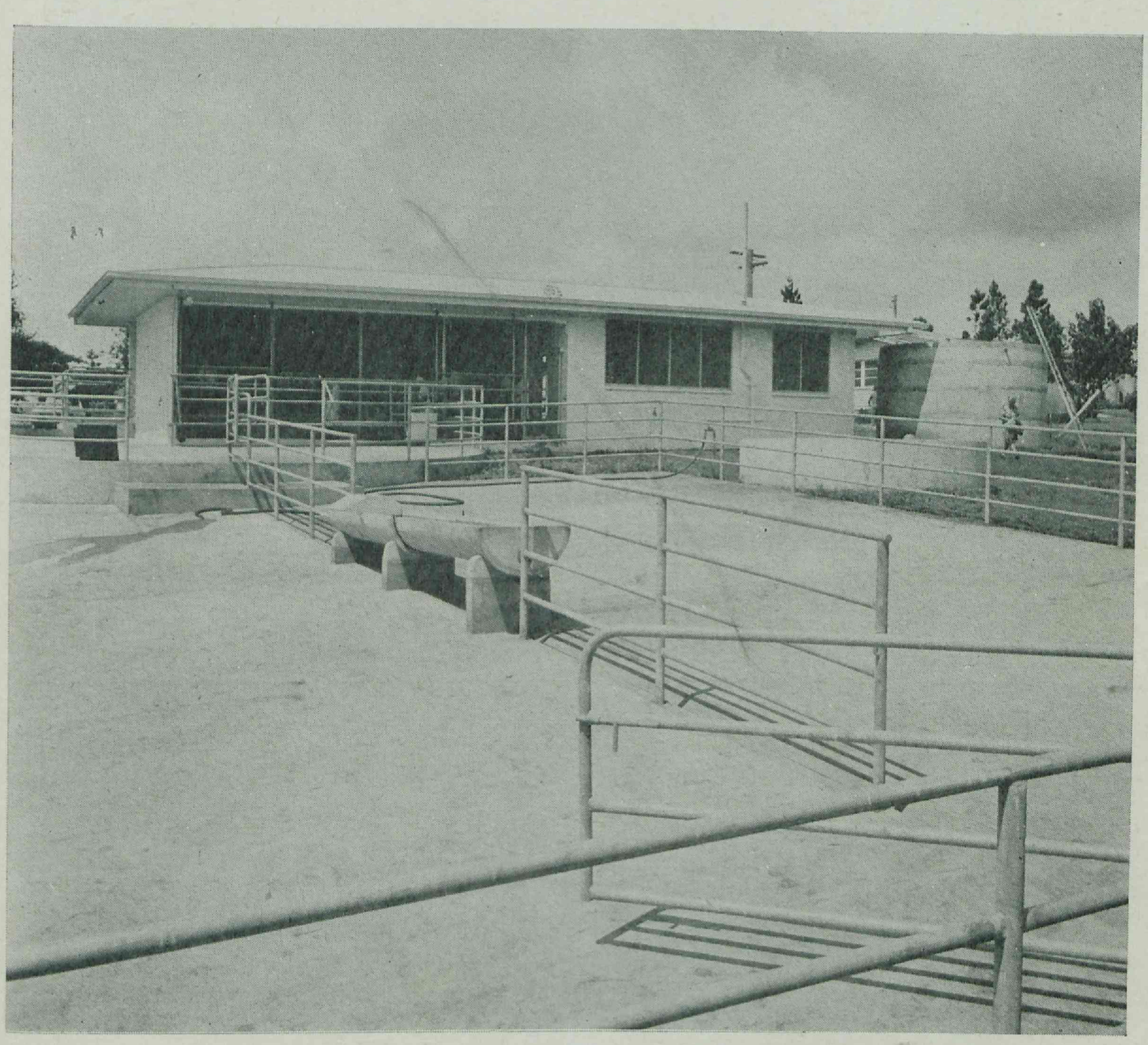
Queensland Department of Primary Industries

ANNUAL REPORT 1969-70



New Dairy Building at Kairi Research Station on the Atherton Tableland

Presented to Parliament by Command

A. 27—1970

Two Angles on Weather Hazards in 1969-70

Many drought-stricken beef cattle in North Queensland were given supplementary feeding blocks to keep them alive.

Widespread late heavy frosts ruined much of the wheat grain crop and extensive areas were cut for hay.

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ORGANISATION OF THE DEPARTMENT AS AT 30th JUNE, 1970

MINISTER FOR PRIMARY INDUSTRIES .. Hon. J. A. Row, M.L.A.

CENTRAL ADMINISTRATION AND CLERICAL AND GENERAL DIVISION—

Director-General and Under Secretary .. J. M. Harvey, D.Sc., F.R.A.C.I.
Deputy Director-General .. .. .. A. A. Ross, M.Agr.Sc.
Chief Advisory Officer (Administration) .. C. L. Harris, A.A.S.A.
Assistant Under Secretary .. .. .. R. V. Riley, B.Com., A.A.U.Q.
Director, Information and Extension Training Branch .. .. C. W. Winders, B.Agr.Sc.
Accountant .. .. H. J. Evans, A.A.U.Q.
Executive Officer, Research Stations Section G. H. Allen, Q.D.A.

DIVISION OF ANIMAL INDUSTRY—

Director of the Division .. .. .. A. L. Clay, B.V.Sc.
Deputy Directors .. .. L. G. Newton, M.V.Sc., J. W. Ryley, B.V.Sc.

Animal Research Institute—

Biochemical Branch—

Biochemist .. .. C. W. R. McCray, B.Sc., A.R.A.C.I.

Husbandry Research Branch—

Director of Husbandry Research .. .. L. Laws, B.V.Sc.

Pathology Branch—

Director .. .. W. T. K. Hall, M.V.Sc.

Beef Cattle Husbandry Branch—

Director of Beef Cattle Husbandry .. B. A. Woolcock, B.V.Sc.

Veterinary Services Branch—

Director of Veterinary Services .. .. K. M. Grant, B.V.Sc.

Sheep and Wool Branch—

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

Slaughtering and Meat Inspection Branch—

Director .. .. B. Parkinson, B.V.Sc.

Sections—

Pig Husbandry (A. Todd, B.Sc., Dip.Agric.Ext., Senior Pig Husbandry Officer); Poultry Husbandry (F. N. J. Milne, B.Sc., Chief Poultry Husbandry Officer).

DIVISION OF DAIRYING—

Director of Dairying .. .. E. B. Rice, Dip.Ind.Chem., M.Inst.Biol.
Deputy Director .. .. G. I. Alexander, B.V.Sc., M.S., Ph.D.

Dairy Cattle Husbandry Branch—

Director of Dairy Cattle Husbandry .. J. G. Young, B.Agr.Sc., Dip.Agric.Ext.

Field Services Branch—

Director of Field Services .. .. .. W. D. Mitchell, B.Agr.Sc., Dip.Agric.Ext.

Research Branch—

Director of Research .. .. V. R. Smythe, M.Agr.Sc.

DIVISION OF LAND UTILISATION—

Director .. .. J. E. Ladewig, B.Agr.Sc.
Assistant Director .. .. A. Hegarty, B.Sc.

Development Planning Branch—

Director .. .. A. Hegarty, B.Sc.

Soil Conservation Branch—

Director .. .. J. Rosser, B.Agr.Sc.

DIVISION OF MARKETING—

Director of Marketing .. .. .. D. P. Lapidge, B.Com., A.A.U.Q.
Assistant Director of Marketing .. .. E. O. Burns, B.Com., F.A.S.A.

Economic Services Branch—

Director of Economic Services .. .. E. O. Burns, B.Com., F.A.S.A.

Marketing Services Branch—

Director of Marketing Services .. .. D. R. Lewis, B.Sc. (Econ.)

Standards Branch—

Director of Agricultural Standards .. .. A. C. Peel, Dip.Ind.Chem., A.R.A.C.I.

DIVISION OF PLANT INDUSTRY—

Director of the Division .. .. .. L. G. Miles, B.Agr.Sc., Ph.D.
Deputy Director .. .. S. Marriott, B.Agr.Sc.

Agriculture Branch—

Director of Agriculture .. .. .. B. L. Oxenham, B.Agr.Sc.

Horticulture Branch—

Director of Horticulture .. .. .. R. C. Cannon, B.Agr.Sc.

Agricultural Chemical Laboratory Branch—

Director .. .. W. J. Cartmill, M.Sc., A.R.A.C.I.

Sections—

Botany (S. L. Everist, B.Sc., Government Botanist); Entomology (W. A. McDougall, D.Sc., Government Entomologist; A. R. Brimblecombe, M.Sc., Ph.D., Deputy Government Entomologist); Plant Pathology (G. S. Purss, M.Agr.Sc., Government Plant Pathologist).

Fisheries Branch—

Chief Inspector of Fisheries .. .. .. G. G. T. Harrison, B.Sc.

Agricultural Bank—

General Manager .. .. F. J. Strutton, A.A.S.A., A.C.I.V.

QUEENSLAND DEPARTMENT OF PRIMARY INDUSTRIES

Annual Report 1969-70

To the Honourable the Minister for Primary Industries,

SIR,

I have the honour to submit the following report on the operations of the Department of Primary Industries for the year ended June 30, 1970.

Yours faithfully,

J. M. HARVEY,
Director-General.

I. General Comments

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

PRODUCTION

Except for some temporary relief during the summer months, drought conditions persisted over about two-thirds of the State. Only the Peninsula and areas adjacent to the Gulf and the east coast have not suffered severely. At the end of June, nearly half of the State was declared drought-stricken, 63 shires being affected.

Though agistment strategy and the adoption of recommended feeding and management practices kept stock losses down, they were nevertheless significant and together with forced sales drastically reduced sheep numbers. Cattle numbers did not decline greatly.

General deficiency of soil moisture seriously interfered with agricultural production. In addition, killing frosts during the spring took heavy toll of maturing crops of winter grains. Summer grains and sugar-cane crops also yielded well below normal expectations.

The effect of rural incomes has been little short of catastrophic. Preliminary estimates indicate that the gross value of rural production fell by some $218 million in 1969–70 compared with 1968–69, a reduction of 27%.

The outlook for 1970–71 is extremely poor.

DROUGHT RELIEF AND ASSISTANCE

The drought conditions which prevailed in most districts for varying periods entailed a great deal of work by the Agricultural Bank in administering various drought relief schemes. This is summarized elsewhere in this report and detailed in the annual report of the General Manager to Parliament.

Departmental field officers were deeply involved not only in the formalities of the delineation of drought-stricken areas, but also in advising primary producers on drought alleviation measures on properties.

These calving cows came through the drought well because they were given full hand feeding at the right time.

The major activity of cattle husbandry and sheep husbandry advisers during the year was in servicing a strong demand from the beef, dairying and wool industries for assistance with drought mitigation. A special handbook on drought feeding of beef cattle was widely distributed and was welcomed by producers. Departmental recommendations on drought management and feeding were well received and have played a major part in minimizing drought losses.

LAND-USE STUDIES

Most of the land-use studies in which the Department is concerned are particularly relevant to mitigation of the effects of drought on the crop and livestock industries.

Two extremes are represented—the arid western country which has to be protected from degradation due to misuse, and land commanded by potential water storages which can be used to overcome the hazard of moisture deficiencies for crops, pastures and livestock.

In the Western Arid Zone Project, progress has been made in a land-use assessment of 37 sample properties and in making estimates of productivity under drought and non-drought conditions. Aerial photo interpretation covering part of the 115 million acres in the zone is proceeding.

In one of the better watered parts of the State, the South Coast, a land-use project has shown that of some 165,000 acres included in rural holdings, nearly half is under introduced or improved native pasture. Over 17,000 acres have been established to introduced pasture in recent years.

Irrigation projects in which land-use studies are under way or were concluded during the year were the Dumaresq Valley Irrigation Project, providing for the stabilisation of production between Pike Creek and Goondiwindi; the Eton (Mackay) Area Project for sugar-cane irrigation; and the Urannah Dam (Broken River) proposal for increasing irrigation water availability on the Lower Burdekin.

A detailed land capability/land use investigation under way in the Isis district also has a drought mitigation aspect, since drought has been a contributing agency in the reduced profitability of sugar-cane growing in the area.

AGRICULTURAL BANK

Administration of various drought relief schemes providing assistance for producers in affected areas figured largely in the Agricultural Bank's activities during the year.

The Schemes initiated by the Government in March 1969 were extended in regard to the amount of loans and expanded to include canegrowers and to provide special advances for other crop growers. In May 1970 additional assistance, by way of a non-repayable grant, was approved to all primary producers, in specified Shires, to meet payment of one-half of the 1970 local authority rates assessment.

Advance approvals in the normal course of the Bank's business have shown a substantial increase over the 1968–69 figure, although the decline previously noted in the number of applications submitted has continued. This, doubtless, is attributable to conditions in drought areas and the reluctance of producers to incur further liability for development. Depressed values would also restrict movement in property sales.

The rate of interest on the Bank's normal advances was increased to 6½% on November 3, 1969, but application of the increased rate has been deferred in those cases where the property is drought-stricken.

Total approvals under all Acts administered amounted to $25,238,900.

ORGANIZATIONAL CHANGES

A major reconstruction of the Division of Dairying was made during the year to strengthen and integrate Departmental extension and research services to the farming and manufacturing segments of the dairying industry.

A Dairy Cattle Husbandry Branch with Mr. J. G. Young as Director was added to the Field Services and Dairy Research Branches which had constituted the Division since its inception in 1945.

The new Branch is concerned with dairy cattle nutrition, breeding and management, facets which previously were handled by the Cattle Husbandry Branch of the Division of Animal Industry. That Division retains beef cattle husbandry responsibilities in a Beef Cattle Husbandry Branch, with Mr. B. A. Woolcock as Director.

To facilitate the co-ordination of the herd recording and dairy cattle artificial breeding services of the Department, the Artificial Insemination Centre at Wacol, formerly within the Division of Animal Industry, and the Herd Recording Section of the Field Services Branch were transferred to the Dairy Cattle Husbandry Branch.

The Field Services Branch is to be more strongly orientated to extension projects on dairy cattle husbandry.

A Deputy Director (Dr. G. I. Alexander) was appointed to the Division on its expansion.

Extension of the responsibilities of the Division of Soil Conservation and Development Planning, established in 1965, led to a change of name of the Division to Division of Land Utilisation. This acknowledges the importance of examining in depth the land utilization projects in developed areas as well as performing the established functions of investigating, reporting and co-ordinating development requirements in State development projects and providing research, extension and technical facilities for soil conservation.

Reorganization of the component branches of the Division has been undertaken. Sections of Livestock Resources Development and Agricultural Resources Development have been established in Development Planning Branch and Sections of Research and Field Services in Soil Conservation Branch.

The Pig Testing Unit previously operated by Pig Section was transferred to Husbandry Research Branch, thus bringing all the facilities at Rocklea Animal Husbandry Farm under single control.

In view of the widening activities of Information and Extension Training Branch in training and servicing extension officers, an Assistant Director (Mr. J. L. Groom) was appointed.

BUILDINGS AND EQUIPMENT

A building to house Departmental officers in Rockhampton was opened during the year and a new Gympie office was well advanced.

A new administration and laboratory block was opened at Redlands Horticultural Research Station.

The Southedge Tobacco Research Station became functional during the year, taking over tobacco research previously conducted at the Parada Station.

A modern Plant Pathology Laboratory at Indooroopilly is well advanced and work at the same centre on a new laboratory for Agricultural Chemical Laboratory Branch has begun. The seed testing section of Standards Branch took up occupancy of stage I of the Standards Branch building at Indooroopilly.

A laboratory/office block was completed at Toorak Sheep Field Research Station. At Charleville, a laboratory/office block for sheep research is nearing completion.

A "wet" laboratory for the study of crown-of-thorns starfish is under construction at Mourilyan Harbour.

Illustrative of new equipment provided for various laborities and research stations are a preparative gas chromatograph for analytical procedures, a microcoulometric detection system for pesticide residue analyses, and a data processing unit associated with an auto-analyser.

ADDITIONAL FINANCIAL SUPPORT

The Commonwealth Extension Services Grant was once again of tremendous assistance to the Department in conducting extension activities and applied research.

The Grant covers salaries of many technical officers and provides for their transport and equipment. It permits the purchase of machinery and materials for research projects and extension needs. It finances the construction of glasshouses and other minor research buildings. Portion of the cost of dairy herd recording is borne by the Grant. It has also greatly improved in-service training of extension and scientific officers and covered the travel costs of overseas study by a number of officers.

The initial 5-year period of the Grant expires in 1971. The Commonwealth Government has intimated that the Grant will be continued, but the scale and scope have yet to be decided.

The projects on which this Department has used its share of the Grant have yielded worthwhile results and a strong case for support at the existing level can be made.

Other substantial grants for extension and/or research were made from various Commonwealth/industry funds. Wheat, tobacco, dairying, beef cattle and wool were the industries attracting most financial support.

Industry organizations continued to support various projects, while commercial bodies also made useful contributions of funds and materials.

STAFF RETIREMENTS

Several officers retired from the Department during the year under age-retirement provisons.

The oldest in service was Mr. S. E. Pegg, Chief Adviser (Herd Recording), who after 19 years as a Dairy Adviser assumed control of the Department's herd recording service in 1948.

Mr. C. P. Joyner, District Inspector of Stock at Toowoomba, had served as a stock inspector in many parts of the State.

Mr. R. B. Young joined the Department after managerial experience in the wool industry and completed his service as District Adviser in Sheep and Wool at Head Office after a long period at country centres.

Mr. E. V. Mann, Dairy Officer, was stationed at Gatton on his retirement but had seen service in several dairying districts.

Mr. R. A. H. McIntosh, an Assistant at the Animal Research Institute, and Mr. E. W. Eldred, a clerk at Head Office, also retired.

Mr. V. J. Brimblecombe (District Adviser in Dairying) and Mr. F. H. D. Marshall (Technical Administrative Officer, Division of Animal Industry), both of whom had given lengthy service, resigned to go into retirement.

STAFF TRAINING

Extensive training of professional and technical staff was effected during the year. Apart from the overseas study tours listed elsewhere, visits were paid by numerous officers to other States to attend courses, to undertake advanced training, to attend conferences, or to examine methods. The branches represented on interstate visits were Agriculture, Horticulture, Plant Pathology, Entomology, Pathology, Biochemical, Veterinary Services, Sheep and Wool, Beef Cattle Husbandry, Husbandry Research, Pigs, Poultry, Dairy Cattle Husbandry, Dairy Field Services, Economic Services, Development Planning, Soil Conservation, and Information and Extension Training. Thus practically every technical branch benefited from the programme of interstate visits.

Numerous technical conferences and subject-matter schools for officers were held within the State, the branches concerned being Agriculture, Horticulture, Pathology, Veterinary Services, Beef Cattle Husbandry, Sheep and Wool, Pigs, Dairy Cattle Husbandry, Dairy Field Services, Economic Services, Development Planning and Soil Conservation.

Two extension methods and one farm management training schools were held, each catering for some 32 officers.

Short induction courses were held for most new technical officers.

Scholarships were granted to a number of students to undertake or continue courses at the University of Queensland or the Queensland Agricultural College. The courses concerned are Agricultural Science, Science, Veterinary Science, Engineering and Agricultural Economics at University level and Poultry Technology and Rural Technology at College of Advanced Education level. Two officers undertook the post-graduate diploma course in Agricultural Extension at the University of Queensland in 1969 and a further two enrolled in 1970.

Several officers are undertaking post-graduate training at overseas centres.

OVERSEAS VISITS

Several Departmental officers undertook overseas study tours or study courses during the year, in most cases with financial support from the Commonwealth Government or other sources.

The Deputy Director-General (Mr. A. A. Ross), in company with senior representatives of other State agriculture departments and the Commonwealth Department of Primary Industry, examined extension organization and administration in South Africa, Europe, the United States and Canada.

Mr. F. W. Berrill (Assistant Director of Horticulture (Extension)), attended the 18th International Horticultural Congress in Israel and studied aspects of horticulture in several countries.

Mr. T. Passlow (Senior Entomologist) examined research and extension in pest control in summer crops in the U.S.A., Africa and India.

Mr. R. R. Staples (Research Plant Breeder) made a pasture plant collection trip in Africa, India, Ceylon and the U.S.A.

Mr. C. W. R. McCray (Biochemist) attended the F.A.O. Symposium on Resistance of Agricultural Pests to Pesticides, held in Rome.

Mr. O. H. Brooks (Assistant Director of Veterinary Services) attended a special school on exotic diseases in New Zealand.

Mr. A. C. E. Todd (Senior Pig Husbandry Officer) toured New Zealand pig-raising areas.

Mr. W. D. Mitchell (Director of Dairy Field Services) studied mastitis control methods and the problem of insecticide residues in New Zealand.

Mr. C. H. Clark (Research Dairy Technologist) studied the operation of herd recording schemes in New Zealand.

Mr. G. W. Swartz (Senior Soil Conservationist) examined stubble mulching methods and machinery in the U.S.A.

Mr. R. Rees (Plant Pathologist at the Queensland Wheat Research Institute) went to South Africa, Europe and North America to study aspects of wheat rust infection and control.

Mr. N. H. Hall (Technical Administration Officer) attended an F.A.O. Seminar in the Philippines on fruit and vegetable marketing.

Mr. T. M. Grimes (Veterinary Officer) examined the poultry disease situation in Great Britain.

Mr. T. Beckmann (Chief Chemist) while overseas on a private visit, attended a meeting of the Collaborative International Pesticides Analytical Committee, held in Belgium.

Mr. G. T. T. Harrison (Chief Inspector of Fisheries) visited Guam at the request of the U.S. authorities for consultation on the planned investigations by a U.S. Scientific team into the crown-of-thorns starfish in the American Pacific Area. He also visited Japan.

STOCK DISEASE ERADICATION

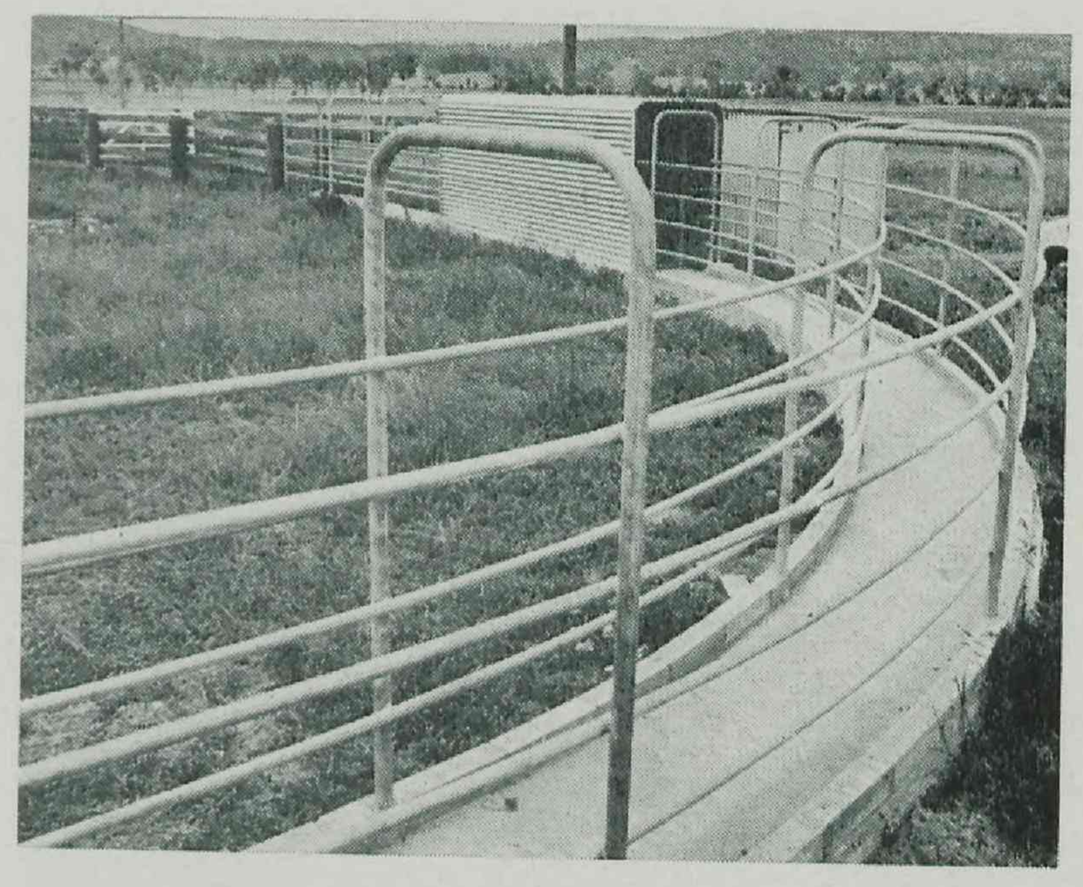
Outstanding success of the national scheme for eradicating contageous pleuropneumonia from Australia can be reported. No field outbreak has occurred in Queensland since 1960 and there has been no confirmed evidence of the disease since 1967. The stage has now been reached at which all quarantine areas have been abolished and only 25 properties have to complete the required vaccination programme. Export meatworks will be monitored over a period of years to detect any residual lesions of the disease.

In anticipation of the inauguration of a national scheme for the eradication of tuberculosis and brucellosis in cattle, four areas in Queensland have been declared protected and the requirements for testing and vaccinating cattle within these areas and cattle to be taken into them have been determined.

The protected areas on which a start has been made are those in which substantial eradication of tuberculosis in dairy cattle has already been achieved.

The eradication of cattle tick from Australia has never appeared to be achievable within a reasonable time and the appearance a few years ago of strains of ticks resistant to the common tickicides postponed further the idea of eradication. The advent of Dursban and subsequently of other tickicides as satisfactory controls for resistant ticks retrieved the position to some extent. However, the discovery of a strain of ticks resistant to Dursban in November 1969 was a setback to control measures, even though alternative insecticides are available.

As a safeguard against the transfer of ticks into New South Wales on birds or in other ways, a voluntary programme of treatment with Dursban was undertaken on 48 properties. This was successful in freeing the cattle from ticks on 41 properties and it is hoped to eliminate infestations on the remaining seven.



This neat set of yards and spray plant for treating cattle for ticks is indicative of the greater care being taken in tick control by stockowners.

POISONOUS PLANTS COMMITTEE

Poisonous plants have always been a source of serious loss in the livestock industries. A great deal is known about the identity and properties of many such plants through observation and research. In fact, some of the Department's most valuable work has been in the field of identification of the toxic substances in various plants.

Despite the accumulated knowledge, there is still a good deal of confusion and ignorance of some aspects of plant poisoning.

During the year, a Poisonous Plants Committee was formed with Departmental and University representation, to bring together regularly scientists engaged in work on plants in Queensland poisonous to livestock.

This Committee's main aims will be to collect, collate and review information, to suggest fields and priorities for research, to assess the economic significance of various poisonous plants, and to suggest ways of minimizing stock losses.

FRUIT PROCESSING FACILITIES

A Departmental investigation committee which examined the feasibility of establishing a fruit processing plant on the Granite Belt reported in 1966 that production potential was such that additional processing facilities could well be warranted by 1970.

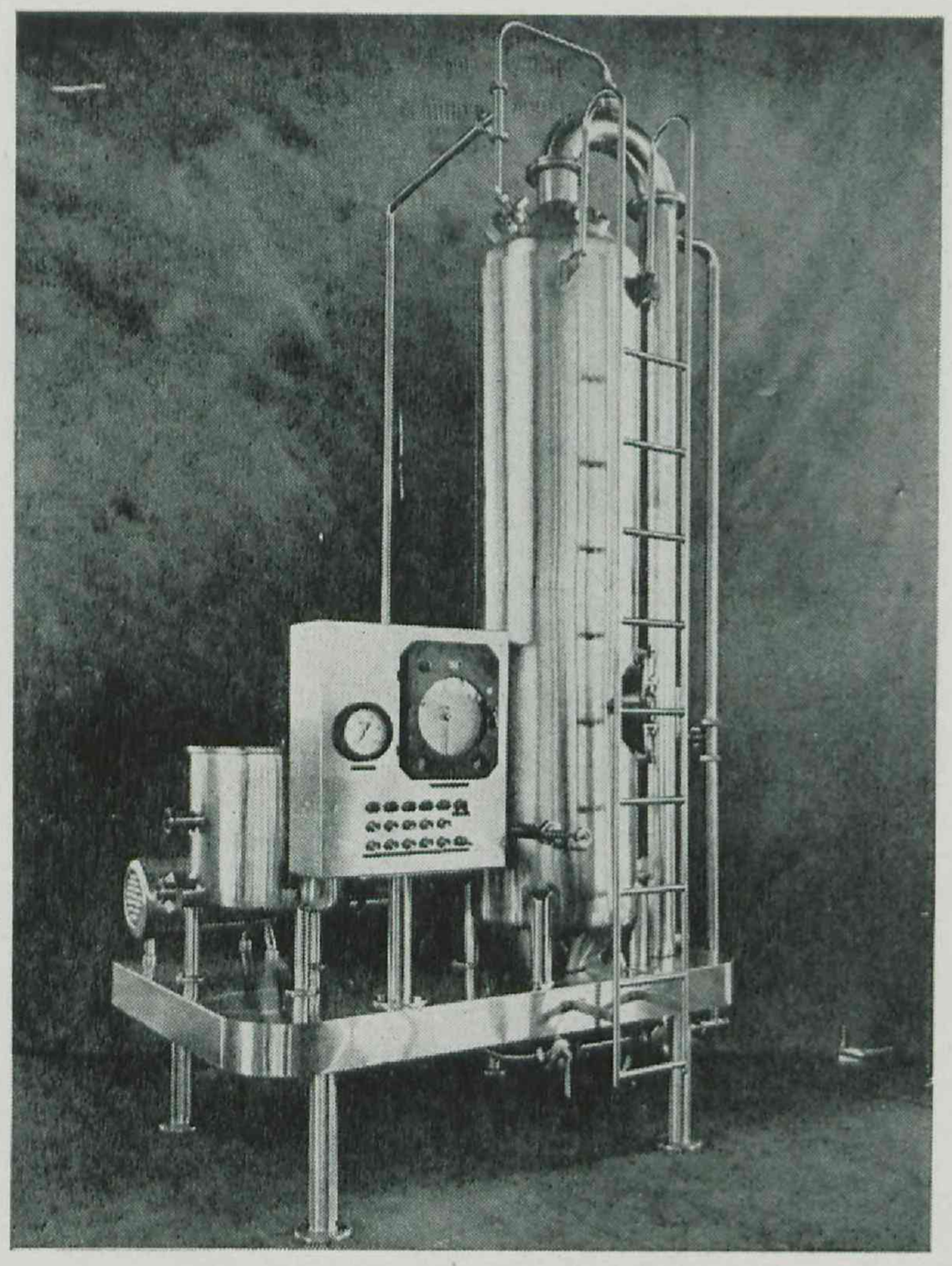
The matter is now being re-examined as a joint investigation by this Department and the Department of Industrial Development, with some financial assistance from the Committee of Direction of Fruit Marketing. A detailed assessment is being made of the type and size of undertaking best suited to the district's needs and the relevant processing and marketing costs.

During the year, a similar inter-departmental committee examined the feasibility of establishing a tropical fruit cannery in the Yeppoon district. The conclusion reached was that such a cannery had little chance of operating profitably under prevailing economic conditions.

To assess the market potential for canned and frozen mango slices, the Department of Industrial Development in association with this Department conducted a consumer market survey on products prepared under simulated commercial conditions at the Sandy Trout Food Preservation Research Laboratory. Results were encouraging. Because the preferred processing variety, Kensington, has a short harvesting period, cool storage to spread factory production has been investigated, with promising preliminary results.

DAIRY PRODUCTS

A new method of cream pasteurization using an ultra-high temperature cream pasteurizer is meeting with widespread adoption throughout the industry in Australia. During the year the first commercial machine in Queensland was installed at the Malanda factory in North Queensland and is being used coupled with a continuous buttermaker. Three dairy engineering firms will be manufacturing this pasteurizer under licence from the Australian Dairy Produce Board, and orders have been placed for six plants with capacities varying from 800 to 5,000 gallons of cream per hour.



A. U.H.T. cream processing plant constructed by a Queensland company for a N.S.W. butter factory.

An important step forward was taken by the dairy industry in Queensland in marketing "Softa" butter. This butter has been produced by modifications in cream processing at factories and has resulted from investigational work carried out in the Dairy Research Branch in collaboration with the Gilbert Chandler Institute of Dairy Technology in Victoria. "Softa" butter is a trade name given by the Queensland Butter Marketing Board to butter with enhanced spreadability characteristics demanded by some segments of the trade.

DAIRY INDUSTRY CHANGES

For the second year in succession, Queensland did not have an exportable surplus of butter and in fact had to import butter from southern States. It seems clear that the time is approaching when Queensland will cease to be a butter exporter and will use all butterfat produced for local consumption as butter or for conversion into butteroil.

Some radical adjustment to the structure of the butter industry may be called for. Steps are being taken to examine the possibility of diverting fresh separated cream from butter factories in the south-east to a centrally situated butter plant in Brisbane. One benefit would appear to be a reduction in the cost of manufacture. Another would be improved butter quality resulting from the supply of fresh cream following separation at the country factories.

AT THE CROSSROADS

With world over-production of wheat resulting in restrictions on production throughout Australia, Queensland wheat growers are looking towards alternative and supplementary enterprises. It is important that Departmental research and extension activities be re-orientated to cater for future needs.

To this end, a meeting of executives of the Queensland Grain Growers' Association and representatives of Plant Industry and Marketing Divisions of the Department was held to consider likely market trends in pertinent field crops and associated animal products. The information provided, together with consideration of regional production potential, has enabled useful decisions to be made on the immediate future of the grain and oilseeds research and extension programmes.

OPERATION DAIRY PUMP

A programme aimed at defining the most important factors influencing dairy pasture utilization, and deciding how the pastures should be managed, was commenced during the year.

Called "Operation Dairy PUMP" (Pasture Utilization and Management Programme), the programme will run for 10 years, during which 1,600 pastures will be sampled regularly to determine whether they are improving, being maintained or deteriorating under the management methods employed.

Forty district officers will participate in the Scheme and C.S.I.R.O. Division of Tropical Pastures will collaborate in the programme.

PASTURE SEED PRODUCTION

Large areas of improved pastures are being sown each year in Queensland and consequently there is a growing local demand for seed of tropical pasture plants. There is also an expanding market in South America for tropical pasture legume seeds.

Unlike grain crops, pasture plants are selected for forage and not seed production. As a result, many of these plants are either shy seeders or present grave difficulties in mechanical harvesting.

A research unit headed by a senior agrostologist has been set up on the Atherton Tableland to investigate the physiological problems associated with tropical pasture seed production. It is anticipated that the information flowing from this research programme will be useful in two ways. A better understanding of the factors governing seeding in these plants will help the pasture plant breeder in his work. Also, the practical agronomists may be able to adapt production methods or suggest districts best suited to the growing of seed crops.

GRASSLAND CONGRESS

Departmental staff played a major role in local organization of the XI International Grassland Congress, held at Surfers Paradise, and of various field tours which took place before, during and after the Congress.

This was the first time that the Congress had been held in Australia. Some 750 overseas and Australian delegates attended. The Congress provided an opportunity for leading overseas pasture research workers to inspect and discuss Queensland investigations. Departmental staff gained considerable benefit from these discussions and were able also to give valuable information to workers in other subtropical and tropical areas.

OVERSEAS AID

At the request of the Department of External Affairs, Mr. W. T. K. Hall (Director of Pathology) visited South Korea to advise on the control of tick fever of cattle in that country.

