

Mr. Bissett (Agric)

Queensland Department of Primary Industries  
**ANNUAL REPORT 1972-73**



Breeding of new hybrid varieties has been vital to the maize industry in the north. Here, a D.P.I. plant breeder, Mr. I. F. Martin, carries out hand pollination.

**Presented to Parliament by Command**





Farmers show interest in the design of a new trash chisel plough at a recent Stubble Mulch Field Day. This machine has about 75 cm under-frame clearance.



A machine adapted to plant grain through stubble and into the subsurface moisture. This technique is important in soil conservation and to give more flexibility to planting some time after rain.



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## ORGANIZATION OF THE DEPARTMENT

<b>MINISTER FOR PRIMARY INDUSTRIES</b>	..	Hon. V. B. Sullivan, M.L.A.
<b>CENTRAL ADMINISTRATION AND CLERICAL AND GENERAL DIVISION—</b>		
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, F.A.S.A.
Assistant Under Secretary	..	R. V. Riley, B.Com., A.A.U.Q.
Accountant	..	H. J. Evans, A.A.U.Q.
Executive Officer, Research Stations Section	..	G. H. Allen, Q.D.A.
Executive Officer, Extension Services Board	..	J. Gibb, B.V.Sc., Dip. Agric. Ext.
General Manager, Agricultural Bank	..	F. J. Strutton, A.A.S.A., A.C.I.
Director, Information and Extension Training Branch	..	C. W. Winders, B.Agr.Sc.
Director, Fisheries Branch	..	G. G. T. Harrison, B.Sc.
Director, Fauna Conservation Branch	..	G. W. Saunders, D.Agr.Sc.
<b>DIVISION OF ANIMAL INDUSTRY—</b>		
Director of the Division	..	A. L. Clay, B.V.Sc.
Deputy Directors	..	L. G. Newton, M.V.Sc., J. W. Ryley, B.V.Sc.
<b>Animal Research Institute—</b>		
Biochemical Branch	..	C. W. R. McCray, B.Sc., A.R.A.C.I. (Biochemist)
Husbandry Research Branch	..	L. Laws, M.V.Sc. (Director)
Pathology Branch	..	W. T. K. Hall, M.V.Sc. (Director)
Beef Cattle Husbandry Branch	..	B. A. Woolcock, B.V.Sc. (Director)
Veterinary Services Branch	..	K. M. Grant, B.V.Sc. (Director)
Sheep and Wool Branch	..	A. T. Bell, B.V.Sc. (Director)
Slaughtering and Meat Inspection Branch	..	B. Parkinson, B.V.Sc. (Director)
Pig and Poultry Branch	..	F. N. J. Milne, B.Sc. (Director)
<b>DIVISION OF DAIRYING—</b>		
Director of Dairying	..	G. I. Alexander, B.V.Sc., M.S., Ph.D. (Director) (Appointed November, 1972)
Deputy Director	..	V. R. Smythe, M.Agr.Sc. (Appointed November, 1972)
Dairy Cattle Husbandry Branch	..	N. C. E. Barr, B.V.Sc. (Director)
Field Services Branch	..	W. D. Mitchell, B.Agr.Sc., Dip.Agric.Ext. (Director)
Research Branch	..	W. C. T. Major, B.Agr.Sc., A.S.B.M. (Director) (Appointed November, 1972)
<b>DIVISION OF LAND UTILISATION—</b>		
Director	..	J. E. Ladewig, B.Agr.Sc.
Assistant Director	..	A. Hegarty, B.Sc.
Development Planning Branch	..	A. Hegarty, B.Sc. (Director)
Soil Conservation Branch	..	J. Rosser, B.Agr.Sc. (Director)
<b>DIVISION OF MARKETING—</b>		
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	..	E. O. Burns, B.Com., A.A.C.A., F.A.S.A. (Director)
Marketing Services Branch	..	D. R. Lewis, B.Sc. (Econ.) (Director)
Standards Branch	..	A. C. Peel, Dip.Ind.Chem., A.R.A.C.I. (Director)
<b>DIVISION OF PLANT INDUSTRY—</b>		
Director of the Division	..	L. G. Miles, B.Agr.Sc., Ph.D.
Deputy Director	..	S. Marriott, B.Agr.Sc.
Agriculture Branch	..	B. L. Oxenham, B.Agr.Sc. (Director)
Horticulture Branch	..	R. C. Cannon, B.Agr.Sc. (Director)
Agricultural Chemical Laboratory Branch	..	T. J. Beckmann, M.Sc., F.R.A.C.I., F.C.S. (Appointed June, 1973)
Botany Branch	..	S. L. Everist, B.Sc. (Director)
Entomology Branch	..	A. R. Brimblecombe, M.Sc., Ph.D. (Director)
Plant Pathology Branch	..	G. S. Purss, M.Agr.Sc. (Director)



# QUEENSLAND DEPARTMENT OF PRIMARY INDUSTRIES

## Annual Report 1972-73

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, 1973.

Yours faithfully,

J. M. HARVEY,  
Director-General.

### I. General Comments

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

#### PRODUCTION

It is pleasing to report that large areas of the State received substantial rains during the recent summer, and as a result of these improved seasonal conditions, buoyant wool prices and an unsatisfied demand for beef for export, there has been a major upturn in the rural economy during the last twelve months. Once again record or near-record sugar production was reported from Queensland's 31 mills during the crushing season extending from May-December, 1972.

After a favourable wet season in most parts of the State in 1972, many areas experienced poor winter and spring seasons. The south-west was drought-stricken early in the year and parts of the central and northern coastal areas deteriorated steadily to the point of being drought-stricken towards the end of 1972.

In many areas dry standing pasture was in abundance but rainfall deficiencies in winter and spring caused widespread supplementary feeding of cattle. Cows with calves lost condition rapidly especially in the coastal areas, and some substantial losses were reported.

Then following one of the best wet seasons in recent years, the position was relieved and by mid March all of the shires declared drought-stricken had their declarations revoked. For the first time in 10 years, the State was officially drought-free.

The south-west and most of the central and north-west and north coastal enjoyed favourable conditions with stock in good condition and expectations of high rates of reproduction. In contrast the south-east, Darling Downs and parts of the Maranoa and Warrego were deteriorating with pastures in poor condition and stock losing weight. Overall, however, the 1973 wet season was a particularly good one and considered by many to be the best since the record wets of the mid 1950's. The Channel Country is in especially good condition at the present time and a steady supply of fat cattle can be expected from these areas over the next 12 months.

As a matter of interest it is worth recording that sheep numbers for the whole of Australia at March 31, 1973, totalled 142.34 million while cattle numbers totalled 28.98 million.

In the past 12 months, sheep numbers fell by 8% in Queensland compared with a 13% fall for the whole of Australia. At the same time, cattle numbers increased by 10% in Queensland compared with a 6% increase for the whole of Australia.

Following the recent recovery in wool prices to levels only exceeded in the boom years of the 1950's, sheep numbers can be expected to increase once more. Favourable seasonal

conditions in most of the sheep country indicate a rapid rate of recovery. Demand for both store sheep and cattle was quite strong during 1972-73. Fat cattle and sheep prices also rose strongly during the period. These high returns to producers were welcome after the succession of drought affected years.

In the 1972-73 season in excess of 2.5 million acres of the major agricultural crops, other than sugar cane, were available for harvest.



A peanut thresher modified to handle navy beans.

While plantings were at high levels, a number of unfavourable factors such as heatwave conditions and pest and disease problems resulted in depressed yields, and the 1972 wheat harvest totalled only 13.6 million bushels at an average yield of 13.7 bushels/acre. Production from the grain sorghum crop harvested in 1973 was below that achieved in 1971 and 1972 and totalled 22.4 million bushels. Areas planted to sunflower seed and soybeans represented record acreages and further price rises to producers indicate a continuation of this trend.

The marketing situation continued to remain attractive for most products and early deliveries of grain sorghum attracted very high prices. Subsequent deliveries did not



attract so much of a premium due mainly to currency realignments between Australia and overseas importers of our products. Average price levels, however, remained at relatively high levels.

The gross value of Queensland rural production for 1972-73 is now placed at \$912m., an increase of over \$100m. on 1971-72. Most of the increase arose from higher prices for pastoral products, in particular wool and beef, but there were also increases in sugar, fruit and vegetables, and pigs. These increases were offset to a large extent by the decreased gross value for grains, in particular wheat, following a poor harvest.

Gross revenue from the 1972 sugar crop is estimated at \$310m., a rise of \$21m. over last year. Final prices for the 1971 season were \$113.58 for No. 1 pool sugar and \$93.90 per ton for No. 2 pool (excess sugar). For the 1972 season, the No. 1 pool price is estimated to be between \$115 and \$120 per ton and the No. 2 pool price between \$105 and \$115 per ton 94 n.t. sugar.

There has been a keen export demand for beef both from the U.S.A. and Japan, resulting in prices up to as much as \$40-\$45 per 100 lb. dressed weight.

Although most industries are now aware of the probable consequences of Britain's entry to the E.E.C. from the beginning of 1973, and measures to meet the changed conditions have been and are being adopted, the real impact has not yet been felt. Indications are that, except for some products such as dairying, and canned and dried fruits, alternative markets can be developed.

The impact of revaluation of the Australian dollar and subsequent changes in the exchange values of certain world currencies has, in many instances, been offset to some extent by improved prices under buoyant world market conditions, and by certain savings in overseas shipping costs in terms of Australian currency.

Final decisions on revaluation assistance for most primary industries have not yet been announced by the Commonwealth Government.

#### AGRICULTURAL BANK

Advances approved during the financial year 1972-73 under the various Acts administered by the Bank were:

Agricultural Bank Acts	\$13 848 717
Farm Water Supplies Assistance Acts	\$630 321
War Service Land Settlement Acts	\$44 706
Soil Conservation Act	\$2 876
	<hr/>
	\$14 526 620

Advances approved under the Agricultural Bank Acts have shown an increase in excess of \$400 000 on last year's figure but it could be assumed that the statutory advance limit of \$20 000 for individual advances has, to some degree, restricted new business, taking into regard present day prices and the ample funds available through trading banks towards the purchase of larger properties. It is anticipated that the approved increase in the Bank's statutory limit to \$30 000 will resolve the situation to an appreciable extent both in respect of prospective new clients and the provision of additional funds to worthy existing clients.

The continued operations of the Rural Reconstruction Board and the Marginal Dairy Farms Reconstruction Scheme have also, inevitably, had an effect of turning aside applications which otherwise would have been made to the Bank for advances for purchase of additional areas for expansion of properties.

Advance repayments by borrowers under the Agricultural Bank Acts during the year have exceeded estimates by over \$3 200 000. This is attributable to generally favourable seasonal conditions and increased prices for produce, which have permitted at least partial clearance of arrears of dues accumulated over the drought years, and extensive movement in property sales. Apart from normal land transfers, sales appear to have been influenced, mainly, by the phasing out of smaller uneconomic farm units and the increasing activity of land developers in the south-western portion of the State.

