

Queensland Department of Primary Industries
ANNUAL REPORT, 1968-69

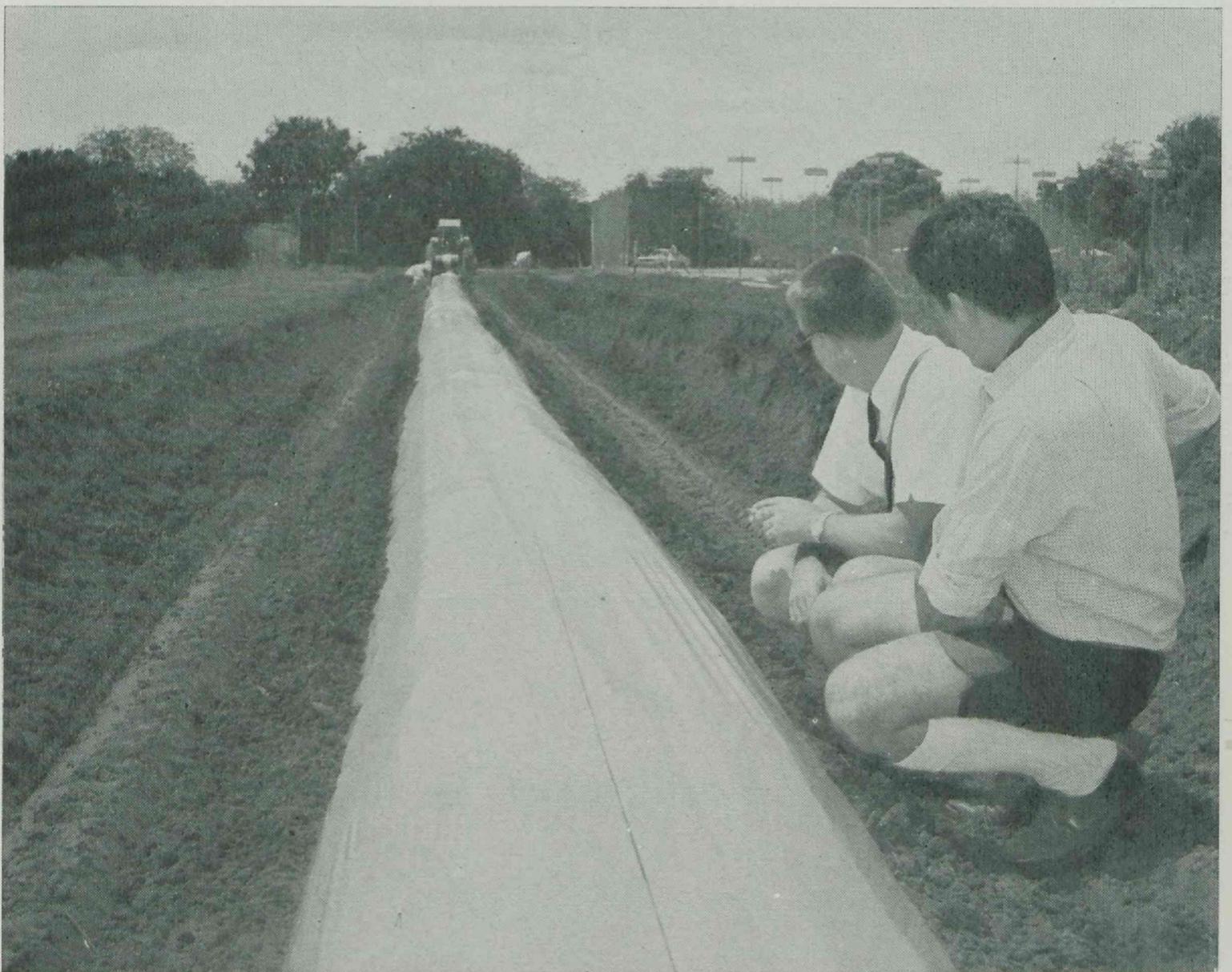


Sorghum breeding glasshouse at Hermitage Research Station on the Darling Downs

Presented to Parliament by Command



Sheep feeding on pushed mulga in the south-west. The Department is expanding its research on mulga utilisation



Laying plastic mulch for strawberries. As a result of research at Redlands Horticultural Research Station, plastic mulch is now generally used as a means of increasing the yield of high quality berries.

CONTENTS

I. General Comments	3
II. Livestock Research and Extension	7
III. Dairy Research and Extension	11
IV. Pasture Research and Extension	15
V. Field Crop Research and Extension	18
VI. Horticultural Research and Extension	21
VII. Development Planning and Land Use	25
VIII. Special Field and Laboratory Services	26
IX. Agricultural Standards	28
X. Review of the Primary Industries in 1968-69	30
XI. Fisheries	34

ORGANISATION OF THE DEPARTMENT AS AT 30th JUNE, 1969

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	Vacant.
Pathology Branch—	
Director	W. T. K. Hall, M.V.Sc.
Cattle Husbandry Branch—	
Director of Cattle Husbandry	G. I. Alexander, B.V.Sc., M.S., Ph.D.
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.
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 DEVELOPMENT PLANNING AND SOIL CONSERVATION—	
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., A.A.C.A., F.A.S.A.
Economic Services Branch—	
Director of Economic Services	E. O. Burns, B.Com., A.A.C.A., 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 1968-69

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, 1969.

Yours faithfully,

J. M. HARVEY,
Director-General.

I. General Comments

In this preliminary section of the report, brief comment is made on a number of points of interest. The first few items deal with production matters; then follow items on organizational and staff matters; and finally comments are made on some miscellaneous aspects of the Department's operations.

PRODUCTION

Variable seasonal conditions ranging from good to severe drought were the most significant factors affecting the State's primary industries during 1968-69. Although the year started on a favourable note, seasonal conditions commenced to deteriorate rapidly from December in many areas. One favourable feature, however, was the excellent season in the far south-west.

Winter grains generally performed well, with wheat achieving a record harvest. However, summer grains experienced moisture stress and production was the lowest in recent years.

Queensland continued to enjoy favourable outlets for its meat exports, although disappointment was experienced with Australia's entitlement on the United States' market during 1969.

The State's sugar producers were heartened following the re-negotiation of the International Sugar Agreement and the consequent increases in the free world price for sugar.

Prospects for 1969-70 are mixed. The livestock industries are faced with a potentially bad winter in many areas. Central Queensland continues to be drought-stricken and a very serious situation could develop in that area unless rain is received soon. Useful winter planting rains were received in the main grain-growing areas of southern Queensland. However, crop yields are completely dependent on follow-up rains.

DROUGHT

Of the State's 131 Shires, more than 90 were declared drought-stricken. This represented 77% of the area of the State, with normal stock populations representing about 84% of the beef cattle, 91% of the dairy cattle and 91% of the State's sheep.

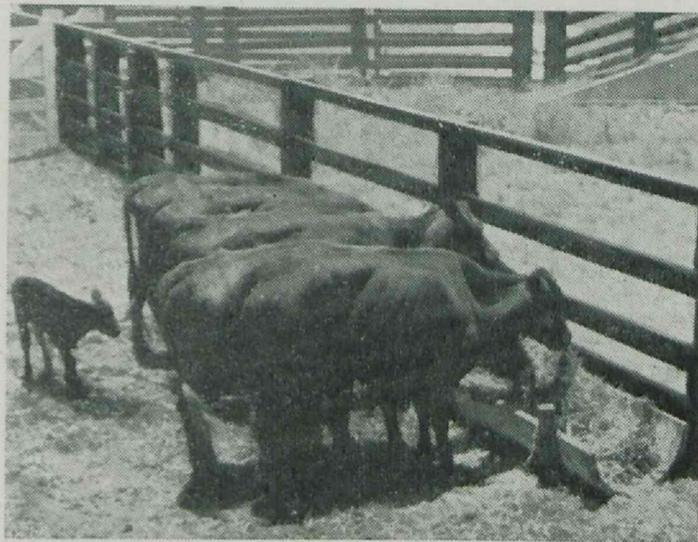
Except for the Darling Downs, the drought is affecting areas with the highest stock density, and the unaffected areas are those in the more extensive areas of the north and south-west with low stocking rates.

Many buyers from New South Wales, southern Queensland and western areas were active at saleyards and on many properties. The majority of sales were effected on properties. It is estimated that movement of stock into New South Wales directly attributable to the drought in Queensland exceeded 300,000 cattle and 2 million sheep.

The Emerald area may be cited as an example of the movement of cattle from drought-affected areas. An estimated 8,000 store cattle were removed to interstate destinations and tick-free areas of Queensland, and a further 6,000 were despatched to agistment areas near Charters Towers and on Central Coast. In addition, approximately 7,000 cattle, many of which were in store condition as a result of forced sales through drought, were despatched to meatworks.

The movement of cattle and sheep affected by drought from tick-infested areas to western areas and other States has been limited by the availability of rail and road transport and the capacity of clearing dips, a waiting period of 3-4 weeks being not uncommon. In many cases cattle too weak to be dipped have been retained on properties.

Breeder cow numbers have been severely depleted and availability and high prices will preclude large-scale restocking, and replenishment will depend upon natural replacement from servicing breeders.



Survival feeding techniques have been widely disseminated by the Department during recent droughts

Supplementary feeding using urea and molasses self-feeders has been adopted as a routine measure on beef properties.

Over large areas, more particularly in the Arcadia Valley and Springsure district, failure of surface and underground water has forced destocking.

The Department assumed additional responsibilities in connection with drought concessions following a Cabinet decision to extend freight concessions to road transport as well as rail.

Drought relief committees with Departmental representation were formed in many centres to advise the General Manager of the Agricultural Bank on the merits of applications for drought relief assistance.

The Department was represented also on a consultative committee set up to advise the General Manager of the Agricultural Bank on the processing of loans.

Restrictions on the movement of slaughter cattle to meatworks within the ticky area were relaxed to assist owners to market drought-affected cattle.

SUGAR OUTLOOK

Negotiations towards a new International Sugar Agreement, mentioned in last year's report, proceeded to a fairly satisfactory conclusion for Australian sugar cane growers. Since the Agreement came into operation in January, there has been a good recovery in world sugar prices.

Though the Agreement provides for a limit on exports which may restrict Australian production for a few years, on the whole the Agreement represents a substantial gain to the industry in respect of both price and stability.

SOIL CONSERVATION

Under the Soil Conservation Act of 1965, provision was made for landholders to take the initiative in the conduct of soil conservation programmes if they desired.

The Act enables districts to be formed under local leadership trusts, which may comprise elected landholder representatives, or the assumption of trust responsibilities by local authorities.

In view of the need for the rate of soil protection to be at least doubled, it is disappointing that not one group has taken advantage of the opportunity to form a district.

The Soil Conservation Branch is currently investigating the reasons for lack of action with a view to assisting landholders to determine how conservation programmes can be accelerated by district activity.

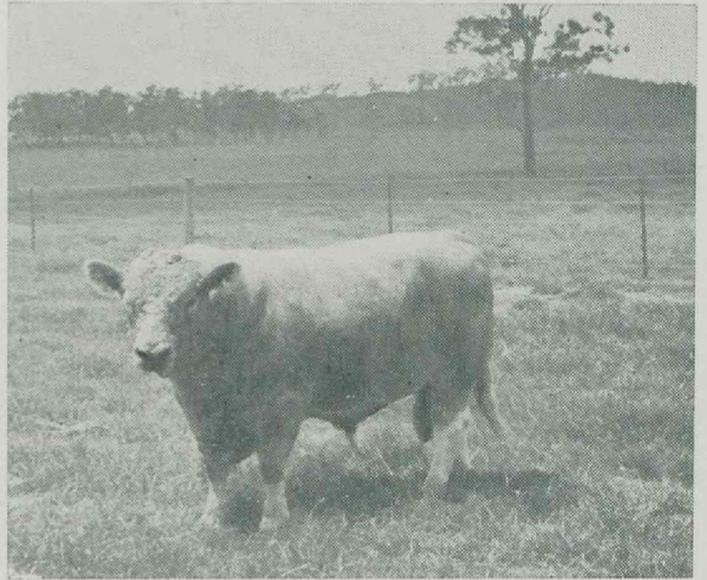
CATTLE BREEDS

The first importation of Charolais semen from the United Kingdom arrived in Queensland in April 1969, paving the way for the establishment of these cattle in Australia. There is widespread interest in this breed and data on its performance under Queensland conditions are eagerly awaited. It is probable that the introduction of Charolais semen has had some influence on the interest of beef producers in the use of artificial breeding.

A number of commercial properties have employed A.I. on portion of their breeding herd during the year. At a recent Artificial Breeding School held on the Gold Coast and organized by a private veterinary consultant, the attendance of cattlemen from a wide area of Australia provided further evidence of the interest in this procedure.

Two breeds which have attracted considerable interest for beef production are the Sahiwal and Africander. These were introduced to Australia in the early 1950's but have not been widely used to date. Quickening interest in these breeds has resulted in formation of the Australian Sahiwal and Red Sindhi Society and the Australian Africander Association to provide for registration and recording of these cattle and organized grading-up systems. The Sahiwal and Red Sindhi Society registers animals bred for dairy production as well as those intended for beef.

The Murray Grey, an Australian breed which originated on the Upper Murray, has also excited interest.



A Murray Grey sire. There is considerable current interest in this Australian breed

PIG INDUSTRY TRENDS

The development of very large units of production has led to fears among small and medium-sized pig producers that they will be forced out of business. While this trend exists it is not, as yet, seen as a threat to the efficient medium-sized operator. However, the structure of the industry is altering and it is possible to identify a total of 32 units each consisting of more than 100 sows (or their equivalent). These units represent about 0.3% of the holdings with pigs but contain about 8% of the sow population.

Evidence of the extent to which vertical integration is taking place in the industry is limited. One large bacon factory has had considerable success in forming a group of "quality producers" to supply almost all of its requirements under a loose contract system, but others have been slow to react. As yet, no fully integrated operations appear to exist.

The industry continues to require Departmental advice, essentially supplied "on the farm", but this is becoming increasingly more technical in nature. It represents a considerable challenge to the staff involved and will require even more co-operation with those working in the veterinary, marketing and economic fields.

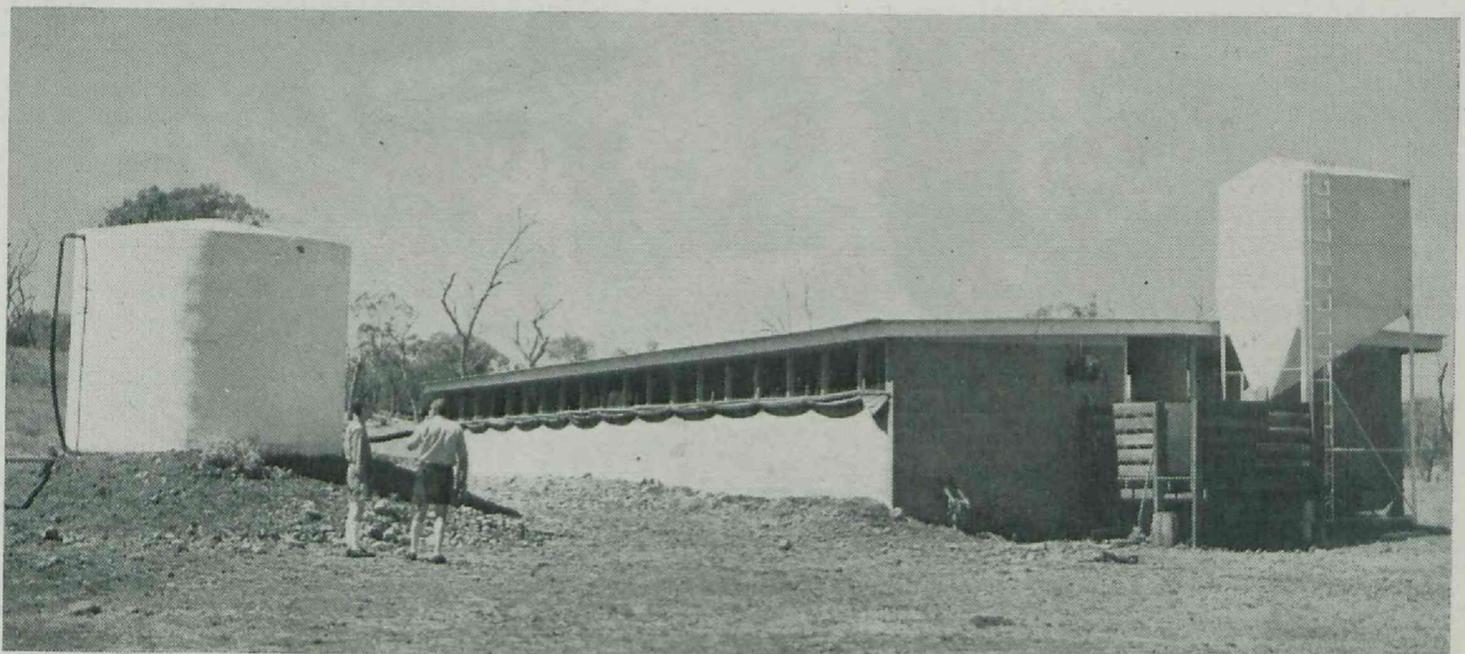
FINANCIAL ASSISTANCE

Appreciation is expressed of the continuing financial grants to the Department for the maintenance and expansion of research and extension activities.

A substantial increase in the Commonwealth Extension Services Grant enabled increased costs under the Grant to be covered and new projects to be undertaken. The Commonwealth Government made some smaller direct contributions towards Departmental research. Further financial support was represented by research and extension grants from various joint Commonwealth/industry funds, particularly in relation to wheat, tobacco, dairying, beef cattle and wool.

Contributions by primary producers were substantial. These were represented in part by grants from joint Commonwealth/industry funds and in part by direct cash or equipment grants by industry organizations.

Industries servicing the primary industries, in particular the agricultural chemicals industry, made useful contributions for specific purposes.



Intensive pig raising is replacing many of the small units of the past

BUILDINGS AND FACILITIES

The programme of building construction and the provision of facilities was maintained during the year.

New offices and laboratories at the Redlands Horticultural Research Station, costing \$150,000, are nearing completion. The building houses modern, well-equipped horticultural and plant physiology laboratories, including radio-isotope facilities. These, together with existing glasshouse and controlled environment chambers, make the Station one of the best equipped vegetable research stations in the Commonwealth.

The Redlands Horticultural Research Station is the centre for vegetable and small crop research in Queensland and the vegetable industries of the State have already derived considerable benefit from the nutritional and plant breeding work at the Station. Queensland is assuming increasing importance as a producer of vegetables as a result of recent and continuing expansion in vegetable processing in this State. Research is being further extended to meet the urgent needs of this development.

A new Horticultural Research Station was opened at Bowen.

A new Departmental tobacco research station has been approved for the Mareeba area, and all major facilities from the Parada station are now in the process of being transferred. The new site is some 7 miles west of Mareeba and contains about 90 acres of good tobacco soils. These were limited in area at Parada.

The modern laboratory office block completed at Toorak Sheep Field Research Station at a cost of \$55,000 is now having final fittings installed and is in use. This building will considerably facilitate laboratory and clerical work on the research station. Development of the Station's Peshurst area, envisaged to cost \$45,000 and currently being financed from Commonwealth and State funds and a wool industry grant, will provide 13 subdivided paddock areas, and water tanks and troughing supplied by reticulation from the artesian bore sunk in that area late in 1966. Increased numbers of sheep will accordingly be used for experimental research.

Wool industry funds have provided a grant for improvements and research work for a mulga utilization trial in the vicinity of the Charleville Pastoral Laboratory. Fencing, water facilities and holding tanks for supplementation of phosphorus in water supplies are in course of construction.

A Metabolism Building, with laboratory and slaughtering facilities and accommodation for large, small and laboratory animals, was completed at the Animal Research Institute at Yeerongpilly.

The new Botany Building at Indooroopilly was officially opened by the Hon. the Premier on September 28, 1968. For the first time the priceless collection of original data represented by the 500,000 specimens in the Queensland Herbarium and the large botanical library are adequately housed in a fireproof building with sufficient working space for their effective employment as tools for botanical research.

ORGANIZATIONAL CHANGES

The major organizational changes made during the year were in the Division of Animal Industry and the Horticulture Branch.

The central administration of the Division of Animal Industry was strengthened by the appointment of two Deputy Divisional Directors. Mr. L. G. Newton, formerly Director of Veterinary Services, became Deputy Director responsible for regulatory and other field activities. Mr. J. W. Ryley, formerly in charge of the Animal Research Institute, assumed responsibility for the Division's research work.

The functions of the Department in horticulture were reviewed and the Food Preservation Research Laboratory Branch was absorbed into the Horticulture Branch. Mr. R. C. Cannon was confirmed as Director of Horticulture with increased status. Three Assistant Directors were appointed—Mr. F. W. Berrill (Extension), Mr. H. M. Groszmann (Research) and Mr. R. E. Leverington (Food Preservation).

Following a reallocation of Ministerial responsibilities by the Honourable the Premier in May, control of the Agricultural Bank and the Fish Board was transferred to the Minister for Primary Industries. The Fisheries Branch of the Department of Harbours and Marine was also transferred to the Department of Primary Industries.

AGRICULTURAL BANK

A full report of the operations of the Agricultural Bank during 1968-69 is submitted to Parliament separately.

Total approvals under various Acts amounted to nearly \$20 million.

The early promise of improved seasonal conditions allowed the finalization of the Graziers' Drought Relief Scheme established in 1965.

The Scheme approved in March 1968 which provided assistance by non-repayable grant to drought-affected graziers to meet local authority rates was also completed.

A new Scheme under the Drought Relief to Primary Producers Acts, implemented in March 1969, provided for assistance to all necessitous primary producers, excluding cane-growers, in declared drought areas. A free grant of \$200 for the purchase of fodder was also made available to eligible stock owners.

The Bank also administered the Scheme approved to allow owners of sheep, beef cattle and dairy cattle, in declared drought areas, to purchase feed wheat on terms.

RESEARCH OUTPUT

One measure of research activity and achievement in an organization is the output of scientific papers recording the results of projects.

In 1944, this Department commenced publication of its own scientific journal, the "Queensland Journal of Agricultural and Animal Sciences", to provide a publication medium for research papers prepared by Departmental officers.

This Journal has been maintained as a quarterly, but the volume of material forthcoming from officers over recent years has far exceeded the capacity of the journal. In 1968-69, over 40 papers were submitted for publication in the journal, and an even greater number was submitted to other Australian and overseas journals.

A feature of a great many of the Department's scientific papers is the contribution made by the Biometry Branch in assisting research staff in designing experiments and analysing and interpreting results. The application of mathematical statistics to biological research has become very sophisticated and a specialized central service is a necessity.

However, since the Department has had access to computers, many research officers have been trained in programming for computer analysis. This training was undertaken initially to give officers an awareness of the ways in which computers could assist them in research work, but many officers have developed their knowledge of computerization to the point where they can write their own programmes.

IN-SERVICE TRAINING

Apart from the overseas visits mentioned later, in-service training of staff took many forms during the year. A plant breeder, for instance, began a 3-year study of genetics at the Waite Agricultural Research Institute in South Australia to enable him to undertake barley breeding. Numerous other officers spent various periods of study and observation in other States, mainly on funds provided under the Commonwealth Extension Services Grant.

Several advisers conferences were held within the State as well as a number of schools for field officers.

Extension seminars and extension methods and farm management schools were held, with a total attendance of 140 officers representing most Branches. A video recorder and ancillary equipment were purchased for training purposes.

Two officers undertook the post-graduate Diploma in Agricultural Extension course at the University of Queensland and others were granted leave to do other post-graduate courses.

OVERSEAS STUDY

Two officers were granted leave up to 3 years to enable them to take advanced studies at overseas institutions. Mr. J. J. Davis is studying entomology in Louisiana and Mr. G. H. Behncken is studying transmission of virus diseases in California.

Arrangements were made for several officers to make study tours or attend technical conferences overseas, as follows:—

- Mr. D. K. Ward—tobacco production in Japan, Canada and U.S.A.
- Mr. S. G. Knott—exotic diseases school in New Zealand.
- Mr. G. L. Swartz—soil conservation matters, particularly machinery types, in U.S.A.
- Mr. J. A. Gartner—animal nutrition and reproduction matters in Africa, Europe and U.S.A.
- Dr. L. L. Callow—study period on blood parasites in London.
- Mr. N. F. Fox—extension organization and methods in U.S.A., Europe and South Africa.
- Mr. E. O. Burns—farm management in U.S.A., Canada and Europe.
- Mr. E. F. Singleton—artificial insemination in Europe, U.S.A. and New Zealand.
- Mr. A. C. Peel and Mr. E. T. Prodonoff—International Seed Testing Association Congress in New Zealand.

COMPLETION OF SERVICE

It is with regret that the death of Dr. S. A. Trout is recorded. Dr. Trout joined the Department in 1945 as Assistant Director of Horticulture and became the first Director of the Food Preservation Research Laboratory Branch in 1960. He had a world-wide reputation as a food researcher and under his direction the Food Preservation Laboratory made notable contributions to food science.

Several officers who had served the Department well over a long period retired under age provisions during the year. These included Mr. J. A. Weddell (Technical Administrative Officer, Division of Plant Industry), L. Cain (Senior Administration Officer), W. A. R. Cowdry (Senior Experimentalist, Research Stations Section), H. H. R. Walker (District Inspector of Stock), W. A. Kearney (Senior Slaughtering Inspector) and G. W. Soper (Agricultural Chemical Laboratory Attendant).

ANGLES ON EXTENSION

There is a growing movement within the Department towards improved extension services. This is seen in many ways from the training of the individual adviser to the integrated functioning of extension services on a regional basis.

So far as the individual extension officer is concerned, raising of standards is following on higher entrance qualifications, competency barriers to advancement, intensive in-service training, and the encouragement of graduates to undertake full-time extension duties.

The efficiency of the extension service is further increased by the trend towards co-operative effort at various centres. Ten years ago there was little formal co-operation among officers at a centre and little was done to co-ordinate the activities of various branches towards a common purpose in an area.

The following comments by Branch Directors in this year's reports typify the new outlook:

"The most notable change in extension is the increasing concern with co-ordinated organization and planning on a district and regional basis. This Branch had recognized the need for a more rational, fundamental approach to extension work by giving basic training in programme planning to all staff during the previous year. Branch staff were accordingly well situated to participate and actively assist in the Departmental seminars on this subject and the subsequent developments in co-ordinated extension in various districts" . . . Director of Cattle Husbandry.

"Most senior officers have by now participated in extension seminars with other branches and a general appreciation of the need for Departmental co-operation and planning in extension has occurred. Agriculture Branch extension officers are now involved in voluntary interbranch co-ordination scheme in six regions" . . . Director of Agriculture.

