Act 1923-1986
Primary Producers' Organisation and Marketing Act 1926-1985
Primary Producers' Organisation and Marketing Act & Another Act Amendment Act 1985
Primary Producers' Organisation and Marketing Act Amendment Act of 1946
Primary Producers' Organisation and Marketing Act Amendment Act 1954
Primary Producers' Organisation and Marketing Act and Another Act Amendment Act of 1965
Primary Producers' Organisation and Marketing Act & Other Acts Amendment Act 1941-1973
Primary Producers' Organisation and Marketing, Fruit Marketing Organisation, Wheat Pool and Diseases in Plants Acts Amendment Act 1930-1984
Queensland Grain Handling Act 1983-1986
Regulation of Sugar Cane Prices Act 1962-1981
Rice Industry Stabilization Act 1973
Soil Conservation Act 1965-1982
The Soil Survey Act 1929
Stock Act 1915-1986
Stock Act & Another Act Amendment Act 1978
Stock Act & Other Acts Amendment Act 1973
Stock Acts Amendment Act of 1965
Sugar Acquisition Act 1915-1985
Sugar Board Act 1966-1982
Sugar Experiment Stations Act 1900-1983
Sugar Experimentation Stations Act & Other Acts Amendments Act of 1941
Swine Compensation Fund Act 1962-1975
Tobacco Industry Protection Act 1965-1985
Tobacco Industry Stabilization Act 1965-1972
Torres Strait Fisheries Act 1984
Upper Burdekin Co-operative Associations Limited Validation Act 1979
Veterinary Surgeons Act 1936-1986
Wheat Delivery Quotas Act 1970-1974
Wheat Industry Stabilisation Act & Another Act Amendment Act 1978
Wheat Marketing Act 1984
Wheat Pool Act 1920-1984
Wheat Pool (Validation of Proclamations) Act 1983
Wine Industry Act 1974-1982

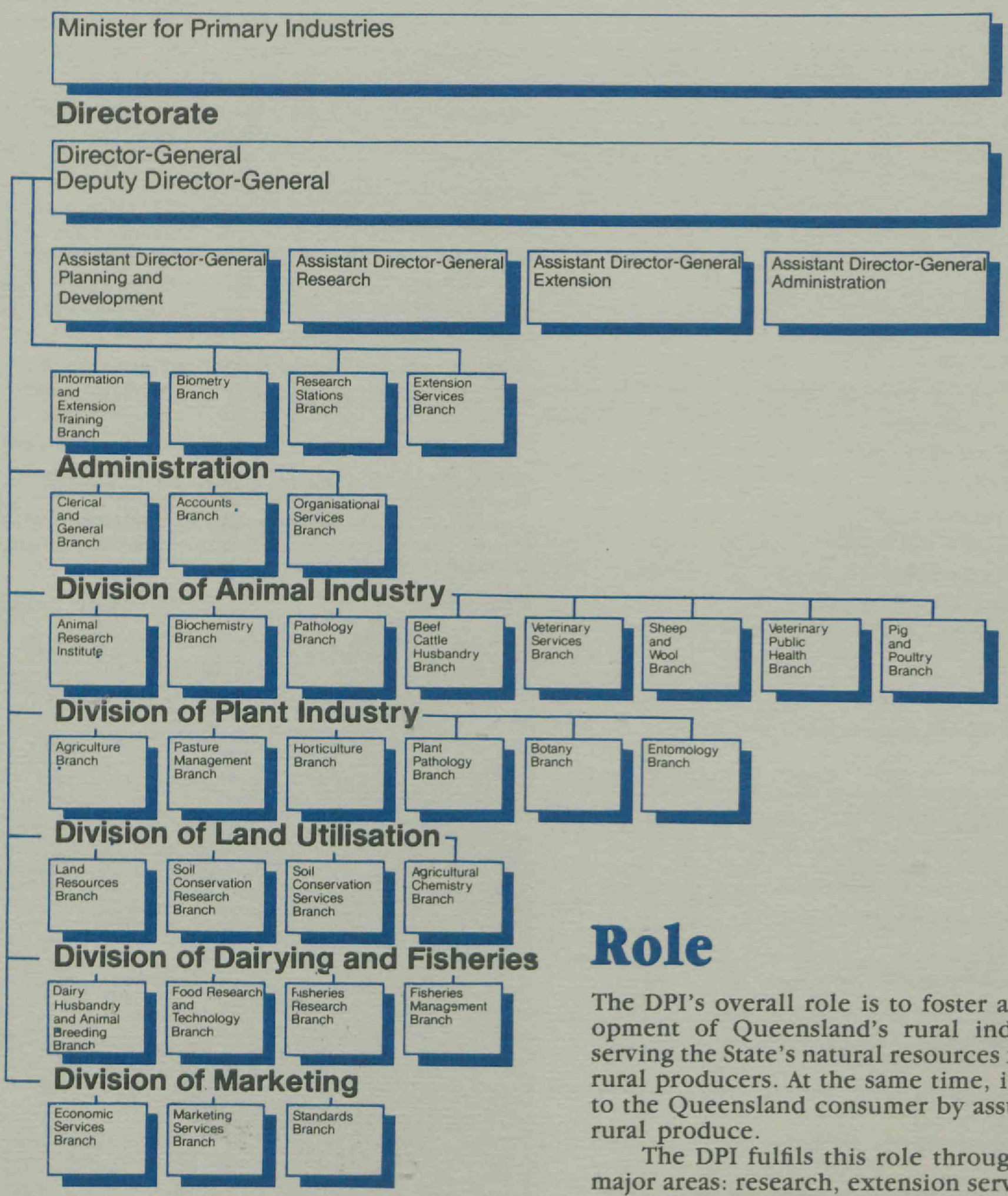
Queensland's deer farming industry is expanding. About 70 deer farms are registered with the DPI, with a total deer population of about 6000. During 1985-86, DPI agricultural economists were involved in analysing the profitability of the industry in Queensland.