Dr. B. Grof (Senior Agrostologist) undertook an F.A.O. mission to advise on the setting up of a pasture research institute in India.

Training in many aspects of technology was provided for numerous overseas scientists and technologists, most of whom were sponsored by various training schemes of the Department of External Affairs.

An International Training Course in Marketing of Agricultural Products was conducted by the Division of Marketing on behalf of the Department of External Affairs. The course extended over 5 weeks and was attended by 23 marketing representatives from 15 African and Asian countries.

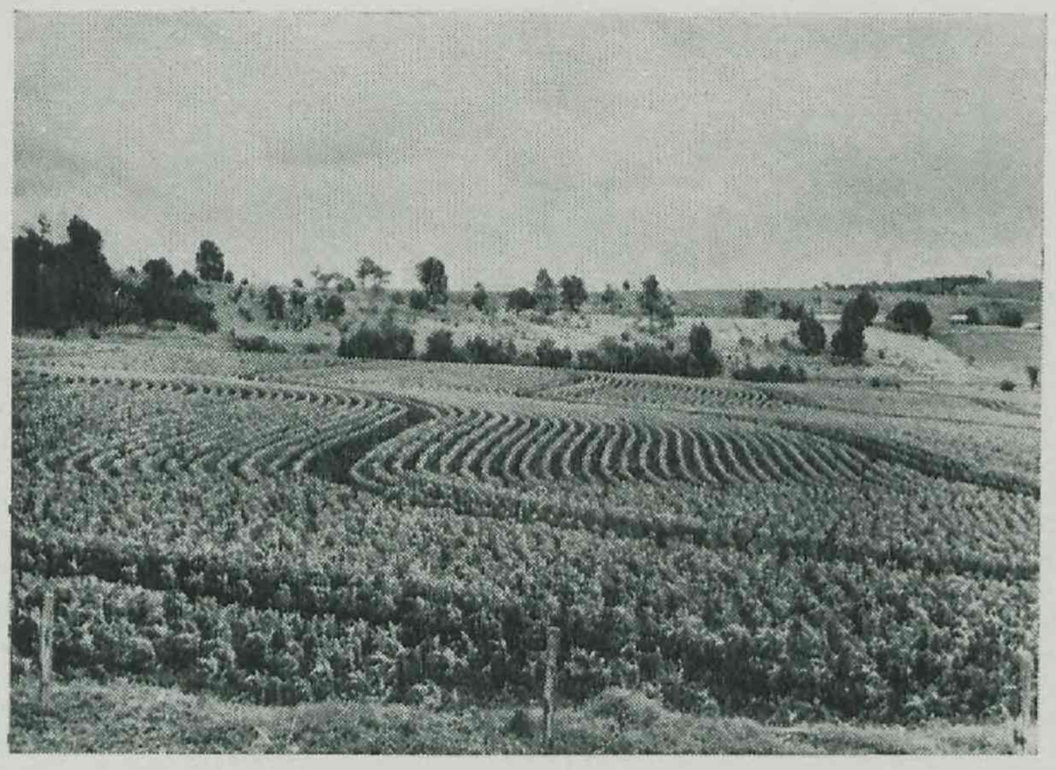
Departmental officers also participated in an International Training Course in Agricultural Extension, which was attended by 20 African and Asian extension workers.

SOIL CONSERVATION

The passing during the year of the 1 million acre mark in contour farming is a milestone in the history of soil conservation in Queensland. However, it gives no room for complacency. The total area of existing cultivation requiring contour farming is estimated to be 4,057,000 acres. Therefore there are still 3 million acres of existing cultivation which have yet to be farmed on the contour.

It has taken just over two decades to get contour farming established on 1 million acres of cultivation. Therefore, if erosion control is to be achieved on all existing cultivation by the end of this century, the rate of adoption of contour farming over the next three decades must, on the average, be four times as great as it was, on the average, in the last two decades.

A comforting thought is that all existing cultivation could be treated within the next two decades if the present rate of adoption of contour farming was maintained. However, should the present annual increase in sloping cultivation area of 0·2 million acres continue, the objective of treating all present and potential cultivation by the end of this century require an annual treatment rate of 0·3 million acres, or twice the present annual treatment rate.



There is a great need for the wider adoption of contour farming to conserve our soils.

Once again it is disappointing to have to record that there has been no general upward trend in the number of requests for advice and assistance in soil conservation. The 1969–70 figure of 3,524 requests compared with 3,503 in 1968–69 and 3,621 in 1967–68. Undoubtedly there would have been more requests had seasonal conditions been better and the financial situation of producers less difficult.

There are approximately 30,000 rural holdings in Queensland with areas between 100 and 10,000 acres. Assuming that three-quarters of these holdings require contour farming and allowing for 7,000 present co-operators, there are still approximately 15,000 holdings which have yet to start treatment programmes.

Assuming also that the complete implementation of a soil conservation programme requires 10 years, then to achieve the objective of controlling erosion on the State's agricultural lands by the end of the century, the co-operation level, at present lower than 600, must be raised to at least 770 new co-operators each year for the next two decades.

Stubble mulching is probably the most important single soil conservation measure and special efforts to gain wider acceptance of stubble retention and stubble mulching were made during the year. At the suggestion of the Council of Agriculture, arrangements were made for a joint team comprising a landholder and a technical officer to visit the U.S.A. to examine stubble retention procedures and machinery in that country. In parallel, machinery firms have made some of this machinery available for testing under Queensland conditions. Initial results are promising and much interest has been stimulated, particularly among the farmers who have been involved in the trials.

RESTRAINTS ON PESTICIDES

The Department has continued its steps to abate the problems attendant on the undesirable use of pesticides in the crop and livestock industries.

Some of these steps have been prompted by the fact that authorities in many countries which import primary products from Australia have limited the amount of pesticide permitted as a residue in or on such products.

Prohibition of the use of DDT for tick control on cattle was one such measure. Another, more recent, was the prohibition of the use for stock foods, or for sale for feeding to stock, of grain treated with certain chemicals.

The Department's research and extension staffs are required to keep two points firmly in mind. One is that alternatives to the more toxic or persistent pesticides should be sought and recommended. The other is that both unnecessary and excessive use of chemicals in pest control must be discouraged.

An active research programme is aimed at screening out pesticides which are likely to create problems of toxicity to operators and to consumers of primary products. Even where no direct threat to the health of humans is involved, pesticides which persist in primary products to the detriment of trade must be phased out as alternatives become available.

Chemists in various Departmental laboratories keep a running check on the incidence of residues in various products. As reported elsewhere in this report, feeding trials are also conducted with animal feedstuffs.

TOWARDS BETTER EXTENSION

Important steps were taken during the year towards further improving the field operation of Departmental extension services for primary producers.

An Extension Planning Committee was set up under the chairmanship of the Deputy Director-General (Mr. A. A. Ross), and representatives of the informal district co-ordinated extension groups of Departmental officers were brought together to discuss various aspects of extension organization and operation with the Planning Committee. Guidelines based on these discussions were prepared for consideration by the Committee.

Mr. Ross subsequently examined extension matters in a number of countries and in the light of his observations the guidelines will be examined further.

In the meantime, there has been considerable activity at the field level in improving the efficiency of operation, and some district groups have made much progress.

The Maranoa and Western Downs Service completed a regional survey and collection of data and launched the Department's first regionally co-ordinated extension programme. This is based on better stock feeding through fodder conservation and its initiation was preceded by 11 meetings of primary producers.

A Near North Coast Service was established and programmes have been initiated.

In the Mareeba district, the inter-organizational tobacco extension advisory committee continued to operate to the benefit of tobacco growers.

Activity at numerous other centres has resulted in the formation of regional development committees composed of primary producers and Departmental officers and of farmer study groups of various types.

An outstanding example of inter-branch co-operation in extension at the field level is the assistance provided by various branches to the Cattle Husbandry Branches in passing on advice on drought management and feeding when a maximum effort was called for.

There is apparent a rapidly developing desire on the part of dairymen to participate in more formal extension exercises than formerly. At these exercises a local problem identification and solution approach is being sought. The groups are small and comprise farmers having similarity of farming system. They are thus able to discuss in detail modifications to technology at more fundamental and operational levels than is possible between groups of people having dissimilar farming systems. There have already been a number of exercises of this type in the south-east area and more are in prospect.

As usual, Departmental officers participated in many field days and producers' schools. The "Queensland Agricultural Journal" continues to circulate widely among primary producers. A large volume of advisory literature was prepared by Information and Extension Training Branch.

FAUNA CONSERVATION

Since 1967 a Departmental zoological research and field team has been intensively sampling kangaroo populations in Queensland.

As a result of this continuing survey, it was indicated last year that a further degree of restraint on operators within the skin and carcass trade was necessary in the interest of prudent conservation.

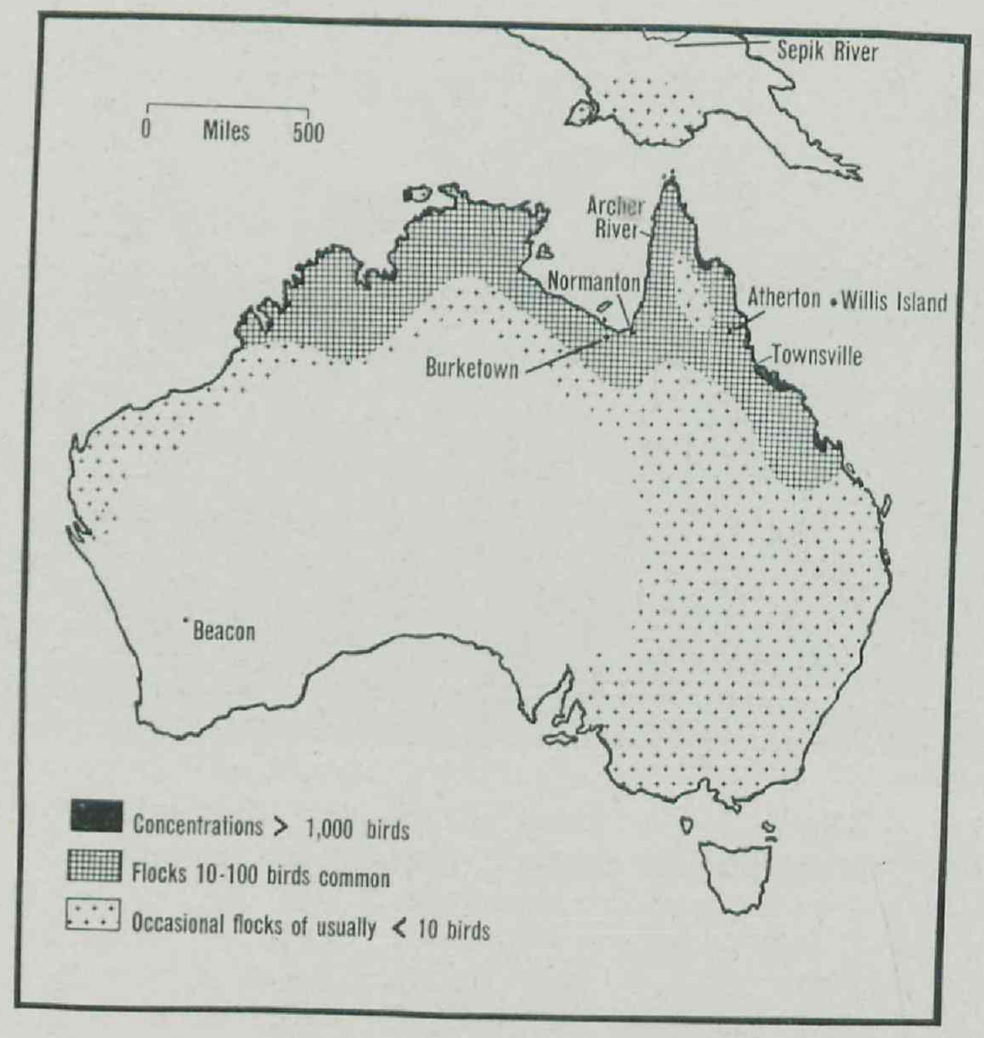
This was due partly to the transfer of some operations from New South Wales, following the imposition of restrictions in that State, which threatened undue development of the trade in Queensland.

The Queensland restrictions fixed the total number of premises permitted to be registered at the figure operating at the end of 1968. Premises now cannot be established on a new site without prior registration, but transfer of site is permitted provided the new site is at least 50 miles from existing premises.

In addition to the limitation of chiller capacity, an increase in royalty from 5 cents to 20 cents per head has tended to reduce the take of kangaroos.

Further attention has been given to other fauna conservation matters, particularly studies of native birds. The accompanying map showing the distribution of brolgas indicates that these birds have a fairly high concentration in Queensland. Protection by legislation, and the increasing construction of water impoundments, have caused a build-up of numbers in more remote areas.

A typical nesting site and nest of brolga eggs at a water conservation impoundment near Townsville.



Present distribution of the brolga.

BARRIER REEF DAMAGE

As reported in the last annual report, the problem of crown-of-thorns starfish damage to coral reefs was considered by the Fisheries Branch to be serious, but assessment was hampered by lack of biological knowledge of the starfish and comparative data on its incidence.

The Chief Inspector of Fisheries visited Guam and Japan on matters connected with the starfish.

Following consultations between the Prime Minister and the Queensland Premier, a committee of inquiry into the infestation of coral reefs by crown-of-thorns starfish was set up. The committee's hearings are in progress.

The erection of "wet" laboratory facilities at Mourilyan Harbour has since been approved by the Government and equipment is being assembled.

II. Livestock Research and Extension

The livestock industries (beef cattle, sheep, pigs and poultry) are given particular service by special branches and generalized services by a number of others.

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

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

The Pig and Poultry Sections are concerned mainly with extension in their respective industries but also undertake field experimentation and certain disease services.

The constituent Branches of the Animal Research Institute provide research and diagnostic services for all branches of animal industry at various centres and conduct the pig and poultry testing sections. The Veterinary Services Branch has a major responsibility for the health of livestock.

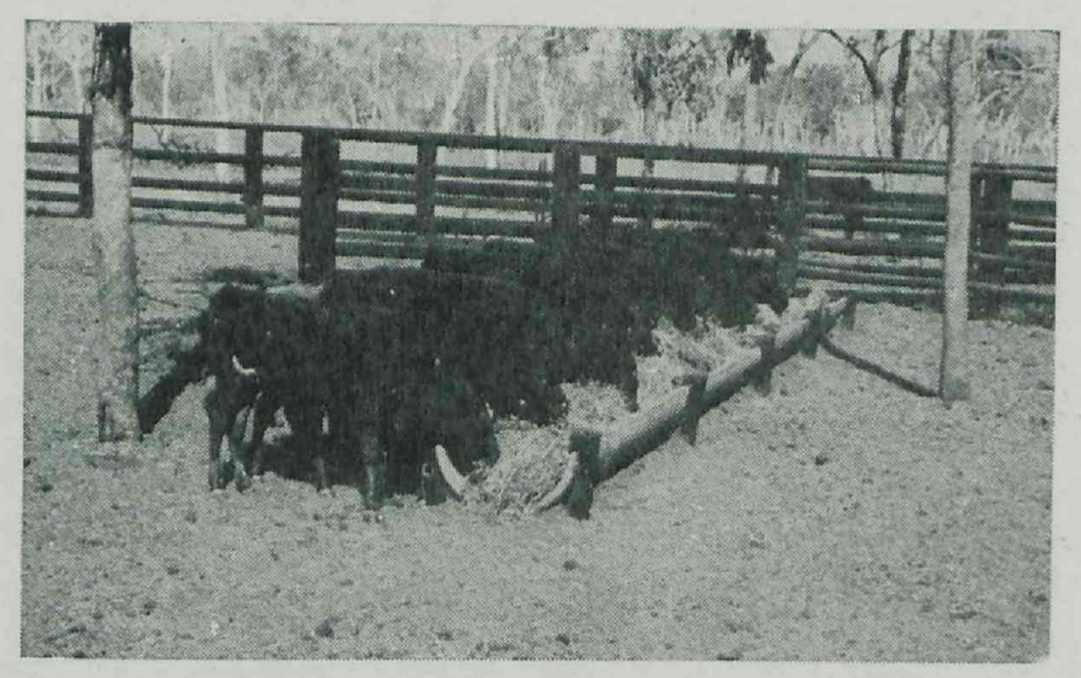
The Slaughtering and Meat Inspection Branch is concerned with hygiene in the processing of meat and meat products and with classification and grading of carcasses.

Various Branches of the Divisions of Dairying, Marketing and Plant Industry provide certain services related to animal production. Services to beekeepers are provided by the Division of Plant Industry.

BEEF CATTLE

Breeding Herd Trials and Surveys

Surveys and trials involving reproduction in beef herds were continued by the Beef Cattle Husbandry Branch in many parts of the State. It was encouraging that in herds adopting recommended procedures, particularly strategic weaning, with a degree of supplementation in the drought conditions, good fertility was maintained. It now seems quite obvious that management practices can lift herd fertility under normal grazing conditions in many areas of the State.



Strategic weaning of calves has been particularly valuable in reducing the mortality of breeding cows during drought.

Pregnancy diagnosis during the breeding season with differential treatment of groups segregated according to age, condition and pregnancy status proved effective in raising calving rates in a herd in the Brisbane Valley.

In trials at Charters Towers, positive responses in fertility have been obtained to urea and phosphate supplements. Increased conceptions, less anoestrus, earlier conceptions and better body condition were seen in supplemented animals.

Reproductive performance in several Brahman herds under good management has proved quite satisfactory. In one Central Queensland herd, pregnancy rates have approached 90% over a period of years. A Hereford herd in this area, using pregnancy diagnosis as a management aid, has also achieved a 90% pregnancy rate over a considerable period.

In south-western Queensland satisfactory breeding performance has been observed in Africander, Santa Gertrudis and Hereford cattle. Fertility in this environment appears to be reasonably high, though subject to fluctuations associated with dry seasons.

In a comparison between Brahman cross and Hereford cattle grazing improved pasture on brigalow country in Central Queensland, the Brahmans averaged 1·22 lb. a day for 481 days, while, in the same period, the average daily gain in Herefords was 1·18 lb. Over a period of 6 years, liveweight gains of 414 lb. per head and 51 lb. per acre per annum have been recorded from an area consisting of two-thirds improved pasture and one-third rough forest country.

Trials involving breeding performance on irrigated pangola grass are in progress at Parada and Millaroo Research Stations. Breeding performance on nitrogen fertilised pangola grass pastures is also the subject of investigation at Coolum Research Station. Reports of dystocia in breeders grazing pangola grass have been received from a number of commercial properties, and the Coolum investigations are aimed at evaluation of this problem and extermination of possible causes.

The time-of-calving trials which have been continued for a number of years at "Brian Pastures" Pasture Research Station were completed. They provided evidence that, in this environment, an early mating, from October to December, induces high fertility, and calves reach higher weaning weight than do those mated from January to June. Foetal losses in this group have also been smaller than in other groups, so a higher calving rate has been reached. These cows also withstood drought conditions well, and the advantages of this breeding system are so obvious that it has now been adopted as normal station procedure.

A supplementary feeding modification which aims at a winter calving is now being investigated, with a view to making maximum use of the pasture growing season as a preliminary step in reducing age of turn-off.

Early investigations had demonstrated the improved performance of calves born in August over those born in October and January. A further comparison has now been made between calves born in August and weaned at either 6 or 8 months of age. The weight advantage of the animals weaned at 8 months persisted to nearly 2 years of age (weight at weaning 314 lb. v. 389 lb.). At 18 months the comparative weights were 466 lb. and 503 lb. Calves weaned at 8 months were superior to those weaned at 6 months, when compared at 10½ months, irrespective of post-weaning treatment. Weaning onto crop gave superior results to all other treatments.

Breeding herd studies at Brigalow Research Station have shown that the performance of calves born during the July to December period is far superior to that of calves born after December. At weaning, early calves born between July and September were 30% heavier than late calves born from January to March. Work at this station has now been extended to include observations on the causes of difficult calving in heifers, which is a considerable problem in a number of areas, particularly on higher fertility soils, such as those of the brigalow country.

An interesting observation on the effect of nutrition on conception rates was obtained by examining liveweight changes in breeders at "Brian Pastures" Pasture Research

Station during the mating period. Daily liveweight gain during the first service mating period of females which conceived (1·697 lb.) was significantly greater than that of animals which did not conceive (1·205 lb.). Daily liveweight gain during the full mating period of females which conceived (1·350 lb.) was significantly greater than that of animals which did not conceive (1·19 lb.). The first service conception rate was 65·3%, and the total conception rate was 87·8%. First-calf heifers recorded the lowest liveweight performance, and had significantly reduced first service and total conception rates.

Lactation studies in Poll Hereford breeders showed that cows calving in winter had lower milk yields than those calving in spring and summer for the first 3 months of lactation. Thereafter they equalled and then exceeded the yields of the other groups. Cows calving in spring had a higher total yield than those calving in summer. It appears probable that total lactation of a given animal may be estimated from a minimum number of observations, by using prediction equations which have been evolved in the course of this work. Studies of this technique are continuing.

Agreement was reached with the New South Wales Department of Agriculture to the use of its Beef Cattle Performance Recording Scheme for an interim period until the national service is available. Considerable interest has been shown by the industry in this scheme and enrolment of a limited number of co-operating stud breeders was commenced.

Artificial Insemination

A programme has commenced at Rocklea Husbandry Research Farm to provide performance tested bulls as beef semen suppliers at the Artificial Insemination Centre at Wacol. The genetic merit of six Poll Hereford bulls was assessed during growth from 300 kg to 450 kg body weight under standard conditions. The two best bulls as judged on growth rate and feed efficiency were transferred to the A.I. Centre. It is proposed to produce sons from them for future testing. Performance testing of Angus bulls is planned.

The custom freezing service processed 38,000 ampoules of semen during the year.

Nutrition

Experiments continued at the Animal Research Institute on the survival feeding of cattle, on the influence of pre- and post-natal nutrition on subsequent production of calves, on the utilization of molasses and/or urea supplements, and on the effects of dipping on body-weight changes of cattle.

When 33 head of cattle accustomed to 2·3 kg sorghum grain/head/day fed twice weekly were changed to the same amount of wheat, 10 animals died within 48 hours. In a similar group in which the change was made gradually, two animals died when wheat was 50% of the ration and another three died when the all-wheat grain ration was fed. When 20 head of cattle accustomed to 2·3 kg sorghum grain/head/day fed twice weekly were changed to the same amount of barley, five animals died within 96 hours. No deaths occurred in a group of animals accustomed to wheat when they were changed to barley. Animals accustomed to wheat or barley could be changed to sorghum without ill-effect.

In an all-sorghum grain survival feeding experiment, steers in several groups were fed a total of 210 kg of grain per head during 120 days. Groups were fed either a constant quantity of 1·75 kg/head/day or varying quantities under six different regimes to make use of possible "compensatory growth". The steers which received the same quantity of feed every day lost less weight than the steers in the groups fed intermittently.

The experiments on pre- and post-natal nutrition have shown that pre-natal nutrition does not affect the subsequent ability of the calf to grow provided sufficient nutritious feed is available. Very poor nutrition early in the calf's life does not have a detrimental effect on its future performance or carcass quality. A restricted calf takes longer to reach slaughter weight. Analysis suggests that low-plane calves have a slightly better overall feed conversion efficiency than high-plane calves.

Weaner cattle on a restricted diet of roughage and barley grain at either 1 or 2 kg/head/day had *ad lib* access to molasses urea mixtures, the molasses being 80, 60, 40 or 20% in water. The molasses intake was independent of the molasses concentration or level of grain in the diet. The level of grain in the diet affected the efficiency of utilization of dietary energy, the higher level requiring approximately 66% as much TDN per kilogram of weight gain as the lower level.

No treatment effects were obtained between groups of grazing cattle that were: (1) dipped 5 times at 10-day intervals followed by 4 times at 12-day intervals in Asuntol dip and at each dipping driven 4 miles, (2) driven 4 miles but not dipped, (3) not driven or dipped.

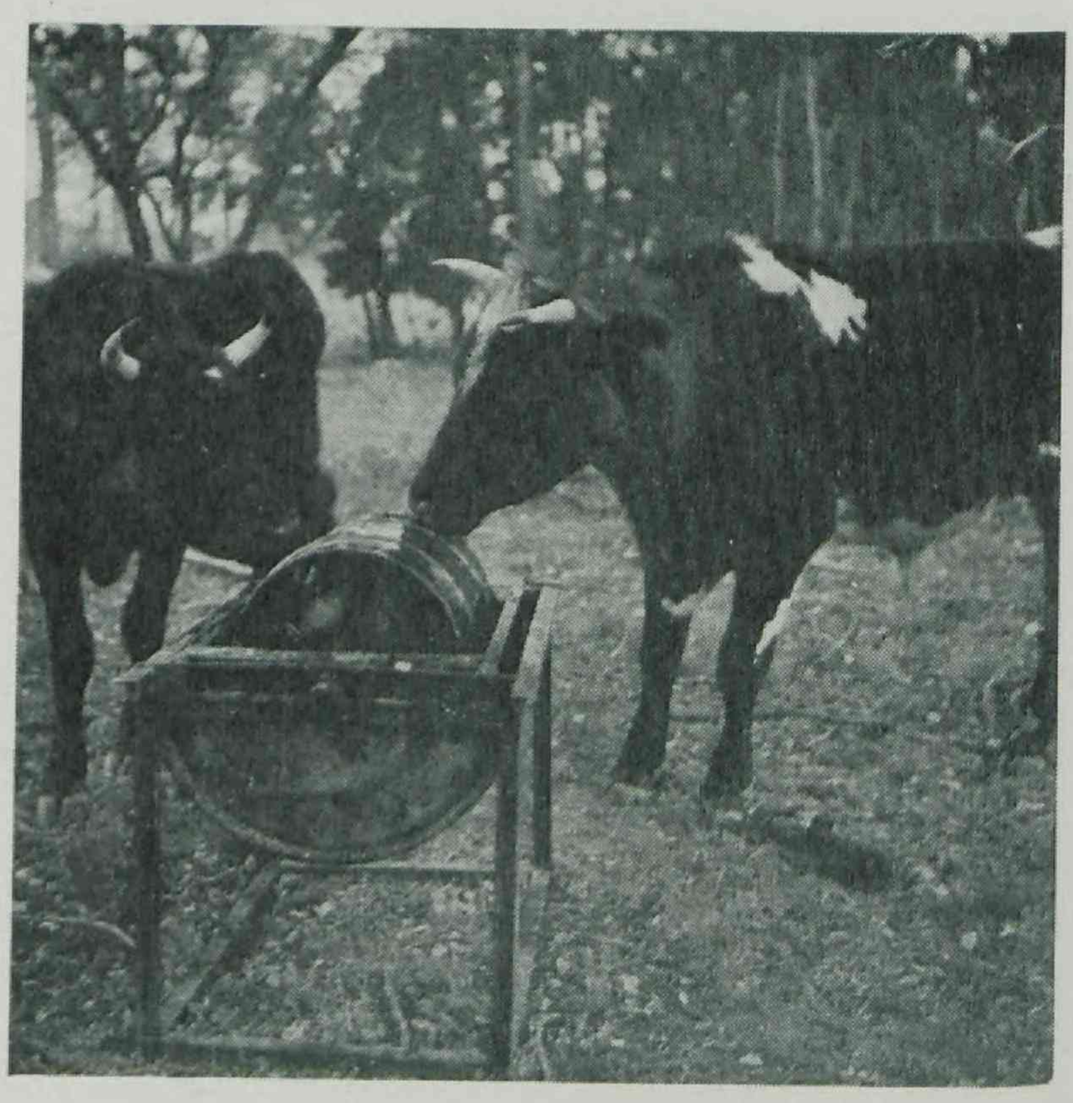
The Biochemical Branch measured changes in blood parameters in heifers fed whole or cracked sorghum grain at the rate of 1·36 kg/head/day either daily or twice weekly. The heifers had lower haemoglobin concentrations, lower packed cell volumes and total red cell volumes, and greater plasma and blood volumes, and a greater quantity of circulating albumin than before survival feeding. With the possible exception of total circulating haemoglobin and albumin, the results indicate, body-weight changes were more efficient in measuring the efficiency of survival feeding regimes than the blood parameters measured.

A considerable number of trials involving supplementation with biuret were carried out by Beef Cattle Husbandry Branch during the year. Some problems encountered related to intake, period of adaptation and the provision of adequate roughage. It is apparent that under field conditions it is necessary to manage the use of this supplement carefully in order to get consistent results. However, positive results have been obtained in some cases, and it is reasonable to assume that this supplement will prove value in the industry.

The growth rate of beef weaners is the subject of a study in the Mt. Isa area. It was found that post-weaning growth was practically negligible between May 1969 and January 1970. The average annual gain was 225 lb., of which 200 lb. was attained from January to May 1970. Calves weaned in both May and September, aged 4–5 months with a liveweight of 200–300 lb., seemed to handle the semi-drought conditions experienced in the area in 1969 as well as much older and heavier weaners.

The use of non-protein nitrogen has developed rapidly in recent years, and the work with weaners reported in 1968–69, using urea-molasses supplementation, was the first really definite evidence obtained in Queensland that urea could be effectively used in the field with demonstrable improvements in animal performance. In 1969–70 a similar dry-season supplementation in weaners again gave positive differences in favour of those supplemented with urea-molasses, and this replication in time may be considered as putting the matter beyond all doubt.

The implications for the Queensland beef cattle industry are great, and there is little doubt that supplementation with non-protein nitrogen will become an integral part of management in this State. The greatest application would appear to be in survival feeding, but there is evidence that reproduction may be materially improved through the conservation of condition in the breeding animal.



Urea-molasses-water mixtures fed through roller-drum lickers were widely used during the 1968-69 drought as a supplement to low quality pasture.

A programme has now been mounted to explore this aspect of supplementary feeding and, in addition, the problem of calving losses following established pregnancy is the subject of intensive investigation.

Pests and Diseases

Cattle ticks.—Following the drought-breaking rains over most of the tick-infested areas of the State there was the usual upsurge in tick populations. On many properties with multi-resistant ticks, routine sporadic dipping procedures were found inadequate. Control was regained by using Dursban and Nexagan at double strength and dipping at 10-day interval. In south-eastern Queensland, a serious upsurge in cattle ticks occurred as a result of mild conditions in autumn and early winter.

The demand for advisory and extension services for tick control has increased markedly. Specialist officers are stationed in the Brisbane, Maryborough, Rockhampton and Townsville veterinary divisions. They have been actively engaged in property visits and where necessary ticks have been collected and submitted to the laboratory for testing for resistance. They have also engaged in a study of the design of plunge dips and sprays and have investigated ways and means of minimizing pollution.

Where a known control problem exists, samples of ticks are submitted for screening for resistance as a routine matter. Of slightly more than 2,000 batches submitted, over 1,037 were found not resistant, 626 had Biarra type and 581 had Ridgelands type resistance. It is clear therefore that tick control in at least 50% of cases is a question of management and dipping practice.

Except for one property near Maryborough, Biarra-type resistance is confined to the area south of the tick line extending from the mouth of the Burrum River to Kingaroy. Cattle crossing this line to the north are required to take clean treatments and this is believed to have had the effect of preventing spread of Biarra-type resistant ticks to the north. It is of interest that two properties at Bundaberg and Mundubbera on which the Biarra-type resistant strain was detected earlier have remained free from ticks since eradication some time ago.

A total of 66 holdings involving some 3,828 head of cattle, and 97 adjoining holdings, has continued under restrictions because of the presence of Mackay-type resistant ticks. Although mainly confined to the areas immediately north and south of Mackay, this type of resistance has been detected on a property near Tully and on several properties at Calliope. The prescribed control programme operating on these properties is under review and will be varied in the near future.

Following control failure with Dursban commencing about the end of 1969, laboratory screening of ticks at the Animal Research Institute uncovered a strain of ticks resistant to Dursban on three properties in the south-eastern corner. The outlook, however, is not as bleak as it was when the Biarra type of resistance was first detected, as a number of alternative insecticides are available to deal with this type of resistance.

The possibility of transfer of ticks, particularly resistant strains, by birds or other agencies into New South Wales from Queensland properties contiguous to the border has caused disquiet to that State and so a voluntary control programme to be jointly supervised by the two States and consisting of nine supervised treatments in 0·025% Dursban at 21-day intervals was commenced at the end of September 1969. The programme was later extended to 11 treatments. A total of 48 herds was involved, 4 of which were known to have Biarra-type resistant ticks. At the end of the treatment programme, herds on 41 of the properties were found to be free from ticks on crush inspection of cattle and 7 had medium to light infestations. Treatments are being continued to eliminate these.

Buffalo fly.—Favourable spring conditions allowed buffalo fly to extend south of Emerald and Alpha. At Townsville and Tully encouraging results have been obtained with a dust bag technique for control of the pest. The application of Asuntol in the form of a paint to the coats of cattle was also investigated.

The Tick Fever Research Centre at Wacol despatched over a million doses of blood vaccine during the year. This indicates that vaccination is accepted by the industry. It is used particularly in areas of low tick burdens and on properties where there is good tick control.

The research programme continues to receive the support of Australian Meat Research Committee. This programme is directed towards many aspects of research on babesiosis but most effort is devoted to red cell free vaccine, a culture vaccine and the factors involved in the duration of immunity produced by vaccination. Work during the year has shown that many of the red cells can be removed from vaccine without detriment. Culture of babesia has not been achieved but this is expected to be a most difficult procedure. Experiments on the duration of immunity are in progress.

Bovine contagious pleuropneumonia.—The last field outbreak of pleuropneumonia was in 1960 and no confirmed evidence of the disease has been forthcoming since mid 1967. Such has been the progress towards eradication that the National Committee agreed at its February 1970 meeting to abolish the Gulf and Carpentaria quarantine area and deal with the remaining properties which had not completed their vaccination programmes on an individual basis. Only 25 properties remain in this category and these will be checked by bloodtesting during the current season. Continued monitoring of the principal export meatworks, searching for residual lesions of the disease, over the next few years will be the most important final step in the eradication programme.

Ephemeral fever.—Sickness suspected to be ephemeral fever, usually affecting cattle under 2 years of age, was reported from the northern areas of the Mt. Isa veterinary division in February 1970. Subsequently outbreaks were reported from the coastal region from Innisfail to Mackay, inland south and west of Emerald and also from the Upper Burnett. The diagnosis was confirmed by laboratory examination of specimens submitted from a suspected case at Ingham.

Survey of cattle viruses.—In association with C.S.I.R.O. Veterinary Parasitology Laboratory, the distribution of such diseases as infectious bovine rhinotracheitis, sporadic bovine encephalitis, mucosal disease and winter dysentery are being investigated. Paired serum samples from selected properties are being submitted to laboratory tests but to date no information of significance has been reported.

St. George disease.—Representatives of C.S.I.R.O. Division of Animal Health, the University of Queensland, the Departments of Agriculture of New South Wales and South Australia and the Queensland Department of Primary Industries met during the year to consider the problem of St. George disease with a view to determining the need for further research. The discussions were valuable in bringing together information on the clinically similar syndromes in each of the three States.

As well as the occurrence of the disease in the Roma–St. George area, a clinical condition closely resembling St. George disease was encountered in the Brisbane Valley during the year.

Botanical surveys were made of a property at Yuleba where St. George disease has been induced experimentally in cattle. However, no plant has been found which is common to all known areas where this disease has been noted and there is no clear indication at this stage that a plant is the cause of this condition.

SHEEP

At Toorak Sheep Field Research Station, research work has been undertaken by the Sheep and Wool Research Branch in two broad fields of sheep production—reproduction and nutrition—and their interactions.