Interest in water conservation is shown by the increase of nearly 40% over the previous year's approvals under the Farm Water Supplies Assistance Acts, and it can be expected that the demand will continue.

From January 9, 1973, the Bank ceased approval of advances under the War Service Land Settlement Acts. Further assistance, within the statutory limit of advance, is now provided to existing clients under these Acts by way of loans under the Agricultural Bank Acts.

Assistance on concessional terms to eligible grain growers under the Field Mice Damage Relief Scheme, as approved by Cabinet on May 16, 1972, was continued until November, 1972, when the scheme was terminated. The amount of advances approved during the year was \$53 000.

Assistance under the Drought Relief Scheme for restocking loans was terminated on June 30, 1972.



Harvesting lucerne for silage, an important insurance against feed shortage in dry times.

#### DROUGHT SECRETARIAT

Following withdrawal of Commonwealth support for the provision of relief concessions to drought-affected property owners, the State reverted to a scheme of assistance similar to the one operating before 1969. Some of the main concessions provided were:

- Rail freight concessions on stock transported to and from agistment and for restocking.
- Rail freight concessions on fodder transported to stockowners in declared areas, including fodder stored in anticipation of drought.
- Road transport concessions on stock travelling to and from agistment and for restocking where rail transport is unavailable or impracticable, and from property to railhead and railhead to property. Railhead to property concessions are also available on fodder movements.
- Road transport concessions on full road journeys involving movements to and from agistment and for restocking where rail is unavailable or impracticable.
- "Free" road permits on the stock and fodder movements above, provided the journeys are less than 25% competitive with rail.

The joint Commonwealth-State Consultative Committee on Drought continued to meet. Items under discussion were improved financial arrangements between the two Governments in relation to drought expenditure, and natural disasters other than drought.

A "three-tier" arrangement for financing expenditure was proposed at an earlier meeting of the Consultative Committee. However, agreement has not been reached on this aspect, and the Commonwealth now requires that States expend a certain amount from their own resources before Commonwealth financial assistance becomes operative. With the change in the Federal Government it is difficult to anticipate further developments.

A Working Party of the Committee comprising representatives of this Department, the Co-ordinator General's Department, New South Wales State Departments and the Department of Primary Industry was established to investigate the associated effects of drought on local government authorities and on rural employment. A tour involving discussions with numbers of shire councils in affected areas of New South Wales and Queensland was conducted in September, 1972.

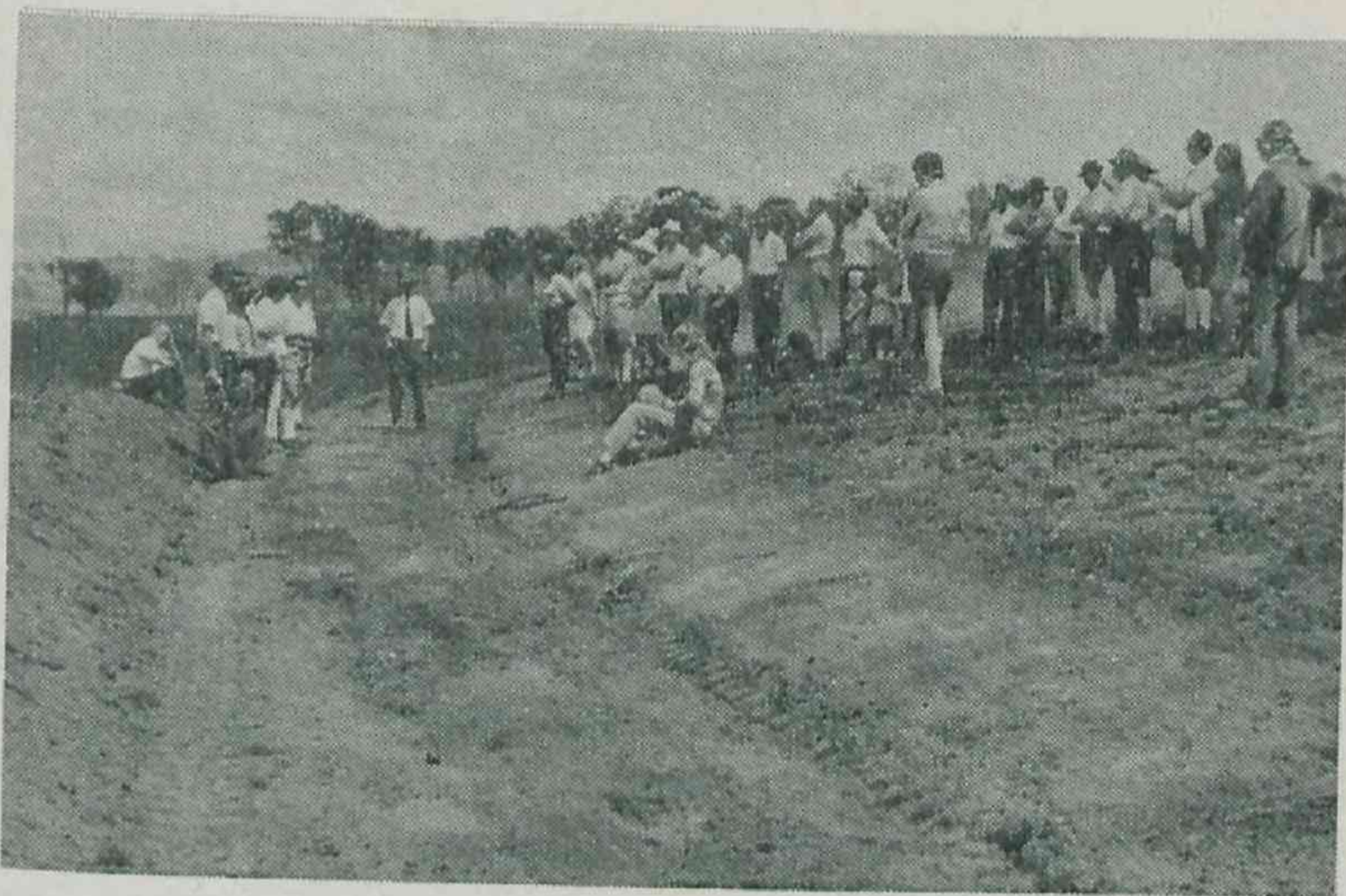
A further activity of the Committee was the establishment of a Study Group to investigate the longer-term aspects of drought. At its inaugural meeting in Brisbane in 1971, it was decided that members of the Group and colleagues from their various organisations could play a useful role in lending technical support to workers involved in related projects in Queensland. This took the form of a modelling workshop which was held in Brisbane in July, 1972, and



which was attended by 13 Departmental officers several of whom are directly involved in study model construction. The workshop was highly successful.

In an attempt to assist personnel involved in the implementation of drought relief schemes, guidelines concerning the declaration of drought areas were prepared by the Drought Secretariat and, after discussion, agreed to by the State Treasury.

The purpose of the guidelines is to provide an objective and uniform basis which, combined with the observations of on the spot stock inspectors as to drought effects, should ensure an improved decision-making process. These guidelines are based on deficiencies in expected rainfall, taking into consideration the influence of the seasonal pattern and the cumulative effect of a run of below-average falls.



Local farmers inspect contour banks on the Boonah whole farm dairy demonstration project.



Visitors inspect a selection of Dolichos lab lab developed at the Brigalow Research Station.

### EXTENSION ORGANISATION

During the year the changes forecast in last year's report were undertaken. An Extension Services Board comprising senior officers of each division of the Department, with the Deputy Director-General as chairman, was established; this Board met on eight occasions and, under its guidance, an Extension Services Section was established. Mr. John Gibb was appointed as the Executive Officer of the Section and Secretary of the Board. Other staff of the Section comprise 10 Regional Extension Leaders appointed during the year to supervise work of extension field staff in all but the semi-arid areas of the State.

Arrangements are in train to present each operational extension region with a detailed "Charter of Operations". This Charter will set out the formal arrangements under the Board's programme for the re-organisation of the extension services and is a development from a workshop conducted by the Board in April involving extension staff drawn from branches and divisions. It will incorporate operational details as to how the guidelines for the extension services enumerated in last year's report are to be followed.

As many officers at a number of district centres have been co-ordinating and programming their extension activities for some time now it is not anticipated that major difficulties will be encountered in the formalisation of the Board's proposals throughout the State. The extension services will work closely with producers and producer organisations at a

district level through a system of District Extension Committees to which local extension staff and some research workers will be appointed.



A sign of the times—the last use of the separator before conversion to bulk milk.

The agricultural extension regions to become operational in the near future are the Far Northern, Northern (formerly referred to as Burdekin), Capricornia (formerly referred to as Central Coast), Burnett, South Burnett, Near North Coast, East Moreton, West Moreton, Darling Downs, Near South-Western and Far South-Western Regions. Some 31 District Extension Committees will operate within these regions. These Committees will focus their attention on defining the more significant problems and/or opportunities for development in the rural industries in their areas and will develop and implement plans of benefit to producers.

A major change was made to the function and staff of the Sheep and Wool Branch during the year. All research facilities and officers trained in research were transferred to the Husbandry Research Branch. Extension and field research based on private property are now the main field functions of the Branch. The Wool Biology Laboratory which is a service facility for fleece measurement to the industry also remains with the Branch. It is expected that the introduction of sale by objective measurement will result in increased use of the fleece measurement service.

### AGRICULTURAL EXTENSION SERVICES

Continuing support from the Commonwealth Extension Services Grant has made possible some significant advances by Information and Extension Training Branch, in particular in the mass media and training fields. The appointment of Regional Information Officers has not only increased the flow of information through established media, but has also permitted a successful entry into television.

The introduction of new machinery in the duplicating room, and rearrangements in the departmental library have permitted a considerable improvement in the services to field officers.

Training facilities have been progressively strengthened and most Departmental officers responsible for contact with the farming community have had the advantage of training at an extension school, and useful assistance in district planning will be available in the future.

Schools and workshops were provided in extension methods and regional extension planning for 200 extension staff. Induction courses were provided for 90 new technical staff.

A great part of this year was spent in planning and preparing for the reorganisation of the extension services, in redesigning staff development programmes, and developing resource information.



### FARMER CO-OPERATION

One of the most effective means by which the Department can pass valuable information on to the farming community is through gaining farmer participation in field trials and demonstrations of practices that are recommended or show promise.

An example of farmer co-operation in this manner is provided by a field experiment on the Atherton Tableland, the Eungella Plateau and the Maleny Plateau. Eight farmers are co-operating with the Department to investigate the effect of stocking rate on productivity of cattle grazing kikuyu grass.

A grant from the Australian Dairy Produce Board to the Dairy Cattle Husbandry Branch is being used to finance the field trials. Kikuyu was chosen because of its high reputation as a nutritive species, particularly in the higher rainfall tableland areas. The efficiency of production from the grass is likely to be affected greatly by a better appreciation of optimum levels of stocking.

The work is a development of similar trials in the Kairi Research Station (Atherton Tableland) where the effect of stocking rate of productivity of Glycine-green panic pastures has been examined for some years.

At high stocking rates, production per hectare has been increased by about 50%.