The seminars referred to were organized on a regional basis by the Information and Extension Training Branch. Senior extension personnel within each region were brought together to discuss and study various aspects of co-ordination and programme planning. Officers of the branch have followed up the seminars by periodical visits to centres in which co-ordination is being effected.

At Mareeba, an extension agronomist has been instrumental in forming an inter-organizational extension advisory committee in the tobacco industry, with the aim of ensuring that all organizations giving advice to tobacco growers issue uniform recommendations.

IRRIGATION INVESTIGATIONS

With the Fairbairn Dam now under construction at Emerald, an intensive programme of agronomic investigations has been implemented to obtain information for the future settlers in the irrigation area. Studies on cotton, maize, grain sorghum and wheat have been in progress for 2-3 years and preliminary work on sunflowers and soybeans has commenced. Forage crops and annual winter pasture legumes are included in the programme.

Crop varieties, time of sowing, plant spacing, irrigation and fertilizer requirements are all receiving attention, and several soil types are being tested for productivity.

One interesting result which came to hand during the year was from ratooning studies in grain sorghum. With October-November planting and February-March ratooning, total yield of the two harvests was around 150 bushels. Earlier plantings gave lower yields and later plantings resulted in the ratoon crop being frosted. It appears at the moment that 2 in. from the ground is the best height to cut the stubble for ratooning and that 100 lb. per acre is the best level for nitrogen side-dressing.

A team of specialist officers is being built up in the Emerald area to service the new irrigation area. Branches represented at present include Agriculture, Soil Conservation, Agricultural Chemical Laboratory, Cattle Husbandry and Veterinary Services.

MILK QUALITY

The Department, the Brisbane Milk Board, processors and dairy farmers have collaborated over the years to improve the quality of milk marketed in Queensland.

In 1956-57, only 1% of Brisbane's bottled pasteurized milk supply passed a bacterial count standard of 50,000 per millilitre. By 1962-63, the figure had risen to 20%. In the six years since then, it has jumped to almost 99%. A graph presented in the section on Agricultural Standards highlights the progress that has been made.

There is good reason to claim that Brisbane now enjoys the highest quality milk of any Australian capital city.

Two important innovations have been made with regard to milk quality on the Atherton Tableland. The first concerns the newly adopted incentive scheme for milk quality applied by the Co-operative Dairy Association and supervised by officers of the Dairy Research Branch. The other is the introduction of a total bacterial count in addition to a thermoduric count for determining the quality of raw milk. The application of both these schemes is being watched with a great deal of interest.

PASTURE PROBLEMS

High incidence of establishment failures is one of the major deterrents to the acceptance of pasture improvement particularly in the medium and lower rainfall areas of the State. In the Burnett area alone it is estimated that 40% of improved pasture sowings are partial or complete failures. The associated financial loss is evident.

In the cropping areas, pasture establishment failures on the heavy black earths are usually associated with unfavourable soil characteristics. The specialized "Triad" seeder developed by this Department to control depth of planting has overcome some problems. Nevertheless, it now appears that sowing should be carried out in the normal pattern of crop production, during the cultivation phase, with companion crops or into stubbles. The cost of pasture failure would then be reduced to loss of seed only.

Other factors contributing to this overall situation include climatic inadequacies and soil nutrient deficiencies. Work on the isolation and definition of particular establishment problems is now being intensified following the appointment of two additional agrostologists assigned to this aspect of pasture improvement.

Drought conditions severely limited pasture production during the year but nevertheless it has been possible to make some very useful observations on the persistence of improved pasture species. It is now apparent that many sown pastures in south-eastern Queensland have thinned out through the loss of the grasses and legumes with higher moisture demands. These include Nandi setaria and greenleaf and silverleaf desmodiums. A noteworthy point, however, has been the performance of siratro. Under a wide range of management conditions it has shown superior establishment, persistence and summer production to any of the other tropical legumes. Also, in central-western Queensland buffel grass has again demonstrated its ability to survive prolonged dry periods.

SCHOOLS AND FIELD DAYS

Schools of 2-3 days' duration have become popular in recent years among primary producers. Usually they are organized by a producers' association in conjunction with local Departmental officers. Speakers are drawn mainly from the Department, but specialists from other organisations, commerce and the primary industries themselves are often drawn upon. Attendances at such schools sometimes exceed 300, though where a particular subject is to be dealt with at some depth, enrolments are limited to permit maximum learning.



Fruit and vegetables growers keep abreast of progress in research at Departmental research stations by means of regular visits

Among the schools in which Departmental officers participated during the year were beef cattle management schools at Yeppoon, Clermont, Townsville and Hughenden, sheep and cattle schools at Dirranbandi and Muttaborra, and various schools for pig farmers.

BANANA INTERCHANGE

The Department was the convening organization for the first international banana gathering to be held in Australia.

This was the Pacific-Asian Banana Culture Interchange, sponsored by the Australian Government and the East-West Center for Technical and Cultural Interchange, an agency of the U.S. Government.

Participants nominated by the sponsors attended from Caroline Islands, India, Malaysia, Pakistan, Philippines, American Samoa, Taiwan, Thailand, Tonga and Hawaii as well as Australia.

Seven recognized authorities on various aspects of banana production were invited to attend as resource personnel. These comprised two from the West Indies, one from the United States, one from Taiwan and three from Australia. Two of the Australians were officers of this Department.

Part of the Interchange was held in New South Wales and part in Queensland.

OVERSEAS AID

The Department again provided technical officers and services to assist various overseas countries in project planning and training of staff.

Mr. A. Hegarty (Deputy Director, Division of Development Planning and Soil Conservation) visited Kenya to advise the Kenyan authorities on their agricultural planning programme.

Dr. B. Grof (Officer in Charge, Tropical Agriculture Research Station) visited Malaysia to advise on pasture aspects of the Government's livestock production plan.

The Department collaborated with the Department of External Affairs in providing a training course for 12 African and Asian poultry experts.

With the co-operation of C.S.I.R.O. and the University of Queensland, the Department organized a conference and study tour on tropical pastures and beef production for 30 delegates sponsored by the South Pacific Commission.

The Department provided two training officers to participate in an extension training course for African and Asian personnel arranged by the Department of External Affairs.



Overseas trainees examining a tropical dairy pasture at Cooroy

Many overseas trainees sponsored by the Department of External Affairs received individual training at Departmental centres.

CLIMATOLOGY

An increasing demand for meteorological information specifically orientated towards the assessment of land development potential resulted in the publication by the Marketing Services Branch of a series of climatological studies. Four reports have been prepared covering the Near North Coast, Southern Border area, the Broken River Basin and the Atherton Tableland. A fifth report dealing with the Eastern Darling Downs is proposed in the near future.

Branch officers also co-operated with members of the Division of Animal Industry in producing an article on the influence of meteorological factors in the spread of ephemeral fever.

Reference is made in the section on Development Planning and Land Use to the possibilities of cloud-seeding as a means of modifying weather conditions to the benefit of agriculture.

FAUNA STUDIES

A noteworthy outcome of studies conducted by a Departmental zoologist (Mr. H. J. Lavery) on the birds of Queensland was the publication during the year of a comprehensive list of birds recorded in the State. Publication was undertaken by the Winston Churchill Memorial Trust. Mr. Lavery took the opportunity while a Trust Fellow to check identifications in museums in North America and Europe.

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 Cattle Husbandry Branch provides field investigations and extension and other services in breeding, feeding and herd management. It operates cattle field research stations at Ayr and 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. 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.

BEEF CATTLE

Breeding Herd Trials and Surveys

Data have been collected by the Cattle Husbandry Branch from a number of herds over a period of years in different parts of the State. Arrangements have been made to utilize computers in recording and processing these data.

At this stage it is apparent that major problems exist. Depressed pregnancy rates in seasons of low rainfall are common. In addition, calving spread is too great to maximize growth potential of calves to weaning and to fit a seasonal breeding pattern for all cows.

In some years, delayed maturity in heifers is noted, and low fertility in well-grown heifers has been observed as a result of the presence of infertility disease.

Pregnancy rates are reduced in lactating cows, apparently as a result of nutritional stress. In addition, there appears to be a problem relating to loss of calves after pregnancy is established due to unknown causes.

In management trials aimed at overcoming these problems, emphasis is laid on strategic weaning to conserve the body condition of breeding cows during the late winter/early spring period. A seasonal mating period of approximately 5 months is employed. Bulls are kept in good condition, and pasture utilization through subdivision, water points, timber control and astute pasture management is given high priority.

In the Central Queensland area, it has been observed that breeders on trial properties are invariably in better condition than average for the district and over the past 4 years pregnancy rates of 86.6% have been achieved in these herds. This compares with a branding percentage for Central Queensland herds of approximately 55.5% for the years 1964-1967.

The Branch is also co-operating with commercial firms in supplementary feeding trials aimed at improving fertility in which proprietary preparations are being assessed against alternative treatments.

At "Brian Pastures" Pasture Research Station, the effect of age at weaning on subsequent ability to calve at 2 years of age was examined by the Cattle Husbandry Branch. Two groups of heifers weaned at 6 and 8 months respectively were bred to calve at 2 years. A 68% calving was recorded, and no effect of weaning age was noted.

Supplementary feeding before and after calving was used in one trial in order to examine the effect on subsequent breeding performance. One group of cows was supplemented with 5 lb. of grain daily for 6 weeks before and 6 weeks after calving. Compared with unsupplemented controls, the supplemented group lost less weight after calving, and 96% of the group subsequently became pregnant, compared with 80% of the controls.



Early weaning of calves helps the fertility of the breeding cows

A problem which has been receiving considerable attention is loss of calves after pregnancy has been confirmed, either around calving or earlier in the period of gestation. Results obtained from time-of-calving trials indicate that seasonal effects may be involved. There were significantly greater losses in cows mated in winter or summer, compared with those mated in spring. Causes of these losses, which in some groups reached 10%, have not yet been defined.

Artificial Insemination

Six Poll Hereford bulls were purchased for performance testing at the Wacol Artificial Insemination Centre. The two bulls with top performance judged on growth rate and feed conversion efficiency will be introduced into the Centre in 1970.

The use of A.I. in the beef industry is only in its infancy but a growing interest is evident and expansion is virtually certain in the future. The custom freezing service introduced in 1967 to provide semen for beef A.I. programmes expanded markedly in 1968 and 20,320 ampoules were processed.

Nutrition

Field trials investigating a number of aspects of nutrition in beef and dairy cattle were continued by the Cattle Husbandry Branch. Particular interest centres round the use of the non-protein-nitrogen supplements urea and biuret. Urea has been successfully used to provide a protein supplement in both beef and dairy cattle. A number of trials have now



Crossbred cattle show a high capacity for fast development

been commenced to assess the value of biuret as a supplementary feed. Biuret has advantages over urea in its palatability and lack of toxicity and should prove to have greater application in supplementary feeding, provided the requirements of availability and economy can be satisfied.

In calf feeding trials it was demonstrated that bobby calves can be successfully reared for the local veal trade as a side-line to cream production. Feeding on skim milk, with good pasture, and offering grain *ad lib.*, proved a satisfactory method, and calves purchased and sold after 50 days on the local market returned a gross profit of \$10 per head.

In a dry-season weaner supplementation trial at Swan's Lagoon Cattle Field Research Station, groups of steers and heifers were grazed on native pastures at a stocking rate of 1 to 5 acres. Treatment groups were supplemented with either molasses or molasses and urea.

Molasses produced no liveweight response, but the addition of urea gave a significant response in liveweight performance. There were visible differences in condition between urea groups and non-urea groups. Sex did not affect weight gains. Compensatory gain occurred in non-urea groups during the 1968-69 wet season, but urea-supplemented groups still held a 41 lb. advantage in June 1969, although supplementation was discontinued in January.

Experiments have continued at the Animal Research Institute on the intensive production of beef from rations containing a high percentage of grain, on nutritional aspects of the survival feeding of cattle during drought and on the effects of supplements on the growth of grazing cattle.

Steers finished on a basal ration of sorghum grain without added sodium salts had a significantly slower rate of daily body weight gain than those given 3.25 grams or more of sodium. Changes in the structure of the adrenal glands occurred in cattle eating the basal ration without sodium. The sodium requirement of steers fed a sorghum grain ration for growth is not greater than 5.0 grams per head per day.

For the last 100 days of pregnancy and for 70 days of lactation, cows were successfully fed for survival either 3 or 4 kilograms of sorghum grain without additives per head per day. The performance of the cows and calves in the 4 kg group was better than that of the cattle in the 3 kg group. Weaning of calves at 3 days of age reduced the body-weight loss of the cows. The weaned calves fed a limited amount of skim-milk grew faster than suckled calves.

Supplementation of steers grazing oats with either 1 or 2 kg of rolled sorghum grain or 1 kg of soybean meal per head per day did not improve growth performance. However, supplementation of steers grazing Rhodes grass pasture with molasses and minerals increased growth rate. The inclusion of urea in the supplement led to a further increase.

Diseases and Pests

Pleuro-pneumonia.—It is 2 years since any evidence of bovine contagious pleuro-pneumonia has appeared in Queensland either in the field or at slaughter.

In the Richmond and Flinders Shires, approximately 70,000 cattle were vaccinated between April 1968 and February 1969—50% of vaccinations were supervised by Departmental officers.

In the Cairns division, 19,000 blood samples were submitted for testing for B.C.P.P.—of these 10,616 were from the Strathgordon quarantine restricted area. Supervised inoculations totalled 31,838.

A total of 22,000 lungs was examined at the Queerah meatworks from 85 properties and 72,000 lungs at the Townsville and Bowen meatworks. No laboratory evidence of active B.C.P.P. infection was found.

The success of the B.C.P.P. control and eradication programme conducted in Queensland by the Veterinary Services Branch was recognized during the year when other States and the Commonwealth Government agreed to the reclassification of an extended South Eastern Queensland Protected Area as a pleuro-pneumonia "free" area. Cattle from the "free" area qualify for export to the Near East and Middle East, and have unrestricted entry to all areas of New South Wales.

It has also been recommended that the South-Eastern Queensland Pleuro-pneumonia Free Area be extended to include Fitzroy and Livingstone Shires, and the Peninsula and Far North Queensland Protected Area to include Etheridge Shire and the northern portions of Flinders, Richmond, McKinlay and Cloncurry Shires and of Mt. Isa City (formerly Barkly Shire). The infected area is now confined to a comparatively small area of the Gulf of Carpentaria, including the Shires of Boulia, Croydon, Carpentaria and the western portion of the Mareeba Shire.

Multi-resistant tick.—On April 3, 1969, Cabinet decided that a stage had been reached in the extent of known multi-resistance in south-eastern Queensland when the retention of quarantine orders could not be justified. Surveys had revealed a high incidence of multi-resistance in properties selected at random.

As the multi-resistance problem was substantially confined to south-eastern Queensland, a tick line was established to require cattle moving north and west across the line to take treatments as for cattle moving from tick-infested to tick-free areas. The tick line commenced at Inskip Point south of Maryborough, thence westward to the coast range, then southerly by that range to the Theebine-Kingaroy branch railway and by that line to Kingaroy.

To minimise the spread of multi-resistance within the south-eastern area, all cattle, other than slaughter cattle proceeding direct to slaughter in the infected area, require one clean supervised treatment within 72 hours of movement.

Over a 3-year period, 400 properties under quarantine for multi-resistance successfully completed supervised treatment programmes and returned to owner control after 8 months of freedom from evidence of tick infestation.

When quarantine conditions were raised in south-eastern Queensland, in early April 1969, 537 holdings (476 owners) were quarantined for Biarra-type resistant ticks, involving in excess of 82,000 cattle and 520,000 acres of country. A further 1,132 properties (1,054 owners) were quarantined as adjoining, which brought an additional 140,000 cattle and 870,000 acres of country under restrictions.

Since the raising of quarantines, testing of tick samples submitted has revealed a further 72 cases of Biarra-type resistance, 10 of which were detected in the Upper Nambour and Gympie districts as a result of surveys in that area.

Quarantine orders for the control of multi-resistance at Rockhampton and Mackay have been retained until the results of a survey of the areas for multi-resistant ticks are known. While the focus at Rockhampton has been brought under control, the outbreak at Mackay shows increasing evidence of being widespread. There are 19 known infected properties at Mackay and 86 adjoining holdings in quarantine.

Ridglands type resistance has been found on 204 properties in the Rockhampton division. Only isolated outbreaks have been detected away from the coastal area, at Blair Athol and the Dawson Valley.

In the Townsville division, 20 of 104 properties examined have shown evidence of Ridglands type resistance.

The Parasitology Section at the Animal Research Institute has been largely engaged on testing ticks for resistance. Of 970 samples of ticks tested, Biarra-Mackay type resistance was shown by 260 and the Ridglands type only by 238. No resistance was diagnosed in the remainder. The method of testing is to rear larval ticks from the engorged females submitted and test these by measuring the mortality in envelopes impregnated with various concentrations of insecticide. This is plotted and the mortality curve is compared with that for normal, non-resistant ticks treated in the same way.

Tick fever vaccine.—The Tick Fever Research Centre continued to produce vaccine for tick fever (babesiosis) of cattle and supplied 1,080,000 doses during the year.

The major work at the Centre is with babesia infections of cattle. Vaccine production and the factors affecting immunity are the main avenues of investigation. The vaccine has been very successful and the demand is still increasing. More has been learned about the duration of immunity. It has been found that repeated vaccination with one strain of babesia does not give a satisfactory immunity against some field strains. In order to overcome this, four different isolates of *Babesia argentina* have been attenuated for use in vaccine. The strain is now being changed every 5 months in order to avoid repeated vaccination with the same strain.

A new compound has been tested and is very effective for both treatment and prevention of tick fever infections.

Cattle tick extension.—A specialist extension officer in tick control has been appointed to the Maryborough division.

Extension officers stationed in the Brisbane and Rockhampton division have continued to carry out a survey of properties for general tick control programmes and evidence of multi-resistance.

The eradication of cattle tick on properties under quarantine for multi-resistance has demonstrated important features of tick control to stock owners, namely the effectiveness of regular short-interval dipping, the overall improvement in the appearance of cattle free of tick worry and the effectiveness of tick fever vaccine in maintaining a satisfactory immunity while cattle are exposed to very low tick infestations.

Drought conditions have upset regular dipping programmes, and with the concentration of cattle at watering and supplementary feeding points tick infestations have been heavier than usual.

Because of drought-affected cattle carrying heavy tick burdens, considerable difficulty was experienced in clearing drought-affected cattle for movement to clean areas and interstate destinations.

Miscellaneous.—Scattered rainfall in February and March favoured the southern extension of buffalo fly infestation to the Bundaberg area, Boyne Valley and Monto. It also

extended in the central Queensland area to the Arcadia Valley south of Springsure and Tambo. Owing to drought conditions infestations did not reach pest proportions.

Botulism is now controlled by vaccination—238,490 doses of type D vaccine were distributed in the far northern areas during the year.

An epizootic of ephemeral fever occurred in Queensland during the first half of 1968 but some experimental work by the Animal Research Institute in collaboration with Queensland Institute of Medical Research has continued since. The virus was adapted to mouse brain and a serum neutralization test developed at Q.I.M.R. This test is now being used at the Animal Health Station, Oonoonba, in a survey of the occurrence and persistence of antibodies in the serum of cattle in North Queensland.

SHEEP

At Toorak Sheep Field Research Station, some observations on correlations between body temperature of ewes and their physiological and reproductive performances have been concluded. Results show that sheep of low temperature status are more productive. If the environment is allowed to play its part in the actual selection of the animals it may be possible to select Merinos in this area on the basis of an "environmental adaptability" test.

Other work at Toorak includes a nutrition/fertility interaction experiment, to examine the effects of environment modification by nutritional supplementation on the reproductive performance of young Merino ewes; and studies to define the stages at which reproductive loss occurs in ewes in the northern environment.

Field research on sheep fertility in the northern environment is also being conducted by the Sheep and Wool Branch.

Mulga utilization by sheep in far south-western Queensland, in terms of phosphorus and/or energy supplementation, and digestibility and mulga intake observations, is to be studied further.

The importance of the liver as the system most determining urea toxicity in the field has been demonstrated at the Animal Research Institute. The influence of a high plane of nutrition in reducing toxicity functions by increasing the concentrations of urea-cycle enzymes—ornithine, transcarbamoylase, arginine, synthetase and arginase. Prior liver damage by hepatotoxic agents such as carbon tetrachloride does not affect this liver function. The increased concentration urea-cycle enzymes acts by reconverting ammonia derived from dietary urea to urea.

Studies on young sheep in north-western Queensland indicate an increasing concentration of hepatic vitamin A in weaner sheep (80 to 265 micrograms vitamin A per gram in a 12-month period), but indicate that prolonged drought could suppress this reserve in sheep fed rations low in carotene.

Resistance of sheep blowfly to organophosphorus medicaments appears to be widespread in the Roma district. Reports of reinfestation 2 weeks after treatment are common.

PIGS

Work on computer formulated least cost rations was continued by the Pig Section and Economic Services Branch and some of these were tested in feeding trials. This work has improved the standard of advice given to producers and has attracted considerable interest both in this and other States.

Several experiments were done by the Husbandry Research Branch to compare protein meals such as safflower meal and meatmeal with fish meal and soybean meal in rations for growing pigs. Pigs on safflower meal rations had lower daily growth rate and feed conversion than pigs on the conventional soybean meal ration. The addition of 0.1% 1-lysine to safflower meal rations improved the pigs' performance. The bulkiness of safflower meal rations was disadvantageous with young pigs. Mature pigs were better able to utilize safflower meal. Safflower meal was unable to completely replace fish meal in sorghum or wheat-based rations but it could satisfactorily replace about 20% of the fish meal.

Rations incorporating meatmeals at 15 or 20% were less satisfactory for growing pigs than rations containing 15% soybean meal or 10% fish meal.

Studies with wheat and pollard based rations showed that pollard could replace all or part of the wheat portion of the ration without affecting the productivity of growing pigs. Where normal levels of protein supplementation were included in the ration the protein content of the wheat (19% or 11.5%) had no significant effect on growth rate, feed efficiency or carcass quality of growing pigs.

During the year two groups of eight boars were performance tested by the Animal Husbandry Research Branch. Two boars, one from each group, judged likely to produce the most profitable offspring were sent to the Hermitage Research Station for breeding.

Progeny testing was continued at Rocklea and proposals to change the system to a performance test reached an advanced stage. This has the support of the Pig Society and will considerably improve the efficiency of the use of this facility.

A number of strains of mycobacteria have been isolated at the Animal Research Institute from lesions of animals and the differentiation of these from organisms causing tuberculosis is of particular importance. Experimental infections with one of the organisms have been set up in pigs and a number of isolates have been sent to the typing centre in Western Australia for further identification.

A full range of extension work was carried out in all districts. Pig Section officers were involved in the design of many intensive piggeries and allied equipment, in addition to services involving nutritional and managerial problems.

A Marketing Services Branch survey of demand and supply prospects for pigs and pigmeats in Queensland is now nearing completion. This report has analysed current trends in the marketing of pigs and pigmeats, and will enable the Branch to assess likely future developments and possible problems.

An Economic Services Branch study has been made of current economic trends in the pig industry and papers have been presented on this subject at two conferences.

POULTRY

Linear programming studies have been continued in the determination of least cost rations for the poultry industry.

At the Husbandry Research Farm, reduced growth rates and feed conversion were observed in chickens fed rations based on sorghum grains of high tannin content. Examination of the tannin fraction in 20 sorghum varieties has indicated polyhydroxyphenols in 5 varieties, including the one inducing ill effects in chickens.

A comparison of tibia from normal chickens and from chickens exhibiting a "bent leg" syndrome at two ages, made at the Animal Research Institute, indicates differences in bone composition at 4 and 8 weeks of age. No differences in bone density, alkaline phosphatase, moisture, ash, citrate, calcium, phosphorus or magnesium were observed between normal and "bent leg" tibias. The leg weakness was shown to have no genetic basis nor was it conditional on rapid growth.

Facets of the management and nutrition of both broilers and caged layers were investigated by the Husbandry Research Branch.

Chlortetracycline, zinc bacitracin, oxytetracycline, viginiamycin, nicotine sulphate, 3-nitro and Payzone added to rations as growth promotants significantly improved body-weights of broiler chickens to 8 weeks. Chlortetracycline, 3-nitro, Payzone and nicotine sulphate were used in layer rations. Only chlortetracycline gave a significant increase in egg production.

The method of debeaking affected the growth rate of broiler chickens kept either on wire or on deep litter. Partial debeaking was better than either block or conventional debeaking. It appeared that debeaking at the fifth day was better than debeaking at day-old. Day-old chickens block debeaked and on deep litter were 6 oz. lighter than controls at 9 weeks.

Investigations on energy-protein balance in broiler starter rations showed that rations of good protein quality could be improved by improvement in the energy/protein balance. Excellent growth rates were obtained with rations of good protein quality and tallow content as high as 7.5%.

Experiments were conducted with caged layers to examine the influence of housing regimes and ration components on production. Egg production was reduced by an increase in bird number per cage but was not influenced by density of housing. Egg production and egg quality were affected by calcium content of the ration but not by energy content. Five levels of calcium ranging from 2.5 to 4.5% were fed. A level of 2.5% was inadequate to maintain good shell strength; the 3.5% level gave the best production. Navy bean meal at 20 and 30% of the ration depressed egg production and egg weight.

The Australorp flock maintained at the Husbandry Research Farm as control for the Random Sample Tests in Queensland and other States has a percentage of fowls with haemagglutination reactions to Kahn's antigen. This is due to a dominant autosomal gene with a frequency of 0.2. Over three generations the constancy of the frequency of this gene has indicated that the flock is efficiently maintaining its genetic stability.

Improvement in brooding techniques was a main aim of the Poultry Section during the year under review. With the aid of temperature and humidity measuring equipment, district advisers have been able to pinpoint faults in many brooding

set-ups. This has created great interest, particularly on the Darling Downs, where there is a constant demand for this service. This equipment has also been used extensively in the Brisbane area to evaluate the efficiency of insulation of broiler sheds using a new and expensive type of brooding system based on forced emission of hot air from oil-fired heat exchangers.

Use of a low-intensity light meter has enabled officers to check on the pattern of light distribution in laying sheds, particularly where cages are used. Light values from as low as 0.3 foot-candle to over 5 foot-candles have been recorded in sheds and sometimes in the one shed at night time under artificial lights. This variation in lighting intensity can result in a variation in individual bird production. The optimum requirement for light stimulation of layers is 1 foot-candle.

The sudden onset and continued heatwaves experienced from December onwards had a serious effect on egg production and it was noted that some fogging systems already installed did not appear to be adequate to relieve heat stress and caused excessive wetting of feed and droppings. A field investigation in co-operation with a laying cage farm and an equipment manufacturer was carried out on the Darling Downs evaluated various fogging nipples and the water pressures needed.