Organisation

The Queensland Department of Primary Industries is responsible to the Minister for Primary Industries, who is also responsible for a wide range of statutory authorities established under Acts of State Parliament.

A director-general heads the DPI assisted by a deputy director-general and four assistant directors-general. Collectively called the directorate, they are responsible for planning and development, research, extension, regulation and administration.

In technical areas, responsibility for coordination and performance rests with five divisional directors, who are supported by their branch structure and senior officers at centres throughout the State. A director heads each branch within a division. The DPI has 5 divisions and 32 branches.



The DPI's approved public service staff establishment at the end of June 1986 was 2916. If officers' major activities are considered, about 20% are involved in administrative and clerical services; about 40% in research and resource activities; about 30% in regulatory and service work; and about 10% in full-time extension. Many research and regulatory staff also have some extension duties.

Role

The DPI's overall role is to foster and assist the development of Queensland's rural industries while conserving the State's natural resources for the use of future rural producers. At the same time, it provides a service to the Queensland consumer by assuring the quality of rural produce.

The DPI fulfils this role through its work in three major areas: research, extension services and regulatory activities. As a consequence, the DPI is involved in activities at all production levels, in processing and marketing, and in consumer acceptance and protection.

Research

Although procedures for research projects follow a common pattern throughout the DPI, they are not completely uniform due to the nature of the industries being serviced, the number of regional officers involved, and the activities of the project group (for example, production research, marketing research, conservation research).