To establish basic data an examination of reproductive wastage occurring at fertilization, at implantation and between implantation and lambing has been conducted. This series of studies has been made on a group of ewes joined in the spring and on a group of ewes joined in the autumn. The preliminary findings indicate that for the spring-joined group the major loss occurs at fertilization. Failure of the fertilized ova to develop into viable embryos is not of major significance and loss of embryos from 20 to 40 days is negligible. In the autumn-joined group, relatively large losses occurred at both fertilization and during the early development of fertilized ova. Variation in losses at different stages in different years makes interpretation of results difficult.

To examine the interaction between environment and fertility and wool production, replicated groups of weaners have been grown in their first year under conditions which reproduce the local body-weight growth pattern of spring and early summer nutritional stress and under conditions which permitted continuous growth. During the second year of life, half of these replicated groups were subjected to reverse conditions. The first year's joining results show that the plane of nutrition in either the first or second year had no effect on oestrus. It was found, however, that regardless of the plane of nutrition in the second year, those on a high plane of nutrition in year one had a higher pregnancy rate at 40 days post-joining. In the second year's joining the oestrus rate of those on a high plane of nutrition in the previous year was higher than those on a low plane. This trial is to continue for at least a further 3 years.

There are no critical data on the effects of prejoining supplementary feeding of rams in the north-western hot arid environment. A trial is currently in progress to obtain information on oestrus, conception, lambing performance and wool production of genetically similar ewes joined as separate groups in the autumn and in the spring.

In the nucleus trial, long-term records of lambing performance and wool production from plain random and wrinkly sheep are being obtained. The low skin fold score group have continued to produce more lambs than the wrinkly group.

In determining the extent of neonatal losses in flock and commercial sheep, one of the major problems in the semi-arid areas has been in differentiating between dry ewes and ewes which had lambed and failed to rear. A technique which involves the placing of a suture in the vulva which is torn out at the birth of a lamb was developed.

In the tropics, Merinos are seldom bred as two-tooths because of their poor lambing performance. A study in the area on the onset of puberty has shown that body-weight of the young ewe and season of birth are the factors which determine when young ewes first show oestrus.

Advantage was taken of the drought situation to examine the value of urea as a drought supplement on dry Mitchell grass. Under the conditions prevailing, where the ewes used lost 17% of their body-weight between September and December 1969, no difference in body-weight loss or survival rate was found. Wool production of the groups will be evaluated after shearing in July 1970.

In a further drought trial, wheat and grain sorghum grain treated with formalin to protect the protein content from digestion in the rumen were used. There was no difference in body-weight between the groups fed treated and untreated grain. Wool growth determinations have yet to be finalized. Formalin-treated meatmeal was compared with untreated meatmeal as a supplement to a basic diet of sorghum silage. There was no significant difference between the groups in body-weight change or wool production.

In a field trial in the south-west, the usefulness of phosphate supplements to mulga is being tested at Charleville. Blood phosphate level, body-weight, wool production and fertility are being recorded.

At the Animal Research Institute, weaner sheep fed grain concentrate rations low in carotene maintained adequate (25 micrograms/100 ml) circulating vitamin A during a 4-month period if supplemented with a single injection of 500,000 i.u. vitamin A when feeding began, whereas weaners not so supplemented showed a decline (8 micrograms/100 ml). When returned to extensive grazing, both groups had similar levels of circulating vitamin A.

Outbreaks of humpyback on two properties have been investigated in some detail by means of clinical, pathological and microbiological examinations and transmission tests have been carried out. A questionnaire for clinical examinations has been designed for use by Departmental field staff to facilitate delineation of the syndromes involved. The conditions commonly referred to as humpyback are certainly more than one disease.

It has been established that pneumonia is one cause of "humpyback". The lung changes have been characterized pathologically as a mild, proliferative interstitial pneumonia with a regular pattern of distribution.

It appears that there may be a high incidence of the disease in affected flocks. This can be seen at slaughter or, in the more severe cases, when the animal is stressed. The pneumonia has been reproduced experimentally by inoculation of affected lung tissue and also by contact.

Microbiological investigations carried out in collaboration with C.S.I.R.O. resulted in the recovery of a mycoplasm, but its role as the cause of the pneumonia has not been confirmed.

Departmental agricultural economists are becoming increasingly involved in advisory work in the pastoral industry through the farm management accounting service, with groups centred on Muttaburra and Dirranbandi.

During the year a comprehensive report was published by Marketing Services Branch on the organization of the wool industry. This report was timely in view of present difficulties being experienced by the industry and current moves for a more effective system of wool marketing.

PIGS

Experiments were continued by Husbandry Research Branch to determine the possible value in pig grower rations of protein supplements such as safflower meal and cottonseed meal. These meals are becoming more readily available as by-products of a growing vegetable oil industry. The availability of amino acids and their biological value were determined in experiments with rats.

Recent trials with safflower meal (42% C.P.) confirmed the results of earlier trials with wheat-based rations that safflower meal could replace about 20% of soybean meal or fishmeal. Although the pigs on safflower meal had slower growth rates and inferior feed conversions, their carcass parameters were similar to those of pigs receiving soybean meal or fishmeal supplements.

The performance of pigs on diets based on either wheat or sorghum and containing 15% cottonseed meal was satisfactory though inferior to the performance on diets containing either 15% or 11% soybean meal or combined supplements of 5% fishmeal and 10% cottonseed meal. Significant growth responses to cottonseed meal diets containing added synthetic lysine indicated that either the lysine level in cottonseed meal is less than that reported or the lysine is only partly available to the pigs. In these trials is was possible to compare the value of the basal grains, wheat and sorghum. The performance and carcass parameters of the pigs on sorghum-based diets were inferior to those of pigs receiving the wheat-based diets. An 11% soybean meal supplemented wheat diet gave growth performance equivalent to a 15% soybean meal sorghum diet.

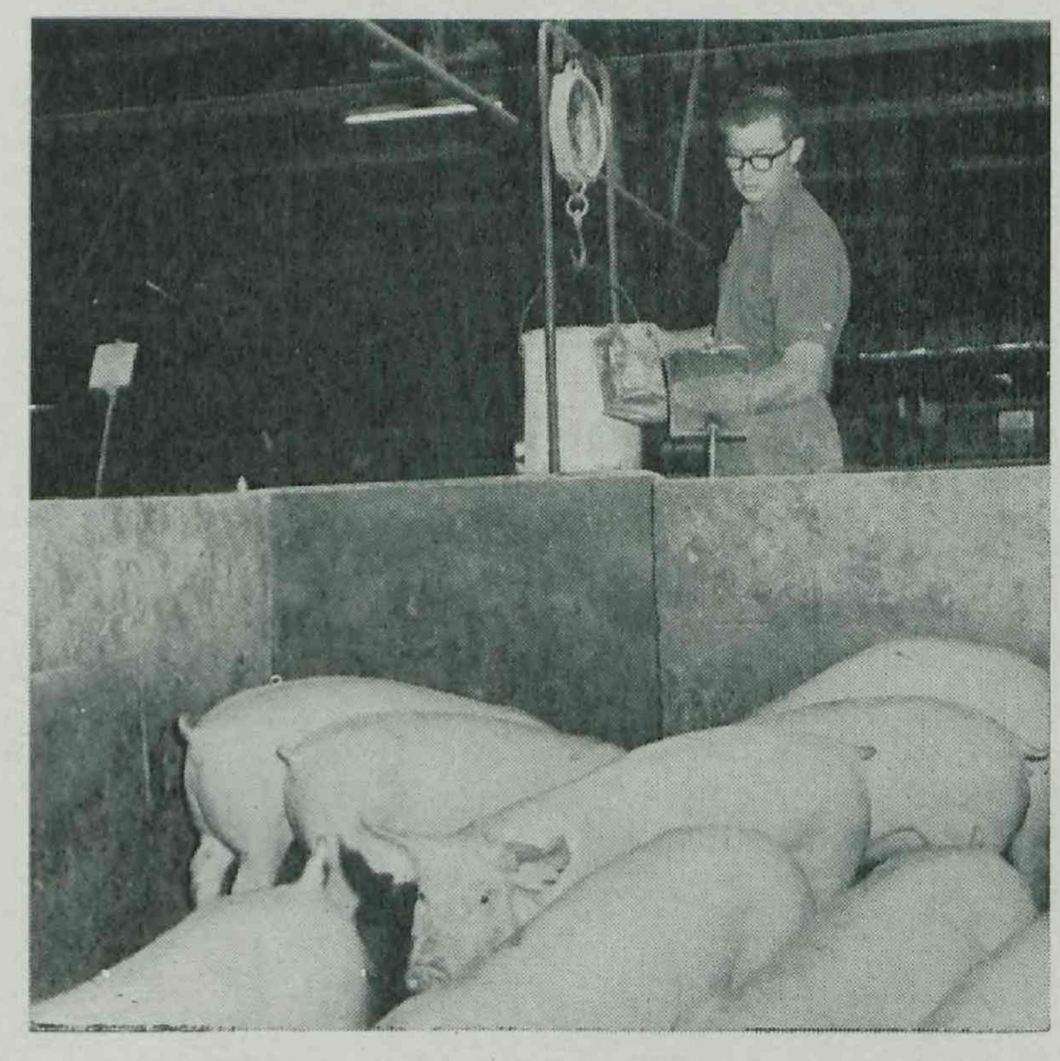
Computerized least cost diets have been compared with conventional diets. In all instances the economy of production favoured the least cost diets, and in most cases the growth performance was superior to the conventional diets.

Following discussion with the Australian Pig Society, a boar performance testing scheme was introduced at Rocklea, to replace the progeny test, which was phased out.

The performance test on commercially bred boars completed the first year. The genetic merit of the boars is calculated from measurements made during growth from 60 lb. to 200 lb. liveweight while the pigs are in the standard environment of the Test Station. Measurements are made of rate of growth, feed conversion and carcass characteristics using an echo-sounder. Superior boars are returned to their previous owners for use as sires and inferior boars are slaughtered. A total of 78 boars was tested and of these 36 were approved as superior sires.

During a year when economic pressures on the industry were severe, producers sought more technical advice, in depth, on ways and means of increasing efficiency, rather than for assistance in expanding their operations, as in previous years.

All extension methods were used to impress upon producers the need to use a ration which produces the most economic return, rather than one which produces the fastest growth or lowest feed conversion. This change in emphasis is being accepted and is assisted by the work on computer-formulated least cost rations which continued to be tested at Research Stations and on farms. A much greater number of requests for assistance in formulating rations were received not only from farmers but also from proprietary and co-operative feed compounding firms.



Numerous intensive pig raisers have made requests for advice on formulating rations.

Producers continued to seek advice on methods of improving carcass quality, since this is a major influence on their returns. As well as through the mass media, and by individual advice, assistance was given by carcass appraisals and through the numerous pork and bacon carcass competitions, where entries were well up on those of previous years.

Determined efforts were made by extension staff in all districts to encourage better record keeping by producers. These range from litter recording systems, aided by the introduction of recording cards and the use of a more complex litter recording book, to records enabling the calculation of the margin over variable costs, and, in some cases, a complete costing. Where it has been possible to provide regular physical assistance with these records, good results, enabling the diagnosis of managerial and other deficiencies, have been obtained. It is anticipated that litter records, at least, will be available from about 100 producers.

Studies have been continued by Economic Services Branch on size-efficiency relationships in pig production. The economics of weaner production as a job for the specialist producer is being investigated on the Western Downs.

A pig recording scheme has been introduced on the Atherton Tableland to provide an assessment of piggery efficiency in terms of the profit margin over feed costs per sow.

The results of a study by Marketing Services Branch of the pig industry's structure in Queensland were published. This study revealed among other things that *per capita* pork consumption has been steadily increasing and has risen from 7·1 lb. per head in 1949 to 16·1 per head by 1968-69. Consumption is expected to rise further and could well reach 20 lb. per head by 1980.

POULTRY

Husbandry Research Branch completed the series of experiments on methods of debeaking broiler chickens, and investigations of energy-protein balance in broiler grower rations were undertaken. With caged layers, experiments to determine the relationship between density and initial body-weight to performance, the effect of ration additives on egg production, the value of navy bean meal as a ration ingredient, and the potency and stability of three commercial egg yolk pigmenters were continued. In addition, trials were begun to investigate protein phase-feeding systems for caged layers and to establish the tolerance of caged layers and of layers housed on deep litter to high ration phosphorus levels.

The debeaking trials confirmed that partial debeaking was better than either conventional or block debeaking. With all methods, but particularly with block and conventional techniques, debeaking at 5 days was better than debeaking at day-old. The chickens were kept either on wire or on litter and were fed crumbles.

In the cage density studies it was found that mortality increased and egg production decreased as bird number per cage increased. Pullets of light initial body-weight were less tolerant of high-density cage housing systems than heavier birds of the same strain. Of the four compounds 3-nitro-4-hydroxyphenylarsonic acid, chlortetracycline, nicotine sulphate and nitravin, only chlortetracycline increased egg production when added to layer diets.

Raw navy bean meal can be included in layer rations at levels up to 10% without affecting bird performance. The presence of toxins reduced egg production at higher levels of inclusion. Heat treatment of the meal reduced the effects of the toxins. None of the three commercial egg yolk pigmenters "Carophyll Golden", "Pigmentene" and "Lutenal" affected egg production, feed consumption or general health of the flocks. They showed similar rates of accumulation of yolk colour. As a source of pigment, "Carophyll Golden" was of relatively high potency, "Pigmentene" was of relatively low potency, while "Lutenal" gave a pink-orange colour to yolks. A decrease in visual yolk colour score occurred when eggs were stored at ambient temperatures or 13° C. for 3 weeks but it did not occur when oiled eggs were stored at 4° C. for 12 weeks.

The eggs of poultry fed a standard layer-type ration formulated from components purchased through trade channels were examined by Biochemical Branch for pesticide residues. The flock maintained at the Husbandry Research Farm, Rocklea, during a 3-month period showed levels of DDT, DDE, dieldrin, HCB and BHC in egg yolk less than "tolerances". The ability of the industry to maintain a low level of pesticide residues has since been demonstrated in surveys of residues in eggs.

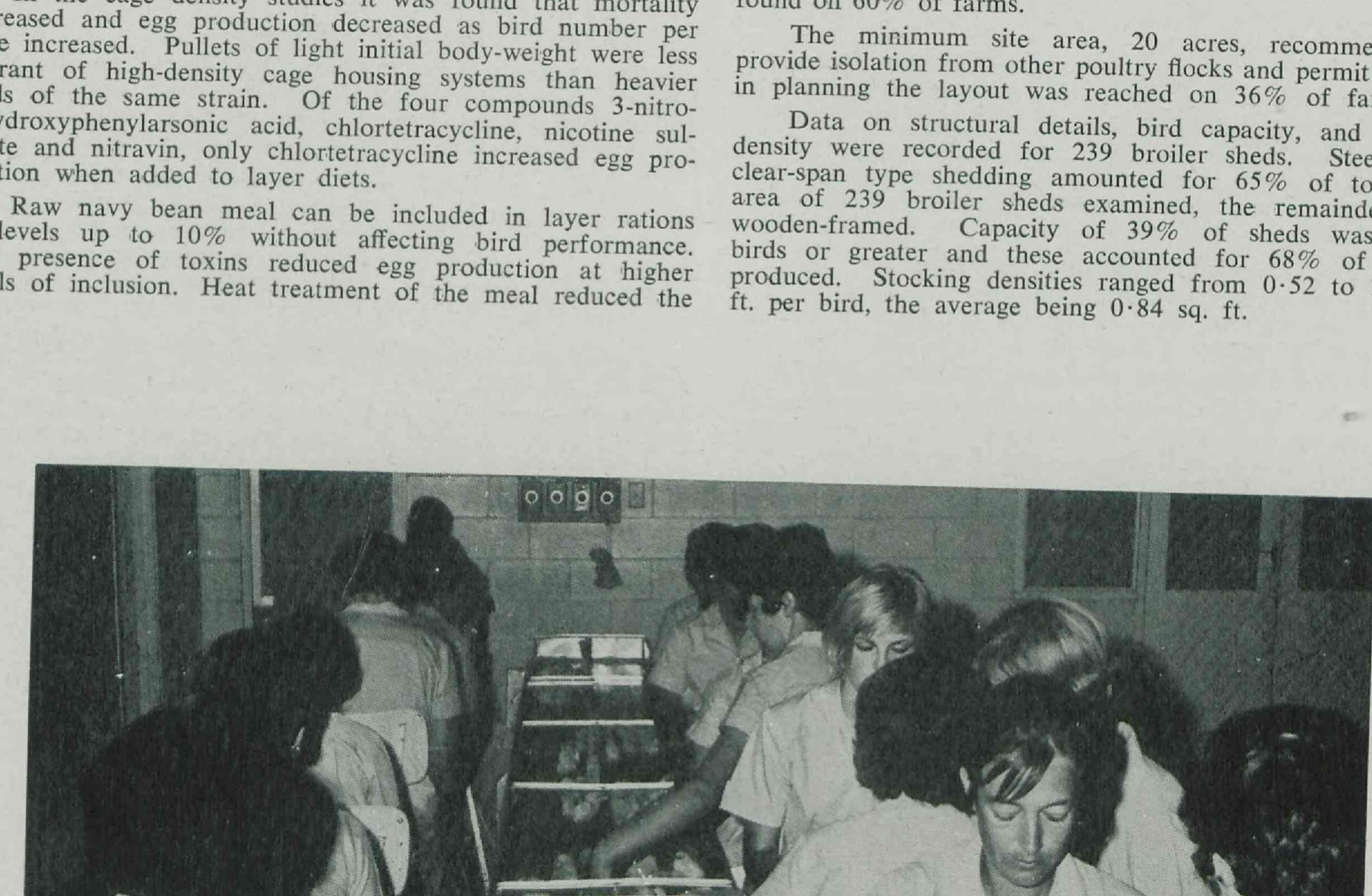
Further investigation of the dominant autosomal gene which confers a haemagglutination reaction to a percentage of fowls in the Australorp flock maintained as the Random Sample Control has shown that embryos which receive the gene from their sires have reduced hatchability. The gene is being used to check the efficiency of the control technique.

A survey of broiler farm practices was conducted by the Poultry Section in 1969 to provide up-to-date information on farm practices and facilities currently employed in broiler production in south-eastern Queensland and to identify common production problems facing broiler producers.

Sixty-nine broiler farms with batch capacities of 5,000 or more birds were included in the survey. Broiler flocks in excess of 18,000 birds, the minimum considered necessary to ensure a reasonable income from broilers alone, were found on 60% of farms.

The minimum site area, 20 acres, recommended to provide isolation from other poultry flocks and permit freedom in planning the layout was reached on 36% of farms.

Data on structural details, bird capacity, and stocking density were recorded for 239 broiler sheds. Steel-framed clear-span type shedding amounted for 65% of total shed area of 239 broiler sheds examined, the remainder being wooden-framed. Capacity of 39% of sheds was 10,000 birds or greater and these accounted for 68% of broilers produced. Stocking densities ranged from 0·52 to 1·20 sq. ft. per bird, the average being 0·84 sq. ft.



Packing chicks for despatch to farmers.

It is estimated that 36% of the total number of chickens raised are brooded with electric brooders, 27% with hot air, 19% with hot water and 18% with gas brooders. Average brooding cost per chicken is estimated at 0·99c for gas brooding, 0·89c for electric, 0·57c for hot air and 0·56c for hot water brooding (estimates include fuel costs and fixed costs).

The tube feeding system is the most common type in use, 57% of broilers being raised with this system. Mechanical feeding systems supply feed to 43% of broilers raised but this percentage is increasing. Automatic metal trough waterers 6–8 ft. long are the most common type in use.

Broiler performance figures were available for 37 farms and mortality figures for 33 farms. Average age of bird at slaughter was 71·3 days, (range 62–77); average liveweight was 3·78 lb. (2·98–4·10); average feed conversion efficiency was 2·43 lb. of feed/lb. liveweight (2·26–2·68). Overall mortality averaged 4·46% of the total number of chickens started.

A survey of lighting practices on egg-producing farms was carried out by the Poultry Section in the Toowoomba area during April and May 1970. Of the 56 farms included in the survey 11 were not equipped with lights, and 10 were operating with ineffective lighting schedules. Morning lighting was employed in 18 of the 32 constant daylength programmes and evening lighting in the remaining 14. It was estimated that approximately one farm in three in the Toowoomba area was not benefiting from artificial lighting.

A poultry farm management recording scheme commenced by Economic Services Branch on the Darling Downs in 1969 has provided useful data on costs of rearing replacement pullets. The scheme has now been extended to obtain data on costs and returns for laying flocks. The economics of feed mixing on the property instead of purchasing proprietary feed mixes has been investigated: any savings in cost are dependent upon the size of the poultry enterprise. A close study has also been maintained of rate of lay, feed and marketing costs and egg price movements in northern Queensland.

At the request of the South Queensland Egg Marketing Board a project is under way to determine the optimum time of replacement for laying flocks.

The 1969 Poultry Industry Festival organised by the Poultry Section in co-operation with the Queensland Agricultural College was held at Lawes. This highly successful event attracted an estimated 600 visitors.

A 3-day Poultry Information Exchange was held at Caloundra in early September, and was attended by 128 people. The aim was to draw on the considerable amount of practical "know-how" available but untapped within the industry and in the ancillary industries serving the industry.

A process for the production of pan-dried egg albumen suitable for use as a crown seal adhesive is being investigated at the Sandy Trout Food Preservation Research Laboratory. The Laboratory is also assisting the Egg Marketing Board to develop a technique for preparing an export quality salted egg yolk containing 12% added salt for use in mayonnaise and related products.

BEES

Early in the year there was an outbreak of European foulbrood disease in the Nambour district, necessitating destruction by burning of two infected honeybee columns. The previous occurrence recorded was in 1959 at Rockhampton.

Increased adult honeybee mortalities were recorded, arising largely from aerial application of pesticides on or adjacent to cultivated crops, e.g. cotton, sunflower, pumpkin, strawberry and citrus. The use of herbicides, particularly on eucalyptus road fringes, has reduced honeybee forage and has been blamed for some losses by poisoning.

MEAT INSPECTION

Much time was given by officers of the Slaughtering and Meat Inspection Branch to implementing the requirements of amended regulations relative to butchers' shops. An attitude of harmony and co-operation between the trade and inspectors has in the main prevailed and a notable improvement in standards has been achieved. Many owners completely rebuilt in modern styling. The better shops in Queensland are equal to the world's best, while the general standard is at least equal to that of other Australian States.

Standards at slaughterhouses killing for local consumption have not improved significantly. This is due partly to the difficulty in determining a policy relative to centralized killing which satisfactorily takes account of the major variations in size and other requirements needed to service a population widely distributed throughout the State.

Commonwealth standards of procedures and judgments in meat inspection and handling procedures at export meatworks raised some problems so far as the local trade is concerned, as State inspectors operating in these works had to make higher liver condemnations for hydatid diseases and set high standards for petfood recovery.

The number of poultry slaughter-houses licensed fell to 119. Poultry processing regulations were prepared and approved in principle but at the end of June awaited uniform action by some other States.

Grading of beef was undertaken at Cannon Hill, Toowoomba, Ipswich and Townsville district abattoirs and at Borthwicks (Brisbane) and Bremer River Abattoir. Generally, good quality stock were supplied in southern Queensland, but Townsville slaughterings, no doubt due to dry conditions, were significantly lower in quality.

Lamb and hogget classification marking was carried out at major abattoirs.

As a preliminary step in a project aimed at instituting a satisfactory system of recording disease incidence at slaughter, with traceback to property of origin, an inspector examined methods of identifying live animals to permit accurate identification of property of origin at time of slaughter.

III. Dairy Research and Extension

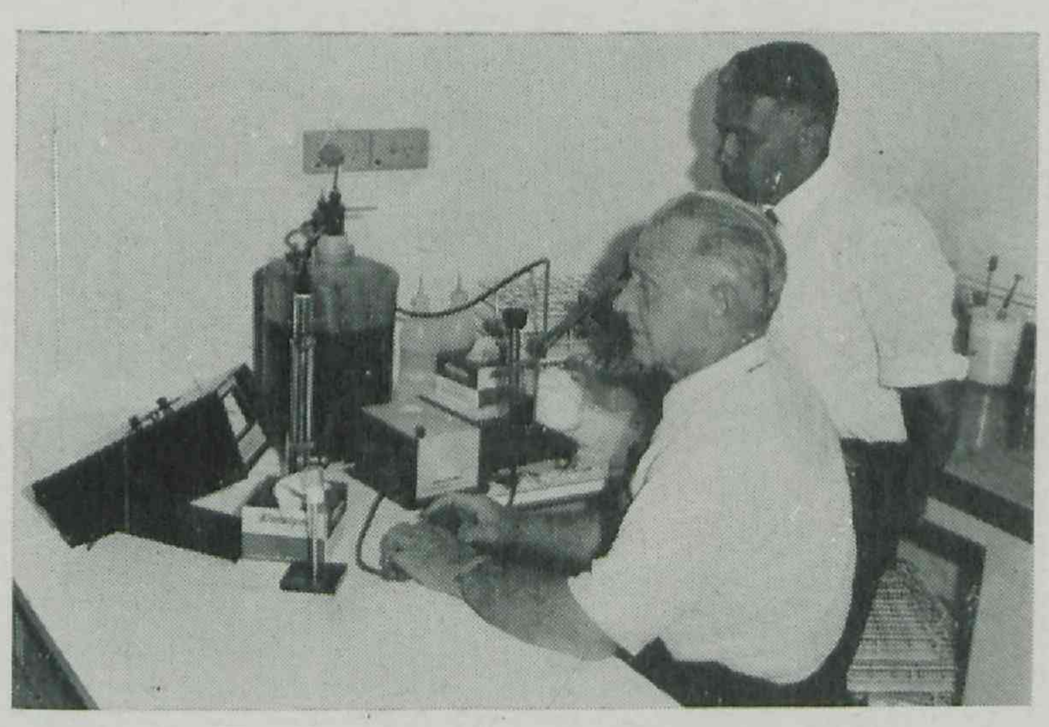
The dairying industry is serviced in one way or another by most Branches in all five Divisions of the Department.

The three Branches of the Division of Dairying are concerned specifically with feeding and herd management, herd recording, artificial insemination, the hygienic production, handling and manufacture of milk and milk products, and utilization research. The Husbandry Research and Biochemical Branches are responsible for various aspects of feeding research. The Agriculture and Agricultural Chemical Laboratory Branches and the Sections of Entomology, Plant Pathology and Botany are involved in pasture and fodder matters. The Veterinary Services and Pathology Branches cover animal health problems. Marketing Services, Economic Services and Standards Branches also have responsibilities to the dairying industry.

FIELD SERVICES

The field Services Branch continued its advisory and inspectorial activities in the field and carried out various field surveys and investigations. Herd recording activities were transferred to the new Dairy Cattle Husbandry Branch halfway through the year.

The special survey of protein content of milk from individual cows and herds commenced in 1968-69 was expanded during the year to embrace up to 120 herds totalling approximately 5,000 samples monthly. The running average protein content is 3·3%, although breed differences have been detected. In association with the Commonwealth Department of Primary Industry, a pilot study of all bulk herd supplies on a composite basis from the Kenilworth and Maclagan cheese factories was commenced to examine payment systems related to both fat and protein content of milk.



Measuring protein content of milk samples.

A major survey concerned with detection and control of mastitis in production recorded herds was commenced in July, 1969. The design of the project was based on the report of the Expert Panel on Bovine Mastitis and was concerned with the adoption of recommended practices rather than the development of new techniques. A total of 135 herds totalling approximately 5,400 cows in four regions is under examination monthly. General results indicate an incidence of 5 to 20% "positive" reactions to the Rapid Mastitis Test and 5 to 12% "suspicious" reactions. A special group of 24 farms have been selected for detailed application of control practices. Information from the survey will be used extensively in extension advisory programmes.

Several special cheese studies were finalized during the year. These were an examination of three microbial rennet substitutes for cheesemaking, commercial manufacture of Feta cheese, brine salting of blue vein cheese and substrates for *P. roquefortii*.

To establish the avenues of diversification being undertaken by dairyfarmers who cease production, approximately 750 properties who withdrew during the 1968-69 season were reviewed. It was ascertained 75% changed to beef, beef and grain or grain enterprises. On the basis of production, 40% of farms produced less than 4,000 lb., 46% 4,000 to 9,000 lb. and 14% 10,000 lb. or more. On the basis of farm size 47% of producers were operating holdings less than 300 acres.

Dairy demonstration farms established in the Ipswich area in 1966 are providing valuable information for extension purposes and well-attended field days were conducted on both properties during the year. These farms are maintained through close co-operation between the local Dairying Development Committees, this Department and the two farmers involved.

Current investigations into factors affecting the supply of milk in southern Queensland and the implications of changing from a cream/pig economy to a wholemilk supply to factories should be finalized early in 1971. Projects to assess the economics of change-over to a bulk milk supply in the Gympie and Mackay regions have already been completed. These studies should provide information of value to the industry, its factories and marketing organizations in their future planning.

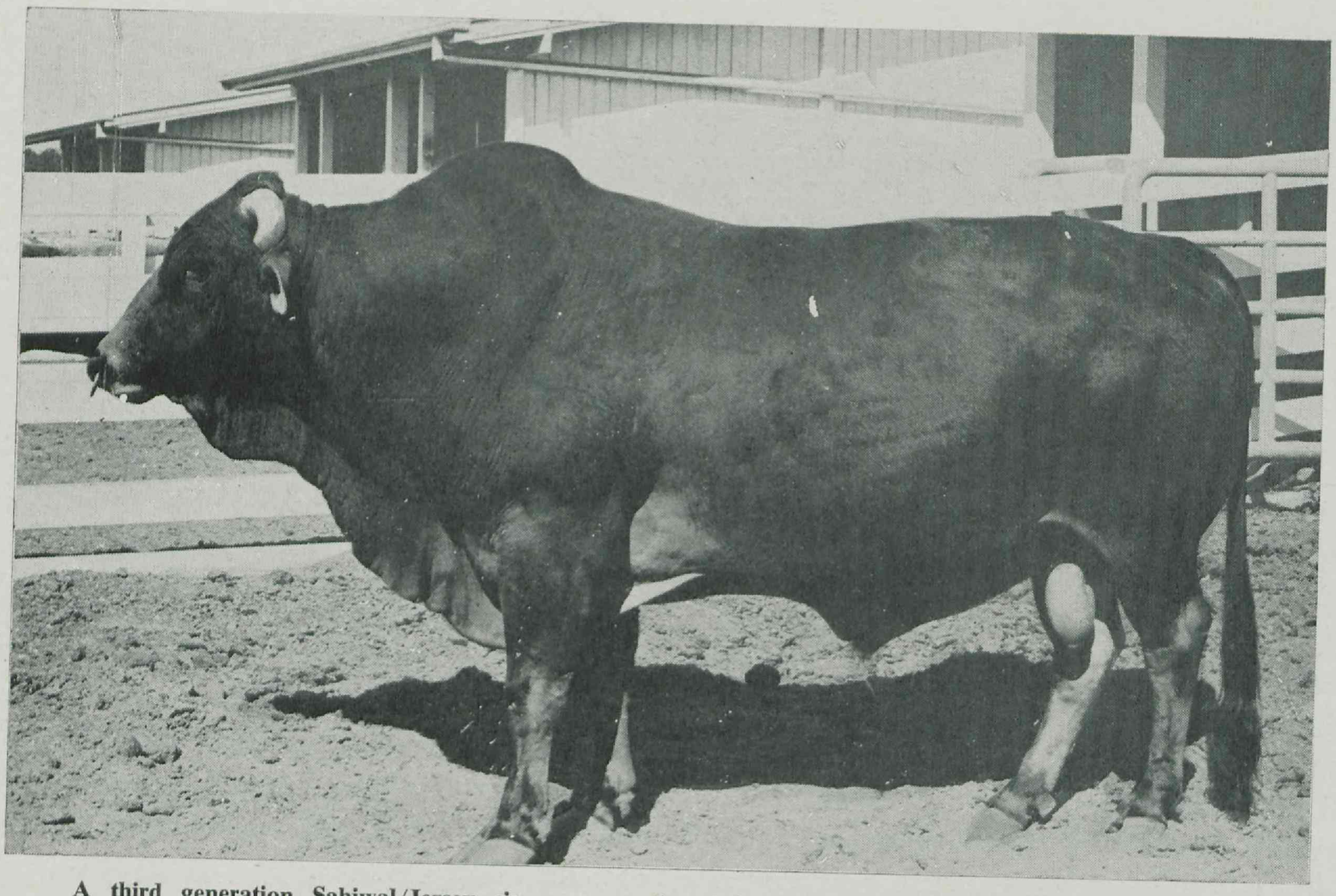
Detailed studies of the optimum size and location of dairy processing plants have been initiated following the appointment of officers to undertake this research.

BREEDING

At Ayr Cattle Field Research Station the dairy cross-breeding programme continued. The programme is based chiefly on Friesian and A.I.S. females and Sahiwal sires. Current performance of second and third generation females is encouraging, with the best yields in the order of 1,000 gal. per lactation from a pasture and forage crop feeding programme.

A small nucleus group of the animals has been established at Kairi Research Station, where the animals will be tested under comparable conditions of feed and management, yield, milk composition and other aspects of performance against a Friesian group.

A total of 54,000 cows was inseminated during the calendar year 1969 with semen produced at the Department's Artificial Insemination Centre, Wacol, conducted by the Dairy Cattle Husbandry Branch. This represents a decrease of



A third generation Sahiwal/Jersey sire progeny tested in New South Wales and acquired for the Department's A.I. Centre at Wacol.