### AGRICULTURAL ECONOMICS

To meet a growing demand for farm business management advisory services, 16 economists are stationed in country centres, and it is hoped that two additional appointments may be made next year.

Over 450 Departmental extension officers have now received basic inservice training in farm business management. This training programme has played a significant role in the present capability of extension officers to provide advice in a

farm business management context as required under regionalisation. Apart from staff training, agricultural economists are becoming increasingly involved in schools for primary producers to assist them with the business side of farming and this is seen as a major field of activity in future.

The Director of Economic Services, Mr. E. O. Burns, was a member of a Farm Management Services Committee whose report to Standing Committee of the Australian Agricultural Council, released last year, will have far reaching effects in setting guidelines for the future development of farm business management advisory services throughout the Commonwealth.

An interstate meeting of farm business management and extension specialists was subsequently held in Sydney in October, 1972, to discuss the report, organise closer liaison between States and plan the first national workshop in farm business management to be held in Perth in November, 1973.

Increasing emphasis is being given to orienting economic research on a regional basis. Studies of resources and production potential in the Cape York and Fitzroy regions, and Condamine-Maranoa basin will be completed this year.

In the dairy industry, future wholemilk supply is being examined on the Darling Downs and Moreton Region. Adjustment problems facing dairy farmers in the Callide Valley will also be studied.

Industry funds have been provided for continuing research into structural changes in the pig industry and the process of decision-making on grazing properties in the pastoral zone.

Whereas in the past, producer schools were mainly concerned with technical aspects of production they now generally devote a significant part of their programme to discussing such topics as farm budgeting, rural finance, taxation and legal aspects of property management.

Over 200 graziers attended a beef management school at Winton in June, 1973, organised by the Central and Northern Graziers Association in co-operation with this Department. A Rural Management School held later that month at Roma attracted a similar attendance.

A one-week farm management school for Rural Youth was conducted at Queensland Agricultural College, Gatton, in January, 1973, being the fourth year this school has been held.

As part of a concerted effort by the Queensland Agricultural College to become more involved in farmer education, this Department combined with the College and the Queensland Institute of Technology to conduct a financial management course at Gatton in January, 1973, for 40 members of the Queensland Grain Growers Association. Some of the course material has formed the basis of a booklet being prepared by the Q.G.G.A. for their members.

Industry economics were also discussed at a Poultry Information Exchange, Caloundra, and at a Chicken Meat Stockfeed conference at Surfers Paradise.

To reach a greater number of producers, economists have given more attention to group activity and the mass media. Experienced economists are also providing more of a support and training role for extension officers rather than concentrating on front line extension with individual producers.

With improved farm incomes, minimisation of taxation is of concern to producers. A tax information guide prepared for graziers in the Charleville district in consultation with local accountants met an enthusiastic response.

With growing capital requirements in farming, some interest is evident in private farm leasing, and guidelines on factors for consideration were published in the press and radio.

A detailed summary of rural credit facilities and practical considerations when borrowing was prepared at the request of the Queensland Council of Agriculture and has been widely distributed through industry organisations.

### MARKET STABILISATION

Planning to ensure a correct balance between supply and demand of primary produce at payable prices has assumed increasing significance in a situation of improving technology and efficiency in primary production, with developing self-sufficiency in some traditionally importing countries and the formation and enlargement of economic blocks such as the European Common Market.

Following the setting up of stabilisation schemes for tobacco leaf and wheat, similar measures have been extended to rice and eggs, while a scheme has been under consideration by the various State governments and the dairying industry to hold production of butter and cheese within the limits of payable market outlets.



Farmer and economic adviser discuss ideas for property development along business lines.



Business management plans are worked out in careful detail.



By the close of the year legislation had been enacted to enable the determination of egg producing flock quotas. However, proclamation of this Act is subject to its acceptance by a poll of growers.

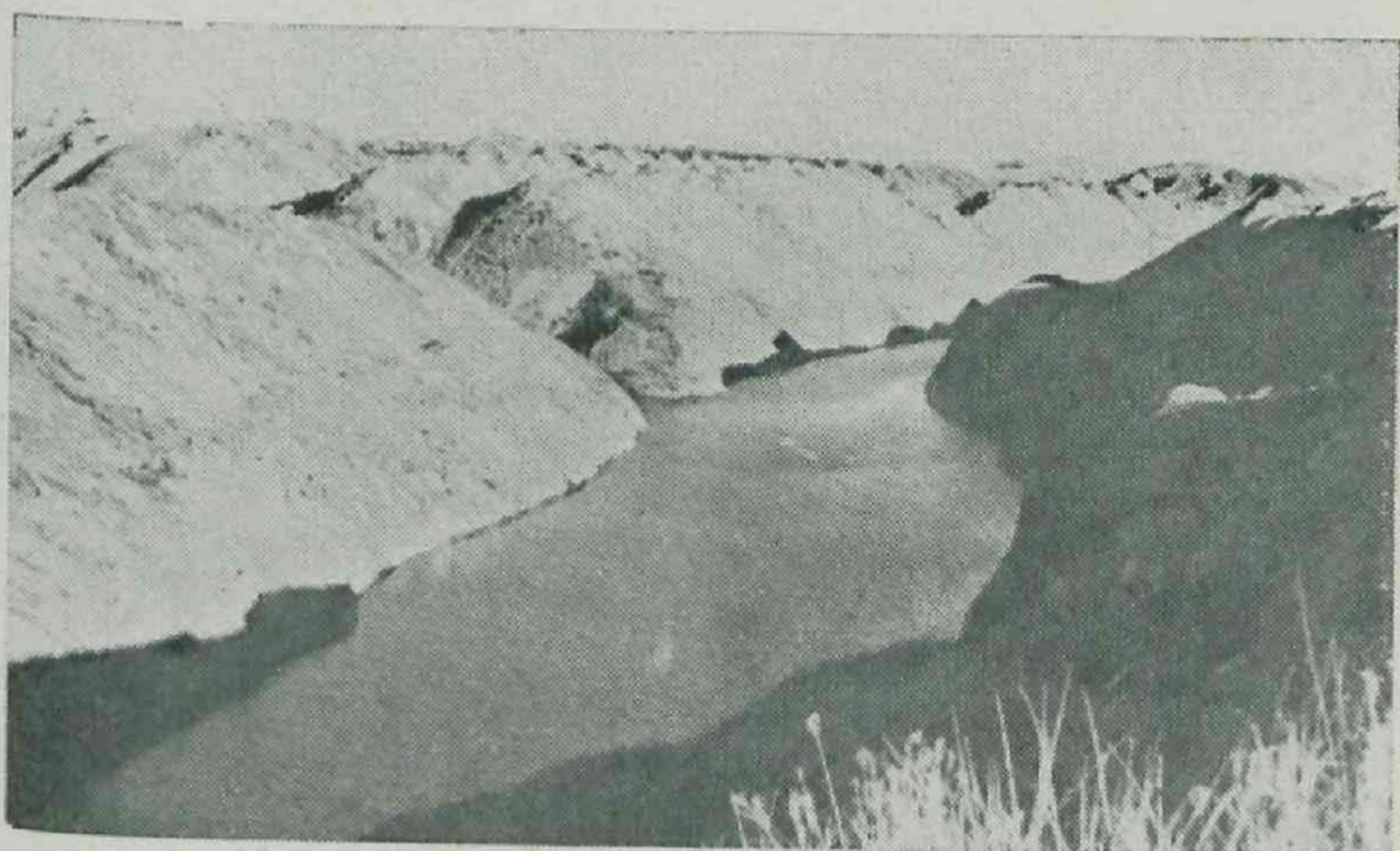
During the year the Primary Producers' Organisation and Marketing Acts were amended. Apart from updating the legislation in certain particulars, provision was made for the setting up of the Queensland Commercial Fishermen's State Council, and for enabling marketing boards and other organisations to make more flexible arrangements for financial accommodation and the investment of their surplus funds.

### PROTECTION OF THE ENVIRONMENT

As a result of a direction by State Cabinet, written reports on environmental studies are now required for all developmental undertakings which, in the opinion of the appropriate statutory or administrative authority, are considered necessary. As a result of this direction, environmental studies are required for:

- (a) Private and company developmental proposals;
- (b) Proposals by State, semi-governmental, and local authorities on planning and developmental undertakings.

At the request of the Irrigation and Water Supply Commission, technical assistance has been provided by specialist officers from Fisheries, Fauna Conservation, Botany, Soil Conservation, Economic Services, Beef Husbandry and Development Planning Branches to enable eight environmental impact statements, in terms of item (b) above, to be completed during the year.



Coal mine spoil heaps in central Queensland. Research is underway to transform these into useful areas.

Statements published or in process of publication have been prepared for the following State-sponsored Water Supply or Irrigation Projects: Pike Creek dam, Lower Dawson River (Baralaba Weir), Mt. Isa water supply (Julius dam), Upper Condamine Irrigation Project (Stage II Leslie Dam), North Eton (water conservation and irrigation), Bundaberg Irrigation Project, Barker's Creek Irrigation Project, Cooyar Creek dam.

The Ecology and Economic Botany Group continued to work on vegetation and environmental impact studies. The field work for the Woody Plants Survey of central Queensland was completed and is now being extended to the southern half of the State. The results of the project analysed to date indicate that it will be possible to forecast problems likely to arise in the areas surveyed.

Work carried out on the vegetation of the coastal sand dunes has provided much useful information pertinent both to the preservation of Queensland beaches and to the vegetation of mined dunes.