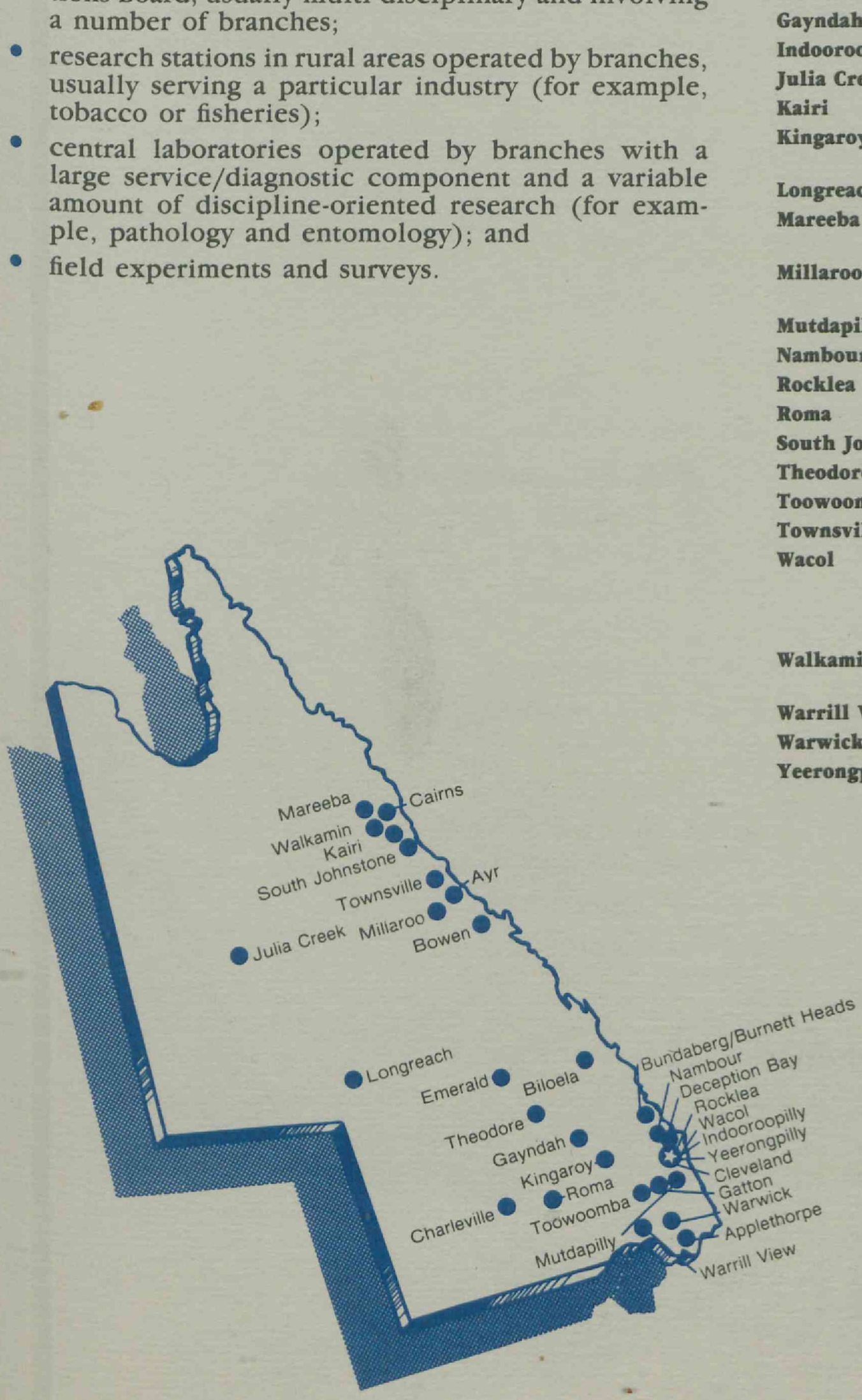
Research is not regionalised; it is administered through branches and divisions for the Research Stations Board. However, regional groups are established within some branches and to coordinate research activities of branches working within the one industry.

Research can be categorised as:

- research stations administered by the Research Stations Board, usually multi-disciplinary and involving a number of branches;
- research stations in rural areas operated by branches, usually serving a particular industry (for example, tobacco or fisheries);
- central laboratories operated by branches with a large service/diagnostic component and a variable amount of discipline-oriented research (for example, pathology and entomology); and
- field experiments and surveys.

DPI research establishments

Applethorpe	Granite Belt Horticultural Research Station
Ayr	Ayr Research Station
Biloela	Biloela Research Station
Bowen	Bowen Horticultural Research Station
Bundaberg	Bundaberg Research Station
Burnett Heads	Fisheries Research Centre
Cairns	Northern Fisheries Research Centre Kamerunga Horticultural Research Station
Charleville	Charleville Pastoral Laboratory Croxdale Field Station
Cleveland	Redlands AI Export Centre Redlands Horticultural Research Station Redlands Poultry Research Centre
Deception Bay	Southern Fisheries Research Centre
Emerald	Emerald Field Station
Gatton	Gatton Research Station
Gayndah	Brian Pastures Pasture Research Station
Indooroopilly	Agricultural Research Laboratories
Julia Creek	Toorak Sheep Research Station
Kairi	Kairi Research Station
Kingaroy	J. Bjelke-Petersen Research Station Redvale sub-station
Longreach	Arid Zone Institute
Mareeba	Mareeba Research Laboratories Southedge Research Station
Millaroo	Millaroo Research Station Swan's Lagoon Beef Cattle Research Station
Mutdapilly	Mutdapilly Research Station
Nambour	Maroochy Horticultural Research Station
Rocklea	Animal Husbandry Research Farm
Roma	Roma Field Station
South Johnstone	South Johnstone Research Station
Theodore	Brigalow Research Station
Toowoomba	Queensland Wheat Research Institute
Townsville	Oonoonba Animal Health Station
Wacol	AB Centre Dairy Herd Improvement Laboratory Pig Research Centre Tick Fever Research Centre
Walkamin	Walkamin Research Centre Freshwater Fisheries Research Unit
Warrill View	Warrill View Research Station
Warwick	Hermitage Research Station
Yeerongpilly	Animal Research Institute



Problem identification

The DPI gives a high priority to problem identification in consultation with industry and other government organisations.