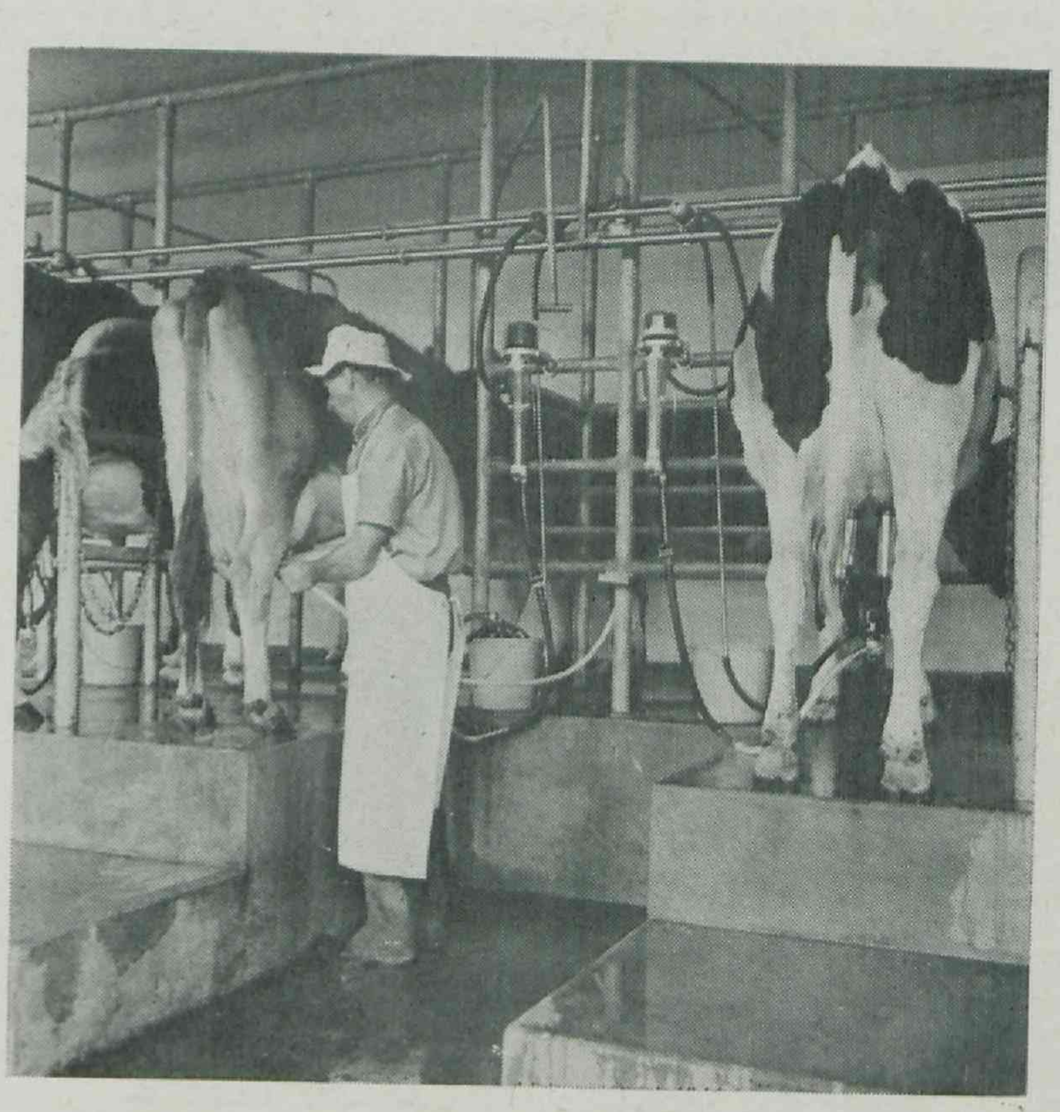
5,000 on the number of cows inseminated in 1968. The number of Co-operative Distribution Centres has fallen from 22 to 19, due mainly to amalgamation of centres. In addition to local sales, 13,500 ampoules were sold interstate and 900 ampoules were exported. Both of these figures are substantially higher than last year.

The overall 60–90 day non-return performance to first inseminations performed in Queensland with semen from Wacol was 69·3%, compared with 68·3% in 1968.

The use of A.I. in the dairying industry has declined for the second year in succession from the peak of 60,000 cows in 1967. All indications are that future trends will be closely allied to the overall movement within the dairy industry.

A Sahiwal/Jersey sire, progeny tested in northern New South Wales and rated highly in tests for tick resistance and heat tolerance, entered Wacol Centre. It was acquired from the Division of Genetics of C.S.I.R.O. Purebred Sahiwal sires are also now available at the Centre.

The progeny testing programmes for dairy bulls of the A.I.S., Jersey and Friesian breeds continued and four bulls of each breed were tested in the herds of co-operating dairy-farmers. The Friesian programme, commenced in 1965, reached the stage where the first "A.I. Proven" bull of this breed was identified. He is "Dasfries Colleen Auklod".



Meters have replaced scales for measuring milk yield in the Production Recording Schemes.

HERD RECORDING

The change to the use of meters for the measurement of milk yield was completed during 1969–70. All milk yield measurements on dairy farms participating in the Production Recording Schemes are now made with these machines. The result is a change in the farm procedures to the advantage of participating farmer and recording officer.

The eventual elimination of the Babcock test for butterfat content of milk and its associated farm routines is the next major task to be studied. To this end some progress has already been made with machines now available for a colorimetric test. Protein as well as fat content may be determined by these procedures. Centralized testing facilities are technically feasible and further changes may be anticipated in recording procedures over the next 2 years.

Results for the 1968-69 year of Group Herd Recording became available in the year under review. A total of 41,814 cows was tested, with average yield figures of 4,876 lb. milk and 204 lb. butterfat. In addition, 4,223 cows were recorded under the Purebred Scheme and average yield figures of 6,674 lb. milk and 286 lb. butterfat were calculated.

NUTRITION

Dairy husbandry programmes at the Ayr Cattle Field Research Station are being developed and will, for the next few years, involve research on the use of nitrogen-fertilized, irrigated grass for intensive dairy production. Two breeds, Jersey and Friesian, will be involved. In addition, digestibility work on these pastures will proceed concurrently.

Molasses has been used in the livestock industry for many years. Its main applications have been as a vehicle for minerals and non-protein nitrogen, as an appetiser and as a drought supplement. Its use as a grain replacer and as an high-energy source for milk production is to be explored at Biloela Research Station in programmes currently being developed.

DAIRY PASTURE SUBSIDY SCHEME

The Dairy Pasture Subsidy Scheme has now been operating for 4 years. During this period, in spite of a continuous decline in the numbers of dairyfarmers in the State, applications for assistance under the scheme have maintained a fairly constant level. Drought conditions in the last 2 years were responsible for a slight fall-off from the peak year 1967–68. A total of 5,971 registered dairyfarmers has received approval to plant since the Scheme commenced. Many of these have applied each year, bringing the total number of applications approved to 13,027.

The Fertilizer Grant announced as a drought relief measure towards the end of last financial year has been availed of by most dairymen participating in the Scheme in drought-declared areas; 3,209 applications were approved under the Grant, with a payout of $447,609.78.

An additional concession to assist farmers who had been unable to plant pastures applied for under the Scheme owing to dry conditions was approved by Cabinet during the year. This permitted applicants to plant the approved area deferred from the previous year and to be paid subsidy on this and the current year's planting. This compounding subsidy arrangement meant that farmers in these areas could plant increased areas and obtain subsidy payments up to $680 in 1969–70. The maximum annual subsidy payable normally is $400 and the total subsidy is now limited to $2,000. Total subsidy payable may be limited by herd size, average rainfall and carrying capacity.

An obvious result of expanding the annual subsidy to a maximum of $400, as recorded in the last annual report, is shown by the increased area per application in 1969-70. This is indicated in Table 1.

TABLE 1

——	To June, 30, 1969	July 1, 1969 to June 30, 1970
Total number of approved applications	9,486	3,541
Total area involved	158,265 acres	70,710½ acres
Average area per application	16·68 acres	19·97 acres
Number of claims paid	6,236	3,755
Total amount of subsidy paid	$976,412·76	$564,982·30
Area covered by subsidy paid	78,836·75 acres	46,429·25 acres
Average subsidy per acre	$11.24	$12.16
Deferred payments made	$132,317.44	$257,115.53
Deferred area involved (approximately)	11,772 acres	21,144 acres
TOTAL SUBSIDY PAID (since inception of Scheme)		$1,798,510.59
Subsidy held in deferment at 30–6–70		$88,409.16
Area deferred (approximately)		7,188 acres

It seems that the expansion of the Scheme has had the desired effect of enabling farmers in low-rainfall regions to benefit by establishing larger areas.

The larger areas planted in lower rainfall districts is emphasised further in Table 2, which shows the distribution in the nine regions compared with 1968-69 and the average acreage per application.

TABLE 2

——	No. of Registered Dairy Farms 1968–69	No. of Registered Dairy Farms 1969–70	No. of Applications 1968–69	No. of Applications 1969–70	No. Increase or Decrease	Average Area per Application 1969–70
North Queensland	532	466	307	253	−54	23·7 acres
Central Queensland	501	451	96	126	+30	45 acres
North Burnett	919	832	233	350	+117	30·4 acres
South Burnett	979	912	393	369	−24	17·9 acres
Wide Bay	1,717	1,537	781	973	+192	16·1 acres
East Moreton	1,300	1,178	369	474	+105	21 acres
West Moreton	1,644	1,475	675	538	−137	11·9 acres
Eastern Downs	1,731	1,675	320	416	+96	20·2 acres
Western Downs	322	300	50	42	−8	31·9 acres
	9,645	8,826	3,224	3,541	+317	

Central Committee has the Scheme constantly under review and adjustments in methods of administration have been made from time to time to increase efficiency and remove anomalies.

Approval was obtained for the provisional inclusion in the Scheme of farmers who intended to enter the dairying industry and who desired to establish improved pastures prior to the purchase of their dairy herd. In these cases, provisional approval may be given, subject to the normal requirements of prior approval to plant and on the understanding that claims may not be submitted until commercial production has been in progress for 4 weeks and the dairy is registered within 6 months of application for approval to plant.

Procedures were revised during the year and the application and claim forms amended as a further aid to simplification and efficiency.

A report has been prepared by Economic Services Branch on the first year's operation of the Scheme. The report covers comparisons of costs, farm areas, herd sizes, fertilizer and species used and seed rates. Figures indicate that the highest cost of establishing improved pasture in that year was $33.24 per acre in the Wide Bay Region and the lowest $17.96 in the Western Downs.

PRODUCTS RESEARCH

Further work has been carried out by the Dairy Research Branch on methods for determining the bacteriological quality of refrigerated milk, using the Prill and Hammer and the King methods for determining diacetyl reductase activity.

Further investigations have also been carried out on the proteolytic psychrophilic *Pseudomonas*, particularly in relation to market milk spoilage. The effect of nutrition on proteinase production by *Pseudomonas* spp., the characterization of the proteinases by use of chemical activators and inhibitors, and purification of proteinases by gel chromatography have received attention.

Considerable attention has also been paid to the possible commercial application of a test for gross proteolysis in milk. It has been established, however, that natural variation in milk composition is an important limiting factor to its successful application.

Keeping quality of table cream has been investigated. Samples of pasteurised commercial cream (18% fat, 42% fat and thickened) have been analysed at regular intervals using total bacterial count, resazurin reduction and residual hydrogen peroxide tests and organoleptic grading as criteria after periods of incubation. Over a range of many hundreds of samples, agreements between the various tests of from 68% to 83% were obtained.

Further investigations have been undertaken concerning the distribution and significance of the enzymes catalase, xanthine oxidase, aldolase, ribonuclease, and acid and alkaline phosphatase in milk. This work has been extended to embrace a study of enzyme levels in milk from mastitis-infected cows with a view to the development of diagnostic tests.

Progress has been made towards settling the current controversy in the literature regarding the number and molecular weight of normally occurring lipase in milk. Chromatographic studies have shown the presence of two lipases and approximate values for their molecular weights have been obtained.

A survey has been commenced in four districts to determine the composition of samples of bulk milk at regular intervals. This work is designed not only to provide information on changes due to district but also as a guide to milk utilization, nutritionally and for processing.

In collaboration with the Division of Tropical Pastures of C.S.I.R.O., milk produced by feeding various legumes has been pasteurized and assessed for tainting levels. Subsequently these milks have been made into cheese to investigate the effects of unusual casein/fat ratios on the quality of the manufactured product.

The pilot plant at the Otto Madsen Dairy Research Laboratory at Hamilton has been brought into more complete operation. In addition to the programme to manufacture more spreadable butter and study the effect and efficiency of various systems of cream and butter processing. investigational work on the fractionation of butter is being carried out. This may lead to the elaboration of additional marketable products.

The effect of methods of manufacture of cheese on the persistence of lactobacilli has been observed. It was found that first quality cheese could be manufactured without the appearance of lactobacilli during the first 6 months of ripening.

A study has been undertaken to assess the reliability of the penicillin-agar count now routinely used in this State as a measure of post-pasteurization contamination in enumerating gram-negative organisms in samples of young cheddar cheese. Because of the very large populations of gram-positive organisms in cheese and the probability that penicillinase is produced, the effective penicillin level may be drastically reduced in the medium.

At the regional laboratory at Toowoomba, trials to determine the suitability of a bacterial rennet for the manufacture of cheese have been continued in conjunction with the Field Services Branch, and regular analyses of samples of cheese directly after manufacture and during maturation have been an important feature of the work at that centre. It has been shown that the use of some bacterial rennets causes a marked increase in the proportion of non-protein nitrogen present in the cheese.

Further trials with the A.P.V. Paracurd 600 machine have been carried out on behalf of the A.P.V. Company in England. The machine produces cheese curd by employing the process of cold rennetting and presetting with starter so that the process of coagulation can be achieved continuously on heating the milk.

Various batches of experimental cheese have been made for chemical and bacteriological projects such as lactose in cheese, lipase in cheese, and methods for determining quality of refrigerated milk.

A spray drier in use in the Department's Dairy Pilot Plant at Hamilton.

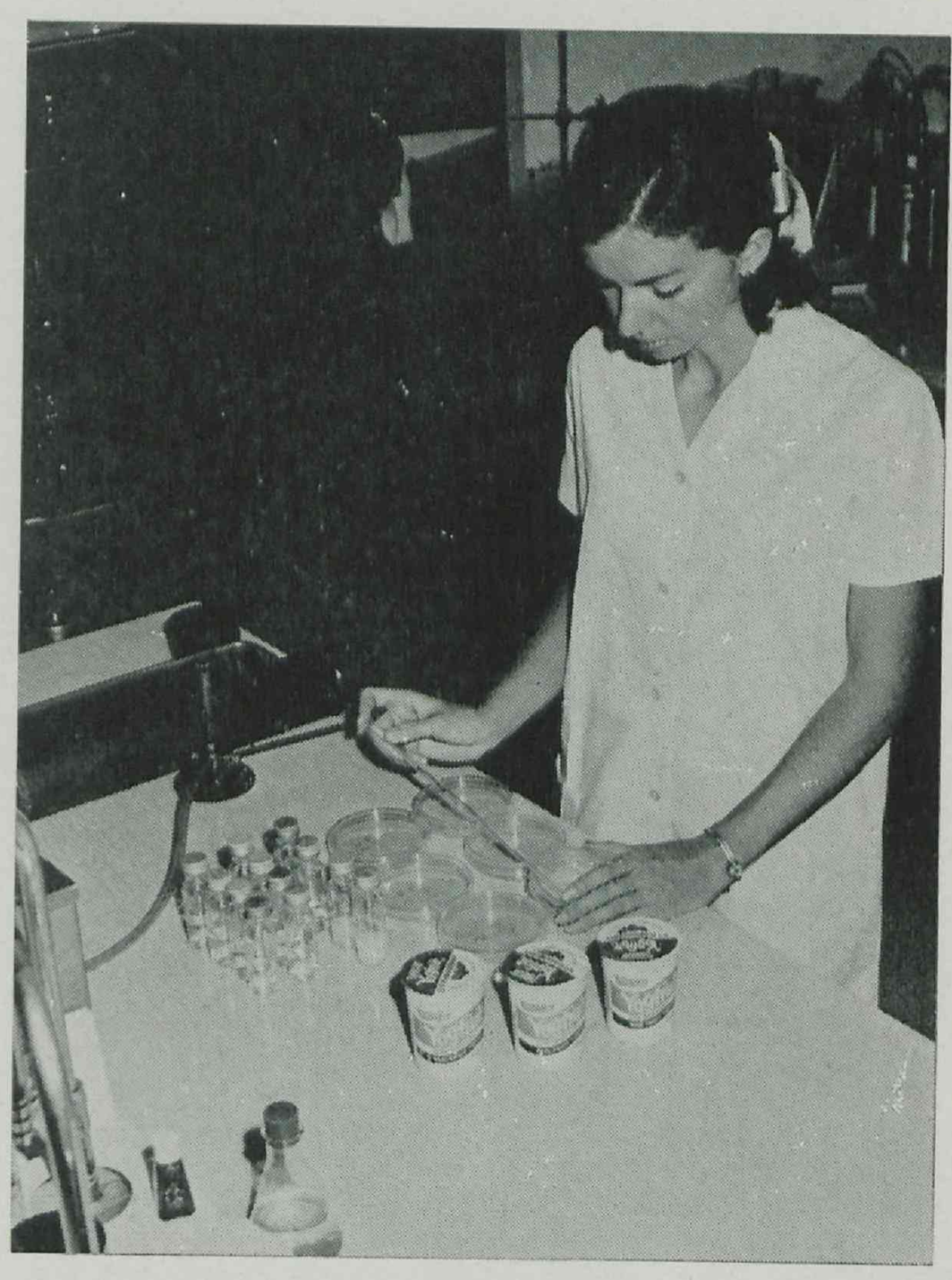
The pilot plant is equipped with machinery for drying of foods by several methods. Some experimental work on foam-spray drying of concentrated dairy produce and low dextrose levels used in the food industry has been completed. It has been shown that the process is successful but it has some limitations in that the sinkability of the powder is poor and some reconstituted foods tend to foam excessively. The production of powdered foods with large discrete particles has been carried out and a feasibility programme completed in co-operation with one commercial firm. In addition, the production of spray-dried quarg has been completed.

An invitation to a serving of pashka, a new dairy food to be eaten with biscuits.

The new Centritherm concentrator has been commissioned and brought into use for the concentration of whole-milk and skim-milk, whey and some fruit juices.

An extensive programme on new dairy foods has been continued. Further work on the production of quarg has been completed and attention has been given to the production of yoghurt to achieve a diversity of flavours as wide as possible.

Trials have also been undertaken to freeze both plain and fruit-flavoured yoghurt produced commercially. A new dairy product to Australia, Ymer, has been manufactured experimentally. This is similar to quarg in that it is a smooth lactic cheese made from either cream or wholemilk.



Bacteriological analysis of yoghurt being carried out at the Otto Madsen Dairy Research Laboratory.

Other new foods, such as milk drinks incorporating fresh tropical fruits, have been developed. Banana and mango milks have been assessed as being most acceptable to adults. In addition, whey has been used to produce some attractive beverages.

Officers of the Dairy Research Branch have been involved in the development of Australian standard methods for the examination of dairy products. Many drafts have been produced and methods of testing assessed in an endeavour to produce standard methods for use in this country.

IV. Pasture Research and Extension

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

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

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

The Dairy Pasture Subsidy Scheme is administered by a committee comprising representatives of various Divisions and the Queensland Dairymen's State Council.

RESEARCH

Inherent weaknesses of native pasture plants in Queensland include their short seasonal growth pattern, low feeding value when mature, poor response to increased soil fertility, inability to tolerate intensive grazing and the complete inadequacy of the legumes. A mosiac of soils and climatic conditions is found over our huge pastoral area. Therefore the development of new pasture plants to overcome the deficiencies of the native ones is a continuing and long-term endeavour.

Hand in hand with this work is the research aimed at identifying and correcting soil nutrient deficiencies. The State's pastoral soils are very often infertile and these deficiencies must be overcome if introduced pasture plants are to achieve their potential for animal production. Their establishment requirements must be defined also, in order that the new species are not choked out by the native grasses and weeds.

Pasture Species Evaluation

Encouraging results continue to be obtained in Agriculture Branch trials in North Queensland with a range of grasses and legumes. The pulse legumes *Clitoria ternatea* and *Phaseolus radiatus* and the perennial legume *Rhynchosia minima* have regenerated and spread over three seasons on a heavy clay soil south of Normanton. On lighter soils siratro and Townsville stylo increased their yield in the second year after planting, while grasses in the genera *Cenchrus, Anthephora* and *Schmidtia* were found to grow particularly well.

The importance of legume introductions was graphically illustrated near Mt. Garnet. On heavy black soils the legumes Leichhardt dolichos, Archer dolichos, Cooper glycine, Schofield stylo and Townsville stylo yielded over 1½ tons of forage or 350 lb. of crude protein. In contrast, introduced grasses yielded less than half a ton of forage or 50 lb. of crude protein. Characteristics such as persistence, early spring growth, higher seed yields, resistance to high stocking pressure and ability to spread into natural grasslands are now being studied in the legumes.

On the seasonal flood plains of the Isaacs-Mackenzie-Fitzroy river system, Bambatsi grass was found to be very tolerant to inundation, while *Urochloa mosambicensis* consistently and successfully re-established from seed after flooding.

At Charleville two annual grasses (giant button and giant Cenchrus) with the perennial grass *Anthephora pubescens* offer prospects for pasture improvement in the mulga zone. Regional evaluation sites are being established which will permit wider testing of the species in large plots. A trial of 168 acres has now been set up to define under grazing conditions the establishment, development and production characteristics of giant button grass in comparison with the native wire grasses.

Seedling establishment studies have been commenced at Charleville Pastoral Laboratory. Initial investigations involve the effect of rainfall and season on the type and number of seeds germinating in mulga soils. These studies are expected to assist in the definition of features required in exotic species for rapid establishment and survival under semi-arid conditions.

Strong evidence is accruing at "Brian Pastures" Pasture Research Station that grass establishment can be greatly improved on cracking clay soils when the seed is under-sown in mulches such as those provided by the stover from sorghum or oat crops.

The south-east of Queensland has had more favourable weather in the last summer than most other areas. Performance of tropical pastures following the 1968–69 drought has taught some important lessons. Outstanding drought tolerance and recovery were shown by siratro, Archer axillaris and lotononis and the grasses green panic, pangola and kikuyu. Losses of desmodiums (often associated with Amnemus weevil attack) and in some cases glycine and setaria have been reported from lower rainfall coastal and sub-coastal areas. In these latter cases, investigations into techniques of re-introducing legumes with minimum cultivation have been accelerated.

Extensive losses of Rhodes grass have occurred in the 20 to 25 in. rainfall softwood scrub and brigalow areas. In such locations buffel grass and green panic are outstanding for drought tolerance.

A comparison of Nandi setaria with the frost-tolerant variety Narok, released by C.S.I.R.O., was made at Cooroy under nitrogen fertilisation. The latter produced over twice the quantity of forage available from Nandi during the late autumn and early winter months. July to September production by both varieties was very low. Seed of Narok is now being produced under the Departmental Certification Scheme.

An experiment commenced at Cooroy in 1967 has shown that mixed plantings of tropical and temperate pasture species should be made in the autumn. Mixed plantings in the spring gave poorest results, while spring planting of the tropicals followed by over-sowing with the temperates in autumn gave an intermediate result.

Pimpama and Canungra experiments have illustrated the importance of sowing rate in pasture establishment and productivity. High grass seeding rates substantially reduce weeds and high legume rates are essential to ensure productivity, nitrogen fixation and therefore high protein content of associated grasses.

Pasture Nutrition

Pot experiments at Charleville have added vital information on the role of phosphorus in the deficient mulga soils and sandy, arid eucalypt soils. Buffel grass seedlings reached the 2-leaf stage in about 8 days regardless of soil phosphorus level. Where phosphorus was added, seedlings developed faster and plants matured in 3 months as opposed to 5 months in untreated soil. The practical implication is important. Rapid establishment and early seedling growth are essential for survival in an environment where rain is infrequent and soils dry rapidly. The greatest requirement for phosphorus is in the seedling stage, and the ability of buffel grass to survive drought when adequately fertilized has been demonstrated also.

Much run-down paspalum pasture on the lower north coast has been replaced by productive subtropical grass/legume mixtures.

On heavy clay soils at "Brian Pastures" green panic pastures were found to be best maintained when fertilized with 45 lb. nitrogen per acre and left ungrazed during summer. Satisfactory cattle weight gains then were recorded with autumn and winter grazing.

A trial at Gympie assessing the effects on kikuyu of strategic applications of nitrogen showed that forage production could be increased over fivefold. The highest yielding plots gave a dry-matter production of 1,788 lb. with 200 lb. of nitrogen applied.

Production of 1,000 lb. beef per acre from irrigated and heavily fertilized pangola grass pastures was achieved for the third year in succession at Parada Research Station near Mareeba. This production was reached with 300 lb. of nitrogen and a stocking rate of three steers per acre. The animals were fattened in three lots over 13 months. In a further experiment nitrogen applications are being tested up to 600 lb. per acre and the stocking rates up to 5 steers per acre.

Pasture Productivity

In a grazing trial at Blackall sheep have now been maintained on buffel grass, on country previously under gidyea scrub, for 2 years at a stocking rate of 2 sheep per acre. At this rate considerably lower fodder reserves have been available than in the 1 sheep per acre and 1 sheep per 2-acre treatments but there has been no change in plant cover and the pasture has remained vigorous.

The effect of continued heavy grazing on survival of native grassland has been demonstrated at Texas. Twelve months after removal of stock from paddocks grazed at 1 sheep to two-thirds acre for 6 years, forage yields were only a quarter of those from paddocks stocked for the same period at 1 sheep to 2 acres. Spring and autumn cultivation of native pastures at Texas has significantly encouraged growth of introduced medics.

At Toorak Sheep Field Research Station, defoliation studies on Mitchell grass during the dormant period over 5 years have shown that high plant mortality results from continued leaf removal. Losses did not occur with moderate levels of defoliation. The significance of this is reflected in drought management. During an isolated drought complete grazing could be justified. However, in a succession of droughts, as at present, total defoliation intensifies the effect of drought in subsequent years, does not produce additional forage and causes increased Mitchell grass mortality.

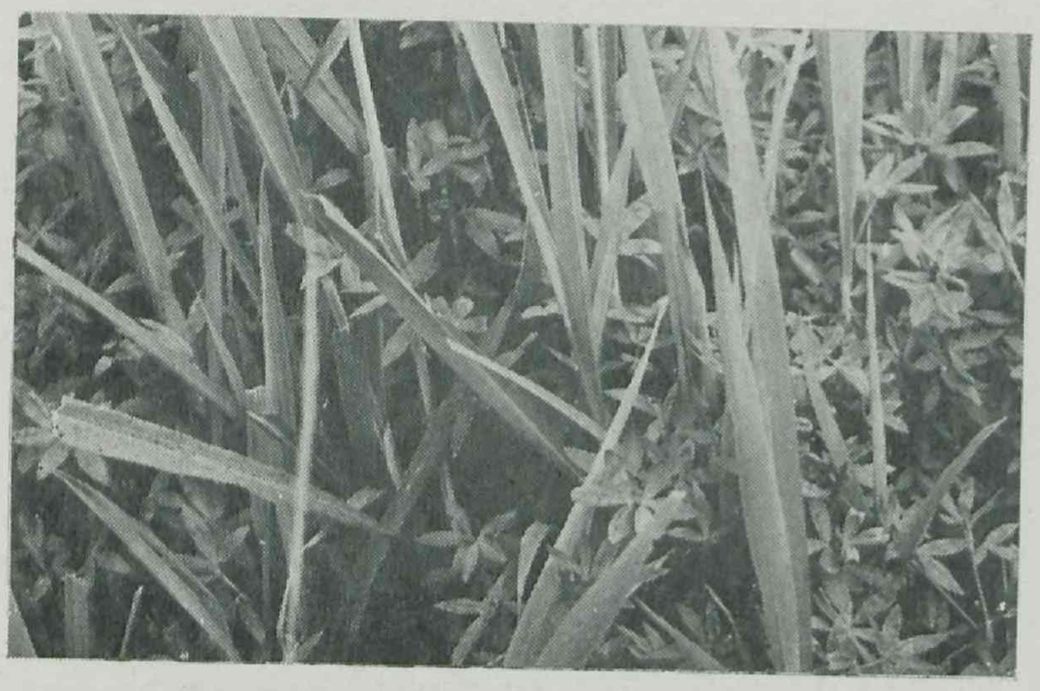
An experiment at Cooroy indicates that hays made from greenleaf and silverleaf desmodium possess good storing quality. There has been little decline in quality over 2½ years and the crude protein level has remained at a satisfactory level of 15%.

Interesting comparisons have been made between the productivity of tropical and temperate pastures in an experiment in the 50–60 in. rainfall area at Ormeau. Tropical pasture production extends from September to May. Frost-tolerant grasses will stand over into winter quite well. Temperate pastures have two periods of high production, April–May and August–November. Responses to nitrogen fertilizer are very much greater from the tropical grasses than from the temperate species, and the tropicals are more efficient water users. Thus both types of pastures have the ability to complement one another in a feed-year system. They can be mixed in the one pasture or planted and grazed separately. Each system has disadvantages in animal and irrigation management but both have been successful in practice.

There is an interest in Cape York Peninsula in the production of Townsville stylo hay to supplement native pastures during the long dry season. Freight costs on urea and molasses supplements are high and this has stimulated the interest in legume hay production. One property harvested 30,000 bales during the season.

Studies on animal performance on fertilized and unfertilized Townsville stylo were continued at "Swan's Lagoon" Cattle Field Research Station. The first phase of this research was completed during the year, and 5 years' results give some assessment of the benefits and the limitations which might be expected of Townsville stylo in this environment. Fertilized Townsville stylo has given considerably increased production over native pasture, but unfertilized Townsville stylo is only slightly better than native pasture. The performance on unfertilized Townsville stylo is of a similar pattern to that on native pasture although gains are usually at a higher rate and for a longer period. Dressing percentage and dressed weight are higher. Dry-season weight losses are so severe at 1 beast to 3 acres that deaths occur in most years.

When fertilizer at 1 cwt. superphosphate to the acre is applied, dry-matter production of Townsville stylo is greatly increased (in 1970, 2,442 lb. v. 1,939 lb.) and the phosphorus content of the material is also increased. This results in increased rate of gain, period of gain and annual liveweight increment, producing better finished bullocks, which can be turned off at a younger age.



Hamil grass and the legume stylo form a productive pasture mixture on the central coast.

Trials have now been modified to explore the effect of phosphorus supplementation on performance in animals grazing unfertilized Townsville stylo.

In Townsville stylo grazing trials in North Queensland, the application of superphosphate in 1968 resulted in significantly improved animal performance associated with increased profitability. However, with the drought conditions of 1969, it was necessary to remove steers from the trial areas, and the value of fertilizer was not retrieved.

In a trial aimed at determining the productivity of dryland Hunter River lucerne for beef production under a rotational grazing system, an area of 5 acres carried and fattened 2·4 yearling steers per acre, producing 806 lb. liveweight gain yielding an estimated 450 lb. of carcase gain per acre. A bloat control preparation has been added to the drinking water, and has apparently given satisfactory control.

At Kairi Research Station a comparison between groups of steers grazing glycine-green panic pastures at different stocking rates is continuing. In the latter trial, a liveweight gain of 501 lb. per acre was recorded at a stocking rate of 1 steer to the acre. At Utchee Creek, observations continue on time and age of introduction of steers for fattening on improved pasture. Slaughter stage has been reached more rapidly than was expected. Bullocks 2½ years of age have been turned off in from 112 to 175 days, while steers 18 to 25 months have reached slaughter weights in from 212 to 248 days.

High levels of beef production have been achieved in grazing experiments with lucerne in the Lockyer Valley.

Results at Brigalow Research Station of the first year's grazing in a large-scale grazing trial involving three pasture species each stocked at three intensities have shown that on the basis of liveweight gain per acre the highest stocking rate, 1 beast to 2½ acres, has been markedly superior to the lower rates, 1 beast to 5 acres and 1 beast to 7½ acres. The pasture containing green panic gave slightly better production than buffel grass pasture, which was superior to Rhodes grass pasture.

The difficulty of maintaining clover content in mixed pastures at Coolum Research Station, in the wallum country, has led to a shift in emphasis to the application of nitrogen to pangola grass. The performance of bullocks at different stocking rates and several levels of nitrogen application is being examined.

An economic assessment of Townsville stylo for beef production in North Queensland has been undertaken. Similar studies on improved pastures are under way in the Mackay and Burnett coastal regions and in the wet tropics around Innisfail.

The regrowth of native trees in land developed for pasture still remains one of the major problems facing beef production in Queensland. Research on some species is being carried out by the Botany Section, by C.S.I.R.O. and by Lands Department but so many species are involved that only a few of them can be studied in depth with existing resources.

Pangola grass pastures are proving successful on southern wallum country, pictured here, as well as under irrigation in the dry north.

Native Plant Studies

Research in the mulga community is clarifying the relationship between mulga tree density and herbage and grass production. At the lowest density studied of 64 trees per acre, sufficient ground forage has resulted to support a sheep to 5 acres for 12 months. With increased tree density, herbage production decreases and stocking rates must be reduced.

The conditions under which mass field germination of mulga seed occurs are being defined. This will permit the formulation of management techniques designed to protect the young seedlings and hasten the regeneration of mulga stands pushed over for drought fodder. South-west of Charleville mulga seedling numbers have increased from 134 to 490 per acre over 4 years even though the rainfall in any one year has not exceeded 13 inches. It had been contended previously that mass germination only occurred in years of abnormally high summer rainfall.

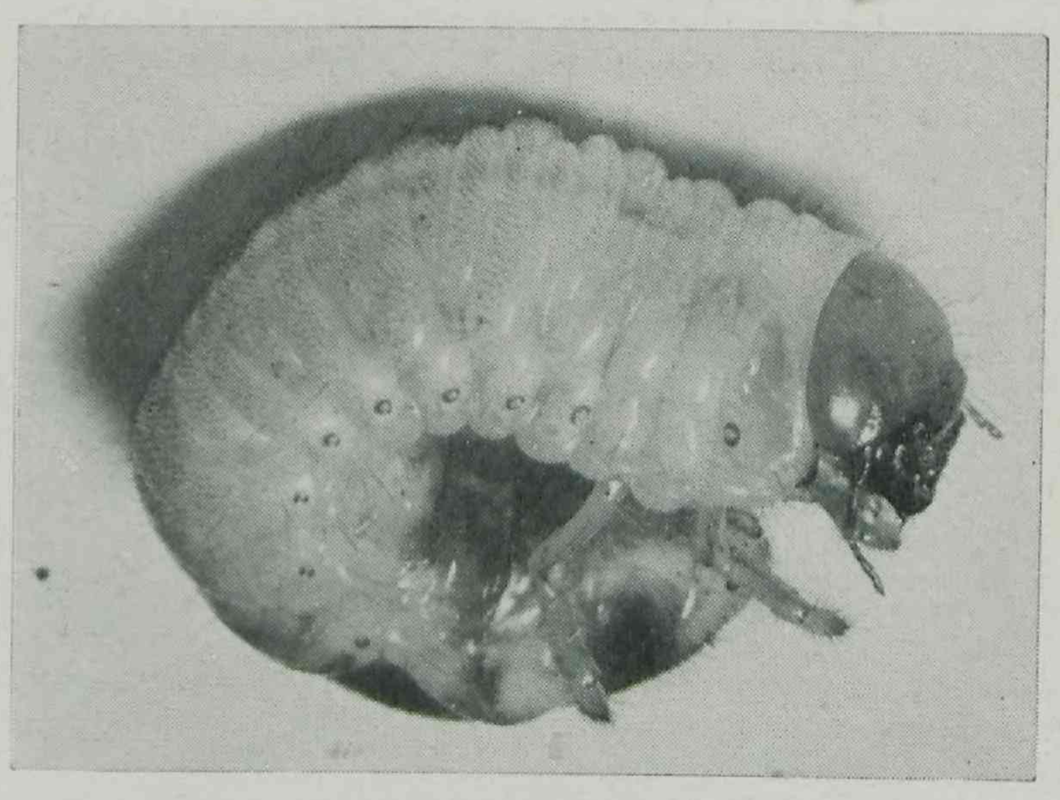
The shrub *Eremophila gilesii,* known as turkey bush, is inedible and is a pest on 4–5 million acres west of the Warrego River. Populations as high as 25,000 plants per acre have been recorded. In such cases it is the sole occupant of the land and the establishment of useful species is prevented. Research on this weed includes studies into germination and growth characteristics, compatability with other plants and control measures.

Legume Bacteriology

In a trial with siratro at Mt. Mee conducted by Plant Pathology Section, there was a decrease in the number of nodules with increasing application rate of molybdenum but individual nodules became larger. A further assessment will be made after one year to gauge longer term effects on nodulation and growth.

Pests

Pasture scarabs, particularly the black soil scarab *Othnonius batesii* (Oll.), caused serious damage in several parts of the Darling Downs and in the southern brigalow area. This damage, combined with drought conditions and consequent overstocking, has resulted in considerable pasture deterioration. Study areas are providing data on the pattern of infestation. Laboratory insecticide mortality studies proved that some chemicals give a high percentage kill of larvae; this information should prove useful if other control measures prove inadequate for pest reduction. The discovery of this pest in the Central Highlands and some other brigalow localities shows that the importance of this pest in relation to the whole brigalow development scheme cannot be disregarded.