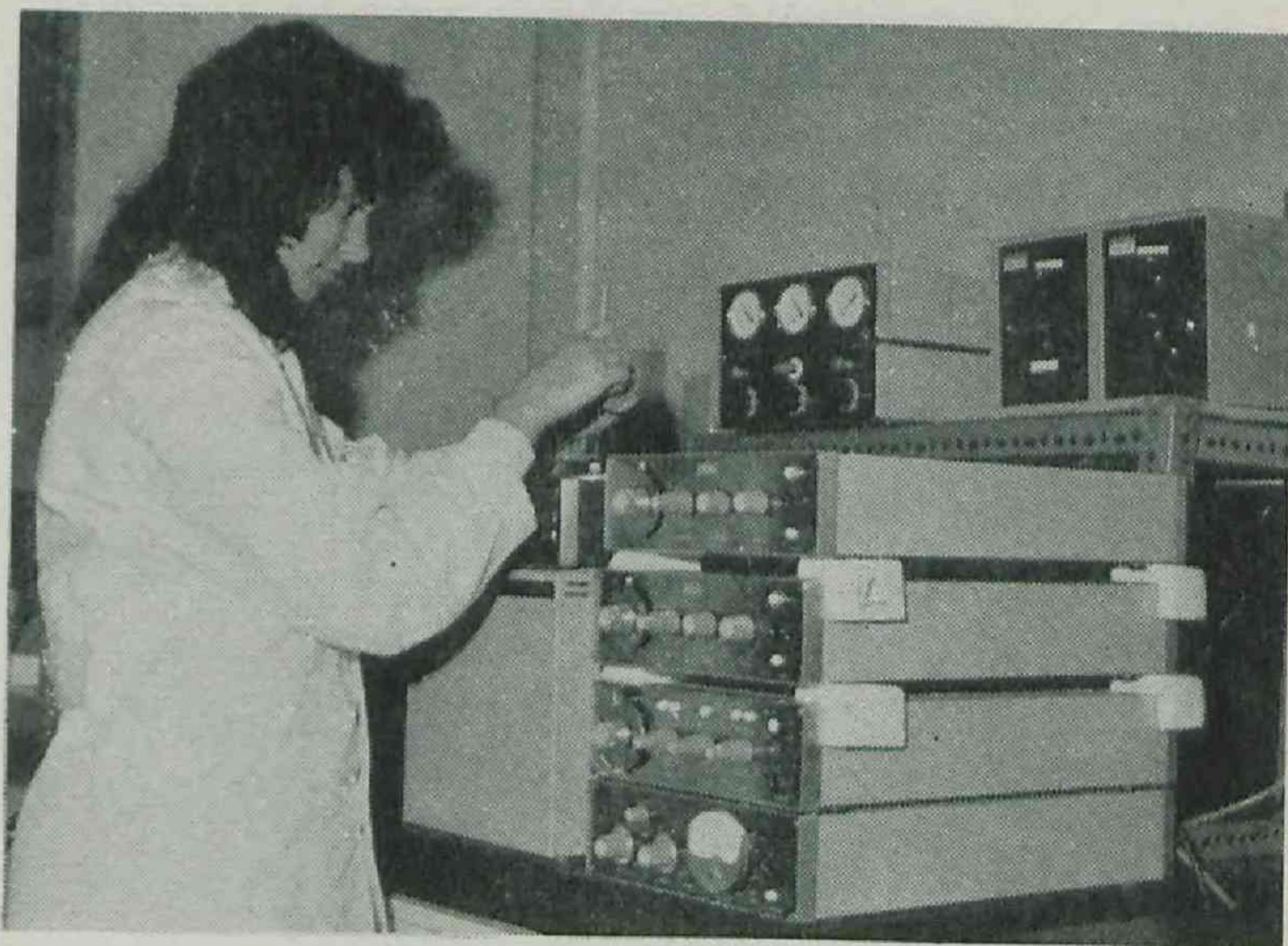
Frontal dune and beach damaged by cyclone. Research on dune vegetation is aimed at assisting repair.

Other studies which will provide information of economic benefit are the vegetation survey in the Moreton region, the Brisbane Airport Development Environmental Study and the Western Arid Land Use Study.

All the information gained from these studies of vegetation is being stored in computer memory for future use in the preparation of detailed vegetation maps of the State.

Crop damage from air-borne weedkillers is causing increasing concern. The number of analyses performed by the Agricultural Chemical Laboratory as a result of complaints of damage by spray drift of herbicides increased considerably. The combination of mass spectrometry with gas chromatography has enabled positive identification to be made of amounts of herbicides hitherto impossible to identify with certainty.

Besides regulatory residue work the Agricultural Chemical Laboratory Branch has collaborated with other branches in determining residues of a variety of insecticides and fungicides.



The concentration of active pesticide in a dipping vat sample being determined by gas-liquid chromatography at D.P.I.'s Animal Research Institute.

### SPRAY DRIFT DANGER

In a move to reduce the risk of weedicide spray drift damaging nearby agricultural crops, the coastal strip north from the Brisbane boundary to Noosa Shire was declared the State's first weedicide spray hazard area. Within this area, covering the shires of Noosa, Maroochy, Landsborough, Caboolture and Pine Rivers, and the city of Redcliffe, weedkillers such as amines of 2,4-D, diuron, paraquat and 2,2-DPA are in a group not affected by the new control. Dust formulations of MCPA; MCPB; 2,4-D; 2,4-DB; 2,4,5-T; fenoprop; 4-CPA; picloram and dichlorprop are banned. If using a third group, the property owner is required to employ a licensed operator or obtain a license himself. This third group includes other formulations of picloram and ester formulations of the chemicals mentioned. Applications for permits must be lodged with the Standards Officer of the Department at least 10 days before it is intended to begin spraying. The new control, of course, does not obviate the need for all users of weedicides to continue to exercise precautions to avoid accidental damage to crops in their neighbourhood.

### LAND UTILISATION

The year under review has been the most significant in the eight years' history of the Division of Land Utilisation. Steps taken have not only confirmed its role as a reference authority on land use in agricultural and pastoral areas but also as the administrative base for the implementation of statutory land use programmes in areas where soil erosion is a problem. In future, the use of land within its capability limitations will be mandatory in declared areas of soil erosion hazard and the project plans being prepared on the Darling Downs are based on this premise.

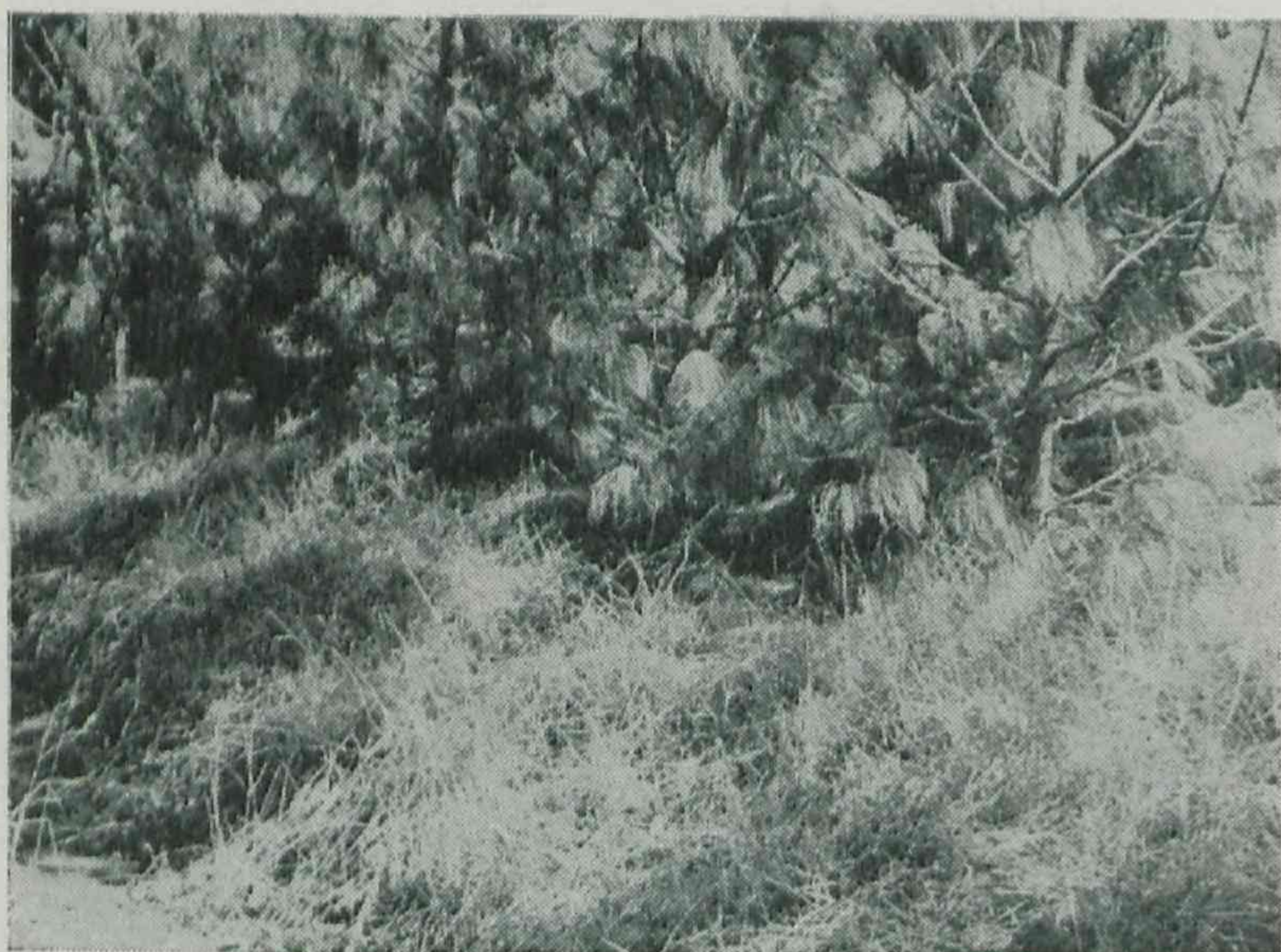
The Division's involvement in land resource assessments continues to expand. This at times puts undue pressure on the limited specialist staff available. However, there is unlikely to be any reversal of this trend due to the competitive demand for these services and an appreciation of the fact that apart from primary industry production there is an increasing need to allocate lands for other purposes such as recreation, wildlife refuges, national parks, scientific reserves and for watershed control above water storages particularly those required for urban water supply.

Land resources assessment projects together with environmental impact studies call for a multi-discipline approach and in this regard the Division plays an important role in integrating the contributions from other units of the Department and, where applicable, those from other departments.





Steep, severely eroded canelands may be reclaimed successfully by reforestation. Exotic pine in foreground performs well in subsoil and grass. Hoop pine in grassed area is struggling for survival.



After about 6 years, the litter from pine trees in combination with native grasses forms a deep mulch to protect and rebuild the soil.

Development Planning officers have been actively engaged in the co-ordination of field activities and the preparation of reports to Government relating to the restructuring of the eroded sugar lands at Gin Gin, near Bundaberg, the preparation of joint reports with the Irrigation and Water Supply Commission on important regional irrigational projects at Bundaberg and Warwick, and in technical and land use studies of the Burdekin Basin, Coastal Lowlands, Western Arid, Eastern Downs and the Granite-Traprock area.