This is done through regular formal meetings of national, state or local groups, through ad hoc meetings to discuss specific topics and through daily contact with producers and others associated with agriculture. Committees of review, with producer representation, have been established to investigate and report on DPI programmes.

The beef industry review committee was one such group that reported last year on beef cattle problems, research and extension.

Industry consultative committees are established for all the major country research stations. Branch and DPI priorities for research, extension and regulation are determined though these consultative activities, except where government priorities assume an overiding importance.

Solutions to identified problems are also sought in consultation with others, particularly the CSIRO and the universities with whom DPI research is coordinated.

Producer representatives help in the planning of extension or regulation that emanates from problem identification and research.

DPI attendance at national review conferences, workshops and meetings also helps co-ordinate State priorities and activities within national programmes to support the rural sector.

Extension

DPI extension services help Queensland primary producers improve their productivity through adopting new and improved practices, and through adapting existing resources using better methods. Extension services help keep primary production efficient, thereby ensuring better-quality and more-economical food and fibre products for all the community.

The DPI services all rural industries except timber and (for some purposes) sugar. It operates a coordinated, regionally-based extension system, which an extension services branch administers within policies established by an extension services board.

Within each region, the units of coordination are industry extension groups, comprising extension officers with the varied technical expertise needed to provide a balanced extension service to each industry.

Most regions employ a full-time regional extension leader to coordinate, assess, develop and improve extension services to help farmers. Increasing complexity and specialisation in primary production mean that extension staff must carefully choose their priorities. Commercial advisory services to farming are now an additional important part of a service that was once expected mainly of the Government.

DPI extension regions

1. Far Northern
2. Northern
3. Capricornia
4. Burnett
5. South Burnett
6. Near North Coast
7. Moreton
8. Darling Downs
9. Near South West
10. Far South West
11. Central West
12. North West

Regulation

DPI regulatory staff administer Acts for both the Queensland and Commonwealth governments.

The aim is to protect both the consumer and the producer through orderly marketing, disease control and product hygiene and quality. These Acts include the *Agricultural Standards Act, Drought Relief to Primary Producers Act, Stock Act, Primary Producers' Organisation and Marketing Act, Wine Industry Act,* and *Veterinary Surgeons Board Act.* DPI regulatory activities include:

- supervising meat slaughtering and meat quality for domestic consumption;
- issuing permits to move stock;
- inspecting butcher shops;
- being responsible for quarantine of livestock and plants as agent for the Commonwealth Government;
- recommending in relation to declarations of drought-affected areas;
- supervising the activities of rural marketing boards and cooperatives; and
- assuring the quality of all rural produce.

Regulatory officers are required to maintain the effectiveness of the Acts for the benefit of farmers and of the community as whole.