It is pleasing to report that the percentage of pullorum reactors removed from all flocks tested in 1968-69 was 0.15, compared with 2.00% for 1967-68. However, there are still problem farms and further intensive blood testing will be necessary to limit the possibility of future outbreaks.

Progress has been made at the Animal Research Institute with the classification of avian mycoplasmas, which are organisms of the same type as that causing contagious pleuropneumonia of cattle. The part some of these organisms play in disease is not well understood but at the very least they are of considerable importance in poultry.

A report on the changing structure of the egg industry in south-eastern Queensland was prepared by the Marketing Services Branch following requests from industry leaders. The results indicate the extent of the shift in concentration of large flocks from the Metropolitan area to the Darling Downs. Availability of cheaper feed grains is suggested as the major contributing factor to this shift.

Marketing Services Branch officers were engaged in the administration of assistance payments to egg producers under the Commonwealth Poultry Industry Levy Acts.

In appreciation of the need for greater use of farm records in poultry management, a recording scheme was instituted on the Darling Downs by the Economic Services Branch early in 1969 to provide co-operating farmers with monthly reports on the progress of their laying flocks.

HORSES

An upper respiratory disease of horses often associated with abortions in mares has been identified by virus isolations at the Animal Research Institute as rhino-pneumonitis. The malady is common and occurs sporadically as an epidemic in station horses, rendering them unfit for work for several weeks.

MEAT

Quality control duties—namely the classification and grading of carcasses—were carried out at the Metropolitan Public Abattoir at Cannon Hill, Brisbane and Toowoomba and the District Abattoirs at Ipswich and Townsville by the Slaughtering and Meat Inspection Branch.

Control was also exercised over the slaughter and processing of prohibited animals and stock for pet food.

Amendments to "The Slaughtering Regulations of 1953" were gazetted. These amendments relate in the main to improved hygiene in butchers' shops and include the provision and construction of approved cold rooms for the storage of meat, the provision of an adequate hot and cold water supply and wash-up facilities and the surfacing of meat preparation tables with an approved material. Meetings were held with the co-operation of local branches of the Meat and Allied Trades Federation at many centres throughout South Queensland for the purpose of discussing the amendments with the trade. Throughout the year, Inspectors of this Branch have used extensive methods at their command to obtain the co-operation of all butchers to ensure compliance with these new Regulations, thereby obviating the necessity for stronger measures if requirements are not met when due.

To date the majority of butchers have co-operated and the effect has been a considerable improvement in hygiene standards of butchers' shops throughout the State.

United States of America Department of Agriculture meat inspection films were obtained by the Branch and shown to the trade and other interested parties. These aroused considerable interest, particularly in view of United States Department of Agriculture requirements now being asked of Australian meatworks.

The occurrence of salmonella in meat and meatmeal has been studied at the Animal Research Institute. These organisms are an important cause of gastro-enteritis in animals and in man. The investigation is directed at elucidating the factors involved in the spread of salmonella and in the contamination of meat products by them, so that preventive measures can be recommended.

A study of the relative economics of slaughteryard operations compared with centralized killing was undertaken by officers of the Division of Marketing in 1968, with particular reference to the Maryborough district.

III. Dairy Research and Extension

The dairying industry is serviced in one way or another by most Branches and Sections of the Department.

The Branches of the Division of Dairying are concerned largely with the hygienic production, handling and manufacture of milk and milk products, herd recording, and utilization research. The Cattle Husbandry, Husbandry Research and Biochemical Branches are responsible for various aspects of feeding, breeding, herd management and artificial insemination. 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 Dairy Field Services Branch continued services to the dairying industry with respect to quality control of dairy products, cow production recording, dairy shed operations, management of the dairy herd, pasture establishment under the Dairy Pasture Subsidy Scheme and preparation and implementation of extension programmes. These involved 4,198 farm visits, an intensity similar to the previous year

despite the drought conditions and the 13% decrease in total number of dairy farmers.

Problems associated with bulk milk quality arose during the year, indicating the need for stricter grading at the farm pick-up location. A survey of local sale butters was again conducted, 285 samples from 30 factories being examined for quality.

Improvement in the standard of dairy premises was maintained but at a slower rate. Under the supervision of officers 115 new premises and 353 renovations were effected. These represented a reduction of 50 and 135 respectively on the 1967-68 totals, no doubt reflecting seasonal conditions and industry uncertainty. Totals of 1,114 bulk vats and 3,790 refrigerators are now installed on farms.

Several special surveys were undertaken by field officers to obtain information on cleaning systems for milking machines, defects in milking machine installations, efficiency of milk separation, and milk stimulation.

Special extension research programmes comprised an analysis of the relationship of group/committee definitions of farming problems and those perceived by the individual farmers which the groups represent, and an analysis of participation/non-participation in the Dairy Pasture Subsidy Scheme.

Demonstrations totalling 145 were conducted under the terms of the Commonwealth Extension Services Grant.

Commercial manufacture of butter with improved spreadability commenced at four factories and technical assistance has been given. Investigations covering the manufacture of unwashed butter were completed and results indicate that butter of at least equal quality to that from normal methods can be produced.

Quality improvement surveys for special purposes were continued. A total of 45 surveys with particular emphasis on coliform contamination was completed. Copper contamination arising from unsatisfactory processing equipment continues to be a major problem with butter.

Supervision of milk distribution outside the Brisbane Milk District was maintained by field staff. A total of 2,794 vendors and shops is licenced and submitted to regular inspection. Milk Advisory Committees have been established in Townsville, Rockhampton and Southport.

HERD RECORDING

Group herd recording membership dropped during the year, due partly to withdrawals from the dairying industry and partly to drought. Recorded cows totalled 49,174 from 1,054 herds and averaged 5,150 lb. milk and 221 lb. fat. The average fat content was 4.3%. Yield was 27 lb. milk and 1 lb. fat better than in the previous year.

Surveys carried out by the biometrician showed that testing every 2 months instead of monthly gave results satisfactory for culling and selection of cows for breeding herd replacements and for the evaluation of sires. As a result of this, it has been decided to introduce a bi-monthly test for group herds desiring it.

The membership of the Jersey and A.I.S. Herd Book Societies continues to drop, and during the year there were a number of dispersal sales of stud herds. The number of members of the Friesian Cattle Club continues to increase. This is a similar trend to that in other States and overseas and will probably continue while market milk is paid for on a gallonage basis.

At the commencement of the Pure Bred production recording year the length of lactation was increased from 270 to 300 days, thus bringing Queensland into line with other States. During the year a total of 4,223 cows completed recorded lactations of 300 days or less, for an average yield of 6,674 lb. milk and 286 lb. fat.

During the year cows from 170 herds were recording, with the following results: A.I.S. 68 herds, 1,506 cows, 7,620 lb. milk, 4.0% test, 308 lb. fat; Ayrshire 7, 150, 6,822, 4.2, 287; Friesian 28, 566, 7,754, 3.6, 279; Guernsey 16, 444, 5,805, 4.4, 257; Jersey 51, 1,557, 5,601, 4.9, 277.

In connection with the testing for protein programme, the A.I.S. Society sponsored a competition for their members, of whom 16 entered. Information is being collected on the nutritional standards of the competing herds and later it is intended to observe correlations between protein and fat production and composition and the nutritional standards.

The range of herd average protein in the 70 herds selected for testing for protein varied as follows: A.I.S. 2.6-3.8%, Friesian 2.5-3.8%, general herds 2.6-4.4%.

Annual Herd Summaries will be issued in respect of protein production in a form similar to that used with fat yields. Later it is intended to attempt correlations between fat and protein production and percentages.

Based on results, it has been decided to standardize on "Tru-Test" milk meters and it is hoped that it will be possible to obtain sufficient meters to supply all Groups by the end of 1969.

Goats from 7 herds were recorded and a total of completed recorded lactations of 300 days or less for an average yield of 1,387 lb. milk and 47 lb. fat.

Once again, surveys were made of all bulls which had 6 or more production recorded daughters during the recording year. Although this provides important information, its value has lessened as the use of A.I. increased.

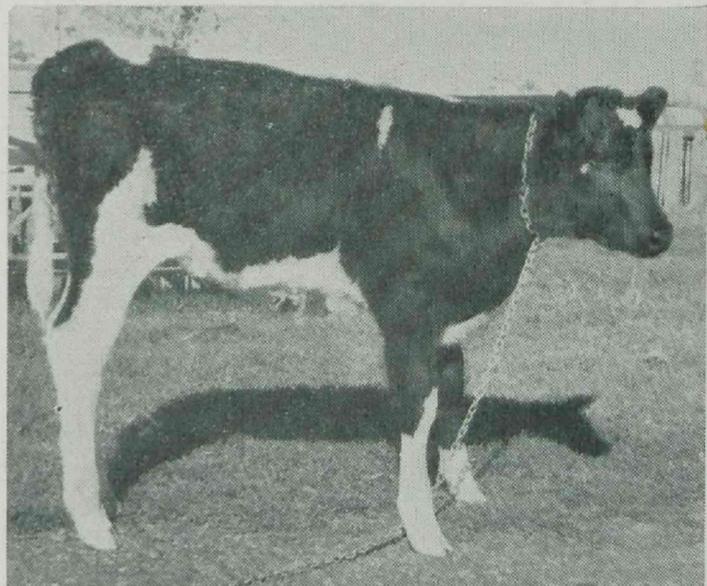
ARTIFICIAL INSEMINATION

A total of 63,000 dairy cows was inseminated during the calendar year 1968 with semen produced mainly at the Department's Artificial Insemination Centre, Wacol. This represents a decrease of 1,000 on the number of cows inseminated in 1967. As well as supplying semen to the 21 commercial A.I. Co-operatives in Queensland, the Centre sold 8,476 doses of semen interstate and 805 doses were exported to Malaysia, New Zealand and the United States of America.

The overall 60-90 day non-return performance of the cows in Queensland inseminated with semen originating from Wacol was 68.3%, compared with the 69.3% non-return performance in 1967. These figures indicate high levels of fertility compared with results achieved in other parts of Australia and overseas.

Proving of four A.I.S. bulls at Kingaroy and four Jersey bulls at Nambour was continued. Assessment of lactation records placed "Goodview Progress IV" as the leading A.I.S. sire and "Rosallen Floreen's Jester 2nd" as the best Jersey in his proving year.

The Friesian proving scheme is now operating with 550 nominated cows within 20 herds. Final proving results of the first sire team will be available in the immediate future. Faulty heifer management and, to a lesser extent, calf management has prevented the mating of some of the progeny by the time they reach 18 months of age. However, this aspect has shown marked improvement in recent years.



One of the progeny in the Friesian bull-proving scheme being conducted by the Department

A corollary to the bull proving projects is the mating of proven sires to leading females in stud herds to provide bulls for future proving years. During 1968, matings were undertaken in five studs, using the proven sire "Valera Lila's Senator", and "Kenstan Chief IV" has been used in four studs.

The Jerseys "Yarallaside Prince" and "Mayfair Sovereign" were each mated in four studs.

The A.B. proven Victorian sires "Quailroost Carnation Professor" and "Trailynd Royal Beau" were contract mated during 1968, and purchase of a Quailroost calf from the Queensland Agricultural College, Lawes, has recently been finalized.

Semen imported from the United Kingdom from the sire "Rurik Charon" is also being used in several stud herds, including the Marsden Farm Home for Boys, Booval, which has a high quality Friesian herd.

MARKETING AND ECONOMICS

In July 1968, a summary of a report prepared by officers of Marketing Division on the marketing of market milk in south-eastern Queensland was submitted to the dairying industry for discussion and comment. This report proposes changes in the marketing of market milk and suggests a rationalization of dairy manufacture in South Queensland dairying areas. This report has elicited much worthwhile discussion and has perhaps helped all sectors of the industry to appreciate the need to fully examine the future direction of the industry in Queensland.

The Economic Services Branch is currently examining several aspects of the dairying industry in some detail.

A study of long-term trends in dairy production, involving a sample of 200 dairy farmers selected at random from each dairying district in southern Queensland, should provide information of value to the industry, its factories and marketing organizations in their future planning.

Current trends in the industry prompted the need for an investigation into the implications of changing from a cream/pig economy to a wholemilk supply to factories. Seventy dairy farmers have been interviewed to obtain information on farming systems, land usage, production costs and returns and the data are now being processed.

A preliminary study of the effect of plant size and the seasonality of supplies on processing costs is now under way.

Demonstration farms established in the Ipswich area in 1966 are providing valuable information for extension purposes. They are maintained through close co-operation between this Department, local Dairying Development Committees and the two farmers involved.

Despite the adverse seasonal conditions experienced and a decline in pig prices during the year, farm incomes on these properties were maintained at the increased levels attained in 1967-68. On the dryland farm, with a small milk quota, tropical pastures established in 1966 are providing good grazing and additional areas have been planted. The irrigation farm has also been granted a milk quota and a new dairy building is now under construction.

PRODUCTS RESEARCH

Work has continued at the Otto Madsen Dairy Research Laboratory on methods for determining the bacteriological quality of refrigerated milk, aided by research funds from the Australian Dairy Produce Board. It has been established that, numerically, psychrophiles, particularly *Pseudomonas*, dominate the microflora of cleanly produced refrigerated milk.

A new test based on catalase production promises to be most valuable for determining the quality of raw milk.

The assessment of psychrophilic numbers in refrigerated raw and pasteurized milks has continued. The growth rates in milk by isolates of these organisms from psychrophilic plates and the changes induced in the milk have also been determined.

Workers in Europe and the United States have advocated a short incubation method for the determination of counts

of psychrophilic organisms in milk. The method proposed has been investigated under Queensland conditions and found to be satisfactory.

UHT pasteurization and non-vacuum deodorization of cream for buttermaking, which was supported by Australian Dairy Produce Board finance to June 1968, has been continued with State finance during the year. Sixty trials were completed during the year, proving the economy and effectiveness of the new process. A commercial plant capable of treating 10,000 lb. of cream per hour is being installed at the Atherton Tableland Butter Association's Malanda factory, and theoretical design details have been provided for a larger unit to treat 50,000 lb. cream per hour, for a Victorian processor.

The experimental manufacture of a number of new dairy foods has been carried out. Foremost amongst these has been quarg, which has been successfully produced in the natural form, in addition to being spray dried and freeze dried. A taste panel assessment based on more than 700 evaluations is being used to determine the actual or potential appeal of these new products. Several varieties of yoghurt have been manufactured, assessed and brought to the attention of industry. In addition, milk drinks flavoured with fruit and beverages produced from whey have been more thoroughly investigated.

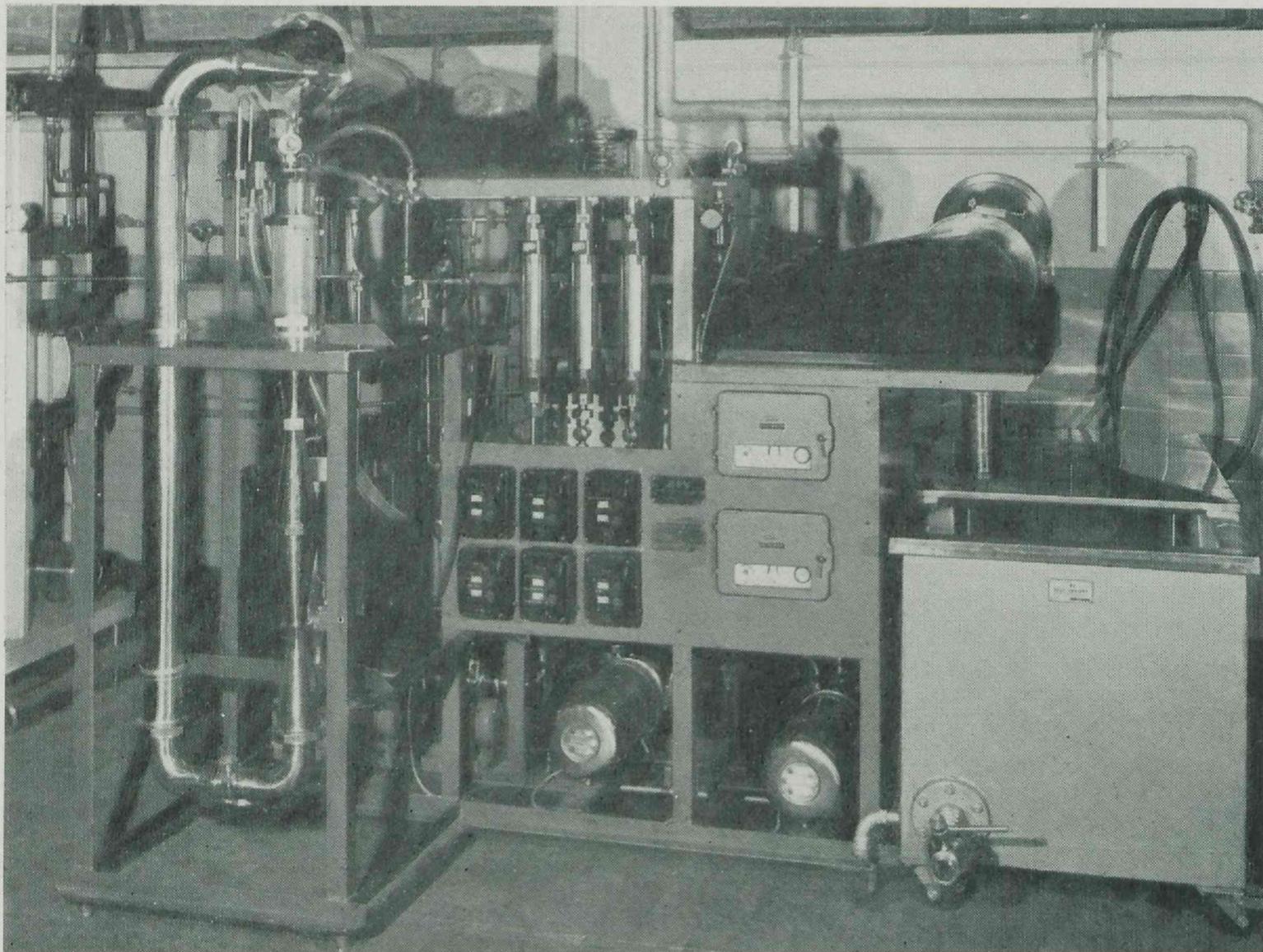
A Dutch method for determination of residues of penicillin in milk by means of disc assay was found to be superior to previous tests used and has now been brought into routine use.

A survey has been carried out of the variations in bacteriological quality of samples drawn from boxes of butter, to determine the correct sampling procedures to be used for this work when analyses are required for particular purposes. An investigation has also been carried out on the influence of salt as a bactericide and/or bacteriostat in butter.

A detailed investigation on coliform organisms occurring in cheese is in progress, largely because of Japan's insistence that imported cheese be free from coliforms. The work shows that coliform organisms die out in cheese at a differential rate according to their species, the pH of the cheese and other conditions.



Experimental manufacture of quarg in a small cheese vat at the Otto Madsen Dairy Research Laboratory



A new experimental cheese-making machine in the pilot plant of the Otto Madsen Dairy Research Laboratory

A paper dealing with lipase activation in farm milk supplies was published during the year. As a result of the findings in this work a more detailed investigation into the effect of agitation and cooling on lipase activation has been undertaken. Other aspects such as temperature activation and effect of stage of lactation on production of "susceptible" milk are also being examined.

During the year a method for the small-scale purification of milk lipase has been developed. This technique, involving ammonium sulphate fractionation and Sephadex gel chromatography, leads to an overall purification of 2,500-fold. However, attempts to utilize the method for large-scale preparation have not been successful, and further investigations have been carried out. A method involving concentrating of the preparations by ultrafiltration followed by fractionation with ammonium sulphate in the presence of dimethylformamide shows considerable promise. Alternative assay techniques for lipases using fluorimetric substrates are being investigated.

Some exploratory work has been commenced to study the surface components of the milk fat globule and examine the role these materials play in hydrolytic rancidity and oxidized flavour development in milk.

The role of haemin in oxidation deterioration of dairy products has also been examined. Several ligands and complexes have been synthesized for use as catalysts in these studies.

Investigations have continued to examine the carboxylic acids in Romano and other cheeses. Satisfactory extraction methods have been devised and identification of the fatty acids obtained has been carried out by gas chromatographic analysis. A new method has been devised to determine copper concentration in acid and rennet casein.

Many hundreds of samples of butter from various Queensland factories have been taken and analysed in the course of an investigation to develop a more spreadable butter. Samples were analysed to determine extruder and iodine values for each. Fairly good correlation has been shown between both values but it would appear that the extruder value, which is a direct measure of spreadability, does not depend on the iodine value alone. As a result the percentage of high melting triglycerides is being examined. Iodine values varied from 27.5 to 39.0, the minimum occurring in the month of January. Extruder values varied from 1.6 to 3.9 kg. Methods in use for factories to produce

a softer butter have been shown to reduce the hardness by as much as 26%. No relationship could be found between refractive indices of butters and their iodine values.

In the Toowoomba Laboratory of the Dairy Research Branch hundreds of samples of cheese have been analysed for total and water-soluble nitrogen in the course of an investigation being carried out by the Dairy Field Services Branch in the use of microbial rennet. In addition, large numbers of analyses have been carried out at the Otto Madsen Dairy Research Laboratory on products manufactured in the course of experimental work.

Investigation into milk compositional problems on the Atherton Tableland has continued at the Malanda Laboratory with particular reference to the examination of the variation of milk constituents. It has been shown that variation in milk protein was largely responsible for the variation in solids-not-fat which occurred during the spring months, and also for the variation in solids-not-fat resulting from the stress suffered by animals during periods of excessive heat. Significant variations were also recorded in the ratios of protein to casein, fat and lactose.

Investigations have been carried out to determine the optimum conditions for the operation of the only continuous buttermaker in Queensland, a Westfalia Buttermatic 800 installed at the Malanda butter factory. In addition, the continuous buttermaking machine has been used for the manufacture of whey butter with fairly satisfactory results.

Trials have been carried out on the spray drier in the pilot plant of the Otto Madsen Dairy Research Laboratory to determine its characteristics while operating with disc atomization and with foam spray drying from the disc. Skim-milk, wholemilk, yoghurt and quarg have been spray dried, while trials have commenced on drying concentrated pineapple juice.

A low-fat spread from butter has been produced which is more spreadable than butter at refrigeration temperatures and remains spreadable at room temperature without the problem of oiling-off.

Experimental batches of cheddar, Romano, Feta, cottage and quarg type cheeses have been manufactured by both traditional methods using brining baths and a technique using stirred curd with the addition of the salt prior to packaging in plastic film.

A Paracurd continuous cheesemaking machine on loan from A.P.V. Company, England, is now installed at the Otto Madsen laboratory and trials have commenced. To date it has been difficult to produce a cheddar-type cheese without the problem of bitterness and soft body, but the machine has been used to produce good quality type curd very suitable for the production of Mosarella cheese.

With finance provided by the Australian Dairy Produce Board, investigation was carried out into caramelized milk products: some very successful batches of caramelized milk were produced.

Nearly 45,000 samples of dairy products and materials have been examined in the various laboratories of the Dairy Research Branch in the course of the year, some of these samples having been taken and analysed under quality control schemes. Others have been designed to directly assist farmers and factories, while some have been necessary in order to issue N.A.T.A. certificates to help exporters establish the quality of products.

[Further reference is made to laboratory services in the section on Agricultural Standards.]

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, 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 projects of various types under way.

The main research centres are Tropical Agriculture Research Station (South Johnstone), 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, the 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 within the Division of Plant Industry.

RESEARCH

Pasture Species Evaluation

Despite the drought conditions throughout Queensland during the year, an active programme of regional evaluation of new pasture species was conducted by the Agriculture Branch. Production potential in many instances was masked but information on performance under adverse conditions has been gained.

At South Johnstone Research Station, 400 lines have been planted over the last 3 years. Those that have been selected for further testing include new strains of guinea grass, para grass, setaria, centro, desmodium and stylo.

Dolichos africanus has exhibited the ability to withstand the waterlogged conditions of the heavy clay Arriga soils near Mareeba. This species therefore could provide useful attributes to the *Dolichos* breeding programme.



Callide Rhodes grass, a strain developed by the Department, being harvested for seed in the Bundaberg district

Pasture types are being defined for the different conditions in the Ingham district. On the volcanic soils green panic has been the best grass, while among the legumes siratro produced better than glycine. However, the latter grows longer into the winter. Siratro and pangola grass comprise a suitable pasture mixture for the infertile, waterlogged sands. On the forest soils Townsville lucerne has spread from the original strip plantings into the undisturbed native pastures. A new stylo introduction, Q8442, has shown a greater tolerance to grazing than the commercial strain due to a larger number of potential growing points close to ground level. Its strong seedling vigour also is important in establishment and it produces early spring growth.

On the "desert" soils of the Charters Towers area, siratro, buffel grass and *Urochloa mosambicensis* have been outstanding. At the other extreme, in a 100 in. rainfall area on the Atherton Tableland, greenleaf desmodium was the best performing legume despite the fact that Tinaroo glycine gave superior late winter growth.

There are several introduced legumes which warrant further evaluation in central Queensland but in commercial plantings lucerne is still outstanding. At Biloela Research Station, when planted with Molopo buffel, Gatton panic or Callide Rhodes grass, it has been responsible for total yield increases of over 100%. The nitrogen contribution to the soil from the lucerne was the equivalent of 100 lb. N in the top 6 in. Biloela buffel retained the greatest nutritive value over winter of the several grasses tested in the same district.

In south-eastern Queensland, the legume *Dolichos axillaris* has been outstanding on warm sites such as hilltops. Introductions of *Setaria anceps* have exhibited a high degree of frost tolerance, although growth is at a minimum in the winter. Siratro has shown better establishment, persistence and summer production under dryland conditions than any other legume.

At Roma, Harbinger and Jemalong medics and the buffel grasses performed well despite the adverse seasonal conditions. In the far west, giant button grass has passed from the initial testing phase to evaluation under grazing. Legumes which successfully survived the 1968 winter include species of *Galactia*, *Vigna*, *Clitoria*, *Rhynchosia* and *Desmodium*. Their value under paddock conditions is yet to be determined.

Pasture Nutrition

One of the most important problems associated with pasture development is soil fertility. Work is being continued by the Agriculture Branch to define the deficiencies of major and minor elements in many areas of the State. Having defined the deficiencies, the next step is to evolve optimum fertilizer applications commensurate with economic and production factors.

In the Julatten district north of Mareeba the use of superphosphate has risen spectacularly since it has been demonstrated that 4 cwt./acre is required to successfully establish stylo-desmodium-guinea grass pastures.

Addition of phosphate to silverleaf ironbark soils of the brigalow belt resulted in a 50% increase in lucerne yield. There was also a response to potash, together with a strong phosphate-potash interaction.