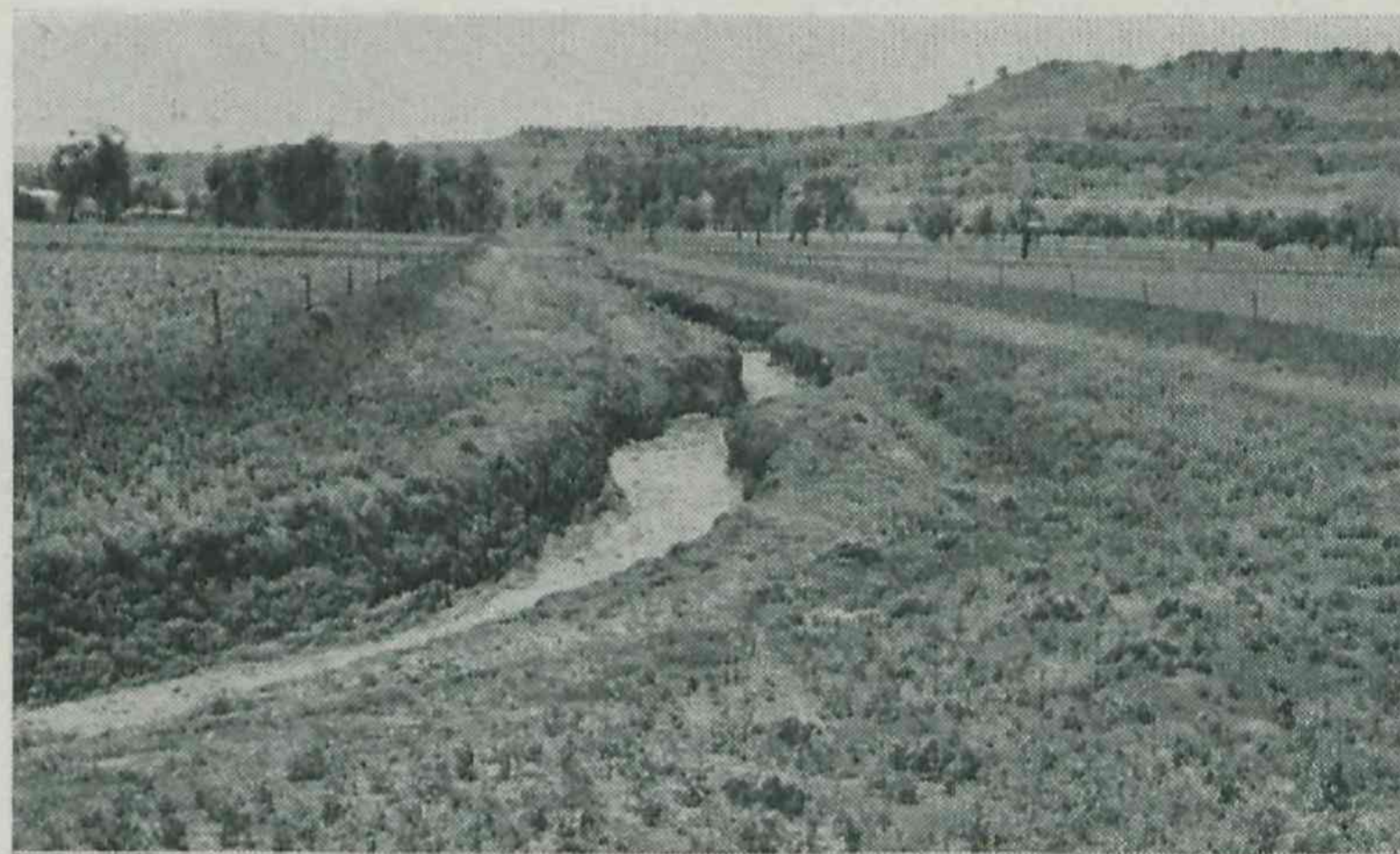
A study of the various factors which may be used to assess the suitability of soils for irrigation has begun in the Emerald Irrigation Area. This study involves not only the Agricultural Chemical Laboratory staff located at Emerald but also a major portion of the resources of the staff stationed at Biloela. Results from the first season's experiments are now being assessed.

#### ACTION ON SOIL EROSION

Soil Conservation Branch's report for 1971-72 indicated a disturbing reduction in soil conservation programmes by farmers over the preceding five years, and proposed that in 1972-73 the causal factors would be assessed and possible solutions devised.

Economic and other studies revealed that farmers' attitudes were being influenced primarily by economic and financial issues but there were indications that firm programming proposals on a statutory basis would stimulate activity.

Excessive erosion, siltation and flood damage occurred on the Darling Downs in late spring, and the severity of damage led to a decision by Government to assume leadership in implementing proposals for dealing with soil erosion problems on the Darling Downs.



A gullied waterway in the Bell area. Instability of waterways and drainage lines is a major drawback to the application of mechanical erosion control measures on the Western Downs.



Gully control measures such as this sill construction (above and below) now constitute a large proportion of extension activities by Soil Conservation Branch officers in the Miles district.

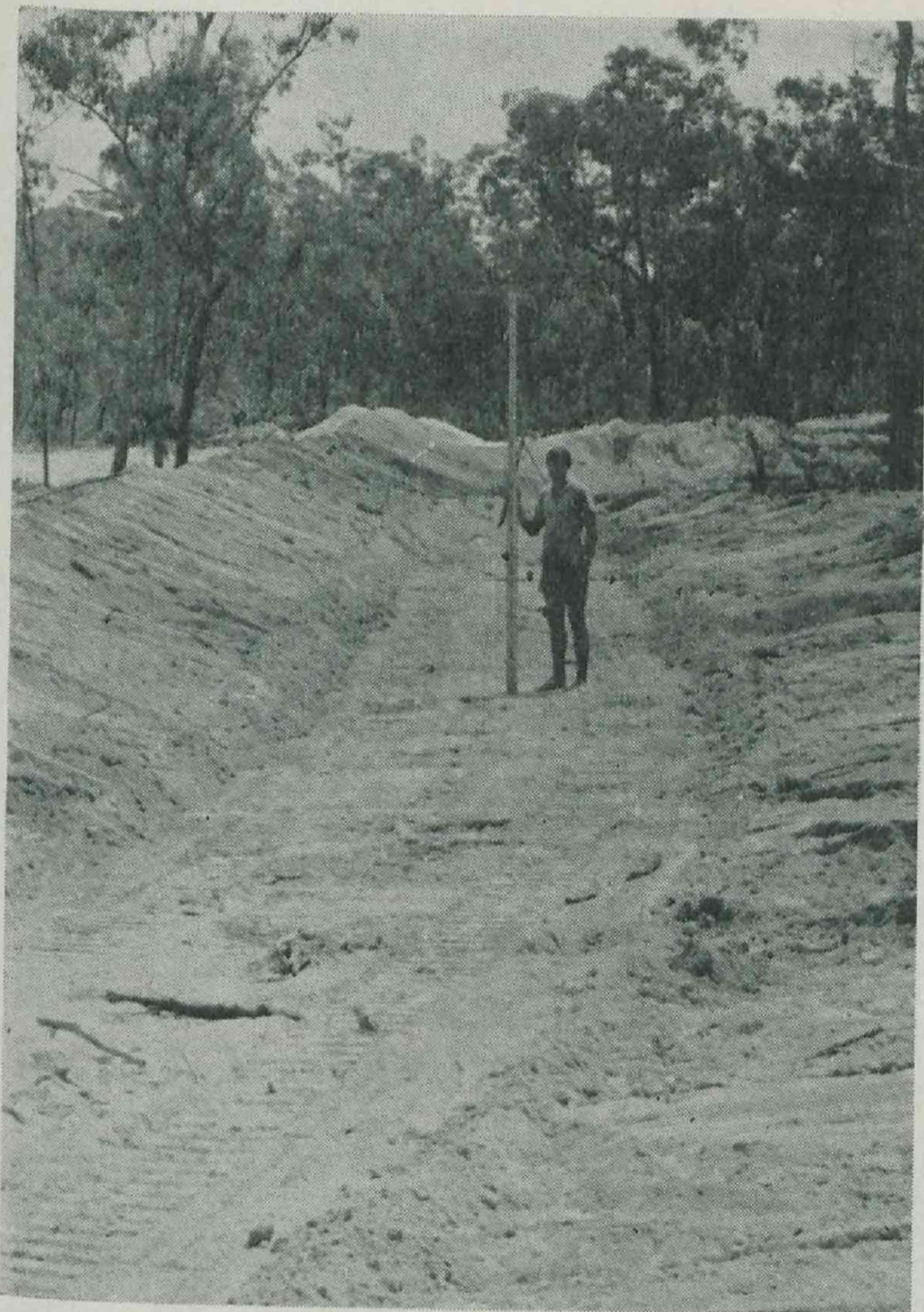


These programmes provide for the planning and resolution of land use and erosion problems on some 1.6 million acres of eroded lands on 7 600 properties by 1986. The Government will provide a financial incentive by a matching grant up to a total of \$1 000 per farm enterprise in relation to expenditure by farmers on soil conservation measures undertaken in accordance with an approved project plan in declared areas of soil erosion hazard. Five shires have been so declared and include Allora, Cambooya, Clifton, Pittsworth and Jondaryan Shires.

At present good progress is being made in the preparation of land use and soil conservation project plans for over 100 000 acres of land in these shires. Liaison is now well established with these local authorities and as a further step a Regional Soil Conservation Committee has been set up to co-ordinate activities with all affected statutory bodies.

There was a marked swing to cattle raising in some agricultural areas, and a consequent conversion of some lands from cultivation to pasture. This trend has been stimulated by the attractive beef prices and the good future prospects which compare with some disappointing results from winter and summer crops in recent years. The trend is especially evident around Biloela and to a lesser extent in other parts of central Queensland and the Western Downs.





Well-constructed diversion bank protecting a tobacco paddock in the Dimbulah District.



A power grader constructing parallel contour banks in the Mareeba District.

Cultivation for crop fattening in the Western Downs is likely to continue, and will be associated with a high soil erosion hazard. Any trend towards pasture establishment in lieu of cultivation would greatly lessen the erosion threat in the region.

Departmental efforts to promote the utilisation of crop residues for erosion control are resulting in farmers becoming increasingly aware of the practicability and benefits of the practice. Consequently, there was a significant trend towards stubble retention particularly in the Western Downs region where special efforts were directed to on-farm trials designed to demonstrate machinery that will handle stubble as a surface mulch.

Progress in achieving broad-scale adoption has been slow but on the Darling Downs stubble mulching will be a specified requirement for most areas included in project plans, and the subsidy scheme covers machinery modifications needed for effective stubble mulching. Consequently, a more rapid adoption of the practice is expected.

Progress is continuing in the land system mapping for areas to be covered by the technical guide to conservation land use, and it is now possible to estimate soil losses under

different land use for each land type and to specify practices required to reduce erosion losses to acceptable levels for each land type.

A general guide for the specification of land use and practices for the Eastern Downs has been prepared in draft form and is being used for planning measures in the Darling Downs statutory programmes.

At the request of the Co-ordinator General, a study involving an area inventory, a land capability classification for a range of non-urban uses and the preparation of land use recommendations for the Moreton Statistical Division was undertaken. The study is expected to be completed shortly and inventory data are held in computer storage.

#### BOTANICAL IDENTIFICATION

The field work for the woody weeds survey of central Queensland was completed and is now being extended to the southern half of the State. A preliminary analysis of the results indicated that it will be possible to forecast the problems likely to arise when land is cleared, and to suggest the most suitable treatments.