Larva of the black soil scarab, a pest of pastures in the Darling Downs and brigalow country.

The Australian plague locust (*Chortoicetes terminifera* (Walk.)) occurred in western and south-western parts of the State. As the areas threatened by the small hopper and adult swarms were usually of low value pastures, few attempts at control were contemplated. Where controls were carried out, maldison at 6 oz./ac. gave good control, thus obviating the necessity to apply hydrocarbon chemicals to pasture.

V. Field Crop Research and Extension

Agronomic work on field crops (i.e. crops except fruit, most vegetables and ginger) is a major responsibility of Agriculture Branch, but various other Branches and Sections including Agricultural Chemical Laboratory, Botany, Entomology, Plant Pathology, Marketing Services, Economic Services, Standards, Soil Conservation, Development Planning, Cattle Husbandry, Sheep and Wool, Pig, Poultry, Husbandry Research, Biochemical, Biometry and Research Stations, are engaged to a lesser extent on various aspects of production and marketing.

Field crop research is conducted on research stations at Southedge, Walkamin, Kairi, South Johnstone, Millaroo, Biloela, Theodore, Gatton and Hermitage, and at numerous field investigation centres.

WHEAT

The pre-sowing drought-hardening study of wheat, conducted by the Queensland Wheat Research Institute plant physiologist, has developed to the stage where it is proposed to have a bulk of seed treated commercially, for evaluation by farmers throughout Queensland during the 1971 season. The average yield increase due to the use of drought-hardened seeds in the 1969 trials was 8·5% for Timgalen and 16·0% for Gamut. Average yield increase for all trials carried out over the last three seasons has been 12%.

In another physiological study, aimed at determining genetic variation in yield under various stress levels, a delay in sowing reduced the yield potential of wheat by approximately 30% per month after June-July sowing. The drop in yield was found to be caused by a reduction in the number of fertile ears per plant, the number of grains set per ear and the weight per grain. As sowing was delayed the proportion of grain produced on the main stem increased, indicating the need for a higher seeding rate for late sowings.

Nineteen soils comprising a cross-section of many of the major soil types utilized for cereal production in the State were screened for mineral deficiencies during 1969-70 at the Queensland Wheat Research Institute. Widespread and often unexpected deficiencies were detected. The black earths of the Central Highlands displayed fairly consistent deficiencies involving phosphorus, sulphur, molybdenum and zinc. Major deficiencies noted in the remaining 14 trials were: phosphorus in 10 trials, molybdenum in three trials, and zinc, sulphur and calcium in one trial each. Further soils will continue to be investigated and as time permits field tests will be conducted on all soils which exhibited mineral deficiencies in the glasshouse studies.

The regional wheat testing programme conducted by Agriculture Branch was disappointing in 1969, frost and dry weather causing failure of most trials. One of the main interests in the programme was to gauge the performance of the new variety Gatcher (previously TR236). The average yield of Gatcher in three trials, two experiencing adverse weather and one good growing conditions, was 1,878 lb./ac. The average yield for Gamut was 1,848 lb./ac. and for Spica, Mendos and Timgalen, 1,777, 1,727 and 1,644 lb./ac. respectively. Gatcher performed well under adverse conditions, while Timgalen performed poorly.

Stem rust (*Puccinia graminis* f. sp. *tritici*) and leaf rust (*Puccinia recondita*) were generally not widespread or serious in 1969 because of dry conditions. However, varieties of soft wheat such as Pinnacle grown under irrigation at St. George were affected by stem rust, sometimes quite seriously. Barley grass (*Hordeum leporinum*) in that area was also found infected with the wheat stem rust organism. It obviously could be important in the epidemiology of the disease.

The Festiguay-attacking race of the stem rust fungus first detected near Warwick in the 1968 season was recorded over widespread areas of the main Queensland wheat belt during 1969, illustrating the rapidity with which new races can be disseminated.

Intensive research into generalised resistance to rust in wheat has begun and a plant pathologist went overseas to examine techniques at research institutions in Africa, Europe and America.

In common root rot (*Cochliobolus sativus*) trials, the local variety Festival showed a level of resistance equal to the best available from Canadian material.

Some significant yield responses were obtained on certain sites on the Darling Downs to seed inoculation with *Azotobacter chroococcum* on some wheat and barley cultivars.

BARLEY

Seasonal conditions also adversely affected the 1969 regional barley testing programme of Agriculture Branch. Yields for four varieties from eight trials only are available for comparison. The Barley Marketing Board has accepted Clipper variety for malting purposes and hopes to change completely to this variety within two years. Because of this, most interest in the variety trials in the difficult 1969 season centred on the comparative performance of Clipper and Prior, which has been the recommended malting variety up to this season. Over the eight trials Clipper yielded 38·3 bus./ac. as against Prior 35·9 bus./ac. The increase in favour of Clipper over Prior was only 7% in 1969 as against 27% from 18 trials under better seasonal conditions in 1968. Dampier and Bussell, two new Western Australian varieties, yielded 35·9 and 37·5 bus./ac. respectively. The new Victorian variety Weeah was included in two trials only and yielded 65·8 and 33·6 bus./ac. Clipper yielded 55·1 and 33·9 bus./ac. in these trials, which were conducted on the southern Darling Downs.

Barley stripe mosaic was recorded for the first time in Australia at Kingaroy during the year. The cultivar Cape appears to be carrying a significant level of seed-borne infection. The occurrence of this potentially serious virus disease will be closely observed during the 1970 season. It is already evident that the disease is widespread.

GRAIN SORGHUM

The inability of hybrid grain sorghums to withstand lodging, particularly in Central Queensland, is the major production problem facing the industry. Only DeKalb E57 among the commercial hybrids has a moderate degree of resistance and it is the only hybrid recommended together with the conventional variety Alpha for use in these areas. A concerted effort is being made by the plant breeders, a recently appointed plant physiologist and agronomists to overcome this problem. The plant breeders have developed among their hundreds of lines a hybrid which shows considerable promise but has still to be tested further in trials and in small farmer plantings before its release can be recommended.

The agronomists' approach to the problem to date has been to concentrate mainly on determining the effect of row spacing and plant population on yield and lodging. In a 1968-69 plant population, row spacing study, Alpha and DeKalb E57 were sown at four populations—15, 35, 55 and 75 thoussand plants/ac.—in 14, 28 and 42 in. rows. Identical trials were conducted at Biloela and Brigalow Research Stations and in the Springsure district. Two trials failed due to drought but valuable results were obtained from the Biloela Research Station trial. This experiment received only 40% of the expected rainfall during the growing season. DeKalb E57 yielded 48·4 bus./ac., 23% higher than Alpha, but dry forage yield of Alpha was 14% higher than that of the hybrid. Sorghum grown in 28 in. rows gave significantly higher yields than in the 14 and 42 in. rows. The 15,000 plants/ac. population yielded significantly less grain and forage than the higher populations.

MAIZE

The maize hybrid QK37, resistant to tropical rust and bred at Kairi Research Station, was only released in 1963, yet in the 1969-70 season sufficient seed was sold to sow 20,000 to 24,000 ac. It is now by far the most widely grown hybrid on the Atherton Tableland. A disadvantage of the hybrid is its pale grain. It is of interest to note that of 20 new hybrids resistant to tropical rust, which have been developed by the Kairi Research Station plant breeding team and which have been handed over for district testing by agronomists, 5 have the desirable yellow grain colour.

A Departmental plant breeder pollinating a maize plant in a breeding programme.

Also on the Atherton Tableland, in a continuing trial comparing three land-use systems, continuous maize receiving 60 lb. N/ac. yielded 97·4 bus./ac., while continuous maize without nitrogen yielded only 54·2 bus./ac. Maize grown in the first, second, third and fourth year after green panic/glycine pasture yielded 91·8, 91·1, 75·7 and 70·8 bus./ac. respectively. Differences in yield between fertilized continuous maize and maize first and second year after pasture were all significantly greater than unfertilized continuous maize and maize third and fourth year after pasture. The percentage of diseased grain was significantly less for maize first year after pasture than for continuous unfertilized maize.

Seasonal conditions also played havoc with the rain-grown section of the 1968-69 regional maize varietal testing programme, in which only the Kingaroy dryland trial produced worthwhile results. However, four irrigated trials at Emerald, Gatton, Walkamin and Dalby performed creditably. Four varieties, DS601, QK37 and DS65A and DS805A, of 15 varieties represented in each of the five trials gave good average performances. DS601 and QK37 were also among the best average performers in the 1967-68 trial series.

In North Queensland, ear rot (*Diplodia macrospora*) was significantly less in fertilized plots when compared with control plots at Kairi Research Station.

Sugarcane mosaic virus was again found to be widespread in commercial crops of maize and sorghum in southern Queensland. It is obvious that a close source of infected Johnson grass is not necessary for moderate to high levels of disease to occur in both these crops. Resistance studies are continuing. At Brookstead, American maize hybrids were almost 100% infected while "Q" hybrids nearby had a much lower incidence.

TOBACCO

The plant breeding and varietal assessment programme is geared to provide the tobacco industry with varieties producing high yields of good quality leaf. Consideration is also given to the diseases of importance in Queensland, viz., blue mould, black shank and bacterial wilt. Varieties with potential resistance to these diseases arising from plant introduction and plant breeding programmes are being evaluated in regional trials. The recently released variety NC95 has good field resistance to bacterial wilt.

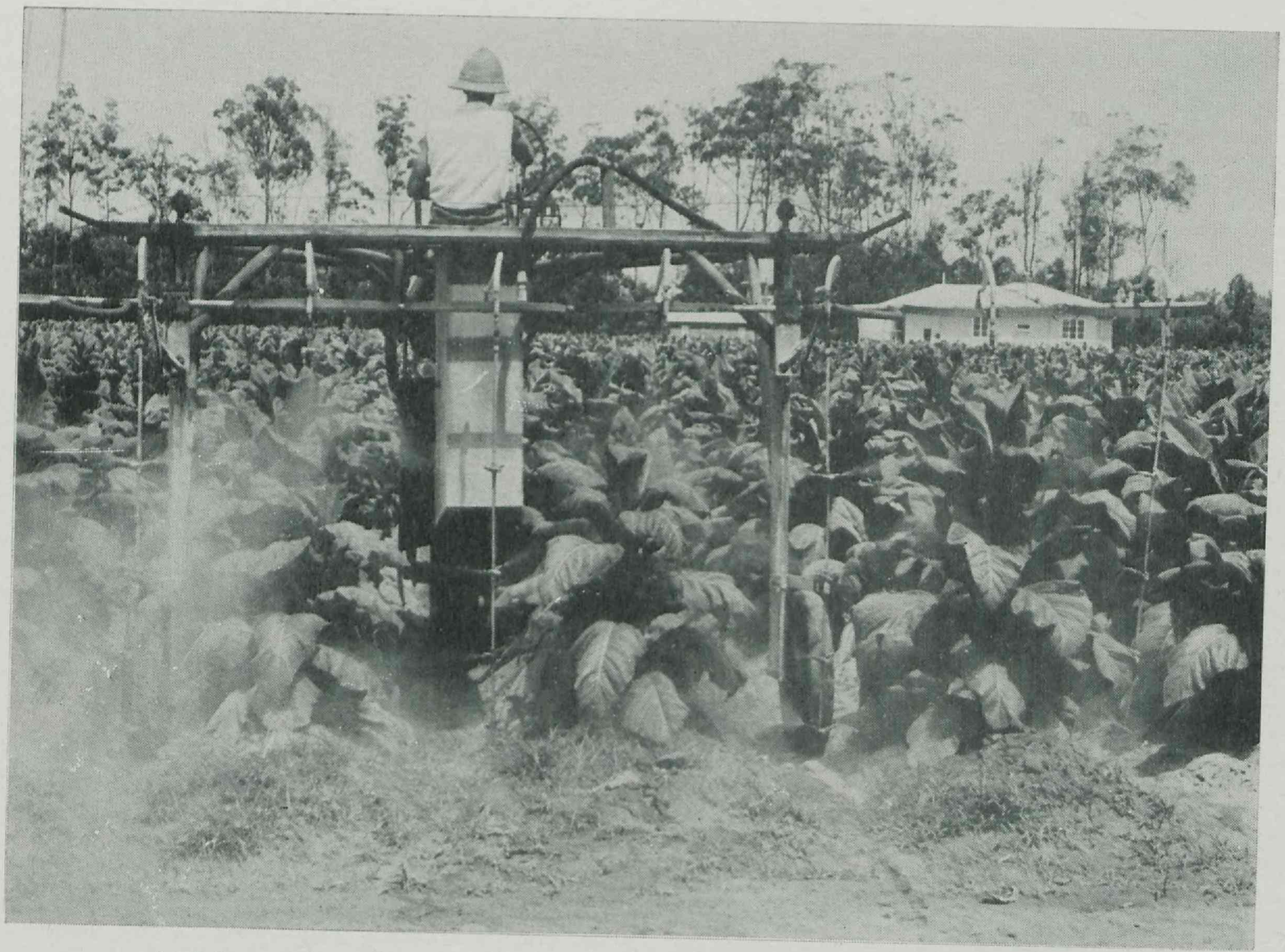
Investigations in the use of ammoniated fertilizers as sources of nitrogen for tobacco production have continued. Last year it was reported that up to 50% of the tobacco plant's requirement of nitrogen could be supplied in the ammoniated form. The past season's work confirmed this finding. This information is of importance commercially because ammoniated fertilizers have advantages from the viewpoint of fertilizer manufacturing techniques.

For some seasons leaf mottling has been observed in the tobacco areas of North Queensland and the visible symptoms appeared to be associated with dry seasons (i.e. little or no supplemental rainfall) and nitrogen-potash nutrition. The appearance of the symptoms is dry seasons has suggested that water stress during the period of grand growth may be a contributing factor and this aspect is being studied. The commercial practice of late applications of potash has been examined on a number of sites and on some of these late applications of potash have been found to reduce leaf yields and quality. Nitrogen-potash relationships are being studied also.

The occurrence of black shank (*Phytophthora nicotianae* var. *nicotianae*) was confirmed by Plant Pathology Section in both North and South Queensland. This disease, a very serious one overseas, had not previously been recorded in Queensland. Very serious losses were recorded in the blue mould resistant cultivar Sirone, which is obviously highly susceptible. Intensive investigation into sources of resistance to the disease are under way at Mareeba. Detailed observations on field occurrence and severity are being carried out.

Black shank has appeared as a serious new disease of tobacco in the Mareeba district.

A pest prediction service was operated by Entomology Section during the recent tobacco season based on district-wide moth trapping and ovary dissection of collected insects. This was the first full season application of pest prediction and it was claimed by all concerned to be a practical success and of immense advantage to the industry. Where the system was followed, growers were able to reduce insecticide applications by up to 50% and still achieve economic control of insect pests. The net result was a cheaper and more desireable crop. This work will be expanded to cover a larger area next season.



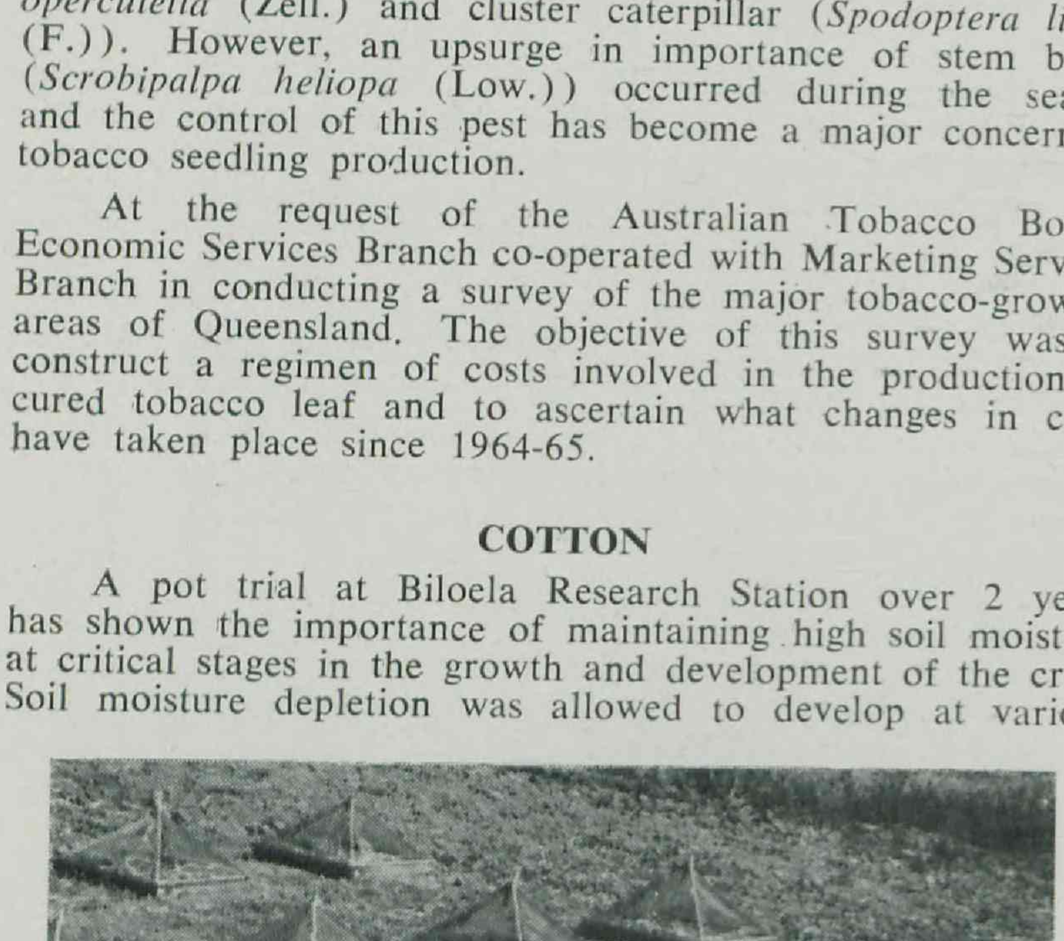
Applying an insecticide to a tobacco crop with a high-clearance spraying machine.

The insecticide recommendations against tobacco pests gave good control of looper (*Plusia argentifera* Guen.), budworms (*Heliothis* spp.), leaf-miner (*Phthorimaea operculella* (Zell.) and cluster caterpillar (*Spodoptera litura* (F.)). However, an upsurge in importance of stem borer (*Scrobipalpa heliopa* (Low.)) occurred during the season and the control of this pest has become a major concern in tobacco seedling production.

At the request of the Australian Tobacco Board, Economic Services Branch co-operated with Marketing Services Branch in conducting a survey of the major tobacco-growing areas of Queensland. The objective of this survey was to construct a regimen of costs involved in the production of cured tobacco leaf and to ascertain what changes in costs have taken place since 1964-65.

COTTON

A pot trial at Biloela Research Station over 2 years has shown the importance of maintaining high soil moisture at critical stages in the growth and development of the crop. Soil moisture depletion was allowed to develop at various successive stages of the cotton plant growth, beginning at the appearance of the first squares. Cotton yields declined for all stresses imposed during the first 9 weeks of flowering. The most drastic results occurred from stress between first bloom and 6 weeks later, the number of bolls being halved and yields depleted to about 43% of the no-stress treatment.



Ground covers used in experiments to determine the percentage emergence of cotton insects buried at specified depths.

The cotton breeding programme at Biloela Research Station is continuing. The aim is for development of a higher strength cotton for Central Queensland, and also an early-maturing cotton with satisfactory fibre strength and yield for Southern Queensland, where cold weather towards the end of the season is a problem.

On the Darling Downs, quality of the cotton fibre has not been good. A survey showed that this is associated with low temperatures, the mean hourly level of 68°F being critical. This indicates that bolls set after the end of February are likely to produce immature fibre.

PEANUTS

Agronomic research with peanuts has intensified in the past year and now includes time-of-planting and fertilizer work on the Atherton Tableland, nutrition and population studies in the South Burnett and a small plant-breeding project at Hermitage Research Station. While no increases in yield or in nut quality have been achieved to date by applying fertilizer at planting in Tableland nutrition trials, marked yield differences due to variation in sowing date have been realized in that area.

The varietal situation in the South Burnett was by no means clarified as a result of the drought-affected 1968-69 Virginia-type varietal trial. The yield order of varieties was virtually the reverse of that in the previous year's trial. The previously consistent performer, Selection 5, produced only 1,423 lb./ac. nuts-in-shell compared with the commerical variety VB Bulk with 1,706 lb./ac.

The Hermitage plant breeder is endeavouring to produce a variety with a red seed coat from the high-yielding, pale-nut imported types which have been under test.

Control of pre-emergence rot (*Rhizopus* spp.) and crown rot (*Aspergillus niger*) continues to be obtained with the use of an organo-mercurial/captan mixture used as a seed dressing. Recent work indicates that P.C.N.B. may be preferable to the organo-mercurial component of the mixture, giving an increased emergence as well as reducing the health risk to operators.

In the continuing trial by Plant Pathology Section at Kumbia, the removal of peanut trash after harvest again resulted in a delay of onset of symptoms of Verticillium wilt (*Verticillium dahliae*) in the subsequent peanut crop. This disease is now becoming increasingly more prevalent in crops on the Atherton Tablelands.

A peanut pick-up thresher operating in the South Burnett.

Economic Services Branch officers have co-operated with the Bureau of Agricultural Economics in a survey being carried out of the peanut industry and alternative crop and livestock activities in the Burnett Region.

OILSEEDS

Sunflower research has been stepped up in an effort to help an industry which has considerable export potential. A recently appointed plant breeder has introduced from the United States Department of Agriculture 105 sunflower varieties gathered from the major sunflower producing countries. The varieties were especially selected by the U.S.D.A. as being potentially suited to the Queensland environment and should therefore provide a good foundation for the breeding programme.

An irrigated sunflower plant population trial conducted on the Darling Downs produced interesting results. Populations of 20,000 to 100,000 plants/acre were grown at 7 to 42 in. row spacings. The highest yields were achieved at the narrower row spacings, while plant population had little effect on yield. The average yield for all treatments in the trial was high at 2,948 lb./ac. The amount of oil produced per acre by the various treatments followed a similar pattern, the average amount produced being 1,189 lb./ac.

In North Queensland, K lines of soybean produced by University of Queensland plant breeders have performed well in Departmental trials. K54 performed best in the 1968-69 trial with a yield of 2,015 lb./ac. The best of the commercial lines, Improved Pelican, yielded 1,600 lb./ac.

Most Departmental soybean research is still centred on the Darling Downs. Semstar (1,638 lb./ac.), Bellaire (1,581 lb.), Boone (1,463 lb.) and Wills (1,431 lb.) were the most successful varieties in an irrigated experiment in the Brookstead area. Dorman (2,354 lb./ac.), Semstar (2,339 lb.), Wills (2,143 lb.) and Hill (1,821 lb.) performed best in a Hermitage Research Station strain trial.

When five early-maturing soybean varieties were tested at three sowing dates at Hermitage Research Station in 1968-69, there was no overall time of planting effect on yield. Nevertheless, October planting was significantly better than December planting for the two more productive varieties, Clarke 63 and Scott, while November planting was also significantly superior to the December planting in the case of Clarke 63. With this variety, yields for October, November and December plantings were 1,400, 1,031 and 914 lb./ac. respectively.

Pseudomonas glycinea, the cause of bacterial blight of soybeans, was positively identified for the first time in Queensland. Rust (*Phakopsora pachyrhizi*) was serious in some plant breeders' plots.

NAVY BEANS

Navy bean research continued in the South Burnett with varietal improvement, varietal testing and plant spacing studies. Under the dry conditions experienced in 1968-69 the late-maturing commercial variety Kerman failed with a yield of only 237 lb./ac. Conditions suited Gallaroy, which is earlier maturing, and it yielded 566 lb./ac. The best variety was a Sanilac x Actopan cross, Selection 45, which yielded 693 lb./ac. Again in the unfavourable conditions, 9 in. and 12 in. plant spacings outyielded 2 in. plant spacing, all in 36 in. rows, by an average of 77%.

Rust (*Uromyces appendiculatus*) caused serious losses in the Gallaroy variety of navy bean but Kerman showed good field resistance.

RICE

The agronomy research programme on rice has continued at Millaroo Research Station with the emphasis on varieties and nitrogenous fertilizers.

In the early-maturing varietal trial, Nata and Lacrosse were the outstanding varieties of the six tested, with yields of 5,266 and 5,382 lb./ac. respectively. Five of the varieties achieved maximum yield at 80 lb. of nitrogen per acre. In mid-season tests, Bluebonnet, Dawn and Fortuna yielded an average 5,096, 5,070 and 5,004 lb./ac. respectively. Bluebonnet and Dawn achieved top yields at 120 lb. of nitrogen per acre. Nine introductions were tested in the late-maturing trial. The top variety was Q8617, with a yield of 5,879 lb./ac. This variety reached its maximum yield at 40 lb. of nitrogen per acre. A nitrogen fertilizer time-of-application experiment showed that increased yields are obtained with split applications. The best result was obtained from 80 lb. of nitrogen per acre, with half applied at planting and half 2 weeks before flowering.

Through the co-operation of rice growers in providing data on land preparation and cropping practices, farm management guide-lines on the profitability of rice growing on the Burdekin have been determined by Economic Services Branch.

TEA

The tea clonal evaluation programme has continued and 15 new clones have been made available from Tocklai Research Station (Assam) after local quarantine. Hot dry conditions in spring and early summer severely tested the four experimental plantings in the Ingham district, where heavy seedling losses occurred. These plots will be persevered with to ascertain whether both shade and irrigation are essential to satisfactory establishment in this region.

The commercial plantings are currently being made from seed. The use of pre-emergence chemical herbicides for weed control is regarded as a possible substitute for the Visqueen sheeting costing about $70/ac. at present used in plantations. If effective weed control can be achieved by chemical herbicides without the accumulation of dangerous residues, this could result in reduced production costs. The recently completed diuron residue trials have indicated that the dangers of high diuron residue accumulation in soil and tea leaves at Innisfail are not serious. Two of the newer herbicides, chloroxuron and metobromuron, are also under field evaluation.

A tea-manufacturing laboratory is currently being equipped with experimental tea equipment with financial assistance from the Department of Industrial Development.

LUCERNE

Laboratory studies of the life history of the lucerne jassid (*Austroasca viridigrisea* Paoli) were made by Entomology Section. Held at a temperature 71±1°F., eggs hatched in 9-10 days. The nymphs were reared on lucerne seedlings grown in soil inside 3 in. x 1 in. plastic vials covered with gauze, and held at constant temperature in a multiple-temperature incubator. Developmental periods for each of the five nymphal instars were 2 days, 1 day, 1 day, 2 days and 3 days respectively when reared at 84°, and 2, 2, 2 and 3 days for the last four nymphal instars when reared at 72°. The mean adult longevity was 29 days at 84°F and 37 days at 72° and maximum adult longevity was 8 weeks. Oviposition occurred 2 days after the emergence of the adults, and usually commenced within 4 days of emergence. The adult females can lay at least 60 fertile eggs during their life.

A vacuum insect collecting unit being used for determining pest populations in lucerne.

WEED CONTROL

Preliminary studies with Mexican poppy infestations in wheat indicated that this weed is much more sensitive to 2,4-D than is generally believed. Good control of seedlings of black pigweed in grain sorghum was again obtained with atrazine at 2 oz. a.i. per acre when the weeds were 1 week old.

Four pre-emergence herbicides—nitralin, trifluralin, amiben and dimethyl—were tested against weeds in soybeans in North Queensland. Trifluralin and nitralin were incorporated using discs and rotary hoe. Highest grain yields were obtained from rotary-hoed trifluralin and nitralin plots. However, none of the four herbicides was particularly effective for broadleaf weed control.

Field studies of wild oat control have again shown that low populations of wild oats (fewer than 50 plants per square yard) do not exert a significant competitive effect on a wheat crop when soil moisture is adequate. On the other hand, populations of 200 plants or more per square yard can reduce a 50 bus. per acre wheat crop by 40%. Again field evaluation of chemical herbicides has shown that barban applications are effective only on wild oat seedlings which have emerged within 10-20 days before spraying. Trifluralin in preliminary trials has given a satisfactory control of wild oats in barley.

Weed control studies in onions have shown that commercial herbicides now available can maintain an onion crop virtually free of weeds throughout its life. These studies indicate that 60% of the total yield loss of the crop due to weed competition occurs during the first 6 weeks.

VI. Horticultural Research and Extension

The main responsibility for horticultural research and extension rests with Horticulture Branch, which is concerned with production, post-harvest handling and processing of fruits and vegetables. Cultural research is centred at five Horticultural Research Stations at Applethorpe (Granite Belt), Ormiston (Redlands), Nambour (Maroochy), Cairns (Kamerunga) and Bowen, supplemented by field trials in major producing districts. Post-harvest and processing research is carried out at the Sandy Trout Food Preservation Research Laboratory, Hamilton. Extension services are provided by the Branch in all fruit and vegetable growing districts.

Liaison with industry is maintained through a number of Horticultural Advisory Committees. Within the Branch informal research/extension committees are responsible for the definition of problems in production and handling and assist in the co-ordination of research and extension activities.

Other sections of the Department involved in horticultural research and extension are Entomology and Plant Pathology Sections, which are concerned with pest and disease control, and Agriculture Branch, which handles the production side of some heavy vegetables—pumpkins, marrows, potatoes and onions.

Marketing Services, Economic Services and Standards Branches are concerned with such aspects of horticultural production as marketing, economic surveys, farm management accounting and seed certification.

DECIDUOUS FRUITS

In spite of the generally low level of natural fertility of the Granite Belt soils, no clear-cut responses to applied nutrients have been obtained in formal trials which have been in progress for many years. This is considered to be due in a large measure to tree-to-tree variability and a new approach is being made to the question of apple tree nutrition by a survey method involving a larger number of trees in a number of representative orchards. Horticulture Branch, Agricultural Chemical Laboratory Branch and a commercial fertilizer company are collaborating in the survey, which is planned to extend over a period of 3 years initially. Soil nutrient levels have been found to decrease with depth but less sharply than was previously thought. Data already obtained have provided evidence of a high correlation between soil nutrient level and tree size, which it is hoped to relate to yields and foliar levels as the work progresses.

Glasshouse investigations of trace element deficiencies and associated disorders are continuing and will extend to field trials as the necessity arises.

It has been evident for some time that root damage resulting from mechanical cultivation for weed control in orchards has seriously reduced the effective available depth of the shallow soils of the Granite Belt. Added to this, mechanical pulverization of the top-soil reduces water infiltration from the limited rainfall, frequently resulting in critical shortages of soil moisture. The use of chemical weed control has been investigated with the object of overcoming these problems. Good weed control has been obtained in apple and peach orchards with both Terbacil and Simazine, the former having a more lasting effect but also being more costly.

An important factor in the economics of apple production is the promotion of commercial crops at as early a stage as possible in the life of young orchards. Vigorous growth necessary to accelerate the attainment of adequate tree size frequently delays the onset of bearing. Growth retardants to check vegetative growth and promote bearing have been investigated. In trials in the district, flowering and fruit set in both Granny Smith and Delicious apples have been effectively promoted by the use of Alar and work along these lines is continuing.

There has been a long-felt need for earlier, acceptable varieties of pome and stone fruit on the Granite Belt. With this objective, introductions of promising varieties from overseas have been made and a local breeding programme has also been undertaken. Early in 1970 a limited release of budwood of introduced peach and nectarine varieties, mostly of American origin, was made from the Granite Belt Horticultural Research Station. These comprised eight early, yellow-fleshed peach varieties and seven nectarine varieties of the Nectared series. The latter are large, yellow-fleshed and ripen in succession at intervals of about a week. They are particularly attractive and should have good prospects in the stone fruit complex of the Granite Belt.

Only 5 years after the initiation of the apple breeding programme, some 30 trees have matured a crop. Based on the general level of fruit type in the first of these breeding progeny, the prospects of superior early red apples emerging from the hundreds of further lines which should come into bearing in 1971 appear particularly bright. There is also the prospect of better adaptation to local conditions since this subtropical area is outside the climatic region in which the majority of commercial varieties have been evolved.

A plant breeder making observations on breeding material in the apple improvement programme at Granite Belt Horticultural Research Station.

The work commenced in 1968-69 to investigate the relation of time of harvest of Granny Smith apples to the early detection and subsequent development of bitter pit has been continued. Associated with this, an attempt is being made to develop a suitable chemical or physical index of maturity.

Spider mite (*Tetranychus urticae* (Koch)) is the most serious pest on apples in the deciduous fruit growing area. Glasshouse experiments conducted by Entomology Section were directed towards the assessment of the resistance of the four major commercial apple varieties to this pest. Potted apple trees were uniformly infested with mites and the varieties later ranked in ascending order of resistance were Delicious, Granny Smith, Gravenstein and Jonathan. This confirmed the results obtained by measuring the intrinsic rate of natural mite increase on detached leaves and suggested that the detached leaf culture technique provides a suitable method for screening apple varieties for resistance to spider mite.

Blossom blight of peaches by the brown rot organism (*Sclerotinia fructicola*) was detected in the Granite Belt. Spray schedules incorporating blossom sprays with the new fungicide benomyl in addition to the previously recommended preharvest schedules gave good control of this disorder.

Detailed studies on the etiology of bacterial spot (*Xanthomonas pruni*) of stone fruit were continued by Plant Pathology Section. The bacteria survive the dormant period in the twig and bud tissue, providing a suitable source of inoculum for re-infection of new growth. Microscopic examination of infected wood and buds has shown that the organism is present in both the cortex and phloem but only very occasionally in the xylem vessels.