Field trials in the traprock country of southern Queensland have shown that sulphur is responsible for the main fertilizer response in lucerne on these soils. However, there is some evidence that phosphate and molybdenum are necessary for maximum yields.

The phosphate content of the lateritic mulga soils and the arid red earths of western Queensland is extremely low. This has been found responsible for slow early growth and delayed maturity in buffel grass, the critical level of available phosphate for establishment being 25 p.p.m. Soil analyses have shown that burning of pulled eucalypt forest in these areas raises the levels of available phosphate and calcium and also the pH in the surface soil; phosphate levels in both the ash and the surface soil then exceed the critical level for buffel grass establishment.

Research into applications of fertilizer nitrogen on grass pastures continues in the higher rainfall country and under irrigation. The spectacular beef production of over 1,000 lb. beef/acre/annum on irrigated and heavily fertilized pangola grass at Parada Research Station has been recorded previously. This work has progressed into a further phase in which even higher rates of nitrogen are being used. Similar investigations are proceeding at Millaroo Research Station and breeding cattle are being tested as well as steers. Current data at Millaroo show that pangola grass has yielded up to 26,000 lb. of dry material per acre with applications of 400 lb. of nitrogen per acre.

Small perennial shrubs, chiefly species of *Eremophila*, *Cassia* and *Dodonaea*, occupy large areas of land in western Queensland. They are avoided by stock and the density of their stands is such that the establishment of useful pasture species is prevented. One possible explanation for the exclusive nature of these is the production of toxic compounds which inhibit germination of pasture species. Preliminary

studies have shown that extracts from the leaves of *Eremophila gilesii* and *E. bowmanii* inhibit germination of buffel grass and the native mulga Mitchell grass.

The nutrient requirements of pastures on the wallum country have been further studied by the Agricultural Chemical Laboratory Branch, with emphasis on maintenance of established pastures. The Branch is also studying the application of foliar diagnosis techniques to an examination of the nutritional requirements of tropical pastures at South Johnstone and some interesting relationships are being found. For example, it has been shown that if the N/P ratio of stylo tips sampled 2 months prior to flowering exceeds 13, a response to phosphate can be expected.

Pasture Productivity

The Townsville lucerne grazing trial conducted at Marlborough by the Agriculture Branch has now been in operation for 4 years. In 1968 all treatments again produced more beef per acre than the native pasture. Best results have been achieved where Townsville lucerne was established over the entire paddock and topdressed with superphosphate. This treatment produced 302 lb. beef per acre from a stocking rate of 1 beast to 4 acres, compared with the native pasture production of 124 lb. when stocked at 1 beast to 8 acres. In the intermediate treatments, where Townsville lucerne was established without fertilizer, either in strips or over the entire paddock, production was 228 and 234 lb. beef per acre respectively.

At Swan's Lagoon Cattle Field Research Station, accent has continued to be placed on studies involving the utilization of Townsville lucerne at various rates of stocking and fertilizer treatments. Both stocking rate and fertilizer level affected liveweight gains. Superphosphate applications increased gains, and improved performance was also recorded at lower stocking rates. The performance of cattle on stands of unfertilized Townsville lucerne was unsatisfactory, and, in fact, inferior to native pasture at a stocking rate of 1 beast to 6 acres. It is thought that the lower content of unfertilized Townsville lucerne reduced intake.



Townsville lucerne at Swan's Lagoon Cattle Field Research Station on the Burdekin

In native pasture trials at Swan's Lagoon under a variety of stocking rates and treatments, discing was the factor which had the greatest effect on animal performance. Live-weight gains, carcass weights, dressing percentage and carcass grades were highest on treatments which were disced. Pasture spelling had little effect on animal performance, and no effect was noted on tick control.

In trials on private properties extended from Swan's Lagoon, application of superphosphate improved yield and quality of Townsville lucerne, rate of liveweight gain, period of gain, hot dressed weight, and dressing percentage. Brahman cross animals made greater gains than British-bred animals.

A study of the profitability of the establishment of Townsville lucerne for cattle fattening is currently being undertaken by the Economic Services Branch to provide some guidelines for graziers interested in this development.



A species of *Pennisetum* introduced from Brazil which has shown a marked degree of frost tolerance

At the end of the first 12 months in the buffel grass stocking rate trial conducted by the Agriculture Branch at Blackall, sheep stocked at 4 to the acre were 40 lb. lighter than those 2 per acre, 1 per acre or 1 to 2 acres, but produced 27.2 lb. of greasy wool per acre. On the other treatments the sheep produced approximately 10 lb. wool per head. It was necessary to implement a hand-feeding programme at the heavy stocking rate when new sheep were introduced after this first shearing.

Investigations at Gatton Research Station into spring production from tropical and temperate pastures under irrigation have shown little difference between the two types so far.

The effect of storage on hay made from the tropical legumes greenleaf and silverleaf desmodium has been examined at Cooroy. After 2 years both samples had maintained a protein level of 15%. Mechanical difficulties associated with haymaking from tropical legumes are also being studied.

The increasing interest in utilizing Pangola grass in combination with nitrogen fertilizer as a possible alternative to legume-based pasture in the wallum led to trials at Coolool Research Station using various stocking rates and nitrogen levels. During an 8-month period completed in June, weight gains ranging from 0.89 lb. to 1.29 lb. daily were obtained. The effect of increased stocking was to reduce the daily gain per animal, but to increase gain per acre.

In a study of the productivity of a Nandi setaria, greenleaf desmodium, white clover pasture, productivity was considerably reduced in the second year of stocking. The total gain the first year exceeded the summer gains, but in the second year, summer gains were offset to a considerable extent by winter and early spring losses.

In a beef cattle tropical legume grazing trial at Cooroy, individual animal gain was better at 1 beast to 2 acres than at 1 to 1.3, but total production per acre (224 lb.) at the higher stocking rate was 37 lb. greater than at the lower rate. The comparatively low daily gains on an apparently adequate protein diet suggested a lack of energy, and in an extension of the trial supplementation with molasses resulted in an extra gain of 30 lb. per head.

At Toorak Sheep Field Research Station, the grazing habits of sheep on Mitchell grass pastures have been under investigation. The animals have shown a preference for the annual components of the sward and eat Mitchell grass only when the annuals are no longer present. The main grazing periods are in the early morning and early evening, with a less intense period around midnight.

Pastures of green panic/greenleaf desmodium and green panic/Cooper glycine at Malanda were grazed by milking cows over a 12 months' period. On an annual basis the stocking

rates possible were 1 beast/2.2 acres for the greenleaf desmodium pastures and 1 beast/3 acres on the glycine. A demonstration pasture of Nandi setaria, Tinaroo glycine and silverleaf and greenleaf desmodiums at Mackay has carried 1 beast per acre for the last 3 years.

Fodder Crops

Comparisons at Brigalow Research Station between Alpha and DeKalb E57 grain sorghum growing at three different row spacings and four plant densities showed that there was no difference in grain production attributable to treatment but greatest forage production resulted from the higher planting rates.

At the Richmond Shallow Water Storage Research Project the first series of cropping trials was carried out in 1968. Work has been concentrated on crop suitability for the area, water usage and fertiliser requirements. Lack of run-off rain to date this year has prevented follow-on investigations. Because of the different rainfall intensities usually experienced at the various times of the year, it has been estimated that requirements for run-off are 3 in. in 24 hours in November-December, 2 in. in 24 hours in January-April and 4 in. in 24 hours in the May-October period. The 1968 crop results were confounded by grasshopper damage but the grain sorghum varieties Broilga, Texas 626 and Alpha performed best, with grain yield potential in excess of 1 ton per acre. No response to fertilizer has been detected as yet.

In grazing trials at Theodore, Camellia oats significantly outproduced Benton in stocking rate and liveweight gain per acre, 20 acres carrying 36 head of steers for two months with an average liveweight gain of 2.4 lb. a day per beast, and 150 lb. per acre.

Pest Control

Regeneration studies by the Entomology Section of pastures damaged by the black soil scarab (*Othnonius batesi* Oll.) near Jandowae were hampered by drought, but in a small-scale trial it was shown that up to 95% of the scarab larvae in the soil can be killed by disc ploughing followed by disc-harrowing.

When considered in relation to biological data, control of pasture webworms (*Oncopera* spp.) on the southern Tablelands may be obtained with non-chlorinated hydrocarbon. Trials there have shown that late instar larvae can be killed by either trichlorphon at 8 oz. per acre or diazinon at 6 oz. per acre applied to the pasture in the spring. This confirms previous work with trichlorphon, which is the current Departmental recommendation.

In biological studies at Biloela, the brief period of 21 days proved to be sufficient for a full life cycle period for the lucerne jassid (*Austroasca viridigrisea* (Paoli)). This included 10 days in the egg stage but only approximately 2 days in each of five nymphal stages. Better understanding of control requirements is provided by the data obtained.

DAIRY PASTURE SUBSIDY SCHEME

The Dairy Pasture Subsidy Scheme, which has been operating for 3 years, has been modified by the Government to increase its value to the industry. Total subsidy payable has been lifted as from July 1, 1969, from \$1,400 to \$2,000, while maximum annual subsidy has been set at \$400 in place of the original yearly subsidy payable on a maximum acreage of 20 acres.

The subsidy rate remains at dollar-for-dollar with a maximum of \$14 per acre, and the total acreage allowed to a farmer will be governed by his cow numbers, the approved carrying capacity of sown pastures for his region, and his costs of pasture establishment. Under the new scheme, a farmer with a 100 cow herd in an under 30 inch rainfall region would be eligible for subsidy on up to 400 acres of sown pasture if his total establishment costs were \$10 per acre. Farmers already in the Scheme will automatically be eligible for benefits such as increased deferred payments after July 1, 1969, and eligibility for increased acreages, but adjustments will not be retrospective.

A special grant of up to \$200 was made operable from May 13, 1969, to December 31, 1969, for purchase of approved fertilizer to be used for the rehabilitation of drought-affected sown pastures previously established under the Subsidy Scheme.

Drought conditions had the expected adverse effect on applications for approval to plant and on the planting of approved areas during the greater part of the year with the exception of the Atherton Tableland and Mackay dairying areas. However, the relief rains received in April and May in south-eastern Queensland provided a stimulus to applications and plantings. This stimulus was enhanced by the fertilizer grant and the enlargement of the Scheme.

A comparison of approved applications for the nine regions is shown in the Table.

	No. of Registered Dairy Farms 1967-68	Approved Applications 1967-68	% of Current Registered Farms	No. of Registered Dairy Farms 1968-69	Approved Applications 1968-69	% of Current Registered Farms	Number Increase or Decrease
Wide Bay	1,945	1,022	52%	1,717	781	45%	-241
East Moreton	1,478	489	33%	1,300	369	28%	-120
North Queensland	572	288	50%	532	307	58%	+19
West Moreton	1,838	673	36%	1,644	675	41%	+2
Eastern Downs	1,939	391	20%	1,731	320	18%	-71
North Burnett	1,130	261	24%	919	233	25%	-28
South Burnett	1,164	382	33%	979	393	40%	+11
Central Queensland	616	131	21%	501	96	19%	-35
Western Downs	400	63	16%	322	50	16%	-13
	11,082	3,700	33%	9,645	3,224	33%	

Since the Scheme commenced, 5,141 registered dairy farmers have received approval to plant pastures. This includes 3,224 approved applications during the year under review, and of these 933 were from new applicants not previously in the Scheme.

North Queensland now has a larger percentage of farmers participating in the Scheme than any other region.

There were more repeat applications during 1968-69 than were received in 1967-68 (2,291 and 1,848 respectively), but new applicants were reduced considerably largely through drought conditions (933 compared with 1,852 in 1967-68).

The Central Committee has under way two projects designed to evaluate the progress of the Scheme, and to provide data to improve its implementation. As about half of the State's dairymen have not participated, a survey has been made of all dairy farmers in the Murgon district to ascertain if there are any reasons why it is not acceptable there. In addition, a comprehensive statistical analysis is being made to evaluate the efforts of the Scheme on land use and farm practice.

Subsidy totalling \$384,542.03 was paid on 2,655 claims in the 1968-69 year, representing 30,865 acres, while deferred payments during the same period totalled \$93,429.93.

Since the inception of the Scheme in May, 1966, to June 30, 1969, a total of \$1,108,734.20 has been paid in subsidy, while \$73,832.88 stands in the deferred subsidy account.

The combined figure of \$1,182,563.08 represents 94,909 acres.

The accompanying table illustrates the progress achieved.

	To June 30, 1968	July 1, 1968 to June 30, 1969
Total number of approved applications to plant*	6,024	3,224
Total area involved	104,845 acres	50,355 acres
Average area per application	17.2 acres	15.61 acres
Number of claims paid	3,581	2,655
Total amount of subsidy paid	\$591,874.73	\$384,542.03
Area covered by subsidy paid	47,971.75 acres	30,865 acres
Average subsidy per acre	\$12.34	\$12.46
Deferred payments made	\$38,887.51	\$93,429.93
Total subsidy paid since inception of scheme	\$1,108,734.20	
Subsidy held in deferment at 30-6-69	\$73,832.88	

* Many farmers make 2 applications per year.

Implementation and supervision of the Scheme occupies a significant portion of the time of a large number of field officers. In most regions the District Committee system of operation has proved effective. In some isolated centres where applications are heavy, staffing problems are evident, and in other centres difficulties with respect to producer attention to procedures are evident.

Central Committee has streamlined the procedures as much as is practicable commensurate with inspectorial and audit requirements.

V. Field Crop Research and Extension

Agronomic work on field crops 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 Parada, Walkamin, Kairi, South Johnstone, Millaroo, Biloela, Theodore, Gatton and Hermitage, and at numerous field investigation centres.

WHEAT

Extremely encouraging results are being obtained in a study by Queensland Wheat Research Institute personnel aimed at determining the influence of presowing drought hardening of wheat seed on subsequent yield of the crop. The overall indications after 2 years of field studies are that, under the environmental conditions prevailing in those seasons, wheat yields can be increased by from 5 to 20% by soaking seed for 24 hr and allowing it to dry out to its original moisture before planting.

The main emphasis in the wheat-breeding programme is on yield, quality and resistance to stem rust and lodging. Facilities now available at the Queensland Wheat Research

Institute will expedite testing for seedling resistance to stem rust. A back-crossing programme has been initiated to introduce resistance to common root rot, and flag smut resistance is being taken into account because of the lack of resistance of Gabo derivatives. Varietal adaptation trials were grown at four sites—Tara, Bowenville, Gatton and Hermitage—and these trials will continue for four seasons. Lines from the International Spring Wheat Rust Nurseries and Mexican semi-dwarf strains are included in the programme.

Favourable seasonal conditions were experienced up to mid-spring in the nine raingrown trials included in the regional varietal testing programme. Thereafter hot dry conditions were experienced and late-planted trials suffered

considerably. Average yield for the nine trials was quite satisfactory at 32 bus./acre. Trial averages varied between 48 and 18 bus. Gemenya gave the best overall performance with an average 35.2 bus., followed by Timgalen (32.9), Gamut (31.7), Mendos (31.3) and Spica (30.6).

A moderate epidemic of stem rust (*Puccinia graminis* f. sp. *tritici*) occurred on the variety Mendos in the Dawson-Callide district. The isolation of a strain of the wheat rust fungus new to Queensland (21-2, 3, 4, 5, 7) during the 1968 season increases to three the number of field strains capable of attacking Mendos. This new strain, recorded from five separate districts in Queensland, has the widest virulence of any previously detected, attacking all varieties except Timgalen, Gamut, Festiguay and Eureka derivatives. A new Festiguay-attacking strain was also recorded during December.

Studies by the Plant Pathology Section have indicated the presence of two distinct forms of *Agropyron scabrum* var. *plurinerve* in Queensland. The form, largely confined to the black soils of the Darling Downs, is the one so often severely affected with stem rust. The relatively high proportion of virulent strains of *P. graminis* f. sp. *tritici* isolated from *Agropyron scabrum* since the end of 1968 season indicates that the grass plays an important role in the over-seasoning of wheat stem rust on the Darling Downs.

The importance of alternative grass hosts in assisting the survival of *Fusarium graminearum*, the cause of crown rot, was further investigated. A total of 25 species of grasses from 15 genera was sown in infested soil in the glasshouse and all became infected to some extent.

BARLEY AND OATS

The Department's barley varietal programme advanced considerably in 1968, when 18 trials were conducted by the Agriculture Branch over a wide range of environments in southern and central Queensland. The outstanding feature of the trials was the performance of the variety Clipper, bred at the Waite Agricultural Research Institute, South Australia. Clipper outyielded the present commercial malting variety Prior by an overall 27% in the trials. Clipper has shown good malting quality in initial tests but this aspect is to be investigated further. Four of the 18 trials were used for a special purpose and consisted of 81 entries, a number of which were unreleased lines bred also by the Waite Institute. It is interesting to note that in this company Clipper could manage only 23rd place, the first 21 places being filled by new Waite Institute lines. The best line in the trial yielded 70.6 bus./acre as against 61.6 bus. for Clipper and 43.6 bus. for Prior.

The Plant Pathology Section definitely identified for the first time in Queensland the fungus *Fusarium culmorum* associated with a severe crown rot of oats. Up until this time it was considered this organism was restricted to southern areas of Australia.

GRAIN SORGHUM

The plant-breeding programme in sorghum conducted by Agriculture Branch has been continued with emphasis on both grain and forage types. Lodging susceptibility and low grain quality are important problems in grain sorghum hybrids, with the result that the high yield potential of the hybrid varieties is not being fully exploited commercially. The softer grain produced by hybrids makes long-term storage difficult. Other factors receiving consideration include resistance to sugar-cane mosaic virus and head smut, the need for open-headed types and the development of yellow endosperm lines.

Seasonal conditions were above average for all 10 trials in 1967-68, in the third year of the regional grain sorghum varietal testing programme. Trial yields ranged from 103.5 bus./acre for the Leyburn irrigated trial and 84.7 bus. for the Hermitage Research Station raingrown trial down to 19.0 bus. for the raingrown trial at Roma. A number of really good hybrids are available for the different regions. The yield advantage to be gained by using hybrid vigour is evident from the fact that the combined average yield from all 10 sites of three popular hybrids—Texas 610, DeKalb E57 and Pacific 222—was 22% higher than that of the open-pollinated variety Alpha. Alpha, however, is still favoured in Central Queensland in situations where subsoil reserves are suspect because of its ability to withstand lodging.

Staggered plantings of grain sorghum in southern areas resulted from patchy rains received in the planting period. In consequence a considerable loss eventuated from the sorghum midge (*Contarinia sorghicola* (Coq.)), because the continuous breeding made control difficult.

The Plant Pathology Section is rating the breeding lines used in the Departmental breeding programme at Hermitage Research Station for their reaction to the Johnson grass strain of sugar-cane mosaic virus. So far no marked resistance has been detected.

MAIZE

The Agriculture Branch hybrid maize breeding programme based on Kairi Research Station, North Queensland, has continued, with current emphasis on grain yield and grain health. The hybrid QK37 was released last year and about 8,000 acres (approximately 40% of the maize acreage) were planted on the Atherton Tableland. Sufficient seed should be available from current certified seed plots to plant the full maize area on the Tableland, if required, in the 1969-70 season. The mean yield increase of QK37 over the older hybrid GH128 through four seasons is approaching 30%. Of 44 new hybrids evaluated last season, none outyielded QK37 but some gave comparable yields as well as improved ear rot resistance, and further testing is proceeding. About 150 varieties were introduced for local assessment.

The second year of the regional maize varietal testing programme produced some interesting yield results in three irrigated trials (Emerald, Brookstead and Gatton Research Station) and two rain-grown trials (Kingaroy and Bundaberg). Sixteen hybrids were tested in all. QK37, GM211, Q23 and DS601 gave excellent overall performances, yielding on average 23.1, 21.1, 20.1 and 14.3% higher than the trial means. All four of these hybrids bettered the trial mean at each site tested. The hybrid QK37 was developed by Departmental plant breeders specifically for use on the Atherton Tableland and the hybrid GM211 is grown almost exclusively on the Atherton Tableland. It is therefore of interest to note their versatility by their good showing in quite different environments. Of course, final choice of varieties suitable for a district is determined by a number of agronomic factors of which yield is only one. The average yield of the two raingrown trials was satisfactory at 43.9 bus./acre but the average yield of the three irrigated trials was disappointing at 66.1 bus..

In a land preparation and rotation trial conducted by the Plant Pathology Section in North Queensland there was again a substantial reduction in both stalk rot (*Marasmius sacchari*) and ear rot (*Diplodia macrospora*) in fertilized plots. Seed treatment followed by in-furrow application with Benlate (Du Pont 1991) reduced seedling blight and stalk rot from 28% to 7%. A second species of *Marasmius*, *M. graminum*, has been found causing stalk rot.

A review by the Marketing Services Branch of world and Australian maize markets has just been completed and will be released shortly.

TOBACCO

The application of Demosan as a soil drench reduced stem rot (*Rhizoctonia solani*) to insignificant levels in trials conducted by the Plant Pathology Section in North Queensland.

Two new varieties NC95 and Hicks Q46 have now been registered and are available for the 1969-70 season. Both of these varieties have consistently outyielded the standard Hicks in Agriculture Branch trials at levels approaching 25%. In addition, NC95 has the advantage of being highly resistant to the bacterial wilt (*Pseudomonas solanacearum*) now present in both the Ingham and Mareeba areas.

The foliar diagnosis programme has reached the stage where the nutritional status of an experimental or problem crop can be defined, and light thrown on deficiencies or other upsets. Particular findings include the fact that the nutrition of the crop cannot be varied markedly after topping, that nitrogen nutrition affects the uptake of other plant foods, and that most of the nitrogen uptake occurs early in the growth of the crop.

Nutrition investigations conducted by the Agriculture Branch over a 3-year period indicate that on good tobacco soils up to 50% of the nitrate nitrogen in tobacco fertilizers may be replaced by ammonia nitrogen without affecting tobacco yield or quality. The commercial use of ammoniated tobacco fertilizers has advantages from the viewpoint of fertilizer manufacturing techniques.

The herbicide Balan is now widely used in all tobacco areas and controls grasses in particular, although it may cause some crop retardation when tobacco seedlings are transplanted into the herbicide incorporated zone. Tillam (4-6 lb./acre) is being used for nutgrass control and is effective for most of the life of the crop.

The damage caused by the insecticide azinphos-ethyl in Entomology Section trial work in tobacco seedbeds largely disappeared by the time the seedlings were due to be planted out. In comparison carbaryl, which had given some promise in controlling the pests, was found to damage young seedlings so badly as to thin the stand and for this reason proved unsuitable for use in seedbeds. In field tobacco, light-trap catches of looper moths (*Plusia* spp.) showed a definite relationship to subsequent larval populations in the crop. From a proposed prediction service based on light-trapping, the many farmers who seem unable to recognize infestation at an early stage will have a greatly improved chance of controlling this major pest. New insecticides recommended for looper control were Cyolane, aminocarb and methomyl. Methomyl also gave promising control of budworms, *Heliothis* spp. and leaf miner (*Phthorimaea operculella* (Zell.)).

COTTON

Four recently established techniques are now generally used in cotton-growing in Queensland. The skip row technique—plant 2, skip 2—is universally adopted for rain-grown crops; the herbicide trifluralin is used on virtually all irrigated cotton crops for control of grasses and many broadleaf weeds; irrigation is applied in the early seedling stage to promote growth and early maturity in southern district; and nitrogenous fertilizers are used on all irrigated crops at rates around 100 lb. N/acre.

The Deltapine Smooth Leaf cotton variety is ideally adapted to Central Queensland and selection programmes are being carried out by the Agriculture Branch to improve yield and fibre strength. For southern Queensland an earlier maturing variety is required and introduction and breeding work is being undertaken with this in view.

An economic study by the Economic Services Branch of cotton production under irrigation on the Darling Downs has now been completed with the co-operation of 14 specialist growers who provided physical and financial records of their cotton production over a number of years concluding with the 1966-67 season. An assessment is now being made on the future profitability of the industry with the phasing out of the existing cotton bounty.

A further advance was made by the Entomology Section in the biological knowledge of the pink-spotted bollworm of cotton (*Pectinophora scutigera* (Hold.)). In studies of the effect of different humidities on the hatching of eggs it was shown that at 87% relative humidity most eggs hatched while at 32% egg mortality was greatest. The incubation period was shortest at 100% R.H. (75.2 hours) and longest at 52% R.H. (101.2 hours).

PEANUTS

Extensive selection and varietal testing programmes have been carried out with Virginia Bunch (large nut) and Red Spanish (small nut) peanuts in the Kingaroy district by the Agriculture Branch. Virginia Bunch Selection 5 has given an excellent performance over a number of years and is expected to gradually take the place of the present commercial strain. In the 1967-68 trial this selection yielded 1,926 lb/acre of nuts in shell, 18.4% higher than commercial Virginia Bunch. An unnamed Red Spanish type, CPI30087/63/1, yielded 1,225 lb/acre of nuts in shell in the 1967-68 trial, 25.8% higher than the commercial line of Red Spanish.

An outbreak of mosaic in the South Burnett, caused by the peanut mottle virus, appears to have been successfully eradicated by detailed attention over a period of three seasons. This has been achieved by the close co-operation of landholders and the Peanut Marketing Board with officers of the Department in the area.

OILSEEDS

The superiority of the Russian varieties of sunflower in terms of oil yield per acre was demonstrated clearly in an irrigated sunflower variety trial conducted by the Agriculture Branch at Brookstead in 1967-68. While grain yields of these varieties were similar to the 2,088 lb./acre produced by Polestar, the birdseed variety, the seed oil content of the better Russian varieties, Peredovik 6296 and VNIIMK6540, averaged 41.4% as against 29.5% for Polestar. Thus oil yields of these Russian varieties averaged 859 lb./acre, some 40% higher than that of Polestar.

Soybean research conducted at Hermitage Research Station over a 3-year period indicates that for the local environment, at least, November-December is the best period to make plantings, and for rain-grown conditions wider row spacings (28 in. or more) are a safer proposition than narrower row spacings. This supports previous research findings from Biloela, Gatton and Walkamin Research Stations which also favoured November-December plantings for soybeans.

NAVY BEANS

The Agriculture Branch's varietal improvement programme, which has seen the release of three navy bean varieties in the past 4 years, is continuing with encouraging results. In the 1967-68 progeny yield trial at Kingaroy, in which the average yield was 1,400 lb./acre, all the progeny material clearly outyielded the old standard variety California Small White. In addition to grain yield and plant type, seed type and quality are important in navy bean production and these factors are being thoroughly investigated.

A review of the Australian edible dry bean industry released by the Marketing Services Branch early in 1969 examined the current and future prospects of the industry in Australia. The report highlighted Queensland's position as the major producing State and the developments which had taken place, especially in navy bean production.

RICE

Investigations into rice markets for Queensland rice were continued throughout the year by the Marketing Services Branch and a report on market possibilities is expected shortly.