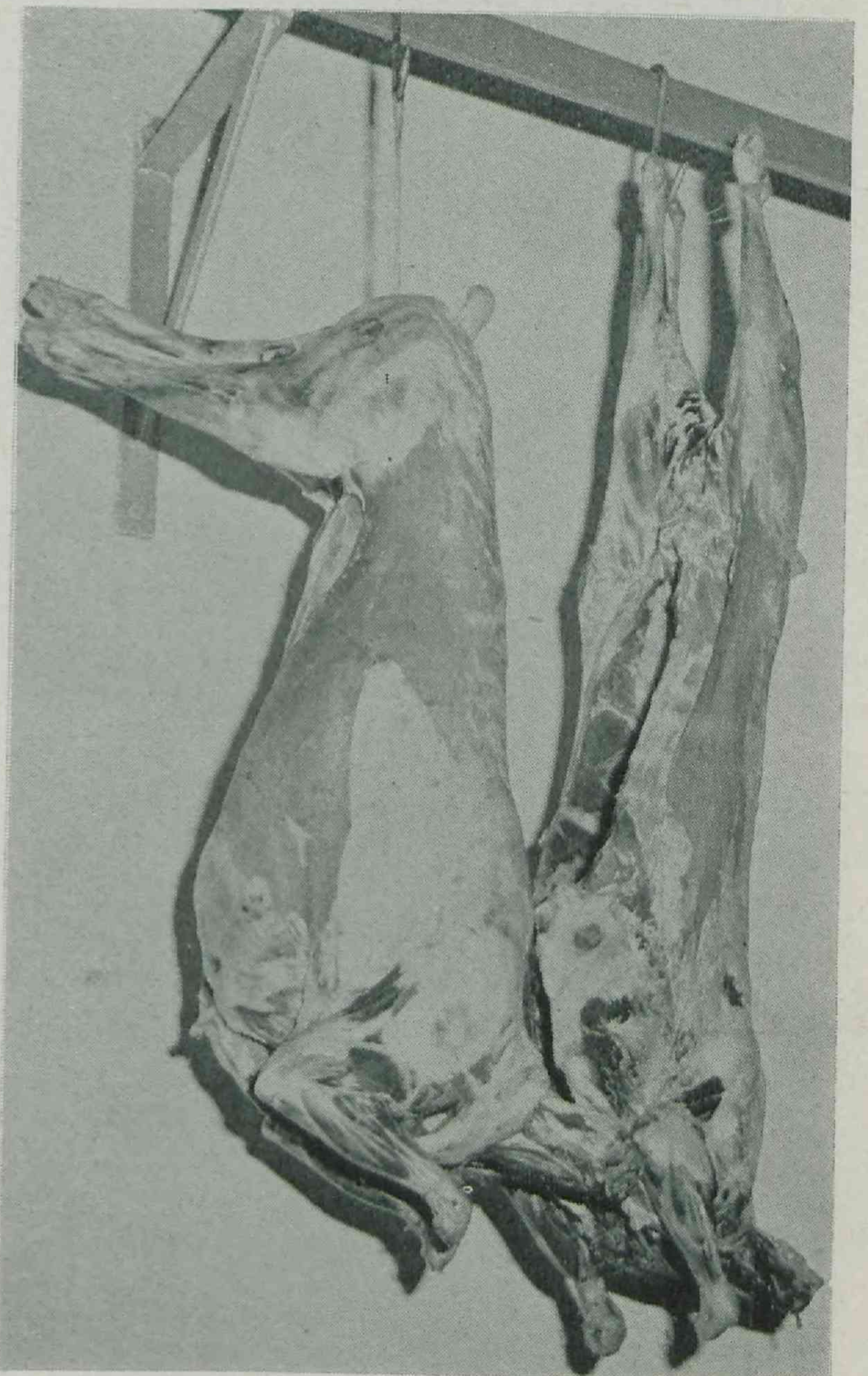
Nine named species of plants not previously recorded as growing wild in Queensland were noted in the field or received for identification. Five of these are recorded from other States. Three are probably new records for Australia, and one is a cultivated ornamental introduced from South America, which has now been recorded as naturalized for the first time in Queensland.

There was a very considerable increase in the number of demands received from the Police Department for the identification of specimens and in the number of court appearances, mainly involving *Cannabis sativa*.

Some progress was made with the Flora of Australia project. The Executive Committee for the project has put into operation the agreed plan to prepare a check list of Australian plant names as a preliminary to the preparation of a full Flora of Australia. Work has already commenced, under the auspices of the Australian Academy of Sciences.

#### MEAT PROMOTION AND MEAT QUALITY

A start has been made in the field of meat promotion and meat quality in the promotion of tenderstretched beef and mutton. A series of 35mm slides were prepared illustrating methods of breaking up beef hindquarters and mutton carcasses. The lack of knowledge on the part of many butchers



Tenderstretched (carcass on left) meat and mutton are being promoted by officers of Slaughtering and Meat Inspection Branch as part of their efforts towards the improvement of meat quality.



of how to break up tenderstretched carcasses is believed to be at least partly the reason why the process has not been used extensively to date. It is apparent that there are many other fields to be explored in meat quality; techniques are available to improve quality but it remains to get trade and consumer acceptance.

The upgrading of slaughterhouse standards in full compliance with the provisions of the slaughtering regulations continued during the year with particular emphasis on the quality of water supplied to slaughterhouses, poultry slaughterhouses and butchers' shops. This activity has been carried out with the co-operation of officers of the Department of Health and Local Authority Health Officers throughout the State. The results of the water sampling undertaken have been most disturbing and it does appear that all water supplies to country slaughterhouses, poultry slaughterhouses and butchers' shops should be chlorinated.

The Meat Industry Act was amended in certain particulars during the year. The date amendments will come into operation has not yet been proclaimed. The amendments give power to the Queensland Meat Industry Authority to grant, renew, transfer, cancel or suspend licences for abattoirs, slaughterhouses, public meat markets, poultry slaughterhouses or knackers' yards, and to make recommendations to the Minister with respect to the setting up of regional meat areas in addition to the public and district abattoir areas. The amendments also provide for compensation to be paid to owners of private abattoirs or slaughterhouses prohibited from slaughtering by reason of the constitution of public, district or regional meat areas. At the financial year's end, draft meat industry regulations which will be operative under the new Meat Industry Act were being prepared for approval. These regulations provide for specific standards in country slaughterhouses based on throughput, and it is to be hoped that when these regulations are promulgated the new standards will lessen the present disparity between the abattoir and country slaughterhouse standard, and make good hygiene more easily attainable.

### LOT FED BEEF

Coupled with the high prices in the fat cattle market is an upsurge in feedlot fattening. Established feedlots on the Darling Downs expanded in capacity and the number of smaller opportunist feedlots increased. The increasing demand on the Japanese market for heavily finished heavyweight grain fattened beef has also increased interest in lot fattening and several large scale feedlots have been developed by meat exporting companies in conjunction with Japanese interests in Queensland during the year. These feedlots have started out at about 3000 head capacity with likelihood of expansion if the economics prove sound. This trend in feedlot development will create greater demand for store cattle as well as for coarse grains and could have an inflationary effect on the market for both commodities.

The increase in feedlotting experience combined with improved financial returns led to further sophistication in feeding techniques. The most noticeable innovations were the use of all concentrate rations and increasing use of high moisture grain.

The number of enquiries on feedlot fattening noticeably increased. These enquiries came from Queensland and other Australian States as well as overseas countries including the U.S.A. and Japan.

Feedlot trials conducted during 1971-72 in the Toowoomba district showed that in the hands of experienced feed lot operators, roughage could be successfully eliminated from the ration. Further trial results indicated that the performance of steers fed an all-concentrate ration was at least equal to that of steers fed conventional roughage-grain rations. All-concentrate feeding does reduce labour requirements, although it is still necessary to feed roughage during the introductory period. Although the addition of 5% cotton seed meal to all-concentrate rations improved performance, this improvement was not economic. By comparison, the addition of chlortetracycline to conventional grain-roughage rations did give an economic advantage over the unsupplemented ration.



Housewives are beginning to show a keen interest in the improved eating qualities of tenderstretched meat.



In another feedlot trial, the performance of steers receiving *ad lib* grain with either 6% commercial premix, 3% tallow plus 3% premix, or 3% premix (control) was assessed. Self feeders were successfully used after initial acceptance problems had been overcome. The estimated daily carcass gains for the 116-day experimental period were 0.81, 0.62 and 0.73 for the commercial premix, tallow and control groups respectively. The respective feed conversion ratios were 12.4, 13.7 and 12.5. Although the overall feedlot performance of the steers receiving the commercial premix and of the control steers was similar, the cost per kg of carcass gain favoured the controls (55.8 c v. 49.4 c). Additional experimentation is required to elucidate the roles of tallows and of true protein and urea mixtures in all-concentrate feeding.

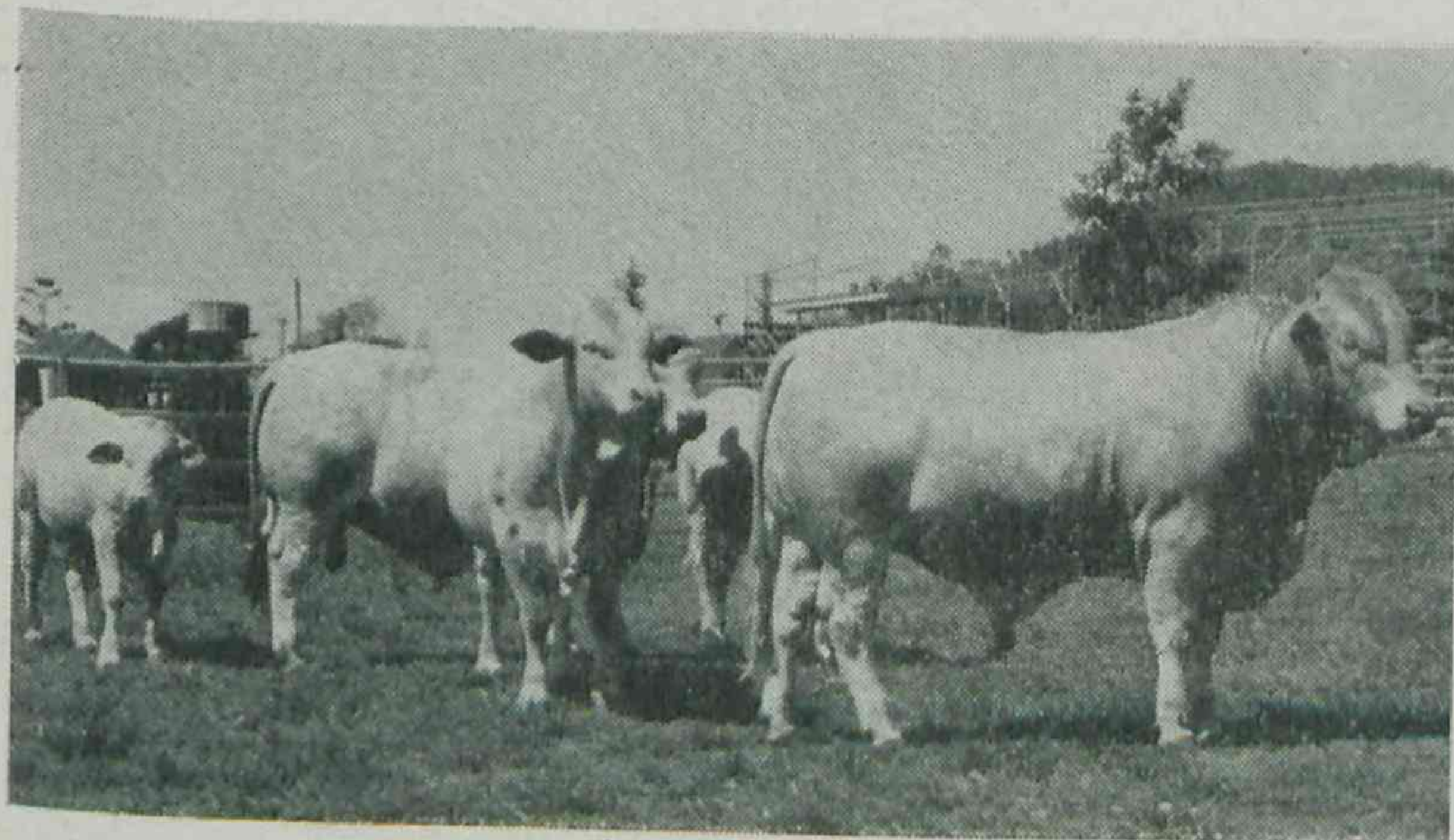
### NEW BREEDS

Because of the great interest shown by the beef industry in importing Simmental semen for crossing with the Hereford, a large-scale experiment is being run at the Department's Research Station at Theodore.