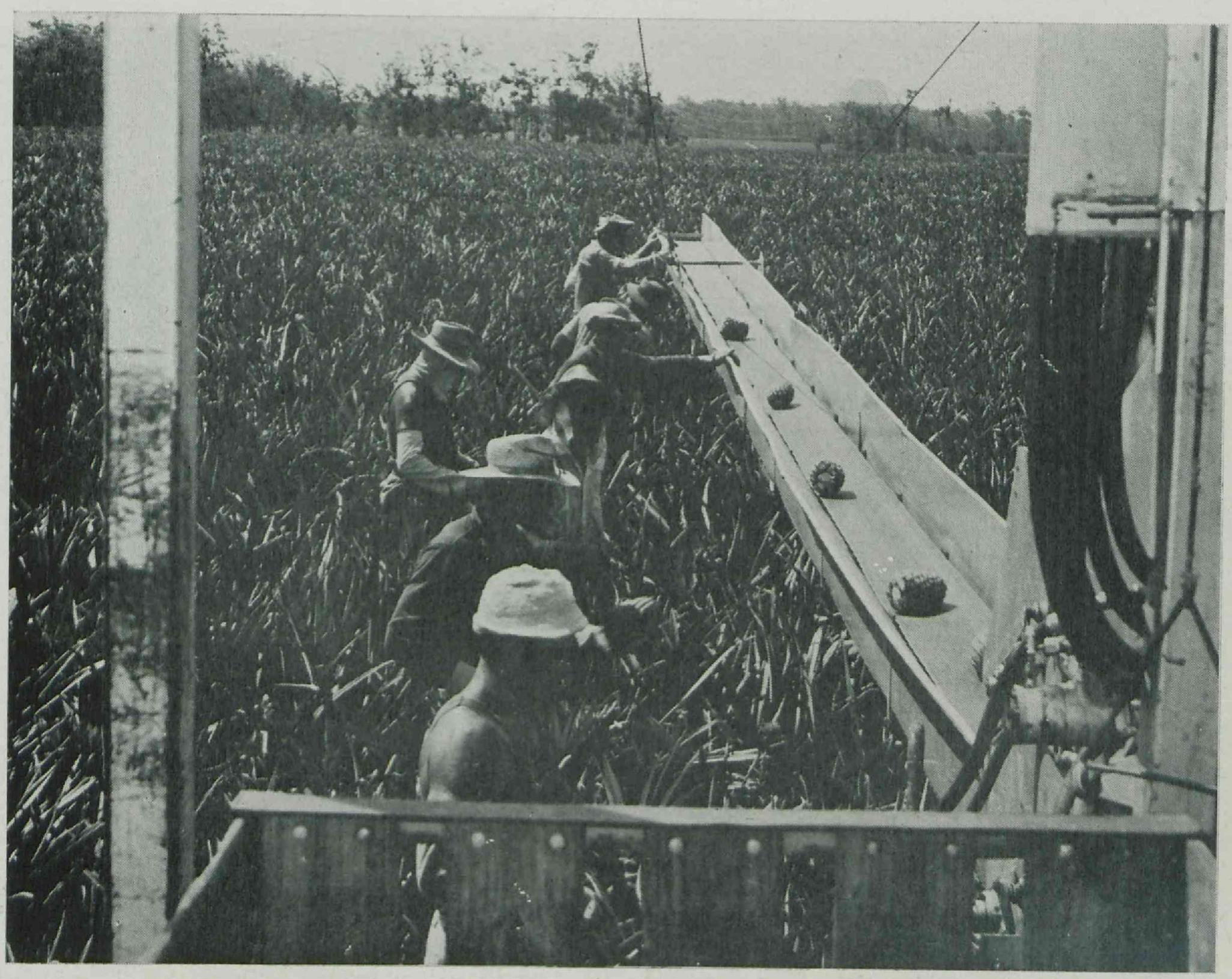
In view of the increasing demand for Australian wines and the interest in the possible development of a wine industry in Queensland, trials are being established to investigate this possibility. A number of wine grape varieties have been introduced from other States through quarantine and the production of sufficient cuttings to enable field trials to be established is being expedited. It is proposed to establish trials in a number of districts in Queensland, including the southern, central and northern regions. It is hoped that sufficient data will be available on agronomic performance and wine quality within 5 years to make at least a preliminary assessment of the potential in any of the districts.

PINEAPPLES

The long-term pineapple selection programme of Horticulture Branch has culminated in the production of a variety well adapted to Queensland conditions which will be known as the Queensland Cayenne. It is derived from five single plant clones of similar characteristics and chosen after careful field testing from a large number of selections made initially. The composite nature of the variety is considered desirable to give sufficient adaptability to minor variations in growing conditions and to safeguard against the presence of any unknown defect which might jeopardise a single clone. The variety significantly outyields existing field-run pineapple material and is much less prone to serious defects in plant or fruit type. Some 37,000 plants of the new variety are now being grown for further multiplication to provide sufficient plants for distribution in substantial quantities to growers. The first stage of the multiplication is being carried out on the Pineapple Industry Farm at Beerwah and it is expected that the first distribution to industry will be made in 1974 or 1975.

As a result of work initiated some years ago it has been confirmed in recent trials that the retention of slips on the parent plant after harvesting retards the development of suckers. This has the effect of delaying the ratoon crops, prolonging the cropping cycle and reducing the ratoon yield. Removal of slips immediately after the plant crop is harvested allows sucker growth to proceed unimpaired and the slips may be used for autumn planting. This has advantages over the earlier practice of allowing slips to remain on the plant until the following spring before removing these for planting.

Nutritional investigations have been directed towards the determination of critical soil and plant tissue levels of major nutrients. The emphasis is being placed on potassium and magnesium and to a lesser extent on nitrogen and calcium. Data so far obtained suggest that some of the soils commonly used for pineapple growing have sufficient potassium to produce a plant and ratoon crop without the inclusion of this element in the fertilizer applied. Even on some of the lighter soils there is evidence that the preplanting application of potassium might be reduced.



Mechanisation is increasing in the pineapple industry.

Chemical weed control in pineapples has been the established practice for many years, during which duiron has superseded PCP. With the advent of new herbicides investigations have been continued to evaluate alternative materials, particularly for the control of nut-grass and couch. Recent trials suggest some promise for the use of Bromicil and Torbacil in pineapples, where nut-grass and couch are a problem.

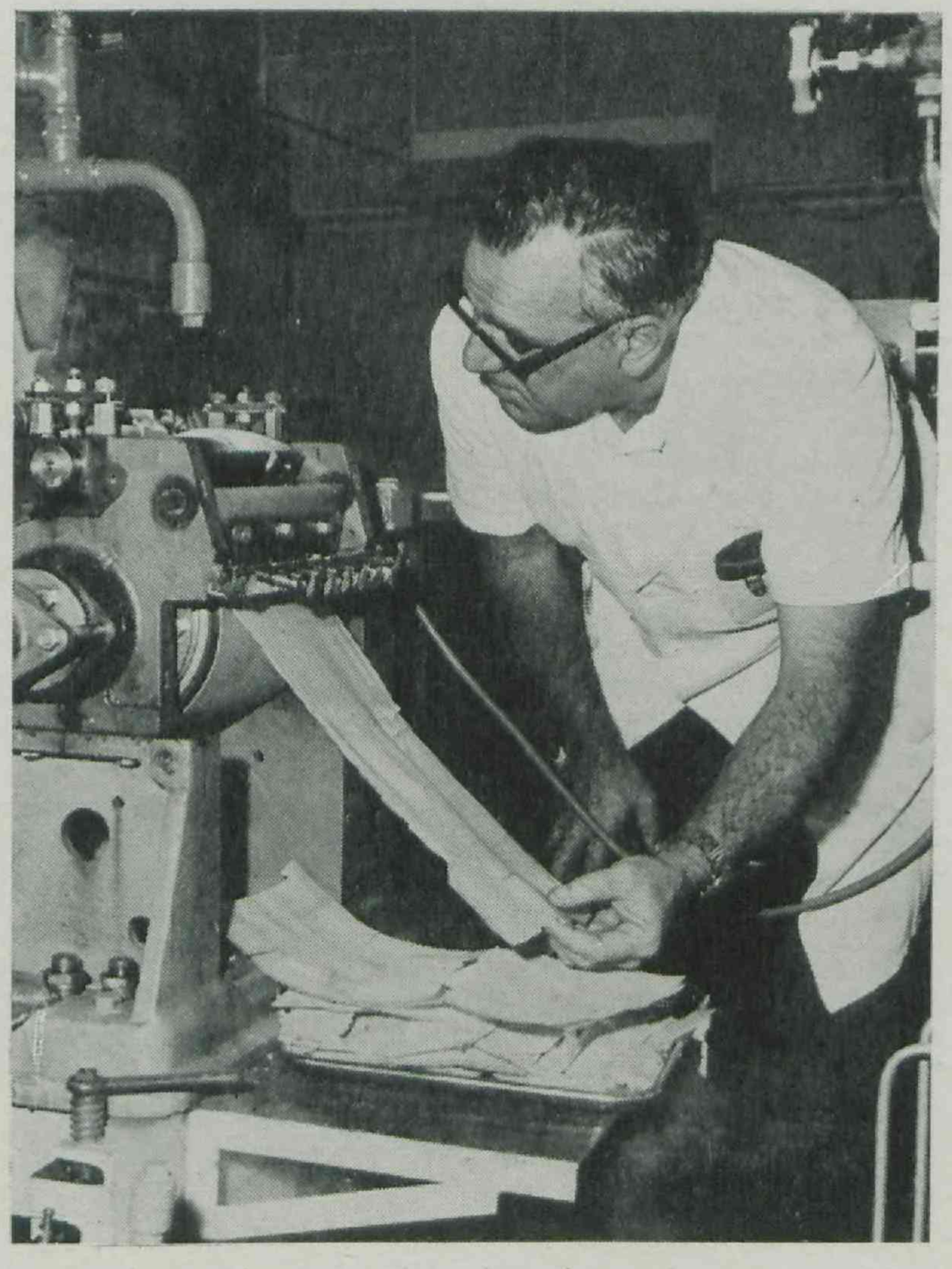
Considerable grower interest was aroused by a demonstration trial conducted at the Pineapple Industry Farm at Beerwah in which top rot and root rot (*Phytophthora cinnamomi*) occurred at the high level of 39% in untreated plots. Difolatan and Dexon reduced this level to 5% and 7% respectively. Yields recorded in each plot were 254 lb. in the control, 708 lb. in the Dexon treatment and 870 lb. in the Difolatan treatment.

Sodium salicylanilide (1%) has consistently been more effective than benomyl and thiabendazole for the control of water blister (*Ceratocystis paradoxa*).

BANANAS

Varietal testing of local Cavendish selections and varieties introduced from overseas is continuing in southern Queensland but the data are not yet sufficiently complete to permit a full assessment of their potential. Land heavily infected with the disease was used to test their resistance to Panama disease and in this trial only three varieties showed immunity. Of these, 2390/2 (from overseas) and M2 (a local Mons Mari selection) appear likely to have commercial value, the yield of M2 being almost double that of 2390/2. Trials of these varieties in northern Queensland have been delayed due to difficulties encountered in producing sufficient planting material under quarantine. Steps are now being taken with a view to rectifying the position.

Following indications from preliminary trials, a comprehensive programme of nutritional investigations has been undertaken in northern Queensland to meet the needs of an expanding industry in that region. There is evidence that heavy applications of potassium, which have been adopted in recent years, induce a magnesium deficiency, with deleterious effects on growth and yield. Timing of fertilizer application has also been found to be of considerable importance and is being further investigated. In the North Coast district a recently recorded disorder of Lady Finger, suspected to be due to a calcium deficiency, is being studied.



A food technologist examines dehydrated bananas emerging from a dryer at the Sandy Trout Food Preservation Research Laboratory.

Trials recently completed in northern Queensland have shown that reduction in effective leaf area, whether due to leaf spot or mechanical means, during bunch development may reduce the green life of the fruit by up to 4 days. These results demonstrate the importance of adequate control measures for leaf diseases in areas or in seasons where leaf spot is likely to be prevalent.

Spacing trials have shown that, within limits, variations in the spacing of banana plants have little or no effect on bunch weight, but do significantly influence the length of the intercrop cycle. Adjustment of plant spacing could, therefore, be used to assist in controlling time of bunching and harvesting and to increase yield per acre.

Work on the post-harvest life of banana fruit over recent years has shown the effect of temperature on its green-life. A reduction in temperature of 10°F. from 70° to 60° will almost double the green-life of fruit. This is particularly important when bananas are consigned to distant markets.

With the acceptance of some markets of dipping in dimethoate against fruit fly it was necessary to develop a continuous dipping procedure for commercial consignments. This is complicated by the "stripping" or progressive reduction in concentration of the insecticide in the dip. To overcome this problem the Food Preservation Research Laboratory has developed a method of dip replenishment which has been successfully adopted at the C.O.D. banana packing shed.

Recent work by the Horticulture Branch packaging research unit has shown that the tight-fill method of packing can be successfully applied to bananas. In trials. a satisfactory technique for the tight filling of bananas as singles into appropriate cartons has been developed. Fruit in this pack sustained no more, and probably less, undesirable skin blemish when subjected to vibration and impact shocks than hand packs. Furthermore, for a given weight of fruit the size of the package could be considerably reduced. Though not yet perfected, this method gives promise of reduced packing, package and transport costs.

Banana fruit blemishes are causing increasing loss to growers. Investigations by Entomology Section have led to the discovery of the flower thrips (*Thrips florum* Schmutz) as the causal agent of the blemish termed "corky scab" in south-eastern Queensland on Mons Mari and Cavendish bananas. Preliminary work on the control of corky scab by injecting the unopened banana bunch with a DDT solution was promising. Another blemish of Mons Mari fruit, designated "maturity bronzing," was found to be associated with banana mite (*Phyllocoptruta musae* Keifer). On Lady Finger fruit this mite and a species of *Brevipalpus* were both associated with a third type of blemish now referred to as "rusty speckle".

PAPAWS

Further trials have confirmed earlier results obtained at the Redlands Horticultural Research Station that nitrate accumulation in the fruit can be reduced by restricting fertilizer applications to early summer. This is of little value when fertility levels are naturally high. Hence, an attempt is being made to breed a variety less prone to accumulate nitrate in the fruit. To this end about 40 papaw breeding lines are currently being tested for nitrate accumulation. It is known that fruit nitrate levels fall as the ripening process progresses. The mechanism of nitrate reduction is being studied at the Sandy Trout Food Preservation Research Laboratory in the hope of controlling or accelerating this reduction process.

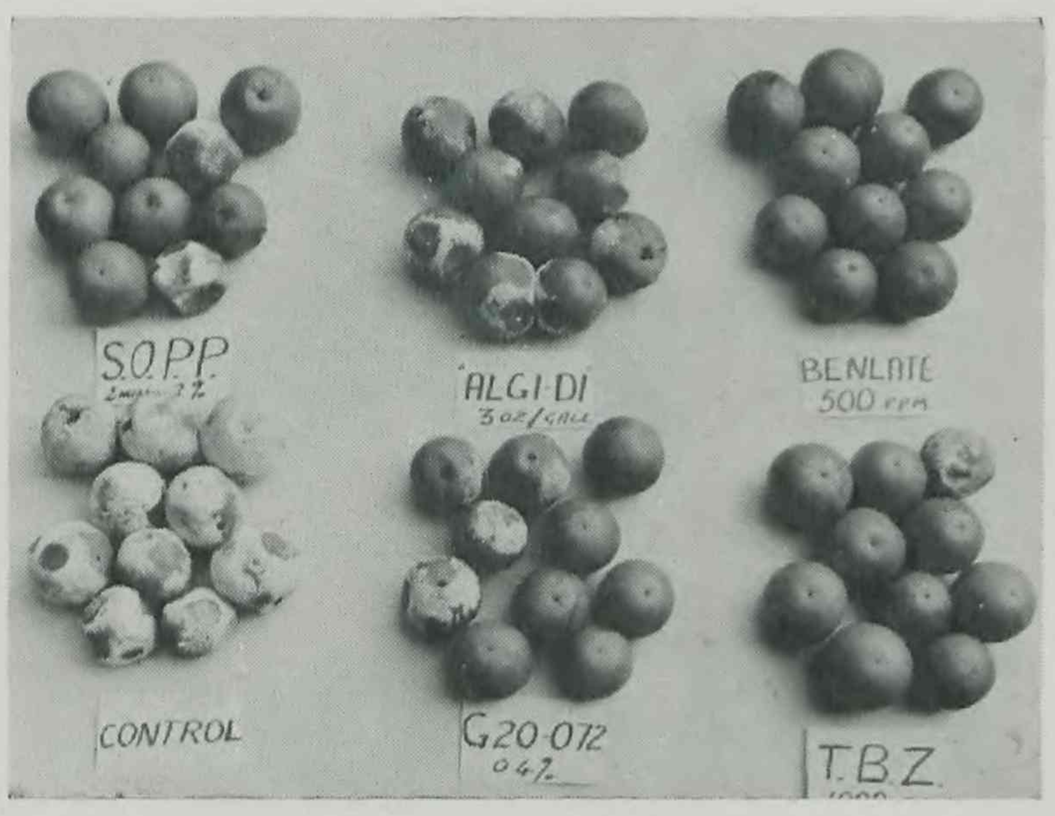
CITRUS

Investigations commenced by Horticulture Branch in 1966 on the fertilizing of citrus trees have now shown that winter applications of nitrogen fertilizers have the predominant effect on the yield of navel oranges and Ellendale mandarins. Comparable data for other varieties are not yet available but similar results can be expected. In the case of navel oranges it has been found that 2 lb. of nitrogen per tree applied at any time between May and August each year is normally sufficient and that additional nitrogen applied in summer has no real advantage and only adds to the cost of application. The schedule is being demonstrated in a number of citrus-growing districts.

The trickle system of "degreening" citrus fruit which was introduced in 1968-69 has been further investigated and it has been found that the process can be accelerated by increasing the temperature up to 95° F., above which detrimental effects are encountered. It has also been shown that mould growth is inhibited at temperatures above 85° F. and that carbon dioxide may accumulate up to a level of 3% without appreciable reduction in the "degreening" rate. A further 10 citrus "degreening" rooms have been installed in the Central Burnett district, bringing the total to 14 since the introduction of the method.

An important development in citrus packing methods is foreshadowed as a result of trials of the tight-fill method of packing mandarins. As in other fruits, a major advantage is the reduction in packing costs.

Tests by Plant Pathology Section have confirmed the efficacy of post-harvest dipping with benomyl and thiabendazole for the control of green mould (*Penicillium digitatum*) of citrus. Thiabendazole, for instance, at a dip concentration of 1,000 p.p.m. gave complete protection for up to 6 weeks after harvest. When used as a field spray 1 week prior to harvest, benomyl also showed promise for the control of this disease.



The effect of various dipping treatments after harvest on the control of green mould of citrus.

Benomyl appears very promising for black spot control in citrus but is ineffective against smoky blotch (*Gloeodes pomigena*). A spray programme consisting of a copper spray at ½ to ¾ petal fall followed by two mezineb sprays gave good black spot control and produced fruit with a very attractive external appearance.

STRAWBERRIES

For many years strawberry production in Queensland has been confined to south-eastern coastal districts, where the crop is harvested over the period from June to October. Recent trials at the Granite Belt Horticultural Research Station have shown that crops in excess of 10 tons per acre can be produced on the Granite Belt and harvested from October to March. These trials have shown that introduced varieties such as Red Gauntlet are superior to Queensland-bred varieties such as Redlands Crimson when grown on the southern highlands. Development of strawberry growing in this part of the State would extend the Queensland producing season considerably.

In trials conducted by Plant Pathology Section, benomyl was very effective against grey mould (*Botrytis cinerea*) and powdery mildew (*Sphaerotheca macularis*), being far better than the standard captan in this regard. Ripe fruit rot (*Colletotrichum acutatum*) was not, however, controlled by this new fungicide.

An explanation for the occurrence of virus symptoms in heat-treated strawberry material has been obtained. Heat therapy easily and permanently eliminates mottle virus. Latent A in a mild or latent form is apparently able to survive and after a period regain full potency. In the early eclipse phase the virus cannot, however, be detected by indicator plants. This applies also to strawberry yellow edge virus. It is apparent that clones will have to be retreated annually until other techniques such as meristem cultures can be employed to obtain real virus freedom.

VEGETABLES

Cauliflowers.—Hollow-stem in Cauliflowers, which is a serious problem in south-eastern Queensland during the warmer months, has been the subject of intensive study over several years. Although the disorder may be induced by a boron deficiency this does not appear to be the sole causal agency and other as yet undetermined factors appear to be involved. It is most prevalent in the popular variety Snowball Y and in the absence of any other practical control measures attempts are now being made to obtain alternative acceptable varieties.

Cucurbits.—*Verticillium dahliae* was recorded at Bowen causing a wilt in rockmelons for the first time in Queensland. The variety Persian was worst affected in the field, with Sampson, Conqueror, Edisto and Yanco Treat also showing symptoms.

Squash mosaic virus was transmitted from squash to squash by the beetle *Ceratia hilaris.*

Difficulty is experienced with the interstate movement of cucurbits such as pumpkins, cucumbers and squash due to possible infestation by the cucumber fly (*Austrodacus cucumis* (French)). Laboratory studies by Entomology Section have resulted in the development of breeding and mass handling techniques for this fly. Small-scale fumigation trials as pilot runs indicate a means of killing fruit-fly larvae in cucurbit fruit. Data and methods are now sufficient to allow a full-scale investigation of commodity disinfestation.

Beans.—Nutritional investigations have revealed that at times of rapid growth, such as at flowering, some nutrient deficiency may occur due to inadequate reserves or retarded uptake from the soil. Recent work suggests that this type of deficiency may be capable of correction by the application of foliar sprays.

The Horticulture Branch breeding programme is aimed at the development of round-podded stringless, dual-purpose varieties suitable for either fresh or processing outlets. Of particular importance is the incorporation of moderate cold tolerance to meet the requirements of the important winter-grown crop. In addition, considerable emphasis has been placed on resistance to "summer death", which has recently assumed major importance in southern States and which has occurred to a lesser extent in Queensland. Redlands Pioneer, Gallatin 50 and Tendercrop, which are major varieties at present grown, are susceptible, whereas Redlands Autumncrop, Tendergreen and the recent introductions Apollo and Idelight have been found to be resistant. The condition is considered to be caused by a mycoplasma.

The field blight phase of "nestiness" in beans caused by *Sclerotinia sclerotiorum* has been a difficult problem to control for many years. The new fungicide benomyl, whose registration for use on edible crops is still pending, has given outstanding control when used at the rate of 1 lb. of active ingredient per acre. A 2-spray programme consisting of a full bloom spray and a petal fall spray have given adequate control under all environmental conditions. Benomyl and thiabendazole are effective as post-harvest treatments, but are slightly inferior to dichloran, which gives virtually complete control.

Field studies by Plant Pathology Section have indicated once again the importance of *Pythium* root rot during cool weather. In the glasshouse, plants developing the disease at low temperatures (60°F.) rapidly recovered when moved to higher temperatures.

Tomatoes.—Blossom-end rot, which is more prevalent on the lighter soils in warm weather, has been shown to be due to a deficiency of calcium. Work over recent years at the Redlands Horticultural Research Station and in the Stanthorpe district has been directed towards cultural practices designed to minimize losses from this disorder. These involve correction of soil acidity to a pH of 6·0 to 6·5, substitution of non-acidforming nitrogen fertilizers, maintenance of a uniformly high level of soil moisture, and, in extreme cases, the application of calcium chloride foliage sprays. Adoption of these measures on a commercial scale has substantially reduced blossom-end rot incidence and fruit losses in the major tomato-growing districts.

In varietal trials in the Bowen district and at the Bowen Horticultural Research Station, the introduced varieties Floradel, Tropired and Manapal have performed well in both early- and late-season plantings. Attempts are being made in the breeding programme to introduce resistance to a new strain of *Fusarium* wilt recently recorded at Bowen.

Soft rots of tomatoes, produced by species of *Rhizopus, Oospora* and possibly *Erwinia,* are causing concern at the Brisbane Market. Chlorine treatment and strict attention to hygiene remain the control measured advised.

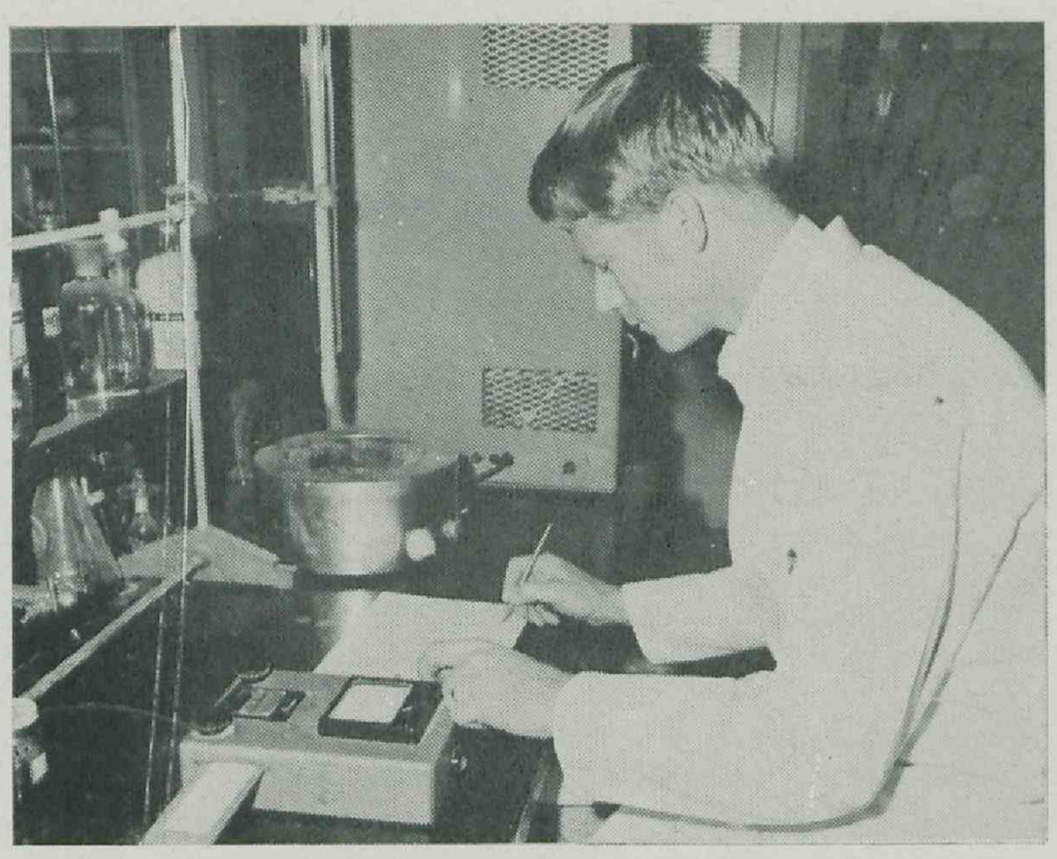
A detailed survey by Plant Pathology Section has indicated that the new pathogenic race of *Fusarium oxysporum* f. sp. *lycopersici,* the cause of Fusarium wilt, is now widespread in the Bowen area. Plants resistant to this new race have been selected from some breeding lines imported from overseas.

An economic survey of tomato-growing is currently being undertaken by Economic Services Branch to study farm management and marketing aspects of tomato-growing in the main producing areas of the State.

Potatoes.—In a potato rotation trial at Walkamin Research Station, the treatments with least stem rot and wilt were (1) potatoes alternated with bare fallow, (2) potatoes alternated with cowpea (seed crop), and (3) potatoes alternated with maize. There was little effect of any of the treatments on stem end rot (*Fusarium* spp.).

GINGER

The results of a series of trials on the Near North Coast in recent years have now been collated and show that yields can be substantially increased by closer spacing of rows, though it is doubtful whether adjustments in size of seed piece or spacing within the row will have economic advantage.



Chemical analysis of the pungent compounds of ginger for quality assessment, using thin layer chromatography.

Biotype 4 of *Pseudomonas solanacearum* has now been recorded as causing bacterial wilt in ginger on 12 farms in the Nambour district. There is little doubt that it has established itself as a continuing pathogen in the area. A further alternative weed host (*Ageratum houstonianum*) for this biotype has been found in the field.

Benomyl and thiabendazole have been found more effective than organo-mercurial seed-piece treatments for the control of Fusarium rhizome rot.

Processing investigations have resulted in a modification of the salt and lactic acid content of the brine to increase the recovery, and modifications of the crystallizing process have been developed to improve the quality of the product. The distinctive flavour of Queensland-grown ginger has been found to be due to the presence of 8–27% of geranial and neral in the volatile oil constituent.

GENERAL

In response to an increasing number of requests for information on the profitability of a wide range of horticultural and vegetable crops, agricultural economists in Gympie and Bundaberg are currently collecting data on costs and returns in these industries in co-operation with Horticulture Branch officers and growers.

VII. Development Planning and Land Use

The Department has a continuing association with other Government Departments in development planning projects and land-use studies. The Development Planning Branch plays a major role in co-ordinating the activities of the many Branches involved in joint work and in addition undertakes various types of field work associated with land use and development.

The Agricultural Chemical Laboratory Branch carries out much independent as well as joint work by way of soil and water surveys. The Economic Services and Marketing Services Branches similarly have an important role in studies of the economics of production and marketing.

DEVELOPMENT PLANNING

Brigalow Scheme.—The settlement of Area III of the Fitzroy Basin Land Development Scheme is now proceeding after a delay due to drought, and shortly after obtaining ballot blocks settlers are provided with a land-use map setting out sufficient detail to enable constructive planning of the initial stages of development. To provide bases for these maps Departmental officers have surveyed 1·7 million acres in the area. Technical advice is provided by a Contact Advisory Officer who has the backing, if necessary, of a multi-discipline Technical Advisory Group. Areas I, Ia and II of the Scheme are now consolidating their production enterprises, though affected by drought, and organized Departmental advisory services are provided in these areas.

Beef industry study.—Of the major agricultural and pastoral industries, the beef industry is outstanding at present in having reasonable prospects in both the marketing and price fields. Long-term forecasts indicate the likelihood of a steadily expanding market for beef, although insufficient information is available on the most suitable type for future markets. There appear to be sound grounds for a steady expansion of the existing industry but there is need for surveys in depth to produce data on which orderly development can be based. This subject has been discussed with other interested State and Commonwealth Departments and a joint working group was formed under the lead of the Director of the Division of Land Utilisation to report on the matter. A sub-committee of the working group has produced a report for consideration and the following recommendations for procedure are made:—

(*a*) The identification of the objective for development of the beef cattle industry.

(*b*) Consideration of the analytical framework for an examination of the capacity of the Queensland industry to achieve the stated objective.

(*c*) Establishment of the necessary methodology to proceed with the study.

As proposed, the study would entail the collation of beef cattle industry resources on a basis of 16 different regions. From a consideration of resources and potential in the light of market opportunities it is anticipated that guidelines for sound development can be outlined with some degree of confidence.

Sheep industry.—Though no specific study is in train, there are good reasons for concern about the problems of this industry and the indirect implications relative to land use. The major sheep lands of the State are devoted to wool production and the wool industry is currently undergoing a very difficult period against a background of two major droughts in the last five years, falling product prices and steadily increasing costs. With a large portion of sheep lands currently seriously affected by drought it is apparent that the higher cost producers are faced with a serious problem, the solution of which lies beyond the limits of established drought relief measures.

During the year the Branch collated Departmental material on the sheep industry which was submitted, on request, to the Land Court review of rentals. The main recommendation of the Land Court was that the existing rent standard for sheep country be reduced by 30%.

Wheat industry.—The current trends in this industry can have far-reaching effects on State development. Because of the production of high-quality wheats, Queensland has been granted an additional quantity of 5 million bushels of prime hard, thus raising the State's quota to 36 million bushels, including 11 million bushels of prime hard. The introduction of the quota system in Queensland has placed a barrier to the development of further lands for wheat production, which has been occurring in the brigalow and associated scrub lands. Farmers on the fringe of established areas will need to consider alternative crops or alternative land-use patterns. There is evidence of a change to grain sorghum, sunflowers and navy beans in some areas. However, provided growers are prepared to accept export prices for grain sorghum, this crop seems to offer the most favourable prospects for high-volume sales.

Land inundation.—Joint studies by Economic Services Branch, Marketing Services Branch and the Division of Land Utilisation have been undertaken to assess the net value of agricultural production in areas to be inundated by proposed water storages on the Brisbane, Albert and Boyne Rivers. Water from these dams is to be used to supplement existing town water supplies in Brisbane and Gladstone.

LAND USE

Western Arid Area.—The land-use study of the Western Arid Area has continued and emphasis has been placed on field work and mapping during the year. This semi-arid to arid area with annual rainfall of less than 15 in. occupies about 115 million acres and presently supports an average of 5 million sheep and 0·7 million cattle. This phase of study involves an interpretation of photo-patterns of the area and the delineation of soils, landscapes, topography, vegetation and soil erosion patterns. The need for inventory work of this nature was highlighted at the Australian Arid Zone Research Conference held at Broken Hill in 1970, when reviewers recognized that degradation of many arid zone lands was occurring but insufficient knowledge was available to deal effectively with the situation.

This study has been proceeding in consultation with three Commonwealth agencies with interests in the area. These are the Bureau of Agricultural Economics, which conducts a continuing sheep industry survey and also has beef cattle survey properties in the region; the C.S.I.R.O. Rangelands Research group; and Northern Division of the Department of National Development, which is concerned with the "beef roads" programme. Recommendations concerning the correct usage of this vast area will have to be made in respect of the need for conservation of national resources, productivity factors relating to the existing pastoral industries and to a lesser extent the mining and tourist industries.

Isis land-use study.—As a result of soil erosion, topographic requirements for mechanical harvesting and drought, portions of the Isis area are no longer suitable for sugar-cane production. A Committee set up to study the land-use problems of the area comprises representatives of the Bureau of Sugar Experiment Stations, Forestry Department, Land Administration Commission, Irrigation and Water Supply Commission and this Department and has been established under the chairmanship of the Director of the Division of Land Utilization. The Committee has been asked to make recommendations concerning the most desirable future development of the Isis district with special reference to sugar-cane, softwood timbers, pasture and seed production and other uses. Officers of this Department have delineated four land-use categories on 22,500 acres and further mapping is in progress. The land-use classification will be a basic consideration in recommendations concerning future land use in the area.

A joint project of Economic Services, Agriculture and Sheep and Wool Branches has commenced with the aim of assessing the resources available and their utilization in the Condamine–Maranoa region. Particular attention is being given to the relevance of research and extension activities in the area with a view to establishing priorities for future activities in the region.

IRRIGATION

Bundaberg Irrigation Project.—This project, referred to in the previous annual report, has received the partial acceptance of two Governments during the year under review.

Urannah Dam.—In collaboration with the Irrigation and Water Supply Commission some attention has been devoted during the year to the examination of a proposal for a dam on the Broken River near Collinsville. This supply would augment that from the existing Eungella Dam and provide water for irrigation purposes in the Collinsville area, along the south bank of the lower Burdekin River and the coastal strip west of the north-south railway line as far south as Guthalungra. Current land use in the non-sugar growing areas is predominantly beef cattle grazing on native pastures. Irrigated pangola grass for beef production, rice, grain sorghum and maize are the main aspects included in the economic analyses. An early estimate indicates that up to 70,000 acres of land might be commandable by reticulation channels and private diversion by riparian landholders.

Emerald Irrigation Scheme.—A special State grant in 1969-70 allowed a rapid build-up of equipment for use in investigations into irrigated crops and pastures. The aim of this programme is to provide data to ensure successful development of the farms which will be irrigated from Fairbairn Dam. Experimental areas are being utilized on two pilot farms and also on a small leased area of open downs type soil. Agronomic information is being sought on ways to increase the potential yield of the main crops proposed for the irrigation area, namely cotton, grain sorghum, lucerne and wheat. Work is also being done to help define the possible place on the irrigation farms of other crops such as maize, soybeans, sunflowers, safflower, barley and oats. Irrigated forage crops also are receiving attention, together with annual winter legumes aimed at providing supplementary grazing for animals utilizing grain sorghum stubbles.

CLIMATE AND ITS EFFECTS

Climate and rainfall studies.—Research has been devoted to an examination of the response of sugar-cane to incidence of rainfall. Analysis over a 25-year period shows that response to rainfall was greatest during the February-March period. It is concluded that response to additional water was related to temperature and radiation conditions. In situations where irrigation supplies are limited, the use of available water at strategic times would result in the best possible yields.

Trends in beef cattle production in relation to rainfall indices expressed in deciles have been examined for 16 regions, which together account for the whole State. Inter-regional livestock movements present difficulties in any analysis of this nature but the effects of rainfall are quite pronounced in those regions of the State which experience low rainfall with a high variability coefficient.

Drought.—Land-use practices have a major bearing on drought survival, while drought imposes limitations on land use. Continuing studies are being made concerning drought and its effects and it is expected that these will facilitate drought assistance to producers, assist with problems of restocking and reconstruction following drought, and encourage measures that would ameliorate the effects of the present and future droughts.

Cloud seeding.—Cloud-seeding activities were undertaken on a continuous basis throughout the State for a period of 3 months during the year, for drought mitigation purposes. Seeding opportunities varied with cloud occurrence and suitability, while the vast distances which had to be covered by one aircraft showed the very limited part that a project of this nature could play in relief of widespread drought.