Research on rice is continuing at Millaroo Research Station on the Burdekin River with a broad programme covering fertilizer needs, seeding rates, grain moisture studies, varietal improvement and ratoon cropping. Bluebonnet is still the recommended commercial variety although six other varieties are being tested. A pure seed scheme to maintain the varietal purity of Bluebonnet on a continuing basis has been commenced.



Winter rice variety trial at Millaroo Research Station on the Burdekin

In a summer-planted Bluebonnet crop, 80 lb. of nitrogen per acre in the form of sulphate of ammonia has given best results on the Oakey and Barratta soils. However, on the Delta soils nitrogen requirements may be less than this, at least initially.

Two post-emergent herbicides, propanil and molinate, give satisfactory control of barnyard grass, which is the major weed in the rice crop, provided they can be applied at the correct time. In a search for a broad spectrum herbicide which can be applied preplanting DCPA (dimethal) has shown promise.

Approximately 40 farmers are now co-operating in a recording scheme to provide factual data as a basis for assessing the profitability of rice growing on the Burdekin.

TEA

Emphasis in the tea research programme of the Agriculture Branch has been placed on clonal evaluation, weed control and regional assessment in the wet tropics. Six clones from Queensland and overseas are under test at Tully. Diuron at 4 lb. a.i./acre has given good weed control for up to 10 months at the South Johnstone Tropical Agriculture Research Station without affecting growth. Small test plots have been established at Millaa Millaa, Topaz and four sites in the Ingham district to assess the potential of these areas for tea-growing.



Queensland's first commercial tea plantation, near Innisfail

VI. Horticultural Research and Extension

Most of the horticultural research and extension work of the Department is conducted by the Horticulture Branch. The Branch operates horticultural research stations at Applethorpe (Granite Belt), Ormiston (Redlands), Nambour (Maroochy), Bowen and Cairns (Kamerunga). The Food Preservation Research Laboratory at Hamilton came under the control of the Horticulture Branch in May 1969 after operating as a separate Branch for some years. Extension services are provided by the Branch in all fruit and vegetable growing districts.

Other sections of the Department active in horticultural research and extension are the Entomology Section and the Plant Pathology Section.

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

DECIDUOUS FRUITS

Soil moisture is a major factor limiting the yield of bearing trees and delaying production in young orchards in the Granite Belt. A simple technique for determining tree moisture stress, based on paraffin infiltration of leaves and capable of direct application in commercial orchards, has been developed at the Granite Belt Horticultural Research Station as a guide to the timing of irrigation and is being used by growers.

Glasshouse investigations have shown spectacular growth responses in young trees where soil moisture is maintained near field capacity. This work is being extended to

investigate soil and orchard management factors affecting soil moisture retention and availability over a range of orchards in the district. Associated with this investigation, irrigation methods, including under-tree and trickle irrigation, are being investigated with the object of economizing in water usage and minimizing leaf scorch and other adverse effects of spray irrigation where saline water has, of necessity, to be used.

Following the overseas trend towards high tree densities in orchards as a means of increasing yield per acre and reducing management costs, a trial with three apple varieties has been established at the Granite Belt Horticultural Research Station with 700 trees per acre.

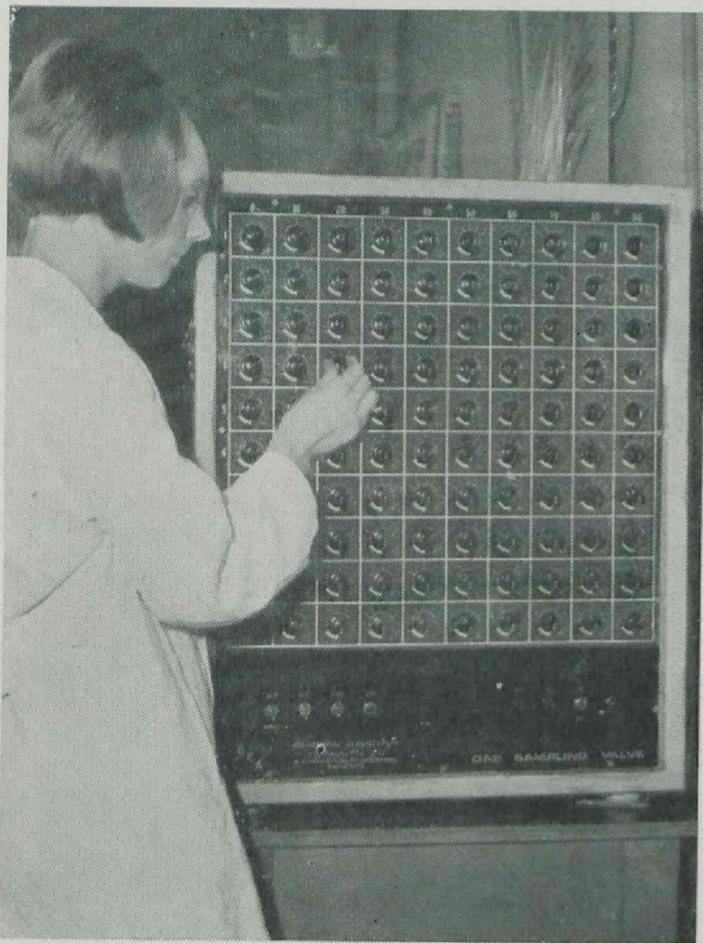
Glasshouse investigations have established the association of "apple measles" with calcium, boron and manganese nutrition and have revealed that the condition is most severe where calcium and boron are low and manganese high. Boron deficiency can be corrected by foliar sprays and manganese toxicity can be minimized by avoidance of acid fertilizers. However, difficulty is experienced in supplying adequate calcium by soil application and the use of calcium sprays is being investigated.

In trials with nursery trees, spectacular results in nematode control have been obtained from soil fumigation, growth having been more than doubled as a result of fumigation with a methyl bromide-chloropicrin mixture.

At the Granite Belt Station, MM109 continued to maintain its superiority as a rootstock for Jonathan apple. For Delicious, Merton 778 and 779 have so far performed well; S4, by virtue of its large tree size, shows considerable promise but its delayed bearing may be a considerable disadvantage. *Pyrus calleryana* as a rootstock for pears has shown superior tree growth to T7 up to the bearing stage, which has just commenced.

A comprehensive trial to obtain data on the relation of time of harvest of Granny Smith apples to the early detection and subsequent development of bitter pit during storage and transport has not yet indicated a significantly higher post-harvest development of bitter pit in early, compared with later, harvests.

It has been shown by the Food Preservation Research Laboratory that superficial scald of apples harvested in mid April and stored immediately is controlled by a diphenylamine dip before mid-May. It has now been shown that the optimum temperature for storage of apples prior to dipping in diphenylamine is 60°F.



Adjusting the timing sequence on an automatic gas sampling valve for the sampling and automatic analysis of atmospheres surrounding experimental fruit—Food Preservation Research Laboratory

Grape storage trials using polyethylene-lined containers have shown that the inclusion of small polyethylene packages of potassium metabisulphate solution is satisfactory for the control of mould during storage. Specially prepared soft-wood chips have been shown to be a suitable substitute for granulated cork in packing grapes.

Deciduous fruit crops were affected more than usual during the dry year by the two-spotted mite (*Tetranychus urticae* (Koch)), and the opportunity was used by the Entomology Section to elucidate some biological and ecological factors relating to this pest. Leaf litter beneath trees was a favourite site for winterform mites but removal of the leaf litter was not alone sufficient to prevent mite infestation of trees in the following season.

The recommended schedule for the control of the codling moth (*Cydia pomonella* (L.)) proved very effective in the Stanthorpe district, where the insect was present as a pest only in neglected orchards.

Benlate (Du Pont 1991) proved superior to thiabendazole, Difolitan and captan for the control of both primary and secondary brown rot in a Plant Pathology Section trial at Ballandean.

PINEAPPLES

From a project commenced by the Horticulture Branch in 1950 to search for superior strains of Smooth Cayenne pineapple, clones 30 and 14 have now been selected for multiplication and distribution to the pineapple industry. Clone 30, while not outstanding in any particular respect, has no serious defects and has performed more consistently throughout the trials than other clones. Clone 14 is capable of higher yields but the fruit has a tendency to develop more small basal knobs than clone 30. In southern Queensland, summer fruit of this clone tends to be low in acid, though not critically so. However, in canning tests of a summer crop fruit from trials in Central Queensland, the average fruit pH was 4.1, indicating a need for high-acid clones or cultural practices which would increase acid concentration in the summer crop fruit. The final selection of a clone for use in Central Queensland will consequently be delayed until data are available from further trials now in progress in this region.

A new flower inductant, Ethrel, was found to be particularly effective in inducing flowering in pineapples, but at the concentrations used it resulted in excessively squat summer fruit. In trials with several flower inductants it has become increasingly apparent that their action is not limited merely to induction of flowering, but that they also have appreciable effects on vegetative growth and on fruit development.

With increasing mechanisation of pineapple production and a growing interest in the application of fertilizer with boom sprays, further work has become necessary on rates of application of urea sprays. Results of recent trials indicate that the crop benefits from increasing concentrations from 2½ to 10%. With sulphate of potash over the same range, yields decreased as the spray concentrations increased. With both spray and orthodox fertilizer applications, yields increased as the amounts of nitrogen and potash were increased from 50 lb. to 100 lb. per acre.

A study at the Food Preservation Research Laboratory of the quality of pineapple juices and blends kept under refrigeration in opened unlacquered cans has shown that, although microbiological breakdown is negligible for some days, the juice fairly rapidly develops a "tinny" flavour.

Spray recommendations with the fungicides Difolitan and Dexon have now been made by the Plant Pathology Section for the control of top rot (*Phytophthora cinnamomi* and *P. parasitica*). Difolitan-treated plots in trial work have consistently outyielded those treated with Dexon. The use of polythene mulching in conjunction with fungicides has shown considerable promise in combating this disease.

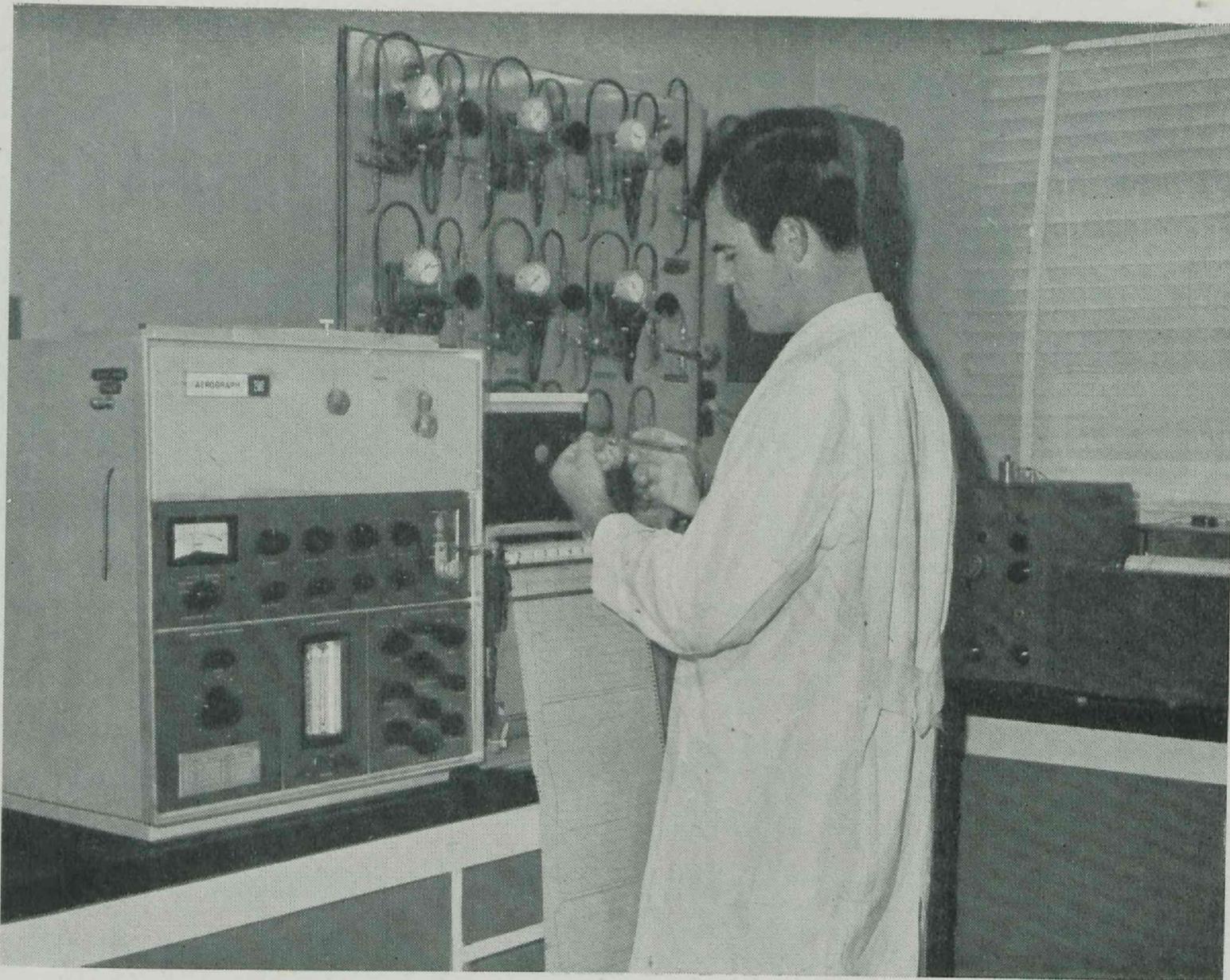
The occurrence of *Symphylla* in pineapple fields was viewed with concern by growers. These potential root pests proved to be present in small numbers on some farms in both the Yeppoon and Maroochy districts, more in damp spots than in dry. There was no evidence that crop yields were threatened by their presence.

BANANAS

In a Horticulture Branch trial near Nambour the variety 2390, recently introduced from Jamaica, appears to have good resistance to Panama disease and produces heavy crops of attractive fruit. With the steady spread of Panama disease in plantings of the Lady Finger variety it has become desirable to replace it by a resistant variety and 2390 is the most promising of a range of introduced varieties and local selections. Several plants of the Mysore variety, which is generally considered to be immune to the disease, have succumbed to the disease in the Nambour trial. Planting material of 2390 is being multiplied in North Queensland for distribution to industry.

In nutritional investigations in North Queensland, evidence is accumulating that, whereas the potassium requirements of the banana plants are high, excessive rates of preplanting application may have deleterious effects, particularly during periods of low rainfall. In some cases, it appears that the extremely high rates of potassium fertilizer applied in recent years have raised available levels in the soil to the point where there is little response to added amounts. Work is in progress on responses to potassium in preplanting and side-dressing applications and the interaction of potassium on calcium and magnesium uptake.

In an investigation of the inter-relation of nutrition and chemical treatment for nematode and root rot control, there is already evidence that fungicidal treatment of the planting material has a significant effect on plant survival after planting. Likewise, DD and EDB fumigation of the soil considerably reduced root knot and spiral nematode populations. Data on the effect of these practices on yield will be obtained when the plant and subsequent ratoon crops are harvested in the current season.



Fruit flavours being analysed by gas chromatography at the Department's Food Preservation Research Laboratory

At the request of the Australian Banana Growers' Council, the Economic Services Branch in 1966 commenced a farm management study which involved a group of specialist growers in an endeavour to delineate key management factors as a guide to raising the level of efficiency in the industry. A progress report on the first 2 years of operation of this project has been prepared.

PAPAWS

Trials at Redlands Horticultural Research Station have shown that summer applications of nitrogen fertilizers to papaws for processing should be made not later than January to avoid excessive nitrate accumulation in the fruit and consequent corrosion of the cans. Recent investigations at the Food Preservation Research Laboratory suggest that an alternative solution to the problem may be possible by a modification of processing techniques designed to break down the nitrate and reduce the oxidizing effect. These investigations are being continued together with studies of the effects of fruit maturity and post-harvest storage conditions on nitrate reductase enzymes and fruit nitrate.

A new papaw selection made by a grower on the North Coast and named Richter has been tested by the Horticulture Branch in comparison with existing varieties. The fruit has good eating and keeping qualities and the fact that it ripens uniformly reduces proneness to ripe fruit rots and permits the fruit to be picked at a more mature stage. Re-selection has been carried out by Departmental officers to fix the type. This has been achieved and the performance of this variety will now be tested in other papaw-growing districts.

The quality of papaws reaching the Melbourne market has been found to be influenced appreciably by ethylene levels and storage temperatures. Fluctuating temperatures result in better quality than when temperatures are maintained at a constant level.

Benlate (Du Pont 1991) gave excellent control of powdery mildew (*Sphaerotheca humuli*) both on the leaves and fruit in a trial conducted by the Plant Pathology Section at Redlands Horticultural Research Station.

CITRUS

Recent Horticulture Branch work on chemical weed control in citrus orchards has clearly demonstrated the superiority of complete elimination of vegetation in the tree zone under dry conditions and in sandy soils with a low water retention capacity. In a trial with young trees the differences in tree growth and cropping are outstanding. It

is expected that this will lead to a modification of sod culture to provide for strip application of weedicides in the tree zones and possible retention of the sod in the inter-row spaces to facilitate spraying and harvesting operations. Current work is being directed towards the most economic method of eliminating existing sod.

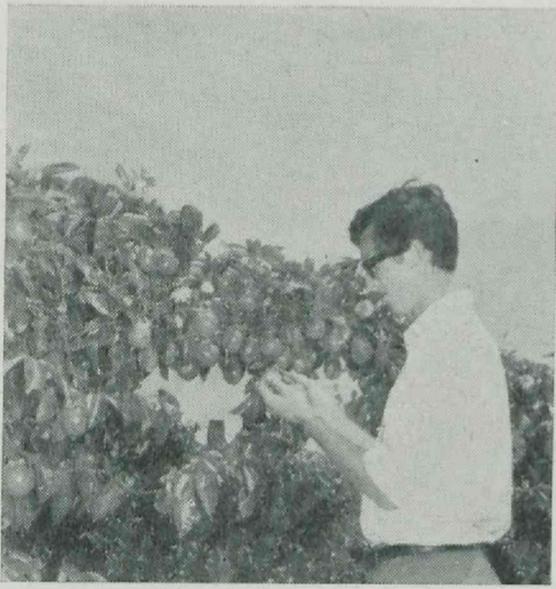
As a result of information obtained by an officer of the Horticulture Branch during a recent overseas study tour, the trickle system of "degreening" citrus, developed in Florida, has been introduced in Queensland. The method depends on preventing the accumulation of carbon dioxide, which retards the "degreening" process. It consists essentially in replacing the atmosphere of the rooms continuously at the rate of one complete change per hour while the "degreening" agent, ethylene, is continuously trickled into the room to maintain a concentration of 5-20 p.p.m. A temperature of 80°F and a relative humidity of 90% are automatically maintained. Four growers' citrus colouring rooms have been successfully converted to this system under Departmental supervision; the treatment time has been almost halved and the explosion hazard considerably reduced.

In an investigation of the processing quality of three strains of Late Valencia orange, conducted at the Food Preservation Research Laboratory, differences proved to be of little significance. However, there were marked differences in the effect of rootstock, Emperor mandarins producing much higher quality fruit than rough lemon.

Laboratory investigation of the two Eriophyid mites on citrus gave results indicating that the maori mite or citrus rust mite (*Phyllocoptruta oleivora* (Ashm.)) may be the more serious pest. The brown citrus mite (*Tegolophus australis* (Keif.)) survived better at low temperatures comparable to winter temperatures, but the reproductive potential of the maori mite was much greater and huge populations of this species could develop rapidly under favourable conditions from a few survivors.

PASSION-FRUIT

In trials by the Horticulture Branch to evaluate the processing quality of several established passion-fruit varieties and breeding lines, it was found that all except the golden passion-fruit had good consumer acceptability when processed. However, some varieties yielded appreciably more juice than others. The demand for passion-fruit has increased markedly in recent years, with considerably greater quantities being used for carbonated drinks. From time to time processors have questioned the suitability of the Redlands hybrids which have largely displaced the standard purple



Cross-pollinating hybrid passion-fruit in a breeding programme at Redlands Horticultural Research Station designed to produce good, true-breeding seedling types



Investigation of nutritional disorders in fruit and vegetable crops at Redlands Horticultural Research Station involves plant tissue analyses using an atomic absorption spectrophotometer

variety. In the above quality assessments made by the Food Preservation Research Laboratory, the Redlands hybrids have rated quite well.

MACADAMIA NUT

The Macadamia flower caterpillar (*Homoeosoma vagella* Zell.) is an early-season pest on this crop. In field studies conducted by the Entomology Section, as many as 337 eggs were counted on one raceme of flowers; 4% of racemes examined in mid-June were infested, increasing to 93% in late July. However, cold weather in August reduced further infestation and also prevented damage to racemes, apparently by killing juvenile stages. At the coldest period, eggs took 11 days to hatch. Trichlorphon 0.05% was found satisfactory as a control for the flower caterpillar, evidently killing eggs as well as larvae in the buds. A block of Macadamia trees was planted on the Maroochy Horticultural Research Station during the year especially to facilitate work on the complex of insect pests of this crop.

STRAWBERRIES

Two new varieties from the Redlands Horticultural Research Station breeding programme are being prepared for release, and plants should be available in commercial quantities for planting in the 1971 season. The distinctive feature of both of these varieties is the concentration of their cropping season, which is expected to reduce picking costs. Another line of considerable interest in the breeding programme is the progeny of the variety Tioga, which was collected in California during an overseas study tour.

Strawberry varietal trials at the Granite Belt Horticultural Research Station indicate that there are possibilities for commercial production of this crop in the Granite Belt, possibly using the introduced varieties Cambridge Vigour and Red Gauntlet.

The virus-free Special Runner Scheme conducted by the Horticulture Branch produced and found a ready market for over 800,000 runners. By far the greatest demand was for Redlands Crimson, a new variety, which was recently bred at Redlands Horticultural Research Station, and which is in its first season of commercial distribution in the Scheme.

MELONS

In rockmelon trials at Redlands, Mundubbera and Bowen, some new varieties showed distinct promise. Yanco Delight, Wescan and Top Mark were three varieties which did well at Mundubbera. Yanco Delight performed well at Redlands and other promising new varieties were Yanco Treat, Sampson Hybrid, and Weslaco. At Bowen a project to breed good fixed types from the Sampson Hybrid is in the second generation of inbreeding and selection.

VEGETABLES

Tomatoes.—Promising tomato varieties emerging from the large number of introductions under test at Redlands Horticultural Research Station include Floradel, from Florida, which has given nearly twice the yield of Grosse Lisse and A66-22, an early variety.

A comparison of the performances of tomato seedlings transplanted to the field at different stages of growth showed that there was an optimum stage for transplanting, this being at about the thirteenth leaf.

Results from a tomato nutritional trial at Bowen Horticultural Research Station suggest that a broader appraisal of fertilizer practices in the district would be desirable. Five widely different fertilizer placements varied little in their effects on yield, and unfertilized plots were equally productive.

Trials at the Redlands Horticultural Research Station on the red loams have shown that low-analysis fertilizers based on sulphate of ammonia and superphosphate are superior as sources of phosphorus to high-analysis fertilizers supplying nitrogen as diammonium phosphate. This is attributed to the presence of sulphur, which reduces phosphate fixation in these soils.

A previously unrecorded pathogenic race of *Fusarium oxysporum* f. sp. *lycopersici* caused severe losses in the tomato varieties AG 4-8 and No. 25 in the Bowen district. Both varieties had been previously completely resistant to this disease in Queensland. The new race appears distinct from the race recently described in the U.S.A., designated race 2.

Beans.—Investigations in the environment control chamber at the Redlands Horticultural Research Station have shown that faulty pod-setting of beans, which is a serious problem in the winter crop, is due to unfavourable effects of low temperatures on pollination. Studies are continuing towards further information which may assist the bean breeder in the production of a cold-tolerant variety.

A survey in North Queensland by the Plant Pathology Section indicated that *Glycine javanica* could well play a very significant role as an alternative host for the halo blight organism (*Pseudomonas phaseolicola*).

Potatoes.—In a potato rotation trial at Walkamin Research Station, the incidence of tuber rot (*Fusarium* spp.) was extraordinarily high, up to 90% in some plots. The indications to date are that there can be a high carry over of soil-borne inoculum from one spring potato crop to the next and that neither bare fallow or summer crops such as maize, dolichos, soybean and cowpea reduce the level of inoculum.

Onions.—Dichloran 4% dust gave excellent protection against storage rots (*Botrytis* sp.) of onion sets being held for planting. This has now been recommended by the Plant Pathology Section for commercial use.

GINGER

The current "seed" treatment used on ginger against rhizome rot (*Fusarium oxysporum* f. sp. *zingiberi*) is an organo-mercurial dip. This creates problems when the crop is harvested as the seed-piece must be picked out and discarded. Recent work by the Plant Pathology Section has indicated excellent control of rhizome rot with both thiabendazole and Benlate (Du Pont 1991).

PACKAGING RESEARCH

Earlier research into packing methods had led to the development and commercial adoption of a "loose-fill" or "volume fill" for tomatoes. This considerably reduced bruising of the fruit as well as the cost of packing. Recent work has been concerned with the development of a "tight-fill" using vibration settling equipment recently installed at the Redlands Horticultural Research Station.

During the year packaging research along these lines has been extended to a wider range of fruits. Particular attention has been given to the packing of stone fruit and more recently work has commenced with apples.

In association with packing research, methods of assessing container strength and performance have been developed, making use of specialized testing equipment recently installed. Precise methods of measurement of container strength have now been defined and will be suitable for use in future packing and packaging research.



The packaging research unit of the Horticulture Branch is developing improved packing methods and testing the performance of containers and packs

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.

Apart from joint projects, much intra-Departmental work is done by the Agricultural Chemical Laboratory Branch by way of soil and water surveys and by the Economic Services and Marketing Services Branches on the economics of production and marketing.

DEVELOPMENT PLANNING

Advisory services to settlers in Areas I and II of the Fitzroy Basin Brigalow Land Development Scheme have been consolidated and, to some extent, streamlined to meet the particular needs of these areas. Because of the relative isolation of many of the properties, individual officers (known as contact officers) have been assigned groups of settlers and have the responsibility of ensuring that the whole range of technical services is available to the producer. This involves some variation of the established "specialist officer" approach and calls for good teamwork and support by research workers. All contact officers meet at 6-monthly intervals and liaison with Head Office is maintained by the attendance of a member of Development Planning Branch at these meetings.

With the commencement of settlement in Area III of the Scheme, it is now possible to ensure a continuity of technical services from the initial land assessment through to advisory services. Both the land assessment officer and the contact officer participate in the formulation of initial development programmes with the new settler and a representative of the Land Administration Commission. The contact officer is supported by a Technical Advisory Group located at his headquarters. A co-ordinating Committee, comprising local representatives of the Land Administration Commission, Irrigation and Water Supply Commission and this Department, co-ordinates area activities where necessary.