The large European Simmental is expected to make a significant impact on the beef industry in the more favoured areas of south-east Queensland. In this area, the nutrition level generally is adequate to allow these faster growing breeds to express their genetic potential for growth.



"Belmont Red" cattle developed at the C.S.I.R.O. National Cattle Breeding Station, Rockhampton, are a stabilised halfbreed based on Africander, Shorthorn and Hereford blood. The use of "Belmont Red" bulls as a third breed in a three-way crossbreeding programme is being studied in central Queensland with promising results.



Semen from a wide range of Continental cattle breeds is becoming readily available in Australia, and the performance of crossbred animals from early inseminations is being observed. These bulls are the result of crossing Charolais and Brahman cattle on a central coastal Queensland property.

For the long-term experiment at the research station, up to 250 Hereford females will be inseminated each year for three years with imported semen from 12 Simmental bulls. The F1 progeny, both males and females, will be back-crossed to Herefords. Comparisons will then be made between the first and back crosses and straight Hereford bred by sires from well-known studs.

Fertility, growth rate, calving difficulties, and carcass quality will all be measured and compared. Apart from the resulting hybrid vigour, the Simmental is expected to lift growth rates and milk yields, while the Hereford should provide fertility, early maturity, and carcass quality.

### BUFFALO FLY TAX

Recent amendments to legislation affecting livestock producers in Queensland included a provision to revoke the Buffalo Fly Control Act from July 1, 1973. This means that no Cattle Sales Stamp Duty will apply to receipts for the sale of cattle in Queensland. The action was taken in response to representations from producer organisations whose members felt they received no direct benefit from the stamp duty which also did not attract a subsidy from the Government as did moneys collected for stock assessments.

### ACTIVITY OF A.I. CENTRES

The proving of dairy breeds for artificial insemination this year gained its highest level of interest and support since its inception in 1955. A critical situation which might have developed through the phasing out of Commonwealth support for this project was averted by an increase in the range and quality of bulls placed under test. This was only achieved with the assistance of breed societies, and with the co-operation of the British Milk Marketing Board and the New Zealand Dairy Board. Bulls have been nominated by the societies and semen donated from proven sires overseas for inclusion in the proving teams. Combined with sons of proven sires from the Departmental programme, the teams have attracted unprecedented interest from farmers, resulting in a high level of co-operation.

The A.I. proven sires for the season completed in 1972 were as follows:—

Australian Illawarra Shorthorn: Cedar Valley Contract, a son of the A.I. proven sire, Navillus Gold with a rating of +113.5 kg (250 lb.) for milk and +5.4 kg (12 lb.) for butterfat.

Friesian: Coolangatta Airman 38th rated +287 kg (633 lb.) for milk and +15 kg (33 lb.) for butterfat.

Jersey: Westwood Silver King, a son of the A.I. proven sire Willowbank Silver Royal II, with a rating of +5.4 kg (12 lb.) for milk and +8.2 kg (18 lb.) for butterfat.

The A.I. export centre at Redlands, designed specifically for processing of semen for the American market, was completed during the year. Bulls have been admitted to the centre where they are housed indoors as a protection against the insect vector of ephemeral fever. With respect to several bulls the exacting health requirements of the United States veterinary authorities have been met and the first shipment of semen is expected to be made early in the new financial year.

Development of a farming system based on irrigation at the Wacol A.I. Centre, coupled with strategic purchase of feeds at favourable prices, resulted in savings in feeding costs of the order of 40%. Bulls are now individually fed according to their requirements, and their condition has been the subject of much favourable comment from visitors to the centre.

With the change from glass ampoules to plastic straws for storage of semen, capacity at the A.I. Centre has risen to a conservative potential production of 30 000 doses of semen a month which is considerably in excess of present requirements.

Total semen distribution, including semen imports, was 113 926 in 1973 compared with a total of 97 120 in 1972. In 1973, the proportion of dairy semen distribution was 69.1%, and of beef semen, 30.9%. Privately-owned bulls held at the centre accounted for 9 245 doses of beef semen while imported semen distributed comprised 7 964.

There is a pleasing trend to the use of proven sires which accounted for over half the dairy semen sales. Semen was supplied to all Australian States and exports were made to Fiji, Malaysia, New Zealand and Papua New Guinea.

Wacol A.I. Centre now offers semen from the largest range of breeds in Australia, mainly because of the variety of *Bos indicus* cattle in use there. The service provided is completely beyond the scope of a private facility at the present time.

### DAIRYING IN THE TROPICS

The comprehensive dairy cattle husbandry research programme involving improved tropical pastures, animal nutrition, herd and pasture management, grain supplementation, and evaluation of a new tropical breed, is capturing the interest of farmers in the north.

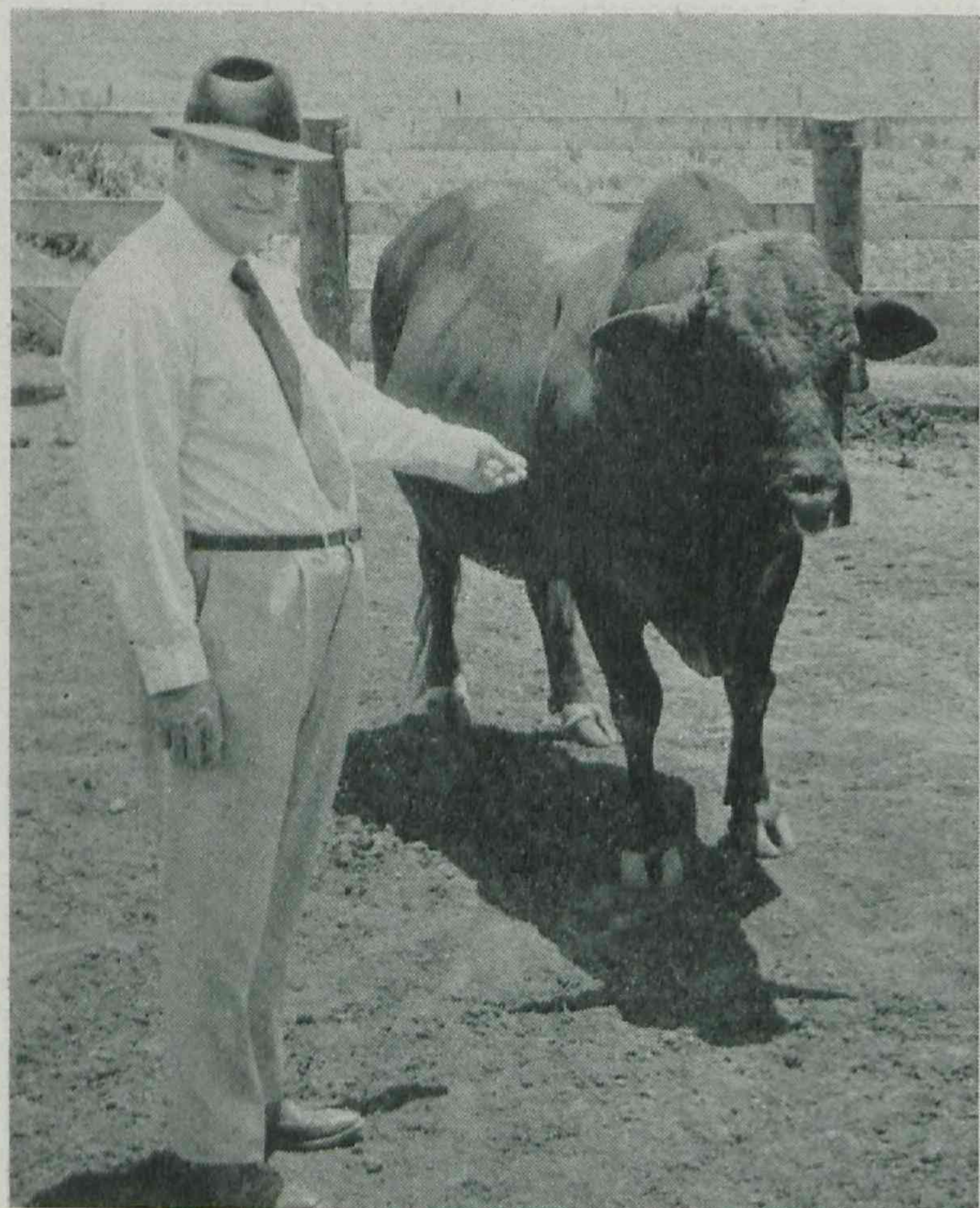


The main Friesian herds at Kairi Research Station are producing very satisfactorily, with milk yields of more than 4 000 kg per cow in 300 days. In studies of differing stocking rates, a milk yield of more than 8 000 kg per hectare is being obtained.

Over most of the improved pasture areas, the stocking rate of 0.64 hectares per cow can be maintained and shows a similar high production per animal.

Dairy farmers have shown considerable interest in the project for rearing of calves by multiple suckling. Up to four calves per cow are being suckled in these projects. Dairy farmers see in multiple suckling an efficient way of producing replacement heifers, and, in some cases, utilising cows surplus to dairy requirements and animals not suitable for use in the herd.

The development of a tropical breed of dairy cattle oriented towards milk supply received a boost with the re-organisation of the breeding programme designed to produce the Australian Friesian Sahiwal. The large numbers of breeding stock required will be built up with the co-operation of the dairying industry. Individual farmers will have access to stock which have been evaluated in tests of production, temperament and tick resistance. Progeny-tested Australian Milking Zebu bulls from the C.S.I.R.O. proving programme will be used as well as proven Friesian sires from the Wacol A.I. Centre. In addition to its local value, a keen interest is anticipated in the potential of the breed for export of both cattle and semen.



The Minister for Primary Industries (Hon. V. B. Sullivan, M.L.A.) inspecting one of the Sahiwal crossbred sires at D.P.I.'s Kairi Research Station.

At the same time, it is interesting to note that in trials at Ayr Research Station Jersey and Friesian cattle have continued to produce very high levels of milk from intensively managed, nitrogen-fertilized irrigated pastures. The optimum stocking rate for Jerseys is approximately 8.4 cows per hectare (3.5 cows per acre). It is obvious that on suitable soils, and given adequate water for irrigation, this system of management in tropical regions can rival and perhaps surpass temperate areas in milk production per unit of land.