WOODY PLANT CONTROL

Brigalow.—Most of the trials at the Brigalow Research Station were completed during the year. The results are now being evaluated in detail and prepared for publication. Apart from confirmation of the present recommendations for controlling brigalow, points of interest which have emerged are:—

(*a*) Except on those plots which were sprayed with 2,4,5-T in 1965 areas cleared, burnt and sown to grass in late 1964 are becoming steadily less productive due to regrowth of brigalow suckers. On the sprayed areas, pasture productivity remains at a fairly high level.

(*b*) In one trial two sprayings on the same day increased the kill of brigalow by about 25% compared with the effects of applying the same amount of 2,4,5-T in a single spray or as split applications several months apart. These results require confirmation but the technique is worthy of further study.

(*c*) In another trial, burning of sprayed area 11 months after treatment increased the percentage kill from 44% on unburnt areas to 75% on burnt areas.

(*d*) There are indications that, in the cattle country of Central Queensland, ½ lb. 2,4,5-T acid equivalent per acre is below the optimum level for killing larger brigalow suckers, whereas in southern Queensland higher rates have not given increased kills. The present commercial level of ⅔ lb. acid equivalent appears to be giving acceptable levels of control when applied according to recommendations but there is a possibility that increasing the rate to 1 lb. might be justified in some situations.

Other woody plants.—Following further field surveys, mainly in the Fitzroy Basin Development Area, the question of research priorities for work on other native woody species was discussed by the Inter-departmental Committee for the Control of Woody Plants. It was agreed that first priority should now be given to budda or bastard sandalwood (*Eremophila mitchellii*), which is or threatens to become a problem in a region comprising some 40 million acres of grazing land. Plans have been completed for a field survey to collect and collate existing information on the distribution, behaviour and control of this species in Central Queensland. At the same time similar data will be collected for Dawson gum or blackbutt (*Eucalyptus cambageana*). Permanent quadrats have been established on newly cleared blocks in Area III of the Fitzroy Basin Land Development Scheme to study the effects of pulling and burning on these two species and other native woody plants of less importance.

FARM MANAGEMENT ACCOUNTING SERVICE

While membership of the Farm Management Accounting Service operated by Economic Services Branch has remained around 300, increasing emphasis has been placed this year on the interpretation and application of the data obtained through a budgeting service designed to assist members to use their results as a basis for farm planning. Wherever possible, members are visited regularly by their regional agricultural economist and receive quarterly and annual financial statements of their farming operations.

The service is continually being modified to cater for the varying interests of members coming from all the major industries. An endeavour is now being made to establish groups of beef producers in North and Central Queensland. In a study tour on farm management extension in South Australia and New South Wales, particular attention was paid to ways in which our service may be improved.

The Australian Committee for Coding Rural Accounts (ACCRA) Code will be introduced in 1970-71. This represents a significant step forward in current efforts to standardize rural accounting procedures throughout the Commonwealth. The Economic Services Branch has played an active role in the formulation and pretesting of this code and special conferences were attended in Sydney and Canberra during the year.

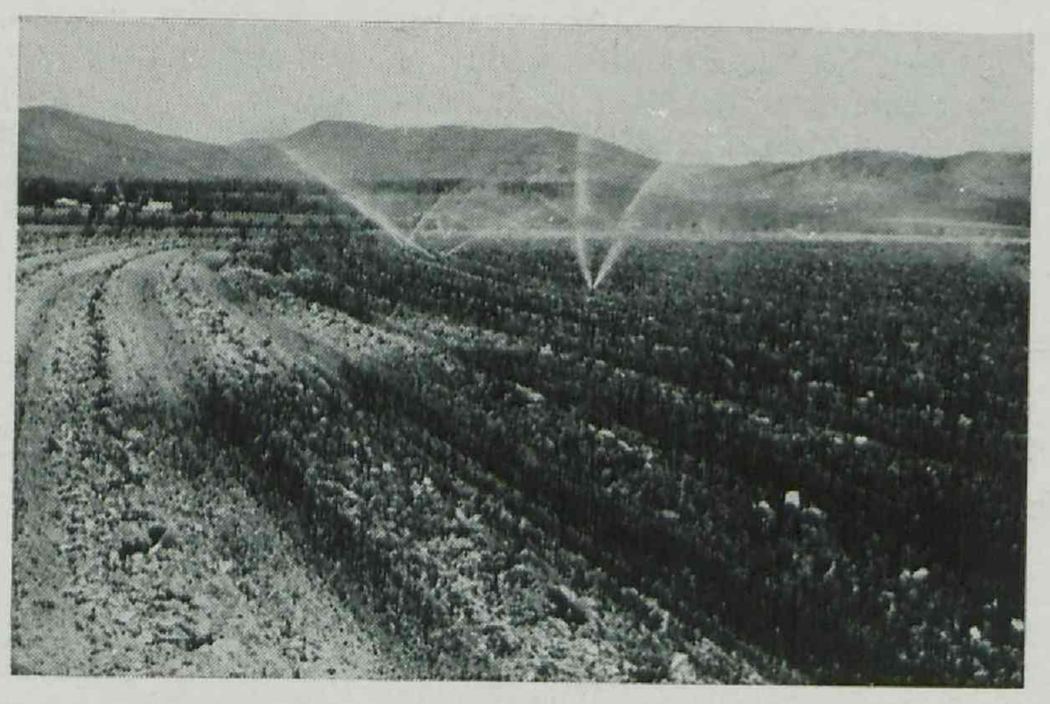
VIII. Special Field and Laboratory Services

The Department operates a number of services ancillary to its crop, livestock and commodity research, extension and regulatory services. Some of these are recorded elsewhere in this report. This section deals mainly with soil conservation services and various diagnostic services.

SOIL CONSERVATION

Officers of the Soil Conservation Branch provided technical assistance to landholders in marking out 81,100 acres of contour banks and 66,400 acres of other contour measures. This brings the total area now worked on the contour in Queensland to over one million acres. Record areas were treated in the West Darling Downs and Burnett Regions, while programmes continued at last year's level in the East Darling Downs, North Queensland and South-East Coastal Regions.

On the Atherton Tableland maize-growing area there has been a pleasing trend towards the broadening of the rotation by including grass and tropical legume pastures. It is estimated that 40% of the area that formerly grew maize is at present under a perennial crop. The value for erosion mitigation is obvious but a financial bonus is evident since increased maize yields of up to 2 tons per acre (double the district average) are reported when the crop follows a period of 2 to 3 years under glycine pasture.



An irrigated tobacco crop planted on the contour in North Queensland.

Although the year was generally characterized by below-average rainfall, some very high intensity storms were recorded and these emphasised not only the inherent erosion risk in most districts but also the dangers of reliance on a one-step approach to soil conservation.

Severe erosion was recorded from summer storms in all Regions except the South-East Coastal Region and the western drought-affected areas. In the Central Highlands the quarter ending in February recorded the worst erosion of cultivated land since 1958. In many Regions the storms exceeded the rainfall intensity threshold representing the upper limit at which contour banks can effectively protect bare cultivated soil and in these cases even contour-banked cultivations suffered serious erosion. Where land was protected by growing crop, pasture or stubble, erosion was markedly reduced and to the observant landholder it was clear that he should not place too much reliance on the contour bank as a single measure with consequent neglect of complementary practices such as stubble.

During the year, 3,524 requests for technical assistance were made by landholders and in response 5,501 visits were made to farms by field officers in providing this service. Requests from farmers have remained at approximately the same level per year during the last 6 years despite a substantial increase in the Department's capacity to service an increased demand. The widespread drought conditions, the influence of preceding droughts and difficult financial conditions in many sectors of the agricultural community have not been conducive to action by landholders in implementing soil conservation programmes.

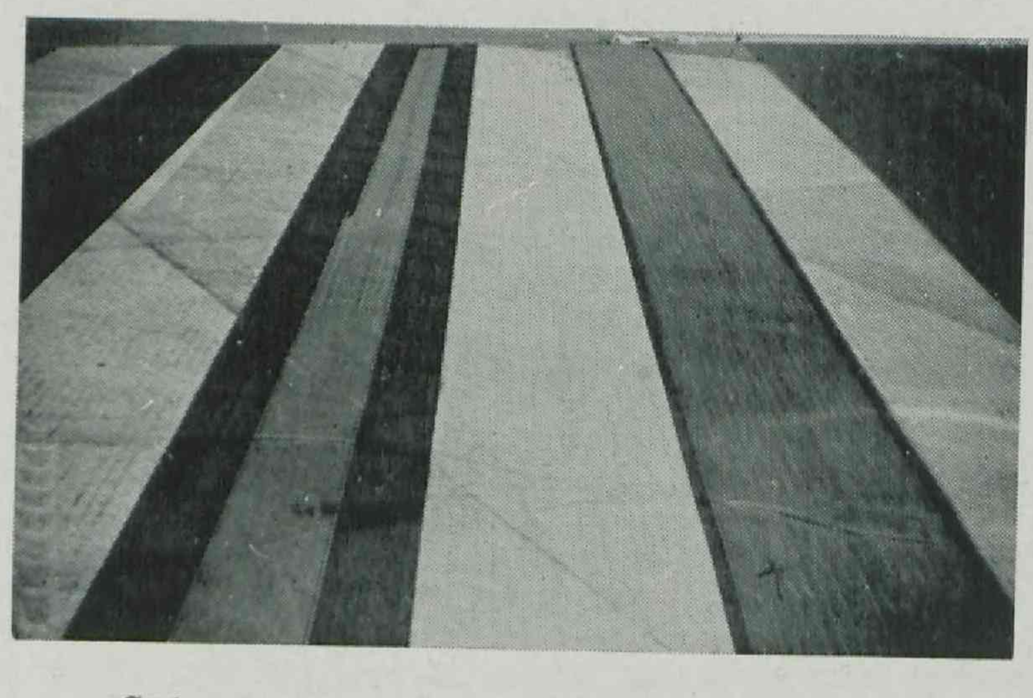
A further 594 landholders commenced contour farming programmes for the first time, making a total of 6,977 farmers now applying these programmes. By comparison, 2,110 farmers were involved in this work in 1961, giving an annual growth rate of 541 per year.

It is estimated that there are still 15,000 holdings which have yet to commence programmes. Assuming that the complete implementation of a farm soil conservation programme occupies 10 years, then an average growth rate of 770 farms per year is required to achieve the present objective of controlling erosion on the State's agricultural lands by the turn of the century.

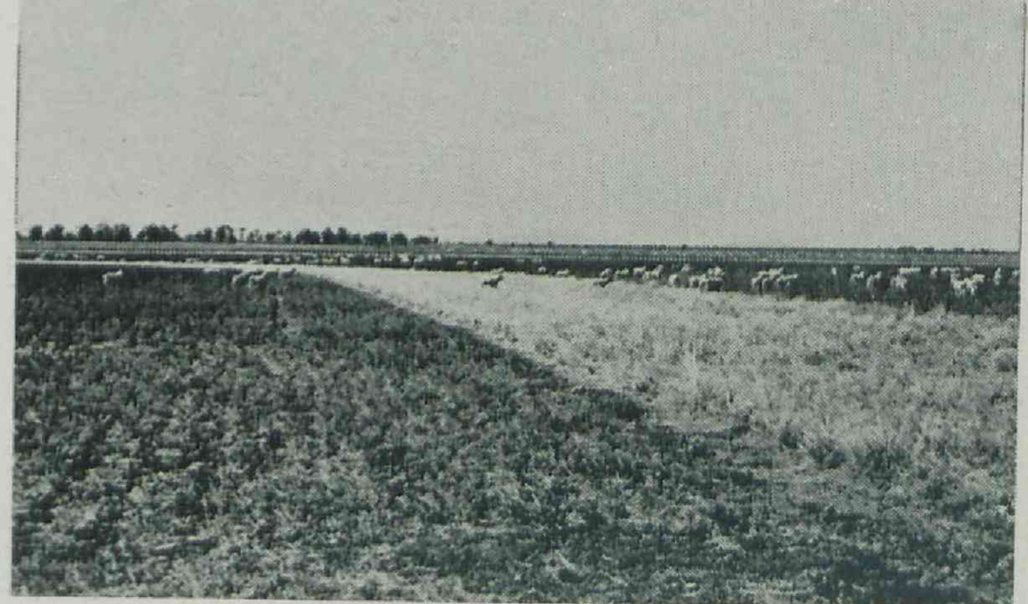
Increased emphasis is being placed on the assessment of the land capability of properties and the preparation of land-use plans rather than plans which only delineate structural works. Technical guides form an essential part of this procedure and give more objectivity and uniformity to the work.

Land-use plans covering 122,400 acres were prepared and issued to 56 landholders during the year. The total area now planned in this way is 364,770 acres.

Farmers on the plains areas of the Darling Downs continue to show a high interest in strip cropping but the rate of adoption slowed down during the year—a reflection of poor seasonal and economic conditions. Grass strips continue to gain favour in the Western Downs. In the Roma, Miles and Wandoan districts grass strips represented the major part of the contouring undertaken during the year and in all these districts performance of these strips as an erosion mitigation measure was particularly good during testing storm rains.



Strip cropping is a valuable practice even on land with a low gradient.



Native pasture strips have proved a useful erosion mitigation measure in the Maranoa.

Preliminary analysis of the 3-year fallow moisture accumulation study has shown certain trends:— (i) The inefficiency of rainfall storage in the soil, particularly under summer fallow conditions, has been confirmed; (ii) additional storage above certain soil moisture levels (which have been defined) is possible only under extremely favourable weather conditions while losses of stored water may be appreciable under adverse weather conditions; (iii) significant fluctuations in soil water levels have been noted on at least three sampling sites and these changes cannot be explained readily by the normally accepted input and output terms of a water balance equation.

Tie-ridging practices, as a means of reducing soil losses, were tested in a number of trials in the South Burnett during the year and the practice was very effective in reducing run-off from minor to moderate intensity rains. Where high rainfall intensity results in over-topping of the water-holding basins, and lower basins are surcharged, serious soil losses can occur on long slopes devoid of contour banks.

Progress has been made in the compilation of a land-use technical guide for the 3·3 million acres Miles survey area, while a start has been made in the development of a similar Guide for the East Darling Downs.

DIAGNOSTIC AND IDENTIFICATION SERVICES

Approximately 21,000 samples of soils, waters, stock foods, fertilizers, plants, pesticides and miscellaneous agricultural materials were handled in the Head Office laboratory of the Agricultural Chemical Laboratory Branch.

With the mounting emphasis on soil surveys in connection with major land development projects, more detailed analytical work is being done on relevant soil samples. In this respect the atomic absorption spectrophotometer has been a great aid for the determination of cations.

In the Emerald Irrigation Area, survey operations have been conducted over approximately 16,000 acres. A check survey was made of the irrigable area on the right bank of the Burdekin River, where the soils occur in a very complex pattern and mapping is only possible in terms of the dominant soil groups. Surveys were carried out also in the Gin Gin and Isis–Childers areas. A report on the soil survey of the Bowen River basin has been completed.

As a consequence of prolonged drought conditions, irrigation waters of doubtful quality are being used in greater quantities in some areas and the possible harmful effects of these waters on the soils are being watched.

Laboratory studies of the factors influencing aggregation of swelling clay soils (e.g. Darling Downs and Brigalow areas) should lead to a better understanding of desirable management practices for these soils.

Branches and stems of hoop pine trees showing malformed growth known as Yarraman syndrome were submitted for chemical analysis by the Forestry Department. High aluminium values in the trees were correlated with high soil acidity. Low values were obtained for copper in the malformed trees, but it is not considered that the answer to this problem is yet at hand.

The determination of sulphur in plants by atomic absorption spectrophotometry has considerably shortened the analytical time and improved the accuracy of the determination

A study of amino acid composition of local sorghum grain varieties has been commenced by the Biochemical Branch following the provision of automated analytical equipment.

The Branch provided 3,219 multiple diagnostic analyses, and analysed 2,113 dipping vat fluids and 7,841 samples from Departmental trials.

A summation method for estimating digestibility co-efficients based on fractionation by extraction with pepsin, ethyl alcohol and ammonium oxalate has been developed. Equations for estimating the digestibility of feeds from cell walls, cell contents and protein content have been derived.

A survey of field populations of *Trema aspera* (poison peach) has been undertaken by Biochemical Branch. Using extraction techniques derived for the isolation of the toxin, followed by toxicity testing in mice, the variations of toxicity of individual trees has been studied. Preliminary findings indicate that marked variations in toxicity can occur in trees from the same property.

Botanical identification and advisory services were maintained at about the usual level, approximately 13,000 specimens being identified during the year. Largely because of press publicity, numerous enquiries about and specimens of suspected drug plants were received. Several samples of marihuana plants were identified for the Police Department but all were from cultivated plants and there is still no evidence that this plant is naturalized anywhere in Queensland.

The results of taxonomic work in 16 families, including a complete revision of the *Mesembryanthemum* complex in Australia, were published as Contributions from the Queensland Herbarium.

Taxonomic studies were also continued in many other plant families. An account of the family Geraniaceae in Queensland was prepared as a prototype for the kind of treatment to be adopted in the proposed new Handbook to the Flora of Queensland.

Manuscript was completed of popular accounts of several groups of wildflowers in south-eastern Queensland.

Field surveys were made and brief accounts prepared of the vegetation in 8 shires in southern Queensland for inclusion in Shire Handbooks.

In connection with the Captain Cook bi-centenary year, a senior botanist spent 2 weeks with botanists from the British Museum (Natural History) and the James Cook University of North Queensland in collecting plants on the Endeavour River. They obtained specimens of about 350 different plants and were able to find most of the species recorded by Banks and Solander in 1770 as well as many additional ones. A more modest botanical survey was made at Cook's landing site in Bustard Bay near Round Hill Head. The vegetation today is very similar to that described by Cook but most of the tea-trees recorded by Cook at the landing site itself are being destroyed for residential development.

Other botanical surveys included a study of galvanized burr in south-western Queensland and north-western New South Wales (on behalf of the Australian Weeds Committee), a study of *Argyrodendron* in the Imbil area, and general botanical collecting in three other regions in Queensland, including the Cooloola Sand Mass, and in Western Australia and the Northern Territory.

The distribution of *Salvinia,* a floating plant which can be troublesome in waterways, was mapped in the Burnett district.

The State Beach Protection Authority has appointed a senior research officer who has assumed the major responsibility for the experimental programme on the revegetation and stabilization of damaged beach-dune systems. The Botany Section has agreed to take part in this programme and has also undertaken to make detailed studies of the floristic composition, structure and behaviour of the vegetation on stable dunes in their natural condition.

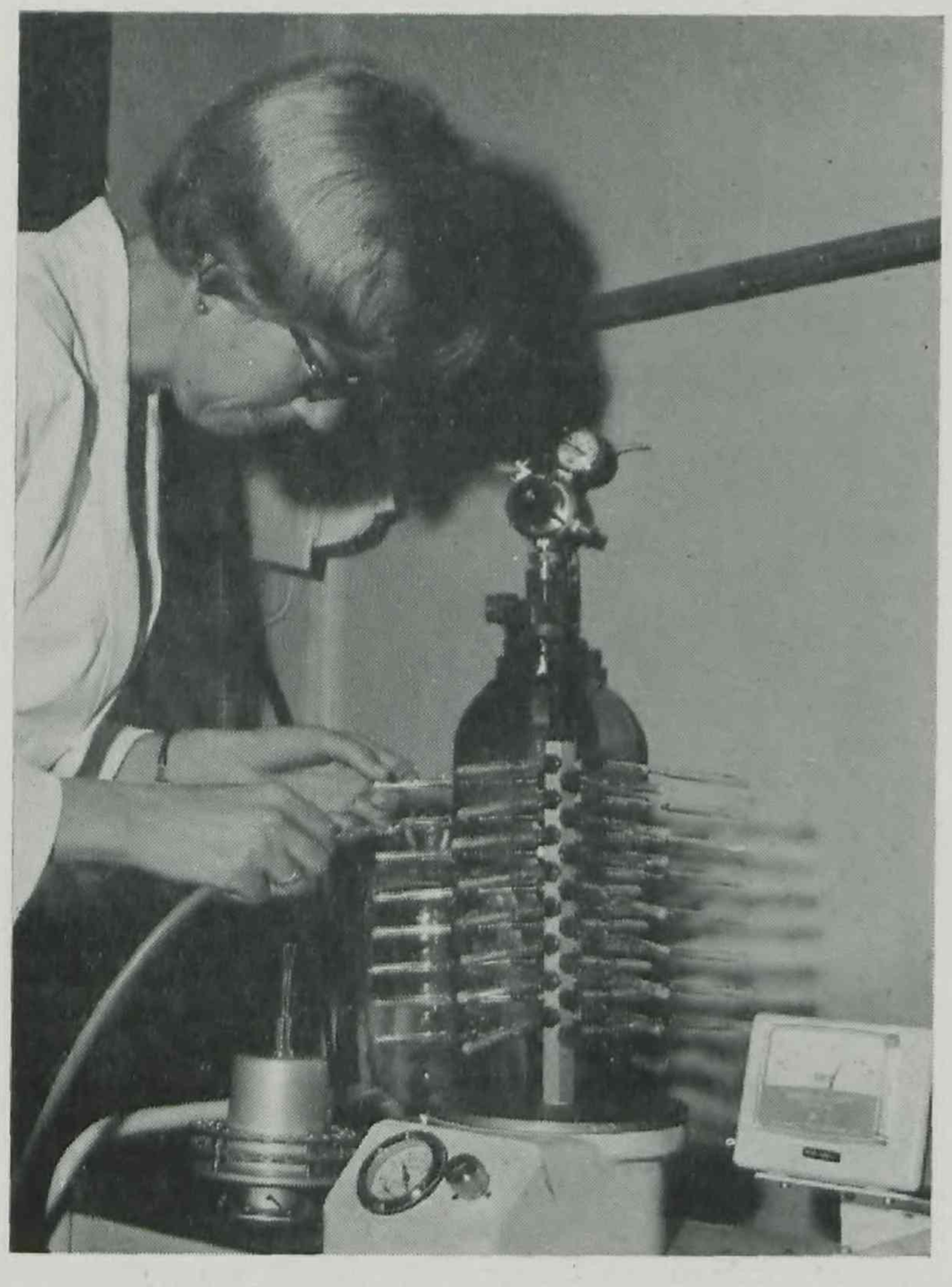
ENTOMOLOGY AND PLANT PATHOLOGY

Laboratory studies by Entomology Section on Heliothis egg mortality have aimed at determining inconsistencies between field egglaying and subsequent larval infestations. Moths of *Heliothis punctigera* (Wall.) readily laid quantities of eggs in the laboratory. Batches of individual eggs in gelatine capsules were submitted to various combinations of temperature and humidity. At temperatures from 60 to 90° F. at various humidities, mortality ranged from 1 to 20% for batches of 100 eggs. At a temperature of 97±1° F. and relative humidities of about 80% and 70% the mortality was 1% and 9% respectively. At a temperature of 100±1° F., high mortalities (80% to 100%) occurred at all humidities, and at temperatures of 105 and 112° F. mortality was 100%. Further work is required because eggs could withstand temperatures up to 112° F. for several hours if held at 84° F. for the remainder of the incubation period.

The Departmental insect reference collections were augmented by specimens from 701 determinations of Queensland insects by authorities in Australia and overseas. Entomologists maintaining the collections provided 1,387 identifications for field stations, quarantine officers, other institutions and the public generally. A collection of *Arachnida* of importance in domestic buildings has been commenced.

Morphological studies of some major species of moths in the family Tortricidae have provided identification details of juvenile stages and thrown more light on the development and life cycles of such pests as lucerne leaf roller (*Merophyas divulsana* (Walw.)), orange fruit borer (*Isotenes miscrana* (Walk.)) and macadamia nut borer (*Cryptophlebia ombrodelta* (Low)).

Phosphine was shown to be an effective material for the control of the tobacco beetle (*Lasioderma serricorne*) and has gained acceptance in the tobacco industry. Studies have shown that sublethal doses of phosphine cause a high level of inhibition of reproduction in several species of stored product pests and this is an additional advantage to the material as a fumigant. However, strains of the rust-red flour beetle (*Tribolium castaneum*) showing resistance to phosphine have been developed in the laboratory. Malathion resistance in the same species is already widespread in the State and the situation was complicated by the discovery of an infestation of the so-called malathion specific strain in a quarantine bond store in Brisbane.



Two important techniques in plant pathology laboratories. Right, sub-culturing plant pathogens growing in artificial culture. Left, preserving plant pathogenic cultures by the freeze-drying technique.

A nuclear polyhedrosis virus has been shown to be widespread in populations of *Heliothis* spp. (tobacco budworm, corn ear worm, tomato grub, cotton bollworm) and to be a significant factor in reducing populations. Further studies are required to establish whether the virus can be used for the control of these pests.

A survey of fruit flies in the South-East Pacific area has produced records of importance to plant quarantine and is continuing to reveal new species in the group. The melon fly (*Strumeta cucurbita*), a potentially serious pest of cucurbits and other crops but which is not yet established in Queensland, was shown to occur commonly in Papua and New Britain. The Queensland fruit fly (*Strumeta tryoni*) was recorded in native fruit at the Fly River delta.

In field trials aimed at improved nematode control in pineapples, bananas, grapes, pome and stone fruits, citrus and tomatoes, nematocides of the non-fumigant type applied to established plants gave promising results.

Other entomological projects and a number of plant pathological projects are mentioned in the sections on pastures, field crops and horticulture.

FAUNA

Fauna conservation field surveys have been continued and research on wild ducks, the brolga, rain-forest fauna and marsupials has been intensified. During the year regulations were gazetted to dampen the harvesting of marsupials throughout the State.

IX. Agricultural Standards

The Department is concerned in many ways with the maintenance of standards of primary produce, both raw and manufactured, intended for local consumption or export. It is also concerned with standards of certain agricultural requirements, mainly agricultural chemicals, and with standards of usage of certain materials. Where standards have statutory force, the Department polices them, in appropriate cases as an agent of the Commonwealth Government.

The Standards Branch is the Branch most involved in standards control, though Dairy Research Branch and Dairy Field Services Branch have prime responsibility for standards control of dairy produce and Slaughtering and Meat Inspection Branch for meat and meat products.

AGRICULTURAL CHEMICALS CONTROL

The Agricultural Chemicals Distribution Control Board was represented at a meeting in Melbourne at which delegates from all States discussed problems associated with the insurance policy available to fulfil the security provisions in the various Aerial Spraying Acts.

Groups of members of the Board developed Regulations and provisions to permit different categories of operators of ground equipment. Methods of conducting examinations of candidates to operate by licence under the Acts were also developed. Members also discussed provisions of the Act with representatives of Insurance Companies, Local Authorities, Forestry, Railway and Main Roads Departments and Electricity Authorities, and gave talks to operators of ground equipment at weed control seminars.

The Agricultural Chemical Laboratory Branch has made numerous analyses of plants sprayed with 2,4-D to obtain information on the detection and effects of traces of this herbicide on economic crops.

Four thousand copies of a reference book for licensed commercial operators—the Commercial Operator's Manual—have been published on behalf of the Agricultural Chemicals Distribution Control Board. This Manual has been prepared for distribution to applicants who wish to be examined for licences for the commercial ground distribution of herbicides. Following gazettal of Regulations under the *Agricultural Chemicals Distribution Control Act* 1966–1970, arrangements are now being made to conduct examinations of pilots and commercial operators.

There was a substantial increase in the number of applications for the registration of standard fertilizer mixtures from 596 last year to 882 this year, while the number of special mixtures of fertilizers for which registration was applied increased from 1,489 to 3,515. During the year "The Agricultural Standards (Stock Foods) Regulations of 1964" were amended in two respects:

(*a*) Schedule I of Regulation 9 was amended so that seeds and/or grains which have been treated with BHC, DDT, dieldrin, endosulfan, endrin, HCB or mercury are prescribed to be harmful ingredients in stock foods. Such seeds and/or grains are not allowed to be sold for feeding to livestock or to be used in the manufacture of stock foods. This amendment is aimed at keeping levels of pesticides in animal products below those levels which are acceptable on world markets.

(*b*) Regulation 7 (1) (*b*) (i) was amended to the effect that the levels of crude protein, crude fat and crude fibre present in a premixed concentrate need not be stated on its label when the rate of dilution in the directions for use is such that the concentration of the premixed concentrate in the final rations is less than 0·5%. This amendment resulted from a submission by the Agricultural and Veterinary Chemicals Association of Australia on behalf of members of that Association.

"The Agricultural Standards (Fertilizer and Lime) Regulations of 1967" were amended to require that maximum levels of biuret be shown on labels of fertilizers which contain this substance.

An amendment to "The Agricultural Standards (Veterinary Medicines) Regulations of 1952" allows the words "condition" or "constitution" to be included in the names for veterinary medicines advocated for administration to dogs, cats, aviary birds or horses. The original ban on the use of these words in the names or description of all veterinary medicines still applies to preparations for other animals such as cattle, sheep and pigs.

SEEDS

Samples of seed received for testing during the year numbered 11,748.

Production of certified seeds in 1968-69 was, with the exception of certified bean seed, below expectations. The Queensland Certified Grain Sorghum Seed Growers formed a company for the sale of grower members' seed.

A quantity of Zulu hybrid forage sorghum seed in excess of 10,000 bus. and a quantity of Minhafer oats seed of the order of 20 bus. failed to meet certification requirements, and were rejected. Plans have been made to expand oat seed certification by the addition of a number of varieties, the first of which will be Bentland. The certification scheme was extended to two pasture cultivars, Oxley fine stem stylo (*Stylosanthes guyanensis*) and Narok setaria (*Setaria sphacelata*).

Following Australia's application for membership in the O.E.C.D. Scheme for the varietal certification of herbage seed moving in international trade, an official representative of the Organization for Economic Co-operation and Development visited Queensland and was conducted by Branch officers on a tour of investigation.

A significant development for seed testing in Australia has been the completion of a syllabus for the Seed Testing Proficiency Course for Analysts. The Director of Agricultural Standards is a member of the Australian panel of examiners.

FRUIT AND VEGETABLES

Improved maturity standards for grapes and citrus provided a better system of quality control over the sale of these fruits. Several lines of unpalatable citrus were withheld from the market. Following a temporary decline in the quantity of citrus exported to the Philippines, there was a sharp decrease in the volume of citrus fumigated with EDB.

Sixty-three farm produce agents are presently licensed under *"The Farm Produce Agents Act of* 1964", 49 of these being in the Brisbane area and 14 in country districts. Three of the country agents trade only as farm produce brokers. Trust accounts and books of account were inspected.

STOCK FOODS

Agricultural standards inspection included, among the normal activities, the inspection of damaged fishmeal removed from an overseas vessel to determine its suitability as a stock food or fertilizer.

EXPORT INSPECTIONS

This year saw the commencement of the use of containers for the shipping of Queensland flour. Twelve container shipments to the United Kingdom were inspected prior to loading. Containerization was also introduced in the export of apples and citrus. Containers of apples were loaded at the production centres in the Granite Belt. Standards Branch also undertook the responsibility for the inspection of nuts intended for export. Three consignments of roasted peanuts were exported. Arrangements have been made with the Commonwealth Department of Primary Industry to inspect export consignments of sorghum, which will be subject to the requirements of the Exports (Grain) Regulations as from July 1970.

A total of 283,940 tons of wheat was inspected and passed for export, and 807 tons were rejected because of insect infestation.

DAIRY PRODUCTS

In order to maintain the quality of dairy products consumed in the State or exported, a total of nearly 45,000 samples was analysed during the year by the Dairy Research Branch. The results of these analyses carried out both chemically and bacteriologically have been made available to farmers, factories, commodity boards and Departmental officers. In addition, an appreciable number of samples have been analysed with a view to issuing N.A.T.A. certificates necessary to enable produce to be exported.

Liquid milk analyses carried out throughout the State, either daily or not less frequently than once weekly, indicated that quality of milk has been well maintained. In some instances there have been indications of some post-pasteurization contamination and where this has occurred the attention of factories has been drawn to the matter in order to apply corrective measures. The incidence of penicillin residues in milk has been kept to an extremely low level by regular sampling and careful sensitive testing by disc assay.

The Butter Improvement Service operated by the Dairy Research Branch has been continued and the advisory standards applicable have been considerably upgraded. Despite these higher standards, the quality of Queensland butter has been maintained at a very high level.

The Cheese Quality Service has shown that cheese quality is being maintained generally at a high standard. All cheese exported to Japan has been tested on behalf of the Australian Dairy Produce Board for the presence of coagulase positive staphylococci and *Escherichia coli* Type I, freedom from both of which is demanded by the Japanese marketing authorities. A total of almost 500 samples was examined in this way and certificates issued. In addition, surveys have been carried out in cheese factories to assist in problems associated with bacteriophage control.

EGG QUALITY

Officers of the Dairy Research Branch stationed at the South Queensland Egg Marketing Board have carried out analyses on more than 5,000 samples of egg pulp. Salmonellae and coliform organisms were absent from all samples of pasteurized pulp. Unpasteurized pulp, however, has been found to carry appreciable numbers of these organisms and as a result legislation has recently been enacted under the Health Act prohibiting the sale of unpasteurized pulp.

SALMONELLA IN FOOD PROCESSING

The occurrence of these organisms in meat, beef, mutton and poultry is being given increasing attention in England, America and in other countries that are customers or potential customers for our products. Observations in Queensland have commenced and already some alterations to procedures have been effected with quite notable improvements in the level of contamination of the product.

FARM MACHINERY

The agricultural engineering section of Agriculture Branch has provided a service to primary producers along three main lines—an advisory service on farm mechanization problems and practices; design of experimental machinery and equipment for departmental research programmes; and liaison with manufacturers and suppliers of farm machinery and farm equipment.

Increased bulk handling of grains with the accompanying storage problems has created a considerable demand for advice on grain drying and storage techniques. This need has been met by technical advisory publications and farmers' schools as well as by individual consultation.

Several items of research machinery and equipment have been completed during the year, viz. a self-propelled plot sprayer; an experimental planter for row crop work, providing precision metering and placement of seed and fertiliser; a mite collection machine for entomological studies; and milling and mixing machinery for farm preparation of grain and concentrates for pig feeds.

In addition, the efficiency of stubble mulching machinery recently introduced from U.S.A. is being determined under Darling Downs conditions.

X. Fisheries

Research, extension and regulatory matters concerning fisheries and marine life are handled by the Fisheries Branch, which has the support of various Departmental laboratories. The Branch was transferred from the Department in August 1969 but was brought within the Department again in February 1970.

Prawns consigned to Brisbane are normally treated with anti-oxidants on landing, to arrest the possible development of melanosis. Due to the method of application, anti-oxidant residues and product quality have been variable. Improved methods of application are therefore being studied. Preliminary investigations have indicated that melanosis development in fresh prawns can be prevented during 24 hours' storage at 40°F. by dipping for 15 second in 1·5% ascorbic acid solution or 0·5% sodium sulphite solution. The anti-oxidant residues in the flesh following these treatments were well within the tolerance permitted. A range of concentrations of anti-oxidants and dipping times are being investigated to determine the most convenient and economic method of application.