DPI country offices south-east Queensland

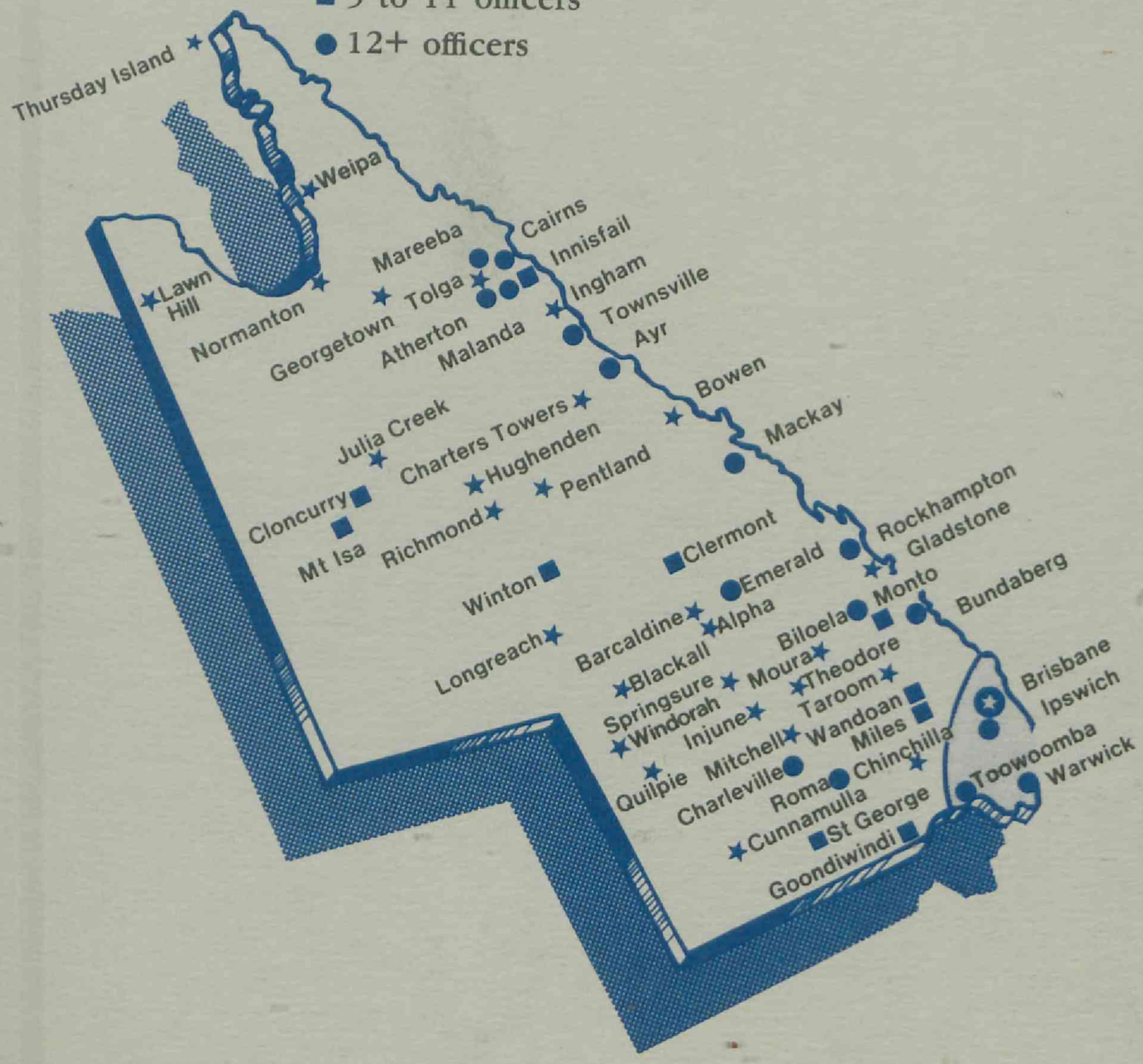
(not including research stations)

- ✶ **1 to 4 officers**
- ■ 5 to 11 officers
- ● 12+ officers

DPI country offices

(not including research stations)

- ✶ 1 to 4 officers
- ■ 5 to 11 officers
- ● 12+ officers



Information services

To complement its research, extension and regulatory functions, the DPI maintains a State-wide information service.

The many facets of this service include:

- the DPI *Annual Report* to Parliament;
- the *Queensland Agricultural Journal*, which is published six times a year, is an important extension vehicle containing comprehensive articles on the practical application of DPI research, and is sold on subscription to commercial and part-time farmers, agribusiness people, students and scientists in Australia and overseas;
- the *Queensland Journal of Agricultural and Animal Sciences*, which is published twice a year and contains scientific papers written mainly by DPI research workers;
- Farm Notes, which are prepared for primary producers to meet their need for timely, practical and concise advice on a single agricultural topic, and which are available on request at DPI offices;
- an extensive range of saleable books, available at major DPI centres and through the DPI Information Centre in Brisbane;
- videos and films that demonstrate farming techniques and outline DPI activities, for showing by extension officers and for loan to rural and farming organisations;
- a weekly news release and special feature service to metropolitan and provincial newspapers and to radio and television stations in Queensland and around Australia;
- a weekly tape of interviews on topical issues with DPI officers and sent to Queensland ABC and commercial radio stations;
- the work of regional information officers in Rockhampton and Toowoomba, who provide professional information support to DPI staff and who publicise DPI activities through local mass media and other outlets;
- displays at the Brisbane Show and major country shows;
- a variety of marketing publications, sent to mass media representatives and other interested people, which include the daily *Fruit and Vegetable Market Report* and the *Fish Market Report*, the weekly *Rural Trend Report*, the monthly *Horticultural Trends and Marketing Newsletter*, the bi-monthly *Agricultural Trends,* and the quarterly *Trends in Animal Industries;* and
- many district extension newsletters sent to primary producers from more than 25 DPI centres throughout the State, covering the dairy, horticulture, pig, poultry, beef, sheep and field-crop industries.

DPI metropolitan centres