Following a recommendation from a contact officer meeting, a 3-day school was conducted for new settlers in Area IA. The many initial developmental problems were considered and, as a result of the reaction of participating settlers, it is now proposed to hold such schools for incoming settlers as soon as feasible after the blocks are allocated.

Land-use assessments on new blocks in Area III, which consists largely of the McKenzie-Isaac River Basin, have continued and recommendations on land use are available for 816,543 acres in this region.

A land capability classification of agricultural and pastoral lands in the Bowen and Broken River valleys in the Collinsville area is well advanced. This is a co-operative effort with other branches, the Bureau of Agricultural Economics and the Northern Division of Department of National Development. Of nearly 700,000 acres for which an assessment has been made, about 150,000 acres are classified as suitable for cash

cropping, a further 150,000 acres as suitable for fodder or cash cropping and 250,000 acres as amenable to pasture improvement. This work provides the basis for an economic evaluation of both dryland and irrigation development of the region.

LAND USE

Field work has commenced on the land-use survey of the under-15 in. rainfall areas of south-western Queensland. This semi-arid area occupies over 100 million acres and presently supports an average of 5 million sheep and 700,000 cattle. The land-use survey is integrated with the Bureau of Agricultural Economics survey of sample properties in the area, with particular reference to the effects of drought. The Department of National Development, C.S.I.R.O. Rangeland Research and the Land Administration Commission are also involved in the project. A major aim of the survey will be to determine the principles of management of soils, vegetation and livestock with the object of maintaining a desirable economic balance consistent with the preservation of the long-term productivity of the region.

Studies by the Agricultural Chemical Laboratory Branch of the surface aggregation of brigalow soil types have pointed to the dominant influence of sodium in the formation of coarse aggregates. Organic matter has less influence than clay minerals on aggregate formation in montmorillonite clays, but has an important binding effect in kaolinitic soils.

Good progress has been made by the Division of Development Planning and Soil Conservation in the compilation of land-use technical guides, and the Jandowae guide for an area of 1.6 million acres of the western Darling Downs reached the final draft stages. Work on a second area of 3.3 million acres extending west from Chinchilla is well under way. Land systems and units have been defined and soils assessments are being made for the various land units as a prerequisite to the determination of land use (including soil conservation) requirements. The guides are unique in the Australian scene but because they enable integration of the factors affecting broad land use recommendations they are to form the bases for an improved soil conservation technology in Queensland.

IRRIGATION

In collaboration with the Irrigation and Water Supply Commission, a report on Water Conservation, Underground Water Supplies and Irrigation, Bundaberg Region, has been

finalized. The purpose of the proposed irrigation scheme in the first stage is to provide water to 1,181 existing sugar cane assignments totalling 93,433 acres and ensure an adequate supply to a further 277 assignments with a gross area of 25,000 acres, which now exploit the same underground supply as the City of Bundaberg.

A survey by the Agricultural Chemical Laboratory Branch of the underground irrigation waters in the Dalby area showed that many are unsuitable for long-term irrigation. Nevertheless they are fairly extensively used, and investigations are under way to determine if certain treatments can be successfully applied to the soil in the area concerned to prevent its physical deterioration.

Irrigation and crop production problems on the Burdekin flood-plain soils have been further investigated by the Branch. Encouraging results are obtained from gypsum applications at 5-8 tons per acre and from deep-ripping treatments, while a combination of the two enhances productivity considerably.

Salinity investigations are an important phase of the research programme in the Callide Valley. The accumulation of salt in the soil horizons may arise from natural causes or from the injudicious use of irrigation water.

Soil surveys are an important facet of the programme associated with the Emerald Irrigation Scheme, and 139,000 acres were surveyed during the year, 15 mapping units being delineated.

WOODY PLANT CONTROL

Work on the control of brigalow proceeded, mainly by the Botany Section at the Brigalow Research Station, where a series of trials begun in 1963 and 1964 is approaching completion. These trials have confirmed most of the findings of an earlier field survey of methods for controlling brigalow. Of particular significance are measurements which show substantial increases in pasture production and decreases in weight of brigalow suckers on sprayed areas compared with those not sprayed. Results to date show clearly that spraying with 2,4,5-T has an important place in the control of brigalow in almost every situation. The roles of ploughing, burning and spraying are now more clearly understood. It is anticipated that completion of the present programme in 1970 will provide almost all the basic data needed to furnish advice on the best methods for handling brigalow in every situation.

Critical reassessment of the limebush problem in the southern Darling Downs and the Maranoa showed that the economic importance of this plant has diminished during the last few years due to a change in the pattern of land use and that many areas formerly heavily infested are now being used for cash cropping.

Survey of the country to be developed in Area III of the Fitzroy Basin Development Scheme indicated that other native woody plants, mainly blackbutt or Dawson Gum, sandalwood and yellow-wood, threaten to become a much more serious problem than brigalow, largely because at present insufficient information is available about the control of these species to give firm advice for handling them in different situations. Research work on the control of these species is being intensified in two directions, firstly by an intensive study of the effects of clearing and burning techniques on subsequent regrowth and regeneration and secondly by a programme of experimentation on chemical control.

CLOUD SEEDING

Statistical analysis of rainfall and results of weather modification methods (namely cloud seeding) indicate that further progress may be possible in these fields. A reassessment of results of the 1966 cloud-seeding operation in Victoria throws doubt on the claim that a significant increase in rainfall was obtained. A preliminary analysis was performed to assess the probability that a Queensland cloud-seeding operation could demonstrate increased rainfall. The results justify a more detailed computer analysis. A decile analysis of Queensland rainfall has been performed for use in a study of beef cattle productivity by regions. The analysis enables trends to be de-seasonalized and also indicates the relationship between rainfall variability and beef cattle production.

MARKETING SERVICES

The demand for up-to-date assessments and information on market outlets, trends, and problems for our rural commodities continues to expand. During the past year, officers of the Marketing Services Branch have been involved in investigations into marketing aspects of a wide range of primary products. Some are mentioned in other sections of this report.

Review articles on the cotton bounty, the sale of second-hand fruit cases, and specific aspects of the marketing of sugar and wool are nearing completion. Studies in the marketing problems of tomatoes and potatoes are shortly to be initiated, while a report on the transportation and marketing of lucerne is expected to be completed later in 1969.

Detailed crop forecasts of area and production of wheat, barley, linseed, canary seed, grain sorghum, maize, panicum, white French millet, potatoes, onions, peanuts, navy beans and soybeans were issued, as in past years.

Monthly reports on production trends and quarterly reports on the poultry industry in south-eastern Queensland continued, while current information on overseas grain markets was published monthly.

Daily and weekly market reports were issued on prices of fruit, vegetables and farm produce at the Brisbane Market. In addition, daily market reports were also issued on behalf of the Fish Board.

FARM MANAGEMENT ACCOUNTING SCHEME

Membership in the farm management accounting scheme conducted by the Economic Services Branch has risen to almost 300. These members receive quarterly and annual financial statements of their farming operations. Regular farm visits are made by agricultural economists to assist in the interpretation of the results and to prepare budgets for members on request. With budgeting, the records provided are utilized for their essential function as a basis for future planning. Improvements to the scheme effected during the year included redesigning the recording books for use in 1969-70. Results from this scheme are published annually and provide valuable information for extension purposes.

While membership of this scheme has been mainly confined to the dairying and agricultural areas of the State in the past, this service has now been extended to the pastoral industry with the establishment of sheep groups at Muttaborra and Dirranbandi this year.

VIII. Special Field and Laboratory Services

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

SOIL CONSERVATION

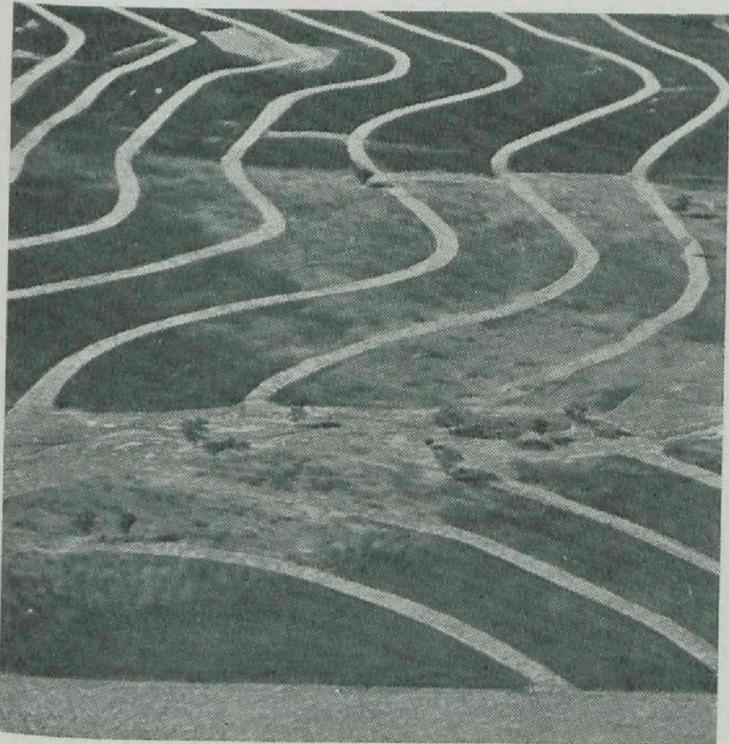
The technical services provided to landholders by officers of the Soil Conservation Branch included site surveys for structures and measures totalling 335,000 chains in length. As a result, contour farming methods were applied to 157,000 acres of cultivation land, bringing the total area worked on the contour in Queensland to 915,000 acres. The area treated during the year was a record, being 28,433 acres higher than the previous highest annual figure set in 1966-67. In the Burnett region alone the aggregate length of lines surveyed in 1968-69 was the equivalent of the distance from Brisbane to Cairns.

The earthworks constructed by landholders with Departmental guidance involved the movement of about 15 million cubic yards of soil, which is treble the embankment fill for the 1.2 million acre-feet Fairbairn Dam.

Strip cropping on the flood plains of the Darling Downs is working out very well and the practice is expanding steadily, reaching 14,000 acres for 1968-69. Continued pleasing reports come from farmers concerning the effectiveness of water spreading by the strips. Cases have been reported where all runoff is being held on strip-covered farms while neighbouring properties worked in the conventional manner lose both soil and water. There are cases where water has

been ankle-deep below fallowed strips, yet this water has been absorbed in the lower stubble strips. Crop yields show an increase where excess water comes in and is absorbed.

Contour grass strips are being applied to an increasing extent on gently sloping lands and these relatively inexpensive measures seem destined to play an important part in soil conservation programmes, particularly where they are applied before serious erosion occurs. Some 43,000 acres of grass strips were installed during the year, mainly in the western Darling Downs and West Central Queensland regions.



Native pasture strips 33 ft. wide left for soil conservation purposes on cultivation land in the Maranoa

Experience in trials and by farmers has emphasized the inadequacy of available machinery to work with stubble, and this, together with the wider acceptance of the principle that stubble-mulching will significantly reduce soil losses from erosion, has led to concerted action, supported by the Council of Agriculture, to import and test stubble-mulching machinery from the United States.

Discussions have been held with machinery companies, and it is anticipated that a complete range of equipment from primary tillage to planting will be made available by one firm for testing by Departmental officers in conjunction with farmer groups. An officer is to visit the United States to inspect techniques and machinery and he will be accompanied by a farmer member of the Soil Conservation Advisory Committee.

The fate of rainfall after striking the soil or its cover of vegetation has a significant influence on the erosion cycle. If a major part is absorbed and used to promote vigorous plant growth the cycle is interrupted. If much runs off it carries soil with it and plant life suffers from inadequate moisture. An initial 3-year study of the fallow moisture accumulation process has been completed and will enable a dynamic computer model to be evolved based on a weekly soil-water balance. This programme will help to achieve an understanding of the processes involved in water entry and accumulation on Darling Downs clay soils.

The Wellcamp Soil Conservation Project Area plan was approved by the Governor in Council on September 21, 1968, and all landholders have agreed to a programme for implementation of works. It is apparent that the runoff control plan for the area will be completed much earlier and to better standards than would have been the case under non-statutory procedures. One new Project Area has been constituted during the year and discussions have been held in two areas in connection with the possible constitution of Soil Conservation Districts.

The financial assistance provisions of the Soil Conservation Act are not being widely used and only four applications, totalling \$8,692, were received for assistance. In the 4 years since inception of this arrangement, 29 applicants have benefited by loans totalling \$838,878.

The Dairy Pasture Subsidy Scheme has influenced the retirement of erosion-susceptible cultivation to perennial pasture and this has applied particularly in the south-east coastal region. Under coastal conditions pastures once established are rarely susceptible to erosion and this change in land use is a very desirable soil conservation practice. At this stage the pastures are considered permanent and the cost of establishment is such that any change back to cultivation is not likely while the pasture remains productive.

The South Burnett district has always been to the fore in the implementation of structural soil conservation measures but more attention to agronomic aspects is needed. Since over-cultivation and loss of protective vegetable cover from the soil still result in erosion, steps have been taken to investigate the possibilities of minimum tillage methods. This work is now proceeding but conclusive results are unlikely to emerge for some little time.

Land development is proceeding rapidly in the western Darling Downs and Maranoa regions and there is evidence that wind erosion may present problems. This aspect, together with the possibility of increased incidence of flooding, provides reason for concern and it is clear that increasing attention must be devoted to this matter of indiscriminate clearing.

ARTIFICIAL INSEMINATION

Artificial insemination in the dairying industry is effected through 21 artificial insemination co-operative associations, which obtain their semen supplies mainly from the Department's Artificial Insemination Centre at Wacol.

Because of the trend away from dairying in cream supply areas, there does not appear to be any immediate prospect of the number of distribution centres increasing. In fact, some centres are feeling the strain of reduced demand, and centres at Bundaberg, Monto, Mundubbera, Biggenden and Nanango provided only restricted seasonal services. While relieving the financial situation, however, this has created difficulties regarding employment of technicians.

The Department provides training for inseminators and six Departmental officers and eight nominees of co-operative associations were granted licenses during the year. Refresher courses were held at Murgon and Brisbane.

A total of 59,000 cows was inseminated in Queensland during 1968 with semen produced at the Wacol Centre. This was 1,000 fewer than in 1967. Semen was supplied to other Australian States and to Malaysia, New Zealand and the U.S.A.

DIAGNOSTIC AND IDENTIFICATION SERVICES

The Agricultural Chemical Laboratory Branch handled over 20,000 samples in its main laboratory: these comprised mainly soils, waters, plants, pesticides, stock foods and fertilizers.

Advances in instrumentation in the laboratory have increased work output. A Steinlite Oil Testing Unit has permitted the rapid determination of oil contents of soybeans, linseed, safflower and sunflower seeds. Complete automation of routine analyses of pasture samples has been made possible by the provisions of a data acquisition unit for use with a dual channel auto-analyser.

Identification and advisory services by the Botany Section were maintained at about the usual level, approximately 12,000 specimens being identified during the year.

With the improved facilities available in the new Botany Building, taxonomic work gathered momentum. "Contributions from the Queensland Herbarium No. 1" was very favourably received and five new journal series are now being received in exchange for this publication. During the year Contributions Nos. 2 to 8 were prepared. A further paper on grasses was published in the Proceedings of the Royal Society of Queensland.

An officer of the Botany Section, working jointly with a soil scientist from C.S.I.R.O., prepared a new account and map of the vegetation of Cape York Peninsula which was accepted for publication by the Royal Society of Queensland.

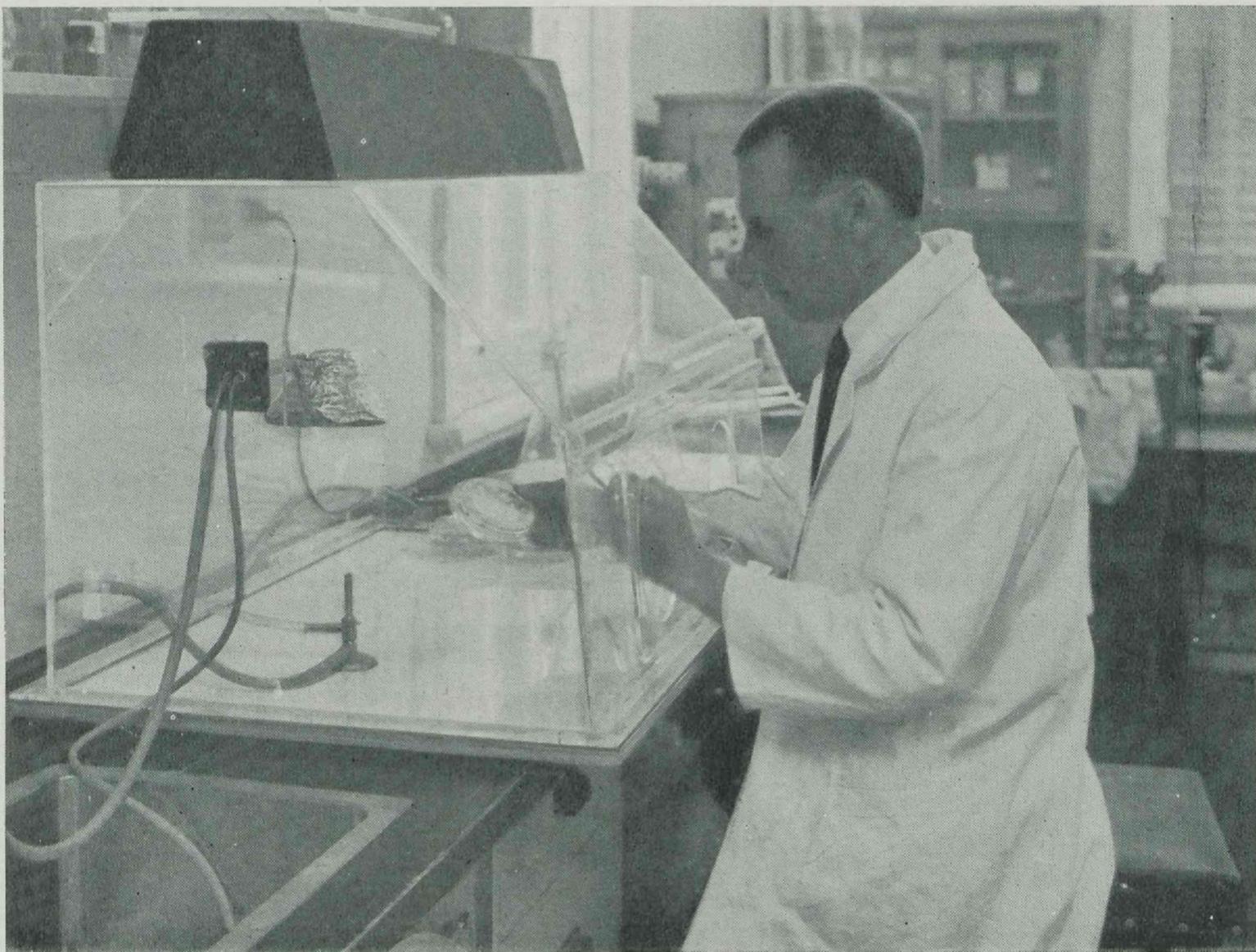
Botanical surveys were made in six existing or proposed National Parks or Scenic Reserves in various parts of the State from near the southern border to as far north as the Bloomfield River in North Queensland. Two papers on the vegetation of Fraser Island were published.

An extensive field survey was made of *Acacia* in south-western Queensland.

At the request of the Beach Protection Authority recently set up within the Co-ordinator-General's Department, a botanist has been made available to make a critical review of the known information about the use of plants stabilizing coastal sand dunes. A programme of research on techniques of establishment and maintenance is being planned in co-operation with the Co-ordinator-General's Department.

Transfer of the 500,000 specimens comprising the Queensland Herbarium to the new building was completed about the middle of 1968. A complete re-arrangement was put in hand but this will take several more years to complete. These specimens are now adequately housed in a fireproof building for the first time. The botanical library, which is one of the best in Australia, is now also adequately housed and during the year cataloguing was brought up to date.

An active programme of loans and exchanges of botanical specimens was continued. Loans outward totalled



A special cabinet used in the plant pathology laboratory for the examination and handling of micro-organisms under aseptic conditions

1,123, inward 242. A total of 3,102 specimens was sent to other institutions on exchange and 5,987 specimens were received during the year.

Botanists from overseas and from other Australian institutions continued to utilize the facilities of the herbarium and library. Following the official opening of the new herbarium in September 1968 a meeting was held of Herbarium Directors and Curators, attended by Botanists from most States and from New Guinea. Problems relating to exchanges, labelling of specimens, arrangement of herbaria and retrieval of information by computer were discussed.

At the Animal Research Institute, diagnostic services were maintained at a high level.

In the Biochemical Branch, samples involving multiple analyses numbered 2,726, while 2,720 samples from dipping vats were analysed. A total of 11,259 samples from Departmental trials was also analysed. Advances in nutritional and physiological chemistry and in toxicology demand more

sophisticated chemistry than previously. There is increasing technical complexity inherent also in providing a dipping vat analytical service embracing 11 separate acaricides.

The Pathology Branch at the Animal Research Institute processed 9,800 batches of specimens and its subsidiary Animal Health Station at Townsville 1,200 batches. Most specimens were concerned with mortality or loss of commercial production in commercial animals. Others involved tests on animals intended for export.

The Branch continued to produce vaccine for tick fever of cattle and 1,080,000 doses were used during the year, mostly in Queensland but also in other States and Malaysia.

Nearly 45,000 sample of dairy products and materials were examined in the various laboratories of the Dairy Research Branch. Some were taken and analysed under quality control schemes, others were designed to directly assist farmers and factories, while some have been necessary in order to issue N.A.T.A. certificates to help exporters establish the quality of dairy products.

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 the Dairy Research Branch and the Dairy Field Services Branch have prime responsibility for standards control of dairy produce and the Slaughtering and Meat Inspection Branch for meat and meat products.

AGRICULTURAL CHEMICALS CONTROL

Steps were taken, in conjunction with other States, to place agricultural chemicals control on a uniform basis throughout Australia. A Technical Committee on Agricultural Chemicals was formed between the Commonwealth and States, to assess the toxicology and efficacy of new agri-

cultural chemicals. All new chemicals for use in agriculture in Queensland must now be cleared through this Committee, before their registration is considered in Queensland.

Changes were made in registration procedure which were aimed at protecting the welfare of primary producers and the general public. One of these changes, which will assist

primary producers in fertilizer quantity calculations, requires manufacturers to label fertilizer composition in terms of chemical elements rather than in the form of oxides of the elements. Another change in registration procedure is expected to reduce possible dangers to human health through contamination of milk by penicillin residues from mastitis treatment: registration of penicillin udder infusions is now limited to those containing an approved marker dye.

The number of agricultural requirements registered reached a record of 4,528, this being 245 higher than the number for the previous year.



This unusual effect on a eucalypt tree was traced to weedicide drift

During the year, the Agricultural Chemicals Distribution Control Act of 1966 was amended to bring its security provisions into agreement with proposals which were agreed to by all Australian States.

The requirements of the Act with respect to aerial and ground distribution, and increasing public awareness of the hazards associated with uncontrolled application of herbicide, have caused a large increase in work in the pesticide section of the Agricultural Chemical Laboratory Branch.

A thorough examination was made of methods of analysis of herbicide residues, particularly of the "hormone" type, and methods more suitable to our requirements have been made. The group of analysts concerned has now acquired considerable expertise in residue analyses on plant material, and from their investigations a number of scientific papers have been prepared.

EXPORT INSPECTIONS

A record export of wheat, 605,455 tons, was inspected at Pinkenba and Gladstone on behalf of the Commonwealth authorities by Standards Branch officers. Barley was included under the Commonwealth Exports (Grain) Regulations for the first time. The initial shipment inspected was found to be insect infested and some 14,928 tons were ordered to be fumigated as a consequence.

Fumigation of citrus fruit against fruit fly has enhanced exports of citrus from Queensland. There was an increase of 50% in citrus exports during 1968-69, due mainly to the acceptance of fumigated fruit by the Philippines. The quantity of apples inspected prior to export was more than double that of the previous year.

During the year, 3,064 cattle were exported to New Guinea and 138 cattle to the Philippines. One hundred and thirty pigs were exported from the Darling Downs to Japan, Malaysia, Solomon Islands and Fiji.

SEEDS

There was a decline of 11% in the number of tests carried out by the seed testing laboratory in 1968-69. Most of this decline was due to a decrease in the numbers of samples taken by Inspectors. The number of tests of a co-operative nature undertaken by the seed testing laboratory in conjunction with other Branch officers, the C.S.I.R.O. and seed merchants totalled 760, compared with 264 for the previous year.

Production of certified seed during 1968-69 was much below that of the previous season. Only about half as much grain sorghum was certified in 1968 as in 1967. Large carry-over stocks from the 1967 season was the main reason for this reduction, although poor seasonal conditions further reduced the acreage planted.



Testing milk for quality in the Otto Madsen Dairy Research Laboratory in Brisbane

DAIRY PRODUCTS

The laboratories have continued to analyse milk samples in order to maintain and/or improve the quality of liquid milk. In the Metropolitan area this work is carried out in direct assistance to the Brisbane Milk Board, while in country areas outside the control of the Brisbane Milk Board the work is of value in ensuring a high quality milk supply for consumers. Samples of bottled pasteurized milk from all factories in the State are analysed no less frequently than once weekly, the results being made available to factories and field officers. The marked uplift in quality of the Brisbane milk supply is shown in the diagram.

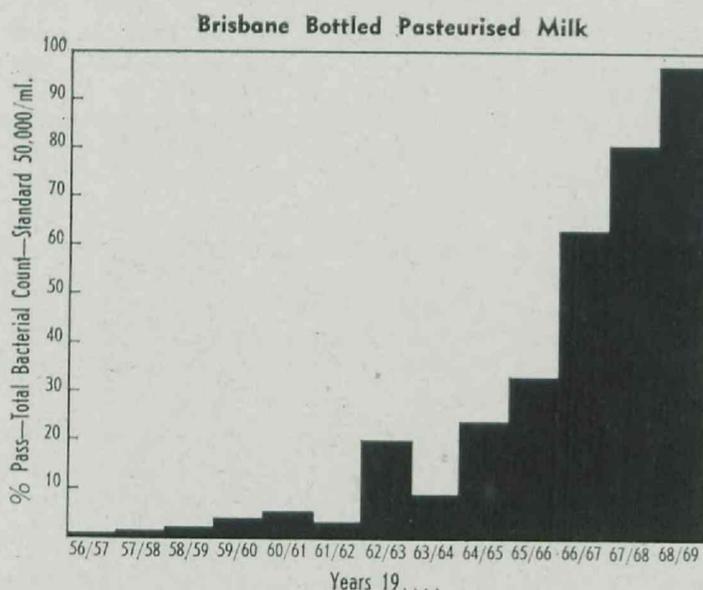


Diagram showing improvement in the quality of Brisbane bottled pasteurised milk since 1956-57

The Butter Improvement Service has been continued. During the year the advisory standards under this service were revised and upgraded. However, even under these new

standards 20% of the butter factories received 80% or more on the hygiene score. With very few exceptions the bacteriological quality of Queensland butter is very good.