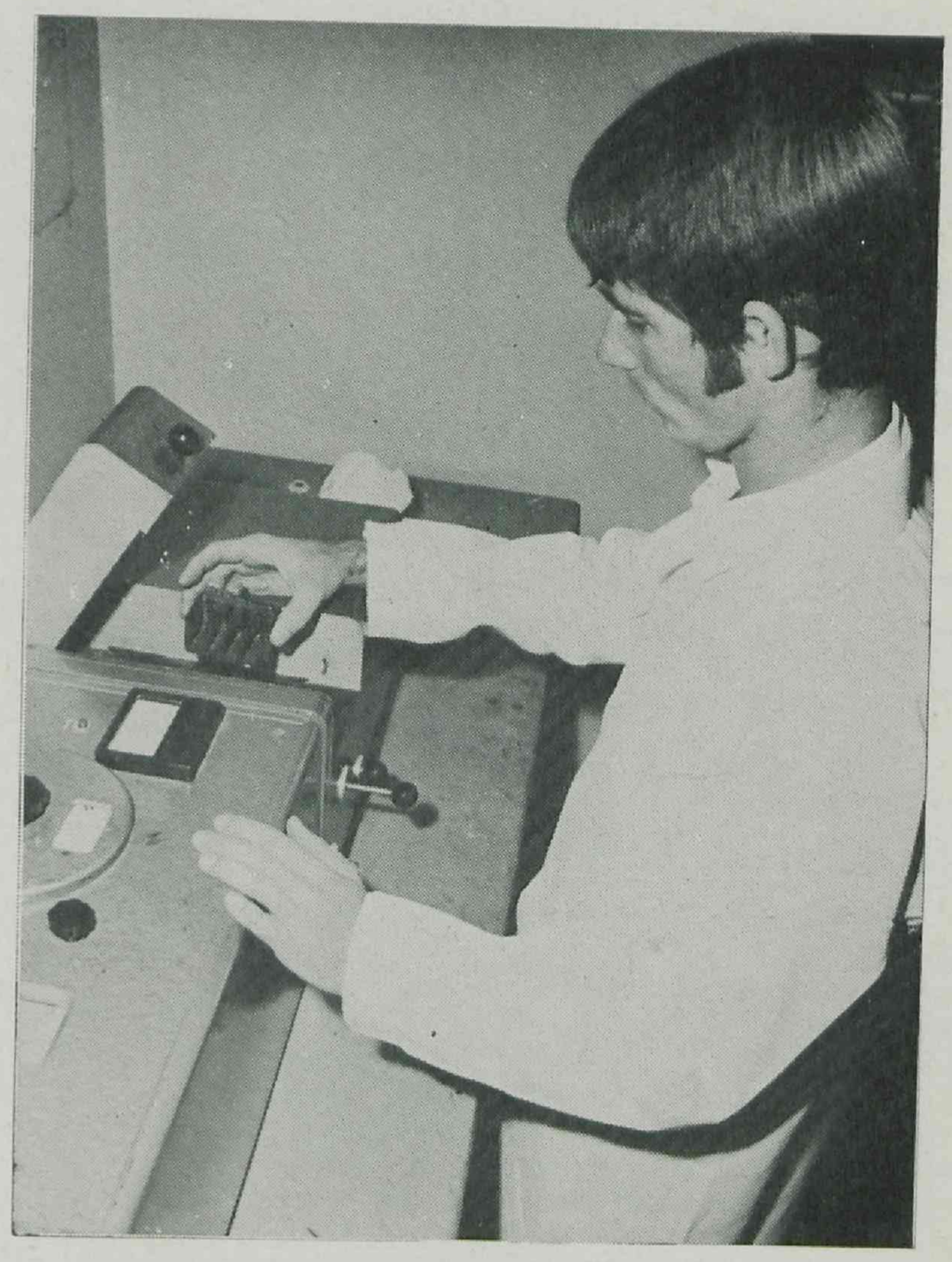
Market sampling of sea mullet at Tewantin was continued. A paper on the problem of "kerosene taint" in the species was produced.

Work continued on the crown-of-thorns starfish. During the year, four expeditions were mounted to monitor the extent of the infestation on the Great Barrier Reef. These covered 21 reefs in the Cairns–Innisfail region, 38 between Port Douglas and Lizard Island in the far north, and 14 in the Capricorn/Bunker group of islands off Gladstone. In association with the lastmentioned expedition, studies were made at the Heron Island marine laboratory on the hatching and rearing of starfish larvae.

A small laboratory has been built at Mourilyan Harbour and the research team is due to commence full-time operations from this base in August 1970, when delivery of a 23 ft. speedboat to provide rapid access to the inner reefs between Townsville and Port Douglas is expected.

A joint Commonwealth/Queensland Committee set up in April 1970 to review the present knowledge of the starfish problem and to advise the respective Governments on future programme planning has already interviewed a number of local and overseas experts and has visited several localities within the area of occurrence of the starfish.

Departmental fisheries biologists visited Thursday Island in an advisory capacity in connection with the grounding of the "Oceanic Grandeur" in March, 1970.



Spectroscopic examination in the Food Preservation Research Laboratory of substances associated with mullet tainting.

XI. Review of the Primary Industries in 1969-70

BEEF AND VEAL

In areas where drought conditions existed in July 1969 there was a general deterioration in the condition of cattle as the season progressed and substantial losses of breeding stock occurred. Heaviest losses occurred in parts of the Gulf and in the Central Highlands.

Drought mitigation measures were responsible for the overall comparatively low stock mortalities which occurred.

Stock responded well following the onset of relief rains in the late spring, and despite the generally light season which followed over much of the State, cattle entered the winter in strong condition.

There was a shortage of cattle suitable to local trade requirements during most of the year and this was reflected in high market values.

Apart from North Queensland, where store trading was practically dormant, there was considerable activity in the early part of the year. Strong-conditioned animals were in demand by interstate buyers but droughty animals were hard to clear. After relief rains in October, fewer cattle were offering and prices rose sharply. Northern conditions did not improve until January. Following failure of the wet season, there was a marked falling off in demand for store cattle.

Beef and veal production in Queensland rose by 9·7% from 1967-68 to 340·7 thousand tons in 1968-69, as a result of a 9·6% rise in numbers of cattle and calves slaughtered. The increased turn-off was partly the result of stock reduction to allow for drought conditions and partly attributable to the buoyant market situation. In the first 9 months of 1969-70 numbers slaughtered fell by 7% compared with the same period in the previous year, while production of beef and veal fell by 12%. This reduction reflected the combined effect of decreased turn-off and a decline in slaughter weights, which resulted from drought conditions that intensified in the second half of 1969. In this period 233,051 tons of beef and veal were produced in Queensland.

Australia's exports of beef and veal rose by 9% in 1968-69 to 460,000 tons compared with the 1967-68 figure. It is estimated that exports in 1969-70 reached 474,000 tons, a further increase of 3%. During the calendar year 1969 Australia's exports to U.S.A., U.K., the European Economic Community, Japan, Canada and U.S.S.R. all increased. It is expected that export levels are likely to be maintained in 1970, with the prospect of significant expansion in exports to Japan and U.S.S.R.

The principal market for Australia's exports of beef and veal is the U.S.A. Countries exporting meat to the U.S.A. have agreed to abide by voluntary quotas to avoid the imposition by the U.S.A. of quotas under the meat import legislation. In Australia, the voluntary quota is administered by the Australian Meat Board through its Export Diversification Scheme, by which exporters must ship meat to other markets to earn entitlements to ship to the U.S.A. The diversification ratio is varied from time to time in accordance with market conditions.

The value of Queensland's exports of beef and veal to all destinations and to overseas countries both rose by 12% in 1968-69. No estimate of 1969-70 exports is available; however, falling production suggests that exports have declined.

Domestic consumption of beef and veal in Australia rose 5% in 1968-69 and totalled 91 lb. per head of population over the year. This is still below the level of about 100 lb. per capita which prevailed from 1962-63 to 1964-65.

WOOL

Some wool-growing areas experienced continuous drought throughout the year. Sheep buyers from southern States bought considerable numbers of sheep during the late winter and spring of 1969.

During the 1969-70 season the Queensland wool industry experienced the lowest price level since the late 1940's. This, combined with drought and continued cost increases, has placed many growers in serious financial difficulty, and most are not earning a satisfactory return on investment.

Wool prices at the 1969-70 Brisbane sales averaged 38·05 cents per lb., against the average for the 1968-69 season of 45·2 cents. Prices in Brisbane have declined almost continuously from 40·9 cents at the first sale to 32·2 cents at the tenth. A total of 563,460 bales of wool (178m. lb. net) was sold in Brisbane during the 1969-70 season for a gross realization of $68m. Approximately 90% of this wool was Queensland-grown, the remaining 10% coming from northern New South Wales.

There are a number of factors which appear to be causing the present low level of wool prices. A general worldwide decline appears to have been brought about by a natural downturn in the textile cycle following the upswing of late 1967 and early 1968. Increasing competition from artificial fibres, and the present international financial situation, particularly high interest rates, have made users reluctant to hold stocks of wool. Locally, drought has caused a fall-off in the quality of wool delivered for sale.

PIGMEATS

Production of pigmeat in Australia rose by 8·8% between 1967-68 and 1968-69, while in Queensland it rose by 5·4% in the same period. However, in the first 9 months of 1969-70, while Australian production rose by 9·2% over the corresponding period of 1968-69, Queensland production fell by 6·7%.

Slaughterings in the first half of 1969 were abnormally high as a result of drought and feed shortages and consequently the need to restock herds would partly account for lower slaughterings and production in 1969-70. The feed grain situation has improved in recent months and this has caused renewed interest in the pig industry and this could also contribute to reduced slaughterings.

A continued decrease in the number of producers and an increase in the average herd size are apparent. The trend towards larger holdings is likely to continue, but there is no evidence that the efficient medium-sized producer is likely to be forced out of business by the very large producers.

EGGS AND POULTRY MEAT

The improvement in egg producers' returns experienced in 1968-69 was not carried into the 1969-70 season. This was brought about by the increase in production surplus to local market requirements. This increased surplus was necessarily sold on export markets, which, while they have improved somewhat, still yield considerably lower returns than local sales.

Australian egg production increased on average by approximately 9·0%. In South Queensland, the rise of 14·0% was exceeded only by that of Central Queensland. Victoria followed with a 12% increase on 1968-69 levels.

Net returns to suppliers to the Egg Marketing Board in southern Queensland for 1969-70 (after deduction of Board handling charges, administrative and other levies, but not the Commonwealth (Equalisation) hen levy which is applied at the rate of $1 per annum per hen) averaged 37·6 cents per doz. compared with 40·77 cents in the previous year (12 months) and 35·94 cents in 1967-68. However, with low prices operating for feed, the major production cost, profitability, except for the last quarter of the year when low prices for eggs were recorded, was better than it has been for several years.

Prospects for 1970-71 are not good. Increased hatchings of chickens indicate further production increases, while overseas prices are unlikely to improve.

Within the field of organized marketing, the operation of a partnership arrangement between the South Queensland and Central Queensland Marketing Boards has proved advantageous in the rationalization of distribution and the avoidance of unnecessary price competition. There is also some evidence of improved co-operation between the statutory marketing boards and egg producers in the northern areas of the State.

The Council of Egg Marketing Authorities of Australia comprising the membership of the various Egg Marketing Boards in the Australian States has functioned throughout the year to the advantage of the organized industry in Australia, particularly in the reduction of trading outside recognized Board channels.

Some degree of controlled expansion took place in the broiler industry. A few new broiler growers were recruited under contract to the major processing companies.

In the space of 10 years the number of hatcheries registered for the business of hatching day-old chickens for sale has fallen from 119 to 54. In the main these are small hatcheries with no interstate franchise arrangements. At the same time, production of broiler chickens rose from 1 million to 15 million and the number of chicks hatched for the egg industry increased from 1½ million to over 2½ million. Already, three hatcheries produce most of the broiler chicks, while six hatcheries produce half of Queensland's total annual pullet chick requirements.

DAIRY PRODUCTS

In Queensland the position has improved with overall production of butter and cheese up by approximately 11% on the low levels of 1968-69. Production reached approximately 22,500 tons of butter and 8,850 tons of cheese.

Increases in Australian production have come mainly from Victoria, and to a lesser extent Tasmania. Production of butter in Victoria has proportionately increased from 46 to 63% of total Australian production over the last decade. This period has seen a continuing decline in Queensland production arising from a drift from the industry in the face of falling returns on export realizations and accelerated by a succession of very unfavourable dry seasons.

One outcome of low Queensland production has been the necessity to import butter from Victoria to meet local market requirements in the off-season.

Prices for butter on the United Kingdom market, the main outlet for Australian butter, have remained fairly stable, falling from 300 shillings stg. per cwt. at the beginning of the financial year to 295 shillings per cwt. early in 1970. Cheese prices on this market, however, increased over the second quarter of 1970 from 225 shillings per cwt., the level which had been maintained through 1969, to 255 shillings per cwt.

Australia was also fortunate in securing an increase of 2,500 tons (to 67,600 tons) in the butter quota of permitted imports into the United Kingdom for the year commencing April 1, 1970. Australian cheese shipments to the United Kingdom under the arrangement included in the combined Australian/New Zealand quota of 86,000 tons will remain practically unchanged. The allocation between the two countries will be subject to negotiation and will depend to a large extent on available surpluses.

The Commonwealth Government has expressed concern at the continuing increase in production of dairy produce surplus to Australian requirements, and following negotiations with the industry has agreed to underwrite returns to farmers at the 1969-70 level of 34 cents per lb. subject to certain qualifications and limitations designed to contain production.

The new scheme of assistance also includes skim-milk powder, casein and other non-fat products as well as butter and cheese. The Government underwriting of production at these levels would increase bounty payments from the current $27m. to $47m. for 1970-71.

The Commonwealth Government is also pressing for the adoption of its $25m. scheme for the rehabilitation of the dairy industry, and decisions on the basis of acceptance of the Commonwealth Government's financial proposals are nearing finality.

Another factor causing concern to Queensland dairymen is the impact of competition of other fats, both animal and vegetable, on the level of domestic consumption. The sales promotion scheme aimed at meeting this competition is now entering its third year of operation. The scheme, which is financed by a levy on local sales of butter, has succeeded in improving Queensland consumption, particularly in the Brisbane metropolitan area.

SUGAR

Queensland produced 2·08m. tons of 94 n.t. sugar in 1969 from a harvest of 14·7m. tons of cane. The sharp fall from the previous season's record crop of 2·6m. tons reflected the adverse seasonal conditions which prevailed in 1969. While it is anticipated that there will be a substantial improvement in the 1970 harvest, it is not expected to approach the 1968 level.

The low harvest of 1969 resulted in a sharp increase in prices realized for the crop. The overall average price of $99.32 per ton was almost $18 higher than that for the previous year. Sugar within peaks averaged $101.59, while excess sugar realized $62.95. The total value of the crop was $206.6m.

On the international scene, Australia's final quota for the United States domestic market in 1969 was 164,749 long tons while the basic quota for 1970 was set at 171,830 long tons subject to increase in the event of shortfall declarations by other suppliers.

The negotiated price quota under the British Commonwealth Sugar Agreement remained at 335,000 tons.

While international sugar prices have improved considerably since the negotiation of the International Sugar Agreement, they have not come up to the expectations of the negotiating parties, who have suggested 4·0 cents per lb. (U.S.) f.o.b. bulk Caribbean Port as the minimum world price acceptable. At one point in late April 1970 the I.S.A. Daily Price almost reached that level, but it subsequently retreated during May and at the end of June stood at 3·86 cents.

WHEAT

Queensland's wheat production in 1969-70 is estimated at 16m. bushels, which was well below the previous season's record of 41m. bushels. Although some 1·6m. acres were sown for grain, as a result of widespread heavy frosts only about 1·2m. acres were retained for harvest. The estimated yield per acre sown, 10 bus., is the lowest recorded since 1946-47.

Comparatively little grain was harvested in Central Queensland and most of the Darling Downs recorded a poor harvest. The bulk of the wheat came from the Western and South-Western Downs, where relatively favourable conditions prevailed. Due to the severe frost damage, only 10% of Board receivals were graded as "prime hard" compared with 87% in 1968-69.

The 1969-70 crop was the second to be marketed under the current Commonwealth Wheat Stabilization Plan. The scheme for this season included some differences in the computation of the home consumption price. In previous years, the home consumption price in a particular season was the same for all wheat sold locally. However, in 1969-70 the home consumption price fixed for wheat milled into flour on an f.a.q. basis is $1.75 per bus., bulk f.o.r. ports. However, wheat used for other purposes such as stock feed is sold at not less than the Commonwealth guaranteed price for exports. This guaranteed price in 1969–70 is $1·459 per bus., bulk f.o.b. ports, up to a maximum of 200m. bus.

The 1969–70 Australian harvest is estimated at 380m. bus., compared with the record 540m. bus. in 1968–69. This reduction was due to the combined effects of wheat delivery quotas for the 1969–70 season and drought conditions in Queensland and Western Australia.

The Australian Wheat Quota for 1970–71, on which the Commonwealth Government has guaranteed a loan to the Australian Wheat Board to pay a first advance of $1.10, is 301m. bus. In addition, the Commonwealth Government approved of a special allocation of 10m. of "prime hard" wheat to be shared evenly by New South Wales and Queensland in order to build up stocks of this grade, which is readily saleable on world markets.

In most States, delivery quotas have been reduced by an overall 20%. However, Queensland and Western Australia failed to fill their 1969–70 quotas because of drought conditions and their quotas for this season were not reduced. The special allocation of 5m. of "prime hard" wheat has increased Queensland's 1970–71 quota to 36m. bus.

Total Australian export sales of wheat and flour for 1969–70 are estimated at 280m. bus., compared with 300m. bus. in 1968–69. Carryover wheat is expected to rise to 300m. bus., compared with 267 bus. in 1968–69.

BARLEY

The total area sown to barley in 1969–70 was estimated at a record 500,000 acres. However, due to widespread damage by September frosts, some 80,000 acres failed and production was approximately 8m. bushels. This was a poor return compared with 12.9m. bus. in 1968 from a planting of 427,000 acres.

Receivals by the Barley Marketing Board in 1969–70 totalled 3·2m. bus., only half of those from the previous crop. Only 40% of Board receivals was of malting quality, compared with 65% in a normal season. Thus the Board was able to supply only a fraction of southern maltsters' requirements. However, orders from local maltsters were met.

Sales of feed on the local market were below average due to the availability of substantial quantities of cheap wheat from New South Wales and the expected large grain sorghum crop. Some 400,000 bus. of feed barley were exported to New Zealand at reasonable prices and it is expected that a further 500,000 bus. will have to be sold on the export market.

A disturbing feature was that the Board received only about 40% of the crop. This was due in part to growers' use of grain for stockfeed occasioned by the prevailing drought. However, there was also extensive selling outside the Board and this lack of grower support could adversely affect the future development of organized markets, both local and interstate.

GRAIN SORGHUM

The area planted to grain sorghum in 1970 is estimated at a record 680,000 acres. However, the failure of late summer rainfall and the persistence of high temperatures took heavy toll of crops that were planted on minimal reserves of subsoil moisture. This resulted in the failure for harvest purposes of an estimated 88,000 acres. From the remaining 592,000 acres, it is estimated that some 295,000 tons of grain were produced. This represents just over 16 bus. per acre, which is an improvement on last year's disastrous yield of about 12 bus. per acre but is otherwise the poorest overall return per acre since 1952.

Despite the poor seasonal conditions in southern Queensland in 1970, record plantings resulted in an estimated record production of 201,000 tons. Due to the large increase in production and the limited size of the local market, 100,000 tons of sorghum have been exported from southern Queensland.

As a result of the poor season, the Central Queensland Grain Sorghum Marketing Board exempted growers from delivery provision of the Acts for the 1969 season. Deliveries to the Board in 1970 are expected to reach about 50,000 tons, compared with the record receivals of 89,600 tons in 1968. Only the Clermont and Capella areas obtained reasonable crops.

MAIZE

The area planted to maize in 1970 is estimated at 125,000 acres, compared with 130,000 acres in 1969. Production is estimated at 3·5m. bus., a yield of 28 bus. per acre sown. This is an improvement on the 1969 crop, which gave the poorest yield in post-war years at 15·4 bus. per acre and resulted in a crop of only 2m. bus.

The Atherton Tableland has experienced an excellent season and could produce a record crop, the harvest being currently estimated at 810,000 bushels. In this area, the outlook for high yields from rust-resistant hybrid varieties is very promising, particularly in view of increased acceptance by farmers of fertilizer application programmes. The Burnett district experienced reasonable growing conditions. The main growing areas of the Darling Downs, however, suffered drastically reduced yields from drought conditions which developed late in the season.

PEANUTS

Peanut production was severely affected by adverse seasonal conditions during the 1969 season. At 16,600 tons from 78,000 acres planted, production level was among the lowest recorded in recent years.

Despite generally unfavourable conditions, particularly during the second half of the 1970 season, the industry is expected to produce a record crop. Production is estimated at 42,000 tons from an estimated 87,000 acres planted, marginally better than the previous record of 41,098 tons achieved in 1967.

Although some marketing difficulties can now be foreseen for the 1970-71 selling year, the results of the 1970 season are highly satisfactory and are of considerable importance to the economy of the main producing areas in view of the generally depressed economic situation.

NAVY BEANS

Severe drought conditions in all navy bean growing areas resulted in a sharp decline in 1969 season production. At 900 tons gross weight from a planting of 10,000 acres, the navy bean crop was sufficient to supply only a small part of the Australian market.

The 1970 season commenced with excellent prospects and it is estimated that some 13,000 acres were planted. However, extremely dry conditions late in the growing period are expected to reduce production from an earlier estimate of 5,500 tons to 2,500 tons gross weight. However, quality to date has been the best yet experienced in the industry.

TOBACCO

Queensland tobacco sales in 1969 amounted to a record 22,140,904 lb. At an average price of 109·4c per lb., realizations totalled $20,229,933. This was substantially in excess of total realizations in the 1968 season, which amounted to $17,697,997 from 15,171,234 lb. sold. However, the average price of 109·4c per lb. in 1969 was considerably less than the 116·7c per lb. recorded in 1968. This was brought about by the sale of low quality leaf in quantity for scrap and on the export market. In 1968 very little of this low quality leaf was sold.

The 1969-70 growing season has been satisfactory and to date 14·6m. lb. of leaf at an average price of 118·1c per lb. have been sold. This compares favourably with sales of 13·6m. lb. at an average price of 118·7c per lb. at a similar stage of the 1969 sales.

COTTON

Overall Australian cotton production for 1970 is estimated at 165,000 bales of raw cotton.

The ginning of the 1969 Queensland crop extended from March to October 1969 and produced 20,237 running bales (20,073 x 500 lb. bales) from 10,036,698 lb. of raw cotton lint. This compared with 17,300 running bales in 1968. Of the 1969 crop, 6,685 bales were exported overseas. The 1970 crop is expected to produce 22,000 bales, of which up to 10,000 bales could be exported. Growing conditions were generally good and yields and quality from the main production areas are expected to be high.

The 1971 harvest under the present bounty arrangement will be the last to attract bounty assistance payments. Bounty payable on the 1970 overall Australian crop will total $3m. and on the 1971 crop $2m. Representations have been made to the Commonwealth for the extension of the bounty scheme and the inauguration of a form of statutory marketing on an Australia-wide basis to provide for equalisation of sales returns from processors on the Australian and overseas markets.

During 1969, the Cotton Marketing Board completed the construction of a second ginnery at Cecil Plains. Treatment capacities for cottonseed and other oilseeds were also increased during the year. The Marketing Services Branch, at the request of the Board, is undertaking a study of current and possible developments following the completion of the Fairbairn Dam in the Emerald district, with particular emphasis on the available sites for new ginneries.

The industry in Queensland is confident that cotton will remain a viable crop, particularly when grown under irrigation and suitable climatic conditions and with acceptable yields of good quality fibre.

OILSEEDS

Soybeans.—Adverse seasonal conditions continued to affect soybean production in Queensland, particularly in those areas without irrigation. Production from the 1969 season amounted to only 940 tons from 3,000 acres planted. Although 1970 plantings were substantially higher at 8,000 acres, some 1,500 acres failed and it is now estimated that production in the 1970 season will amount to 3,000 tons.

Safflower.—Safflower seed production in 1968-69 amounted to an estimated 9,867 tons from 43,589 acres planted, compared with 14,560 tons from 95,351 acres in 1967-68. Due to the continuation of the extreme deficiency in soil moisture in the main growing areas, it is likely that very little safflower seed will be planted in 1970-71.

Linseed.—Also affected by drought, linseed production remained at a depressed level during 1968-69. At 6,132 tons from 21,459 acres planted, results were marginally worse than the 6,571 tons production from 27,764 acres in 1967-68. Prospects for 1970-71 season are not good at this stage. Of the 20,000 acres intended, only 6,000 acres have been sown to date and a substantial improvement in seasonal conditions will be necessary for the intended planting figure to be realized.

FRUIT AND VEGETABLES

Pineapples.—Production for the year ended June 30 is estimated at 114,000 tons, an increase of about 5,000 tons on the 1968-69 production, but still well below the record of 127,000 tons of 1967-68. The heavy 1970 summer crop was the main contributor to increased overall production. Processors experienced no great difficulty in handling the increase factory intake. Plantings have been normal.

The Pineapple Industry Rationalisation Plan, introduced in December 1968, worked satisfactorily throughout the year. Average prices to growers improved considerably, partly as a result of the introduction of the Plan, but also because of increased sales of pineapple products on the domestic market, which is more remunerative than overseas outlets.

Average returns for smoothleaf pineapples on the Brisbane wholesale market (fresh fruit) showed only a very slight decline (less than 2%) on the returns for the previous year. Contrary to some expectations, therefore, the Pineapple Industry Rationalisation Plan would not seem to have had any adverse effect on fresh fruit market prices.

Bananas.—Banana production returned to a more stable pattern during 1968-69 following the generally very dry conditions of the previous year. However, prices on the Brisbane market dipped sharply during the year and were, on the average, about 16% lower than in the previous year. There was a drop of about 10% in the area planted.

Production in the Tully area of North Queensland continues to expand and now comprises over half of the State's output of bananas, which is estimated at 1½ million cases.

The swing to fibreboard cartons has become more pronounced and this type of packaging will probably replace timber cases for most uses in the near future.

A new method of transporting bananas which prevents ripening without the need for refrigeration has renewed interest in export markets.

Apples, stone fruit and grapes.—This season's apple production in the Granite Belt has been estimated at only 1·2m. bus., well below the 2·0m. bus. recorded last year. Several severe late frosts during the flowering period were responsible for the drop in production. However, the small crop resulted in a substantial improvement in average unit returns as compared with the disastrously low prices for much of the 1969 season. Estimated quantities of apples available for export overseas are 40,000 cases to the United Kingdom and 16,000 cases to other destinations. New plantings at 145 acres were 40% down on those in 1969.

The Stanthorpe stone fruit crop were also hard hit by the unseasonal cold weather. A medium crop of peaches (about 130,000 bus.) was harvested, but plums (about 100,000 bus.) and apricots and nectarines (about 30,000 bus.) were light. Consequent upon the light stone fruit harvests, values on the Brisbane market were generally well up on the previous season.

A further effect of the small deciduous crop has been the lack of fruit for processing. Growers are naturally reluctant to consign fruit to a factory when better returns can be obtained from the fresh fruit outlets.

There was a medium to heavy crop of grapes, amounting to about 8 million lb., and values were up substantially on last year, particularly in the early part of the season. Some 9,000 new rooted stock were planted on the Granite Belt.

Citrus.—Citrus areas generally have not fully recovered from last year's drought but harvests improved during the autumn-winter period and estimated production is about 1 million bus. Returns for oranges showed some improvement, while grapefruit values have been running at record levels as a result of a strong demand. There was a slight increase in citrus export, approximately 40,000 packages of mandarins and 73,000 of oranges being exported to the United Kingdom, Canada, New Guinea and Asian markets.

Miscellaneous Fruits.—Avocado plantings exceeding 100 acres were made in South Coast districts.

Passionfruit production has increased and the South Coast alone should produce an estimated 75,000 bus. from about 300 acres.

Strawberry plantings in the major districts have been made almost entirely with Redlands Crimson. The 1969 crop yielded about 1¾ million lb.

Macadamia nut plantings are expected to total about 1,000 acres at the end of the 1970 planting season, with about half in production.

Ginger.—Plantings for the 1970 ginger crop were estimated at 350 acres, an increase of 10 acres on the previous year. Excellent growing conditions prevailed and outstanding production results have been achieved. Early harvest yielded 1,511 tons, compared with 736 tons in 1969. Losses from any cause other than weeds have been virtually non-existent. In keeping with the high yields achieved from early harvests, it is expected that the total late harvests will produce a further 3,370 tons, including seed, compared with 1,162 tons in 1969. Should these figures be realized, the 1970 season will be a record.

Vegetables.—Potato production for the year has been estimated at 113,000 tons, compared with last year's 120,000 tons. The main reasons for a decline in potato plantings in 1970 appear to be the consistently poor returns since March 1969 and the knowledge that there is no shortage of supplies in southern States.

Onion production was slightly up on last year's and is estimated at 24,000 tons. Onion prices on the Brisbane market fluctuated considerably throughout the year—with no clearly definable pattern evident.

Because of the light fruit crop in the Granite Belt, heavy plantings of tomatoes, cabbage, cauliflowers, brussels sprouts and beans were made during the season. Larger areas would have been planted if more water had been available for irrigation.

Bean prices were rather unstable during the period but there was a trend towards improved average pea prices, especially during the first half of 1970. Production of beans for processing continues to advance in the Lockyer and Bundaberg districts, spring plantings in the two districts being about 650 and 700 acres respectively.

Estimated tomato production for the year is about 1¼ million bus. Bowen district production expanded, and the Bundaberg district is becoming a major producing area also.

FISHERIES

The approximate return to operators from commercial fishing during the year was $8,500,000.

The estimated production of edible fish was 3,709 tons with a gross value of $3,829,386. The production of crabs was 755,777 bodies, comprising 667,562 sand crabs and 88,215 mud crabs, having a gross value of $263,780. Total production of scallops was 849,663 lb. of shucked meats, valued at $403,648. This represents an eightfold increase on the previous year's landings and more than double the previous highest annual production.

Prawn production is estimated to be of the order of 10 million lb., valued at $3,900,000. There was a general decline in production along the eastern seaboard, but a larger fleet of vessels operating in the Gulf of Carpentaria has maintained total production for the State at approximately the same level as in the previous year.

The offshore (or reef) fishing of the entire State provided good sport for anglers, although there are growing indications of a need to fish deeper and more remote waters in order to keep catches at their present high level.

Tables relating to production (1969-70) and equipment (1968) are appended.

RETURN SHOWING LICENSES UNDER "THE FISHERIES ACTS, 1957 TO 1962," ISSUED AT ALL PORTS DURING THE YEAR ENDED JUNE 30, 1970

Port	Description of Licenses							
	Oyster Banks	Oyster Boats	Oystermen's Licenses	Coral or Shell-grit	Fishing Boats		Fishermen	Fish-traps
					Commercial	Non-Commercial		
Brisbane	187	70	127	15	..	..	1,680	..
Maryborough	57	7	25	3	..	..	153	..
Bundaberg	5	1	8	..	..	..	187	..
Gladstone	3	2	2	..	..	..	71	..
Rockhampton	43	9	29	1	..	..	129	22
Mackay	41	9	33	10	..	..	256	20
Bowen	..	..	..	..	..	..	86	..
Townsville	7	7	15	9	..	..	324	4
Innisfail	..	..	..	..	..	..	78	..
Cairns	3	1	2	11	..	..	311	..
Port Douglas	..	..	..	..	..	..	2	..
Cooktown	..	..	..	..	..	..	..	..
Normanton	..	..	..	..	..	..	3	..
Burketown	..	..	..	..	..	..	..	..
Thursday Island	..	..	..	..	..	..	44	..
Karumba	..	..	..	..	..	..	68	..
Totals	346	106	241	52	2,045*	..	3,047†	46

* Licenses for commercial fishing boats are all issued from Brisbane.

† Includes 1,709 master fishermen's licenses and 1,338 employee fishermen's licenses.

Commercial Fishing Boat Registrations—1968
Number of Vessels and Value

District	Under 20 ft.		20 ft. and under 30 ft.		30 ft. and under 40 ft.		40 ft. and under 50 ft.		50 ft. and under 60 ft.		60 ft. and under 70 ft.		70 ft. and under 85 ft.		85 ft. and under 100 ft.		100 ft. and Over		Totals		Tender Boats		Persons Engaged
	No.	$	No.	$	No.	$	No.	$	No.	$	No.	$	No.	$	No.	$	No.	$	No.	$	No.	$	
Brisbane	171	130,393	135	304,823	113	779,250	87	1,260,800	52	1,243,400	10	376,500	1	120,000	1	90,000	2	550,000	572	4,855,166	226	48,570	1,057
Maryborough ..	10	4,880	31	43,470	20	100,300	10	175,300	3	56,000	..	..	..	..	..	..	..	..	74	379,950	100	18,445	135
Bundaberg	54	11,710	17	26,940	12	72,500	19	212,000	4	115,000	..	..	..	..	..	..	..	..	106	438,150	32	12,422	213
Gladstone	14	8,745	16	48,460	4	30,000	4	56,000	1	15,000	..	..	..	..	..	..	..	..	39	158,205	19	7,620	64
Rockhampton ..	33	21,955	14	49,600	5	34,000	8	108,000	2	45,000	..	..	..	..	..	..	..	..	62	258,555	26	10,335	83
Mackay	53	55,904	39	145,911	15	138,100	8	115,000	1	32,000	..	..	..	..	..	..	..	..	116	486,915	37	22,620	212
Townsville	46	38,003	35	151,060	21	134,700	10	171,000	1	30,000	..	..	..	..	..	..	1	96,000	114	620,763	25	11,220	207
Cairns	64	80,163	51	822,139	19	177,200	14	211,000	4	155,000	2	76,000	1	96,000	1	250,000	1	22,000	157	1,889,502	42	25,352	294
Far North	14	9,071	8	27,200	5	42,600	5	90,000	7	157,000	4	199,000	1	110,000	..	..	..	..	44	634,871	7	2,425	86
Interstate	12	10,140	2	4,500	5	58,000	20	322,000	15	505,200	4	230,000	1	40,000	1	30,000	5	1,170,000	65	2,369,840	8	3,430	188
Totals	471	370,964	348	1,624,103	219	1,566,650	185	2,721,100	90	2,353,600	20	881,500	4	366,000	3	370,000	9	1,838,000	1,349	12,091,917	522	162,439	2,539

GENERAL FISHERIES, EXCLUDING OYSTERS, PEARL-SHELL AND TROCHUS-SHELL

Year	Number of Boats Licensed	Number of Men Licensed	Estimated Quantity of—		
			Fish	Prawns	Crabs
			Tons	lb.	Bodies
1965–66	3,298	5,162	4,564	6,033,710	523,747
1966–67	2,885	4,582	4,175	5,933,842	518,624
1967–68	2,758	4,203	4,301	10,558,588	587,809
1968–69	1,946	2,979	3,551	10,030,862	570,282
1969–70	2,045	3,047	3,709	10,000,000 (est.)	755,777

FISHING UNITS CLASSIFIED ACCORDING TO GEAR USED—1968

District	Beach Seine Net	Mesh Net	Ring Net	State Net or Tunnel Net	Otter Trawl	Hand Line	Troll Line	Crab Net or Crab Pots
Brisbane	69	161	20	19	272	99	40	58
Maryborough	32	56	38	10	14	13	10	9
Bundaberg	23	45	2	2	39	13	6	15
Gladstone	2	14	..	..	1	18	10	20
Rockhampton	5	25	..	..	9	27	10	7
Mackay	9	46	3	1	4	67	54	5
Townsville	15	34	..	..	20	51	41	6
Cairns	5	39	1	..	15	106	78	1
Far North	..	18	..	..	16	8	9	..
Interstate	5	9	..	..	45	14	3	..
Totals	165	447	64	32	435	416	261	121

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