A regularly conducted scheme for cheese manufacturing hygiene and cheese composition is conducted to assist cheese factories in maintaining high bacteriological quality and satisfactory composition for their product. In addition, a cheese starter culture service has been maintained to assist factories in the use of pure highly active starter cultures so necessary in cheese manufacture.

All samples of milk have been regularly analysed for the presence of penicillin residues. By means of this work the incidence of samples found to contain such residues is kept to a very low order.

EGGS

Officers of the Dairy Research Branch stationed at the Laboratory of the South Queensland Egg Marketing Board, Brisbane, have, with the assistance of Egg Board staff, continued to carry out analyses of pulp and shell eggs. Total of 4,624 samples of pulp and 847 samples of eggs in shell were analysed bacteriologically. Certificates have been issued for pasteurised export pulp, certifying to bacteriological condition and freedom from Salmonella organisms. In addition, analyses for moisture and resazurin tests have been carried out.

FARM MACHINERY

With increasing mechanization, there has been increasing demand for agricultural engineering advice both from primary producers and from Government departments. This advice ranges from grain drying through implement haulage requirements to mechanization of pig and poultry production enterprises.

There has been emphasis also on the design and manufacture of experimental equipment for research purposes. Linkage-mounted planters capable of accurate placement of seed and fertilizer for grain crop research have been designed and made. Other projects include the production of a pasture furrowing machine, a self-propelled sprayer, an insect collecting device and a laboratory soil shaker.

X. Review of the Primary Industries in 1968-69

BEEF AND VEAL

Favourable seasonal conditions over most of the State during the winter-early spring of 1968 resulted in cattle continuing to improve in condition at a time when body-weight loss is a normal occurrence, and cattle entered the subsequent drought in strong condition. The situation in the south-eastern corner was not so favourable and cattle started to decline in condition from the onset of winter.

When the failure of normal summer rains became apparent, cattlemen quickly adopted drought relief measures, including reduction of stock numbers. There was a ready outlet for sale or agistment in the southern States, where seasonal conditions were very good, and the exodus of cattle was heavy. It is likely that many of the agisted cattle will not be returned to Queensland.

Though losses through death have not been particularly high, the combined loss through premature disposal and deaths will be a major setback to the industry, coming at a time when it was still recovering from the effects of the 1964-65 drought.

Production of beef and veal at Queensland meatworks is estimated at 300,000 tons for 1968-69. This follows a 17% increase in production that was apparent for the first 9 months of the year. The improved seasonal conditions early in 1968-69 lifted production with higher slaughterings and heavier animals. Towards the end of the year, the dry conditions were reflected in the high slaughterings of lighter weight animals.

Fat cattle values have shown only minor fluctuations throughout the year and prices have remained fairly buoyant at levels operating over the previous two years. This is despite greater numbers of cattle being forced onto the market by drought and increased slaughterings following voluntary restrictions on beef exports to the United States in October-November 1968.

Australian exports of beef and veal for the first 9 months of 1968-69, amounting to 184,086 tons, were below the 187,274 tons exported over the same period in 1967-68. This was the result of reduced exports to the United Kingdom. Exports to the United States, Japan and Canada were all higher than for the same period in 1967-68.

In October 1968, the Australian Meat Board voluntarily imposed restraints on exports to the United States under the Meat Export Diversification Scheme in order to avoid the imposition of import quotas by the United States. The voluntary restraints by Australia and other exporters successfully maintained U.S. imports of beef and veal below the "trigger" level which would oblige a compulsory quota system.

The Japanese import quota on beef and veal was lifted to 21,000 metric tons for the 1968 Japanese fiscal year. Australia is the major source of Japanese imports and provided 72% of total imports in the calendar year 1967.

Australian consumption of beef and veal in 1967-68, estimated at 483,000 tons, was 44,000 tons above the 1965-66 level. The increase in consumption of beef was in conjunction with rises in the consumption of all other meats, and is expected to rise again in 1968-69.

Per capita consumption of beef and veal in Australia rose to 90.7 lb. per head in 1967-68. This was higher than consumption in 1966-67 but still below the level of 92.6 lb. per head in 1965-66.

WOOL

Generally, 1968 winter conditions in the sheep areas of Queensland were good following good relief rains but conditions deteriorated rapidly after the end of 1968. Some areas received drought-relieving rains in March, but large areas did not receive satisfactory rainfall until the end of May.

The Bureau of Agricultural Economics has estimated Australia's wool production for 1968-69 at 1,832m. lb. greasy, an increase of 64m. lb. or 3.6% over the revised estimate of 1967-68 production.

In Queensland, the average price at auction in 1967-68 was 43.5c per lb., a fall of 3.4c per lb. on the previous year. The 1968-68 season opened with an average price of 45.3c per lb. and improved to 49.8c per lb. in October. Thereafter there was a general weakening to the end of the season when prices were as low as 43c per lb. at the end of May. The average price for 1968-69 is estimated to approximate the 1967-68 average.

To the end of June 1969, 740,000 bales were sold at Brisbane auctions and by private treaty, an increase of about 8.5% on offerings for the 1967-68 season.

PIGMEATS

Australian pigmeat production for 1968-69 is estimated at 160,000 tons and substantially exceeds the previous record production of 149,172 in 1967-68. The effect of the drought in Queensland during 1968-69 resulted in exceptionally high monthly slaughterings since December 1968 and a record production of pigmeat is expected for 1968-69. However, pig numbers and pigmeat production are expected to fall in 1969-70 as a result of abnormally high slaughterings during the first half of 1969.

The very rapid increase in production which occurred during the previous year continued during the early part of this year but was checked, first by a decrease in price, particularly for overfat pigs, and second by rising food costs occasioned by the drought. Production has continued at a record level but an unknown proportion of slaughterings have been due to unloading of stock, particularly by the smaller producers. It appears that total production may exceed that of the previous year by about 8% but may shortly fall from its record level.

Many smaller producers have left the industry as a result of a decrease in the availability of skim-milk, general economic pressures and the effects of the drought. Medium and large producers, who are more fully committed to the industry and are better able to plan ahead, have increased production but at a slower rate than previously.

Industry organization has been stimulated by the less favourable economic climate and signs of possible over-production. The Queensland Commercial Pig Producers Council and a newly formed Pig Industry Promotional Association have been engaged in discussions over industry representation.

EGGS

Egg producers' returns in Australia during 1968-69 were an improvement on the unsatisfactory levels of the previous year. This improvement resulted from better returns from overseas markets and from increased local consumption. Controlled production in the area of the South Queensland Egg Marketing Board declined by 6% to 19.6m. doz., whereas Australian overall production increased by approximately 2.5%, with the main increases occurring in Victoria and New South Wales.

Average net returns received by suppliers to the Egg Marketing Board were 40.78c per doz. (all grades), compared with 35.94c per doz. in 1967-68. From these returns must be deducted Commonwealth hen levy payments made by producers, estimated at approximately 6 to 7c per doz., depending on rate of lay. The actual levy rate is \$1 per hen per annum.

The long-term outlook for the industry is still uncertain, and will depend on the extent to which Australian consumption can be increased and on the extent of surpluses which have to be sold on overseas markets, at present predominantly Japan and the United Kingdom.

Other factors which will have an important bearing of the future of the industry are the future of the British Egg Marketing Board's operations, the extent to which subsidy may be extended in that country, the entry of Britain to the E.E.C. and that Community's agricultural policy.

DAIRYING

Australian production of butter and cheese in 1968-69 amounted to 196,500 tons and 67,750 tons respectively. Butter production remained relatively stable but cheese production increased.

Queensland produced the lowest quantity of butter since 1923 in 1968-69 and the lowest output of cheese for 10 years. Butter production was about 19,250 tons, while approximately 7,750 tons of cheese were produced.

The principal reasons for the continued decline in dairying in Queensland were the drift from dairying and a succession of unsatisfactory seasons culminating in severe drought. Because of the adverse seasonal conditions in 1968-69, not only in Queensland but particularly in Victoria, Australia was unable to fill its butter quota allocation on the United Kingdom market.

The United Kingdom, however, remains the chief outlet for Australian butter and cheese, and prices remained steady at 300 and 225s. per cwt. respectively, although some discount specializing was necessary. Prospects for a retention of these prices are not bright.

A new 5-year Commonwealth Stabilization Plan commenced in 1967-68. The main features of the Plan are the continuation of \$27m. bounty allocation for each of the 5 years on account of the production of butter and cheese and related products, with a review of an annual guaranteed return having regard to average costs of production. There is also provision for the continued payment of \$800,000 on account of the export of processed milk products.

A Commonwealth Government scheme for the rehabilitation of the dairy industry is still under negotiation. The State Government dairy pasture subsidy scheme continued to materially assist in the rehabilitation of dairy pastures, resulting in improved milk yields.

A sales promotion scheme financed by the industry from a levy of 0.75c. per lb. on local sales of butter, and administered by the Commonwealth Dairy Produce Equalization Committee Ltd., operated throughout the year and was successful in increasing butter consumption throughout Australia.

SUGAR

The 1968 sugar harvest of 17.4m. tons of cane yielded 2.6m. tons of 94 n.t. sugar, an increase of 0.4m. tons on the previous year and the highest production on record.

The overall average price of \$81.53 per ton (including devaluation compensation) was \$1.85 per ton below the 1967 figure. Sugar within peaks averaged \$89.29 per ton, while excess sugar realized \$38.55 per ton. The total value of the crop was \$212.26m.

During the first half of 1968-69, world market prices remained at very low levels, but with the successful conclusion of a new International Sugar Agreement, the Daily Price on the London Terminal Market increased sharply and after allowance for sterling devaluation was at the end of June the highest since late 1964. Australia's basic export quota under the new agreement of 1.1m. tons is second only to that of Cuba and is in addition to the export quota to the United States of America and the Negotiated Price Quotas under the Commonwealth Sugar Agreement.

Negotiations between the signatories to the Commonwealth Sugar Agreement were held during 1968 and resulted in Australia retaining a Negotiated Price Quota of 335,000 tons at stg. \$43.5 per ton of 96 n.t., for the period 1969-71. The basic Overall Agreement Quota of 600,000 tons was retained and adjusted for 1969 to 662,000 tons. An understanding was also reached that, in the event of the accession of the United Kingdom to the European Economic Community, Britain could not be committed to contractual obligations under the agreement after December 31, 1974. However, in this event, Britain would endeavour to find other ways of achieving the agreed objectives of the Agreement.

In other developments of the international scene, Australia secured for 1968 a final quota of 181,496 long tons on the United States domestic market. The 1969 quota has been fixed at 172,265 tons but is subject to increase in the event of shortfall declarations by other suppliers during the year.

WHEAT

A record planting of 1.8m. acres in Queensland in 1968-69 is estimated to have produced 42m. bus. of wheat, 6.3m. bus. more than the previous record of 35.7m. bus. in 1966-67, and well above the 1967-68 production of 27.4m. bus. Average yield is estimated at 23.3 bus./ac., compared with 18.6 bus. in 1967-68. The Western Downs and Central Queensland had an excellent season, with yields above average. The quality of the grain was exceptionally high and about 85 per cent. of the crop was graded as "prime hard". The much larger crop put considerable pressure on the available State Wheat Board bulk storages, which are expected to reach 30m. bus. by the beginning of the 1969-70 season.

Due to the lack of summer rains the outlook for the new season is not bright. However, as at the end of June, most districts had received sufficient rain to commence planting but further general rain will be necessary to assure a good crop.

The 1968-69 crop was the first under the current Wheat Industry Stabilization Plan. The new scheme includes some radical differences from the previous ones, including a departure from the cost of production formula and the severing of the link between the guaranteed price and home consumption price. For the 1968-69 season the home consumption price is \$1.71 per bus. bulk f.o.r. ports and the Commonwealth Government guaranteed price for exports up to 200m. bus. is \$1.45 per bus. bulk f.o.b. ports.

The 1968-69 Australian harvest is estimated at a record 540m. bus., nearly double the 277m. bus. recorded in 1967-68, and well above the previous record of 406m. bus. recorded in 1966-67. Large increases were experienced in New South Wales, where production was double that of 1967-68, while in Victoria production was trebled. For the first time exports of grain and flour are expected to exceed 300m. bus. compared with 280m. bus. in 1967-68. However, carryover wheat is estimated at 264m. bus., compared with 50m. bus. in 1967-68.

Due to the record production from the 1968-69 crop and the consequent storage and marketing difficulties, the Commonwealth Government announced that the first advance rate of \$1.10 per bus., which has been the rate for many years, would be limited to an overall delivery to the Australian Wheat Board of 357 m. bus.

The Australian Wheat Growers' Federation proposals for achieving this limit, which envisage delivery quotas, was accepted in principle by State and Commonwealth Governments, and it is expected that the necessary legislation will be enacted in 1969-70.

BARLEY

Barley production from the 1968-69 crop is estimated at 11.5m. bus., some 3m. bus. higher than from the 1967-68 crop. Nearly 10m. bus. of this production are expected to come from the Darling Downs. Crops elsewhere did not experience a very good season.

Planting indications for 1969-70 appear to be about 20% higher than last year, and can probably be attributed to the proposed introduction of wheat quotas.

Receipts by the Barley Marketing Board totalled 6m. bus., compared with 3.9m. from the previous crop. Some 30,000 tons were exported. A disturbing feature was the sudden cessation of deliveries in November resulting in only 50% of the crop being received by the Board. The extent of sales outside the Board intensified the problem affecting the Board's ability to sell forward and it is regrettable that lack of grower support could adversely effect the future development of local and interstate markets on an organized basis.

GRAIN SORGHUM

The Central Queensland Grain Sorghum Marketing Board received a record 89,600 tons of the 1968 crop. Of this quantity, a record 67,300 tons were exported, all going to Japan.

Severe drought conditions throughout the State limited 1969 plantings to an estimated 250,000 acres, of which about 140,000 acres have been retained for harvest. Production is estimated at 3m. bus., the lowest since 1951. The expected yield of 12 bus. per acre sown is the lowest in more than 20 years. In Central Queensland, more than half the grain sorghum failed or was fed off and the proportion retained for harvest is expected to return a poor yield per acre.

As a result of poor prospects, the Central Queensland Grain Sorghum Marketing Board has exempted growers from delivery provision of the Acts for the 1969 season.

MAIZE

The area planted to maize in 1969 is estimated at 130,000 acres, compared with 147,000 acres in 1968. However, due to poor seasonal conditions only 95,000 acres are expected to be harvested. Production is estimated at 2m. bus., giving a yield of 15.4 bus. per acre sown, the poorest result in post-war years.

The only area with any bright prospects at all is the Atherton Tableland, where crops are late but are reported to be making good progress. In this area, the outlook for high yields from rust-resistant hybrid varieties is very promising, particularly with the better acceptance by farmers of fertilizer application. Stem and cob rot diseases still remain a problem.

PEANUTS

Peanut production in Queensland during the 1968 season fell substantially from the record level achieved during the previous period. At 30,110 tons, production was 27% lower than that recorded during the 1967 season.

Although approximately 5,000 tons were carried over from the 1967 season, the Australian market found no difficulty in absorbing available supplies during 1968-69.

It is now probable that yields from the 1969 season will be one of the lowest recorded in recent years following severe drought conditions experienced in the main growing areas. Production is currently estimated at 13,000 tons from 72,000 acres sown.

Following publication of the Tariff Board report on Vegetable Fats and Oils in September 1968, the Commonwealth Government deferred consideration of the Board's recommendations in relation to the peanut industry until it was in the possession of further information not contained in the Board's report. Accordingly, the Bureau of Agricultural Economics was instructed to conduct a survey of the overall economic situation of peanut growers and field work is expected to commence early in the new year.

NAVY BEANS

The 1968 navy bean season was a record from many aspects, producing an estimated 5,400 tons from 13,000 acres planted. For the first time, the Queensland industry was in a position to satisfy a significant portion of Australia's annual requirements. Severe drought conditions experienced in the South Burnett during the growing period had a disastrous affect of the 1969 crop and it is estimated that the harvest will now not exceed 950 tons.

TOBACCO LEAF

In 1968, Queensland tobacco growers sold 15,171,234 lb. of tobacco leaf at an average price of 116.7c per lb., realising \$17,697,997. This compared favourably with the average price of 109.9c per lb. received for the Queensland crop at the 1967 sales. The substantial shortfall in Victorian production, because of drought conditions, meant that Queensland growers were able to sell their entire production.

The 1968-69 growing season has been a good one and to date 13.6 m. lb. of the State's crop has been sold at an average price of 122.4c per lb. This compared with sales of 13.6 m. lb. of leaf at an average of 118.7c per lb. at a similar stage of the 1968 sales.

The most interesting development in the operation of the Australian Stabilization Scheme during the past year was the establishment of the Tobacco Industry Leaf Finance Agency. This agency was set up by grower marketing boards in New South Wales, Victoria and Queensland in consultation with the Australian Tobacco Board to help overcome some of the problems faced in financing the purchase and carrying of stocks of Australian tobacco leaf. This scheme has apparently helped to overcome some of the few remaining problems in the Stabilization Scheme.

Growers rejected at a ballot a Hail Insurance Scheme prepared and submitted to them by the Tobacco Leaf Marketing Board.

COTTON

Australian production of raw cotton from the 1969 season is estimated at 161,000 bales and exceeds the previous record of 150,000 bales from the 1968 harvest. In Queensland, a harvest of 19,000-20,000 bales is expected in comparison with 17,300 bales in 1968.

Yields in Queensland from irrigated areas were good and averaged approximately 2 bales per acre. Quality of raw cotton was good. The harvest in some irrigation areas suffered from water restrictions and many dryland crops failed through drought.

The Commonwealth Government announced its intention to phase out bounty assistance over the next three seasons as production has now virtually reached the level of Australian spinners' requirements. The effect of this will probably be the concentration of production under irrigation, where economic yields can be expected, and to areas where good quality can be attained with reasonable certainty.

During the year, the Cotton Marketing Board brought a new ginnery into operation to serve the expanded production in South Queensland. If production increases further in the St. George area, and in new irrigation areas of Central Queensland, at least two further ginneries can be anticipated in the next 3-4 years. The final outcome will depend on the viability of cotton-growing without subsidy, on an increase in demand by spinners, and on the entry of Australian manufacturers into cotton print goods manufacture.

OILSEEDS

Queensland soybean production from the 1968 season amounted to 849 tons from 2,369 acres planted and was again far short of satisfying Australian demand.

Interest in soybean production continued and it is currently estimated that plantings in respect of the 1969 season will amount to some 5,200 acres. However, due to severe drought conditions, it is estimated that only 4,500 acres will have been retained for harvest, which will yield an estimated 1,200 tons.

Safflower seed production in 1967-68 amounted to 14,560 tons from 95,351 acres planted, compared with 23,037 tons in 1966-67. The reduced production was directly attributable to the generally adverse seasonal conditions experienced in the main growing areas. With the development of drought conditions, particularly in Central Queensland, it is currently estimated that only 30,000 acres will be planted in safflower in respect of the 1968-69 season and it is not expected that production will exceed 11,000 tons.

The 1967-68 linseed season produced 6,571 tons from 27,764 acres planted, compared with 7,300 tons being harvested from 17,800 acres during the previous season. Prospects for the 1968-69 season indicate another crop of about 7,500 tons.

PINEAPPLES

Production for 1968-69 is estimated at 108,000 tons from 11,500 acres, a yield decrease of 15% on the record 1967-68 level.

The combination of the record 1968 summer crop and unseasonal weather conditions, which forced the destruction of some fruit which was beyond canners' capacity to handle, was instrumental in the establishment by the industry itself of the Pineapple Industry Rationalisation Plan. The Plan, which is intended to stabilize the industry at an economic level, is based on a two-pool system and came into operation in December 1968. At the same time, the Pineapple Direction was suspended in order to enable the operation of the Rationalisation Plan.

Sales of solid canned pineapple on the Australian market during 1968-69 showed considerable improvement and the average price paid to growers for canning fruit rose slightly. Average returns from smoothleaf pineapples on the Brisbane wholesale market (fresh fruit) also showed some improvement on the returns for the previous year.

Plantings for the current season have been similar to last year, except in the Central district, where a reduction of about 30% is expected. This will reduce the area under crop in that district to approximately 2,000 acres.

CITRUS

Citrus production in the State during 1969 is expected to reach about 1 m. bus. from a total area under crop of about 6,300 acres. This represents a slight decrease on the production for the previous year, largely due to a heavy fruit drop in early varieties resulting from the dry conditions in non-irrigated orchards.

In the Central Burnett district the 1968 crop of 810,600 bus. was an all-time record in spite of the unfavourable conditions. This included 221,000 bus. of Washington Navel oranges and 210,000 bus. of Ellendale mandarins. A total of 89,600 bus. of all varieties from the Central Burnett area was processed in 1968.

Exports of citrus during 1968 represented only 9.5% of the total production and mainly comprised Late Valencia oranges and Ellendale mandarins. The reduction in the volume of exports appears to have been caused by increased competition from overseas countries, particularly South Africa, with a resultant reduction in prices.

Recent plantings again indicate a preference for mandarin varieties, particularly the Imperial variety, as compared with oranges.

BANANAS

Except in the far northern districts, dry conditions had an adverse effect on banana production, estimated State yield being 900,000 bus. from 10,700 acres. A high proportion of ripened fruit during the early summer months had very little flavour, depressing both sales and prices. Prices improved in the first half of 1969, due mainly to shortage of supplies.

DECIDUOUS FRUITS

Apple production in the Granite Belt in 1969 is provisionally estimated at 2.0 m. bus., the highest on record, from 11,000 acres in bearing. Exports are in the vicinity of 200,000 bus., compared with 85,000 in 1968 and 50,000 in 1967.

The heavy crop resulted in generally lower average returns to growers for all varieties. When it was evident that the size of the crop would produce heavy consignments to the Brisbane wholesale market, an attempt was made to stabilize the market by fixing a minimum price of \$2 per bus. for fancy grade Delicious, Jonathan and Granny Smith apples. This was done by agreement between growers' representatives and market agents. At the same time an appeal was made to growers to limit their shipments. This scheme was only partially successful and for only a limited period.

Cool-stored apples from the 1968 crop amounting to 277,000 bus. were cleared by the end of November. To date 548,000 bus. of apples from the 1969 crop have been placed in cool stores, comprising 303,000 bus. of Granny Smith and 221,000 bus. of Delicious.

The Stanthorpe stone fruit crop was moderate to heavy and hail caused some damage. The hot humid conditions in midsummer which helped to produce heavy crops also caused some losses from brown rot.

Average returns to growers for apricots and plums were slightly below the previous year, but prices for peaches during the 1968-69 season again showed an increase on the previous season, thus continuing the trend of recent years.

An excellent crop of grapes was picked and prices showed an increase over last season. An increasing interest is being shown in the development of the wine industry in Queensland.

MISCELLANEOUS FRUITS

Increasing interest is being shown in the production of Macadamia nuts, and the area under crop has now reached approximately 820 acres.

The area under mangoes remains fairly static at 900 acres, but production was slightly better than the previous year, being approximately 70,000 bus.

A small area of pecan nuts approximating 40 acres is expected to produce about 15,000 lb. of nuts this year.

The area under avocados has remained fairly static at 190 acres, but as a result of early fruit drop under abnormally dry conditions estimated production will not exceed 20,000 bus. In many districts tree losses as a result of *Phytophthora* root rot have been quite appreciable in spite of the drought conditions. There is some indication of an increased interest in this crop and plantings during the current year may increase.

The area of custard apples has remained static at approximately 230 acres, but production was lower at 24,000 bus. as a result of unfavourable climatic conditions.

The total area under papaws has decreased slightly to approximately 950 acres and in most districts yields have been variable and usually below average. This has been due to the generally dry conditions and to tree losses. Estimated production is approximately 6,000 tons. On the basis of planting made last year, there appears to be little prospect of any increase in production next year and indeed a decrease appears more likely.

Interest in passion-fruit production continues to increase and in most areas there has been appreciable expansion during the past season. The area under crop is estimated at 350 acres, but this has not yet all come into production. The hybrid Redlands Triangular now comprises the bulk of the plantings, since it is favoured by processors, even though the Redlands Pink Hybrid gives a greater yield and a higher juice recovery.

Many new growers have entered into strawberry production and this has resulted in a substantial increase in plantings. The recently released Redlands Crimson variety has gained even further in popularity and now represents the bulk of plantings.

Harvesting of the 1969 crop has only just commenced, but indications are that production will exceed the total of 1,200 tons in the 1968 crop.

GINGER

Plantings for the 1969 ginger crop were estimated at 340 acres, an increase of about 35 acres on the previous year. However, the lack of adequate water during the critical growing period severely curtailed crop yields and it was anticipated that only 700 tons of early-crop harvest and 870 tons of late-harvest ginger would be obtained from this acreage, compared with 780 tons early-harvest and 1,190 tons late-harvest in 1968.

BEANS AND PEAS

Production of beans for the fresh market in the 1968-69 period reached approximately 6,000 tons even though the productive area had been reduced to approximately 4,500 acres as a result of drought conditions. Production of beans for processing continues to expand in the Lockyer and Bundaberg areas and a total of approximately 4000 tons is expected.

Bean seed production is expected to total approximately 1,300,000 lb. from 1969 planting of about 1,500 acres to the end of June.

The production of peas for processing continued, being largely confined to the Lockyer district. Last spring some 1,500 acres were grown, the principal varieties being freezer types—Sprite, Coronet, and Perfection. Yields generally varied from 1 to 2½ tons of shelled peas per acre with a few reaching 3 tons. Total production of peas for processing this year is expected to reach approximately 2,000 tons, while production for the fresh market should be in the vicinity of 200 tons.

TOMATOES

Expansion of tomato production in the Bowen area has continued, with increasing emphasis being placed on the variety C1402. In the Granite Belt, the acreage had decreased slightly but production has been maintained in spite of this. In the North Coast district production is increasing and Q2 and Grosse Lisse types are still popular compared with the more recent introductions. In Metropolitan coastal areas, Indian River is a major variety but reasonably large plantings of introductions such as Floralou, Manapal and Floradel have also been grown.

Total State production of tomatoes was slightly below average for the year, and it is estimated at approximately 1,200,000 bushels.

ROOT CROPS

The area under beetroot for processing has shown a slight increase; this crop now approximates 1,000 acres in the Lockyer and 100 acres in the Fassifern districts. Yields have been variable, ranging from 8 to 12 tons per acre, but the expected total production is in the vicinity of 13,000 tons. There has been an increasing tendency towards mechanization, and this has created a greater interest in the use of herbicides for weed control.

Production of carrots during the past year was slightly below normal as a result of the dry, hot conditions in the late spring to early autumn period. Main crops have been centred in the Fassifern district and, to a lesser extent in the Redlands area. Increased interest is being shown in production of carrots for processing and a planting of about 40 acres for this purpose is being made this year. Total production of carrots is expected to reach approximately 4,000 tons.

MISCELLANEOUS VEGETABLES

Adverse weather conditions have resulted in a more or less static situation regarding production of cabbage, cauliflower, and Brussel sprouts. Cabbage production is estimated at about 450,000 dozen, and cauliflower at 180,000 dozen.

The production of celery is steadily increasing, being mainly centred in the Granite Belt. This industry is largely restricted to a few growers who specialize in the crop.

Although fairly extensive plantings of cucurbits were made last year, approximately half of the areas failed on account of the drought conditions. Where irrigation was

adequate good crops were obtained, although losses in water-melons occurred late in the season following severe hailstorms. Cucumber production from 1,000 acres amounted to approximately 250,000 bushels, watermelons reached 13,000 tons from an estimated 4,000 acres, and the estimated production of rockmelons from 1,000 acres was 140,000 bushels. The production of zucchinis has remained fairly static at 40,000 bushels from an estimated 220 acres.

Lettuce production has been slightly below average during the past year and quality deteriorated following the onset of abnormally high temperatures late in the season. Wet weather resulted in losses in a number of late autumn plantings. Estimated production from an area of 400 acres is 500,000 bushels.

Production of rhubarb remains fairly static at about 1,200 tons, this crop being largely restricted to the Mt. Tamborine area where some 14 to 16 growers are involved. It is considered that the market for this crop could be developed by improving the presentation of the product. Trials during the past year have demonstrated the advantages of packing rhubarb loosely in polythene lined cartons as compared with the present practice of bundling.

FLOWERS

An industry which has been developing fairly rapidly over the past 6 to 8 years in the Redlands area is the production of gladioli as cut flowers. These are mainly forwarded to southern markets, principal plantings being made from February to September. The annual area under crop is about 250 acres and the value of the crop is conservatively estimated at \$500,000.

XI. Fisheries

Fisheries

The prawn fishery failed in the Gulf of Carpentaria after good catches had been recorded during March, the first month of the season. The banana prawns, which were reported to be abundant in the rivers, did not migrate seawards due to the very poor rains in the area. However, the total catch for the year in the Gulf was not much lower than in the previous year. The banana prawn catch has failed generally throughout north and central Queensland due to the continued drought.

Individual catches of king and tiger prawns have generally remained at the satisfactory levels recorded last year. The fall in the total prawn landings has been caused by the reduced fishing effort in some areas due to bad weather and by the number of vessels which missed the peak season because they were being fitted out for operation in the Gulf of Carpentaria.

These results are in agreement with earlier predictions which pointed to the king and tiger prawns as being the mainstay of the northern prawn industry and to the bananas as being an unreliable resource which would provide a highly profitable extra return in years of normal or good rainfall.

The thirteenth Session of the Indo-Pacific Fisheries Council took place in Brisbane during October. Forty-one overseas delegates, representing 12 nations, attended. This is the second time that this Council has met in Australia.

The U.S.S.R. fisheries research vessel "Vitiuz" visited Brisbane and the scientists on board met Queensland scientists at the University and on Heron Island. An interesting operation was the work carried out between February and May in the Great Barrier Reefs area by the Japanese research submersible "Yomiuri" and her mothership "Yamato". Professors Eguchi and Suehiro of Tokyo were on board.

Work has continued on the Crown of Thorns starfish and high densities are now known to exist widely through the Pacific region. The "Yomiuri" was used during part of this work off Townsville and enabled deep coral structures to be observed.

The mullet fishery had a disastrous year. A drop of half a million pounds in the landings of mullet in 1967-68

was followed by a further fall in the past year of almost one million pounds. Much of this was due to the fear rather than the fact of "kerosene" taint. The effect on marketing was serious. Catches in which any tainted fish were detected were condemned and this led to fishermen voluntarily reducing landings.

The tailor catch was back to "normal" after a very good season in 1967-68. This species is subject to wide seasonal fluctuations. The mackerel catch declined, particularly in the north. The conversion of the State's largest mackerel vessel to prawning has contributed substantially to this fall in the landings. Bad weather was also an important factor.

Oyster farming, as opposed to oyster harvesting, is beginning to show results in Moreton Bay and the next crop should be a good one.

The first meeting of the newly created Australian Fisheries Council was held in Darwin following the meeting of the Standing Committee. The existence of this body and of the Australian Fishing Industry Council denote an enhanced interest in the fishing industry.

GENERAL FISHERIES

An appendix table compares general fisheries figures since the year 1964-65.

Revenue from fisheries licensing, etc., amounted to \$106,948 during 1968-69, which included \$67,889 on account of oyster bank, coral, pearl shell and shell grit licences.

Direct expenditure on Fisheries administration and research amounted to \$97,514. In addition, \$80,247 was expended on shark safety measures. Research expenditure totalled \$44,372, including \$31,414 on prawn research.

The approximate return to operators from commercial fishing during the year was \$6,152,447.

Totals of 2,979 personal licences and 1,946 fishing vessel licences were issued during the year. These represent decreases of 1,224 personal licences and 812 vessel licences, but it should be noted that the granting of licences associated

with amateur netting operations was discontinued from January 1969. Details of the various licenses issued are shown hereunder:—

Personal Licenses	1967-68	1968-69
Master Fishermen	1,357	1,509
Employee Fishermen	1,003	1,437
Net Fishermen	1,843	33

Vessel Licenses	1967-68	1968-69
Vessels engaged in taking fish for sale (including net boats, dories and tenders)	1,751	1,928
Vessels operated by net fishermen ..	1,007	18

The estimated production of edible fish for the State for 1968-69 was 3,551 tons, with a gross value of \$1,880,906. Figures for the previous year were 4,301 tons with a gross value of \$1,847,207. The decrease of 750 tons was due mainly to a considerable drop in the production of mullet, mackerel and tailor. Five species made up 71% of all receipts of fish at the various markets and depots operated by the Fish Board and the North Queensland Fish Board. These were—mullet 36%, mackerel 13%, whiting 9.4%, tailor 7.4%, bream 5.1%.

The production of crabs in 1968-69 totalled 570,282 bodies (468,811 sand crabs and 101,471 mud crabs, having a gross value of \$213,307. These figures include crab meat converted into bodies, and the value of crab meat. The production for the previous year was 587,809 bodies, valued at \$177,787.

ANGLING

The extraordinarily good angling reported in the previous year continued into the past year, which was a particularly good one for bream, large whiting, flathead and tailor in the central and southern portion of the State. The near offshore reefs of the south also fished well for snapper and sweetlip.

The catches reported by skilled anglers indicate quite firmly that the fish are still available and that there is no justification, at present, for any further restriction of commercial net fishing activities. The elimination of the amateur net fishing license in December 1968 has removed the main source of trouble by reducing the competition faced by the angler on the fishing grounds.

PRAWNS

Following a record catch of 10,558,588 lb. valued at \$3,776,782 in 1967-68 and relatively good fishing in the second half of 1968, it was confidently expected that a further spectacular increase in the State's production of prawns would occur in the year under review. A large fleet of trawlers moved into the Gulf of Carpentaria for the start of the 1969 banana prawn season, and both existing and new processing plants were geared to handle a greatly increased production in this area. However, following a promising start in March, catches were well below expectations. The Gulf, along with the rest of Queensland, experienced extraordinarily dry conditions during the 1968-69 summer, and it is believed that this contributed substantially to the paucity of the Gulf banana prawns in the second part of the review year. Banana prawn catches were also low along the eastern seaboard of the State.

There was a considerable fall in the production of bay prawns from the Moreton Bay grounds, but this may have been due in part to the fact that many trawlers were being outfitted for the Gulf during the height of the Bay season. On the other hand, an exceptionally heavy run of school prawns occurred in the Noosa Lakes system, where approximately 500,000 lb. were taken by the fleet of small beam trawlers operating from Tewantin and Boreen Point.

Total production for the State was approximately 10,030,862 lb., valued at \$3,894,811. The regional break-up of landings is shown hereunder:—

	Lb.
Gold Coast	251,004
Moreton Bay	2,725,322
Sunshine Coast—Tin Can Bay ..	2,205,559
Central Sub-tropical Coast ..	223,531
Tropical East Coast	702,348
Gulf of Carpentaria	3,923,098

SCALLOPS

Total production of scallops for the year under review was 103,388 lb. of shucked meats, valued at \$56,854.

OYSTER FISHERY

The estimated production of market oysters was 3,233 sacks valued at \$91,692 compared with 5,662 sacks valued at \$101,269 in 1967-68. In addition, holders of oyster bank licenses purchased from Crown oyster grounds 1,280 sacks of oyster culture with a value of \$2,806. Most of these oysters are intended to be placed on licensed banks for maturing purposes on natural oystering grounds, and by the use of tray cultivation.

The number of licenses issued for oyster banks was 360, against 310 in the previous year. The number of boats licensed was 100, while 324 licenses were issued to persons to engage in oystering operations compared with 94 boats and 223 licenses in the previous year.

Generally, oyster banks in the Moreton Bay and Maryborough districts produced less marketable oysters as compared with the previous year. The decrease may be due to the fact that more licensees are undertaking developmental work on their leases and more of the natural stocks of oyster culture is being used for cultivation on trays instead of being harvested and sold.

There has been an increase in the estimated value of sea rock oysters harvested in districts north of Maryborough. In the year under review, 982 sacks of sea rock oysters with a value of \$25,865 were produced, compared with 778 sacks with a value of \$16,715 in the previous year.

While there is evidence that some licensees are making a more serious attempt to develop and cultivate oysters by the adoption of modern oyster farming methods and techniques, most oyster banks licensed are still undeveloped.

During the year under review, due to reclamation and development in the Broadwater south of the Grand Hotel, licenses for the remaining nine oyster banks in the area were either surrendered or terminated.

Further investigations were carried out during the year by officers of the Fisheries Branch with a view to determining the potential for the development of an economical commercial oyster fishery. In particular, consideration was given to the policy to be adopted in the Moreton Island area of Moreton Bay, as a means of fostering the expansion of the oystering industry.

FISH TRAPS

The number of permits in force for sites for the erection of arrow-head fish traps, which may be operated in open waters from Rockhampton north, was 85 compared with 89 in the previous year. The decrease has been brought about by the present policy of refusing permission for new traps or the transfer of traps where the site is adjacent to tourist areas, and as a result of some trap fishermen resorting to other more profitable methods of fishing.

SHELL GRIT AND CORAL

Forty licenses were issued for the removal of shell grit and 24 for coral, the revenue being \$66,943, compared with 45 licensees for shell grit and 20 for coral in the previous year, when revenue from fees was \$58,688.

PEARL CULTURE OPERATIONS

The number of shells introduced to Queensland pearl culture farms fell from 490,141 in 1967 to 438,858 in 1968. This compares with 148,490 in 1961.

PEARL SHELL AND TROCHUS

Pearl shell taken in Queensland during the year ending January 31, 1969, totalled 369 tons, valued at \$578,817. The number of boats working dropped from 31 to 18 for the season and the total weight of pearl shell taken decreased by 62 tons. The reduction of the number of pearling vessels engaged arose from a voluntary production containment implemented by the industry following over-production during 1967. A by-product of the reduced fishing effort has been noted in the form of a marked improvement in the production of each vessel.

The quantity of shell taken for manufacturing purposes fell from 189 tons in 1967 to 138 tons in 1968. However, this represents only 37% of the shell fished and indicates a decline in the percentage of shell taken for mother-of-pearl when compared with 44% during 1967.

Pearling activities were responsible for the employment of 306 persons, 65 fewer than in the previous year.

Some revival of interest in trochus production is indicated by the 1968 production figure of approximately 7 tons.

Figures for pearl shell and trochus shell fishing for the 1964 to 1968 seasons are given in an appended table.

CROWN-OF-THORNS STARFISH RESEARCH

A Departmental fisheries biologist made a further investigation in the Cairns area during December 1968 to note the extent of coral regeneration in the four areas marked on the Green Island reef for this particular purpose. The amount of regrowth of hard corals was found to be very small at that

time. A number of deep dives made in the vicinity of Green and Arlington reefs disclosed destruction of coral polyps by starfish at depths of over 100 ft.

In March 1969 the Chief Inspector of Fisheries and the Fisheries biologist were given the use of the "Yomiuri", a research submersible, and her mothership the "Yamato" for three weeks to study the reefs adjacent to Townsville, including the sea bed, at depths to 212 ft. Information was collected on the location of the southernmost front of heavy starfish infestation and its effect upon coral reefs in deep water. The owner of the vessels, who is also the owner of a large Japanese newspaper, met much of the cost involved. This opportunity to further scientific investigation in the Great Barrier Keef was greatly appreciated.

At the end of the year the crown-of-thorns starfish had been found southwards as far as Broadhurst reef and about 30 of the 100 reefs examined during the survey were found to be heavily infested by starfish.

The problem is presently considered to be serious but its assessment is hampered by a lack of knowledge of the actual biology of the starfish itself and comparative data on its incidences.

In May 1969 the United States Department of the Interior, following receipt of a report of heavy infestations of the starfish at Guam, initiated a major investigation into the matter. A report on this investigation, expected in October 1969, is being awaited with interest.

SEA MULLET

During the year under review market sampling at Tewantin continued. No analyses of data were attempted. Limited tagging of adults was carried out in the Maroochy and Brisbane Rivers in connection with the problem of "kerosene"-tainted fish. This matter has become a major cause of economic loss in the mullet fishery and investigation is to be intensified in the current year.

MARINE BIOLOGICAL STATION, HERON ISLAND

The Department makes a contribution of \$2,000 per annum towards the maintenance of this station which is owned and operated by the Great Barrier Reef Committee.

Five continuing programmes of research are currently being carried out at this station. Two film units worked at the station and there were visits recorded by the U.S.S.R. research vessel "Vitiaz" and the Japanese research submersible "Yomiuri" and her mothership "Yamato".

Station facilities were used on the basis of 196½ scientist weeks and 110 student weeks during the year and only minor problems arose.

Plans have been prepared by the Committee for a new laboratory block and some additional self-contained accommodation units for visiting scientists. These facilities are additional to the new workshop, accommodation and alterations which were approved late this year and are urgently required to widen the range and scope of the work which can be carried out at the station.

LIBRARY

Routine work has continued in the Fisheries library during the year. Thirty-five new books were purchased and five new periodical subscriptions were placed. These have been received and are now housed in the collection.

PROTECTION FROM SHARKS

Details of the shark-fishing programmes are given in appended tables.

The season's programmes closed down on June 18, 1969, with totals of 1,255 sharks, 770 pups and 761 rays having been taken for a cost of \$76,644. The number of sharks taken by net was 1,104 and by drumline, 151.

Sharks measuring 6 ft. and over in length totalled 675, which represented less than 54% of the catch. This take of large sharks showed a further drop on previous years. The largest shark taken was a female tiger measuring 13 ft. 7 in. in length, from which 59 pups were taken. The largest litter of pups recorded during the season was 61, which was taken from a tiger 12 ft. 4 in. long. The numbers of potentially dangerous species taken remained high, with a marked increase in the catch of tigers.

Since the commencement of the shark-fishing programmes on November 1, 1962, to the conclusion of the season's work in June, 1969, totals of 9,250 sharks, 5,058 pups and 6,327 rays had been taken for a cost of \$592,166.

Weather conditions throughout the season were generally good with the exception of the Mackay area. The schedule of work in that area was disrupted on several occasions due to adverse weather and masses of floating seaweed being washed on the beaches.

For the second year in succession no new nets were manufactured and by the continued concentration on the overhaul of nets good reserves were maintained. The departmental netmakers engaged on the general overhaul of nets greatly assisted in prolonging the working life of nets and gear, and by the reconstruction of nets were able to return

to service a considerable number which otherwise would have been written off. There is a back-log in respect of the reconstruction work which it is anticipated will be overcome during the current year.

Due to general deterioration of net fabric it is envisaged that construction of new net will become necessary in the near future. This position will be closely watched during the ensuing season.

In all areas the contractors continued to carry out their work efficiently and gave full co-operation to the Department. The season's work in the Gold Coast and Near North Coast areas was the first of a new contract for 2 years. This contract commenced on August 9, 1969, and provided for a fishing season extended by 6 weeks. With a catch of 51 sharks in the Gold Coast and 18 in the near North Coast area during the period of additional protection, it would appear the extension was justified.

The catch of 378 sharks, plus 67 pups, and 231 rays in the Gold Coast area was taken by 12 nets and 18 drumlines covering beaches from Main Beach south to Greenmount. The number of sharks taken in this area since meshing commenced on November 1, 1962, to the termination of the season's fishing totalled 2,810, plus 996 pups, with 1,866 measuring 6 ft. and over in length.

In the near North Coast area totals of 205 sharks, 84 pups and 169 rays were taken by 11 nets and 24 drumlines covering beaches from Noosa south to Worrin Beach, Bribie Island. A total of 2,266 sharks plus 1,035 pups has been taken in this area since the introduction of meshing on November 1, 1962, with 1,830 being 6 ft. and over in length.

In the Mackay area 5 nets and 24 drumlines were operated and these accounted for a catch of 231 sharks, plus 172 pups, and 135 rays. This brought the total catch in this area to 1,232 sharks, plus 673 pups, and 774 rays, with the number of sharks measuring 6 ft. and over being 647.

Totals of 158 sharks, 173 pups and 66 rays were taken in the Townsville area, bringing the totals since the commencement of meshing in the area to 1,172 sharks, plus 767 pups, and 633 rays. Of the sharks, 622 measured 6 ft. and over. This catch was taken by 6 nets and 24 drumlines.

The catch in the Cairns area was 283 sharks, plus 189 pups, and 245 rays, which were taken by 5 nets and 24 drumlines. This season's fishing concluded a 2-year contract in this area, which was renewed for a further period of 2 years as provided for under the contract.

On July 25, 1969, shark-fishing was introduced to the Central Coast area. This contract covers eight beaches from North Yeppoon south to Emu Park and operates 6 nets and 24 drumlines.

FISHERIES LEGISLATION

1. Repealing Order in Council of the 4th September, 1958, and providing a total prohibition against the take of turtles and their eggs—Order in Council 18th July, 1968.

2. Amending Order in Council of 2nd December, 1949, by repealing the twenty-seventh Schedule, relating to garfish nets—Orders in Council 1st August, 1968, and 17th October, 1968.

3. Promulgating Regulation 26, of 1st August, 1968, providing for quarterly Pearl Culture Returns.

4. Amending Order in Council of the 22nd December, 1949, relating to the use of otter trawl nets for the take of prawns in Queensland ocean waters—Order in Council 8th August, 1968.

5. Further amending Order in Council of the 1st August, 1968, by repealing the twenty-seventh Schedule relating to a net for the take of garfish and certain other species of fish—Order in Council 17th October, 1968.

6. Amending Order in Council of the 9th March, 1967, by exempting 4 Caloundra resident master fishermen and their employees not exceeding 3 from the prohibition in relation to the taking of fish with a net in the waters of Pumice Stone Strait between the south head of Bell's Creek and one mile south of Bell's Creek—Order in Council 31st October, 1968.

7. Amending Regulation 22, of the 21st November, 1964, relating to registered numbers or registered markings of commercial fishing vessels—Regulation 12th December, 1968.

8. Order in Council of the 23rd January, 1969, declaring and describing 7 Fisheries Habitat Reserves in Moreton Bay.

9. Regulation of the 23rd January, 1969, providing for the protecting of Fisheries Habitat Reserves.

10. Repealing Regulations 13 and 14 (Part II—General Fisheries) relating to the take of dugong and turtle—Regulation 20th March, 1969.

11. Amending Order in Council of the 2nd December, 1949, to omit the seventeenth Schedule relating to nets for the take of dugong—Order in Council 20th March, 1969.

12. Order in Council of the 20th March, 1969, prohibiting the take of dugong in Queensland waters.

PEARL-SHELL AND TROCHUS-SHELL FISHERIES

Season	Number of Boats Engaged	Number of Men Employed	Pearl-shell										Trochus-shell			
			Commercial Pearl-shell Fished		Live Shell Fished for Pearl Culture		Total Pearl-shell Fished		By-product M.O.P. from Pearl Culture Farms		Total M.O.P. Produced		Trochus-shell Fished			
			Tons	\$	Tons	\$	Tons	\$	Tons	\$	Tons*(a)	\$	Tons	\$		
1964	28	408	..	..	..	..	..	..	..	..	..	..	..	..	..	..
1965	41	415	193	137,581	185.7	199,980	378.7	337,561	68	28,672	288	186,484	31	5,394	..	..
1966	52	412	179.3	121,706	169.4	402,283	348.7	523,989	75.8	28,618	261	166,253	8.4	1,480	..	..
1967	31	371	189	99,154	242	544,440	431	643,594	59.15*(b)	32,077	255.1	150,324	2.6	317	..	..
1968	18	306	138	41,400	231	537,417	309	578,817	88.5	28,130	248.15	178,877	1.0	..	..	..
											226.5	69,530	7	689	..	..

* (a) Does not include by-product M.O.P.

* (b) Amended

PROTECTION FROM SHARKS

CATCH FOR YEAR ENDED JUNE 30, 1969

Month	Gold Coast	Near North Coast	Mackay	Townsville	Cairns	Total
July ..	..	..	..	..	..	..
August ..	8	6	6	11	35	66
September ..	21	11	22	26	31	111
October ..	26	19	17	14	29	105
November ..	135	44	33	8	21	241
December ..	49	20	37	16	28	150
January ..	10	18	24	21	17	90
February ..	36	6	20	20	24	106
March ..	11	35	39	14	32	131
April ..	29	12	15	15	17	88
May ..	10	22	10	7	26	75
June ..	43	12	8	6	23	92
Totals	378	205	231	158	283	1,255

CATCH ALL AREAS 1ST NOVEMBER, 1962, TO JUNE 30, 1969

Year	Gold Coast	Near North Coast	Mackay	Townsville	Cairns	Total
1962-63 ..	526	547	..	..	*87	1,160
1963-64 ..	412	349	*89	*98	295	1,243
1964-65 ..	340	298	244	295	221	1,398
1965-66 ..	359	359	189	252	249	1,408
1966-67 ..	403	227	250	181	348	1,409
1967-68 ..	392	281	229	188	287	1,377
1968-69 ..	378	205	231	158	283	1,255
Totals	2,810	2,266	1,232	1,172	1,770	9,250

* Experimental fishing only.

COMPOSITION OF CATCH FOR YEAR ENDED 30TH JUNE, 1969

Month	Tiger	Whaler	Black Tip Whaler	White Pointer	Blue Pointer	Hammer-head	Grey Nurse	Others	Total
July ..	..	..	..	..	..	..	..	..	..
August ..	9	19	6	1	..	26	..	5	66
September ..	15	14	20	4	..	45	..	13	111
October ..	14	21	10	5	..	43	2	10	105
November ..	20	23	38	6	..	135	1	18	241
December ..	14	11	36	1	..	74	..	14	150
January ..	21	13	17	..	..	33	1	5	90
February ..	9	23	38	..	..	26	..	10	106
March ..	16	15	33	..	..	60	..	7	131
April ..	19	23	22	1	..	20	..	3	88
May ..	8	21	26	2	..	14	..	4	75
June ..	10	29	24	1	..	24	..	4	92
Totals ..	155	212	270	21	..	500	4	93	1,255

COSTS AND ALLOCATION OF GEAR 1ST NOVEMBER, 1962 TO 30TH JUNE, 1969

Year	Cost	Gold Coast		Near North Coast		Cairns		Mackay		Townsville		Number of Beaches	Total	
		Nets	Lines	Nets	Lines	Nets	Lines	Nets	Lines	Nets	Lines		Nets	Lines
1962-63 ..	\$ 93,078	10	24	10	24	*4	*16	..	..	..	..	31	24	64
1963-64 ..	103,444	10	24	10	24	4	16	*4	*20	*6	*24	37	34	108
1964-65 ..	95,616	10	24	11	24	4	16	4	20	6	24	38	35	108
1965-66 ..	83,615	10	24	11	24	5	20	4	20	6	24	39	36	112
1966-67 ..	75,689	10	24	11	24	5	20	5	24	6	24	39	37	116
1967-68 ..	71,031	10	24	11	24	5	24	5	24	6	24	39	37	120
1968-69 ..	76,644	12	18	11	24	5	24	5	24	6	24	39	39	114

* Experimental fishing over Christmas holiday period only.

RETURN SHOWING LICENSES UNDER "THE FISHERIES ACTS, 1957 TO 1962," ISSUED AT ALL PORTS DURING THE YEAR ENDED JUNE 30, 1969

Port	Description of Licenses							Fish-traps
	Oyster Banks	Oyster Boats	Oystermen's Licenses	Coral or Shell-grit	Fishing Boats		Fishermen	
					Commercial	Non-Commercial		
Brisbane ..	178	68	123	32	..	9	1,312	..
Maryborough ..	84	15	42	1	..	..	180	..
Bundaberg ..	5	1	1	2	..	1	188	..
Gladstone ..	1	1	1	..	..	..	54	..
Rockhampton ..	41	4	20	3	..	5	125	24
Mackay ..	39	7	25	9	..	1	227	23
Bowen ..	..	..	..	..	..	..	64	4
Townsville ..	8	4	8	3	..	..	362	29
Innisfail ..	..	..	..	7	..	..	90	..
Cairns ..	4	..	4	7	..	..	300	5
Port Douglas ..	..	..	..	..	..	..	5	..
Cooktown ..	..	..	..	..	..	..	1	..
Normanton ..	..	..	..	..	..	2	27	..
Burketown ..	..	..	..	..	..	..	3	..
Thursday Island ..	..	..	..	..	..	..	41	..
Totals ..	360	100	324	64	1,928*	18	2,979†	85

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

† Includes 1,509 master fishermen's licenses, 1,437 employee fishermen's licenses and 33 net fishermen's licenses.

REVENUE FROM FISHERIES FOR THE YEAR ENDED JUNE 30, 1969

License Fees	Oyster Bank, Coral, Pearl-Shell and Shell-grit Licenses	Total
\$ 39,059	\$ 67,889	\$ 106,948

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

Year	Number of Boats Licensed	Number of Men Licensed	Estimated Quantity of—		
			Fish	Prawns	Crabs
1964-65 ..	3,944	6,347	Tons 3,580	lb. 5,736,761	Bodies 531,719
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