Stocking rate trials on glycine-green panic pastures at Kairi Research Station are entering an interesting phase and some of the limits to production are being defined. There was an almost linear decrease in production per cow as stocking rate increased and conversely a linear increase in production per hectare. The decreased production of cows in high stocking rate treatments appeared to be due to reduced persistency of lactation rather than lower peak yields. The maintenance of a higher stocking rate is dependent on an increased winter-spring feed supply, therefore highlighting the future importance of techniques such as irrigation, conservation and nitrogen fertilization.



Some of the Sahiwal x and Friesian dairy cattle at Kairi Research Station.

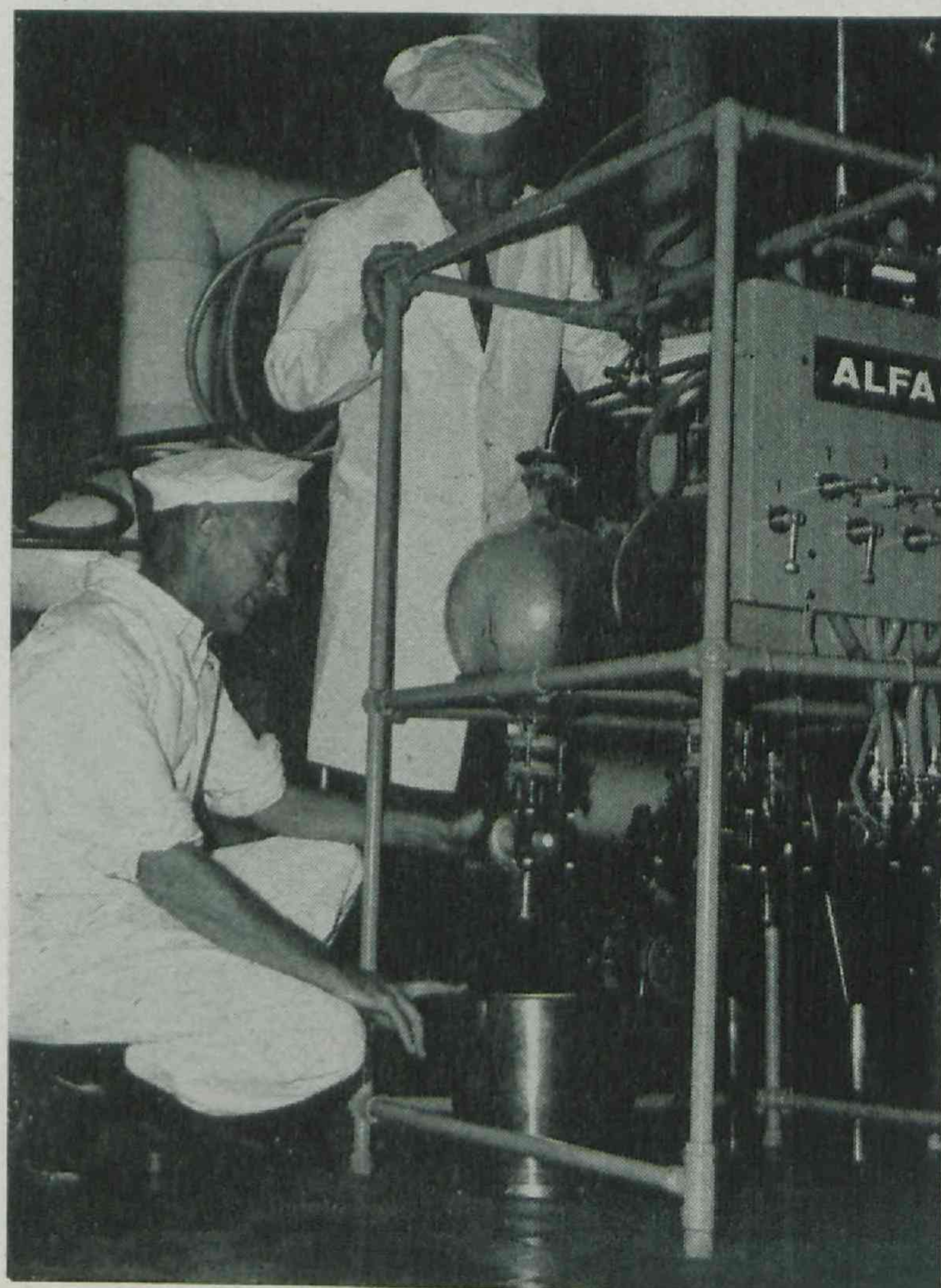
These stocking rate trials clearly highlight the importance of developing highly productive pastures, and the need for farmers to pay due attention to the efficiency of individual animals.

### NEW DAIRY FOODS

The Dairy Research Laboratory is continuing its efforts to expand the markets for dairy products.

Whey concentrate was successfully substituted for egg albumen in dessert preparations. Fruit juice concentrates were successfully incorporated into milk based drinks. Surveys were commenced with the co-operation of Field Services Branch officers to assess consumer acceptance.

Work on the inclusion of sunflower oil in butter was undertaken on behalf of the Butter Marketing Board, and involved the addition to the cream before pasteurising of sufficient sunflower oil for it to replace up to 25% of the fat in the resultant butter. The mixture was pasteurised, cooled and churned in the pilot plant of the Otto Madsen Dairy Research Laboratory. The resultant butters had exceptional spreadability but were otherwise indistinguishable from butter made without addition of oil.



Centritherm concentration of whey products carried out at the Otto Madsen Dairy Research Laboratory at Hamilton.

Tests on the addition of butterfat fractions to milk for cheesemaking showed that up to 20% of the milk fat in cheese milk could be replaced with either the hard or the soft fractions of butterfat before loss of grade occurred, relative to control vats made from other portions of the same milk without replacement.



Preliminary experiments showed that up to 30% of the milk fat in wholemilk can be replaced with hard butter fat fraction without interfering with the spray dried product.

Modified starches were used with and without additions of skim-milk powder to enable the production of smooth, high viscosity yoghurts without homogenisation, to enable small-scale yoghurt production at factories with limited local markets.

#### ANIMAL DISEASE CONTROL

The tuberculosis and brucellosis eradication schemes have been launched with great vigour and have involved the expenditure of approximately \$1 million during the past year. If the present rate of progress is maintained, then at least 75% of the State will be virtually free of tuberculosis in about five years. The brucellosis eradication programme has revolved around the vaccination of exposed and infected herds, while surveying by field teams is being carried out to determine the location and incidence of infected beef herds.

An ephemeral fever epizootic developed in the Hughenden and western peninsula areas during September, 1972. Favoured by the best summer wet season since 1956, the disease spread with great rapidity through central Queensland and by June had involved the whole of the State.

Multi-resistant tick foci became widespread and as this was associated with the development of additional chemicals capable of controlling multi-resistant ticks, it was felt that the time had come when the area and property concept of control should be abandoned. As a result, the administrative controls on individual properties infested with resistant ticks were removed on May, 29, 1973, and the tick line from Round Hill Head to the Great Dividing Range revoked. Uniform conditions now operate in the movement of cattle in the tick infested areas of the State.

A severe tick outbreak in clean country occurred at Kaimkillenbun where 13 properties were found to be infested and another 55 properties were involved in restrictions.

Anaplasmosis is increasing in incidence and importance. Producers are now being encouraged to actively immunise young stock under 12 months of age with bivalent tick fever vaccine, containing *Babesia argentina* and *Anaplasma centrale*.

Surveys have indicated that trichomoniasis is more widespread in the beef cattle industry than was previously thought, and the present policy relating to trichomoniasis infected properties may have to receive further consideration.



Environmental conditions in poultry buildings are important in their effect on production. A poultry officer and the manager of a large Brisbane caged layer farm discuss the significance of radiant heat measurement obtained with the globe thermometer.

Marek's disease remains as a serious poultry disease problem. However, field vaccination trials using turkey herpes virus (THV) are showing promising results.

Pullorum disease, a serious disease of chickens up to three weeks of age, again appears to have been reduced to insignificant proportions.

In a major attempt to control mastitis, considerable effort has been given to the development of W.M.T. (Wisconsin Mastitis Test) testing programme to prepare data for extensive advisory action.

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About 3 000 herds are being examined monthly in 20 centres. In addition an evaluation of practices on 60 of these herds was initiated in the East Moreton region using herds in the consistently low, consistently high and fluctuating range of cell counts. Of the 3 000 herds milks examined monthly by field staff 50-55% of samples recorded "below 500 000 cells per ml" and 5% recorded results "above 1 000 000 cells". As part of next year's extension on mastitis control, individual producers will receive progressive running average results, and a series of advisory services will be available for those interested in introducing remedial measures.

Two farmer programmes concerned with self-education in the forms of a carrel and individual work sheets are being evaluated in addition to a packaged project activity for school children. These programmes are designed to provide a wide range of methods to increase awareness and improve motivation.

#### PLANT PEST CONTROL

Extensive heliothis infestations occurred in coastal and subcoastal districts throughout the State. Activity by the insect pests began in early summer and subsequently intensified under the influence of persistent high temperatures. Infestations in some of the major agricultural areas reached unprecedented levels of severity.

Vegetable and field crops attacked included cotton, sorghum, tobacco, lucerne, maize, navy beans, soybeans, peanuts, sunflowers, french beans, tomatoes, lettuce and cabbages.

There were a few instances of naturally occurring virus diseases reducing pest numbers to uneconomic levels, but in general, biotic control factors were either non-existent or inoperative. Consequently, frequent and precise applications of insecticides were necessary to keep damage to tolerable levels. Even so, the intense infestation pressure made it difficult to achieve satisfactory control, particularly on the Darling Downs. The problem in this area was aggravated by the emergence of strains of *H. armigera* with resistance to DDT. Laboratory tests have indicated that larvae of *H. armigera* from Brookstead are approximately 25 times more resistant to DDT than comparable larvae from the Biloela area. On this basis it is considered highly unlikely that DDT will provide satisfactory control of *H. armigera* on the Darling Downs in the forthcoming 1973-74 season, and it is probable that this situation will be duplicated in other parts of the State. Alternative control measures are available but an intensive programme of insecticide testing and evaluation of biotic control measures against *H. armigera* is planned for the Darling Downs region for the 1973-74 season.

Research of fruit fly disinfestation is facilitating the interstate movement of fruit and vegetables from Queensland through the development of reliable commodity treatments. Such treatments are necessary to enable compliance with quarantine regulations of other states and countries.

Most of the methods used have been derived from experimental studies on gas fumigation of various fruits and vegetables infested with different developmental stages of fruit flies. The emphasis is on efficacy with safety. In any fumigation work there is always the possibility that hazardous levels of toxic residues may persist in treated commodities. Consequently, effective dosages have to be given a safety clearance by the National Health and Medical Research Council before they may be adopted for commercial practice.

Successful treatments have already been devised for zucchini marrows and pumpkins.

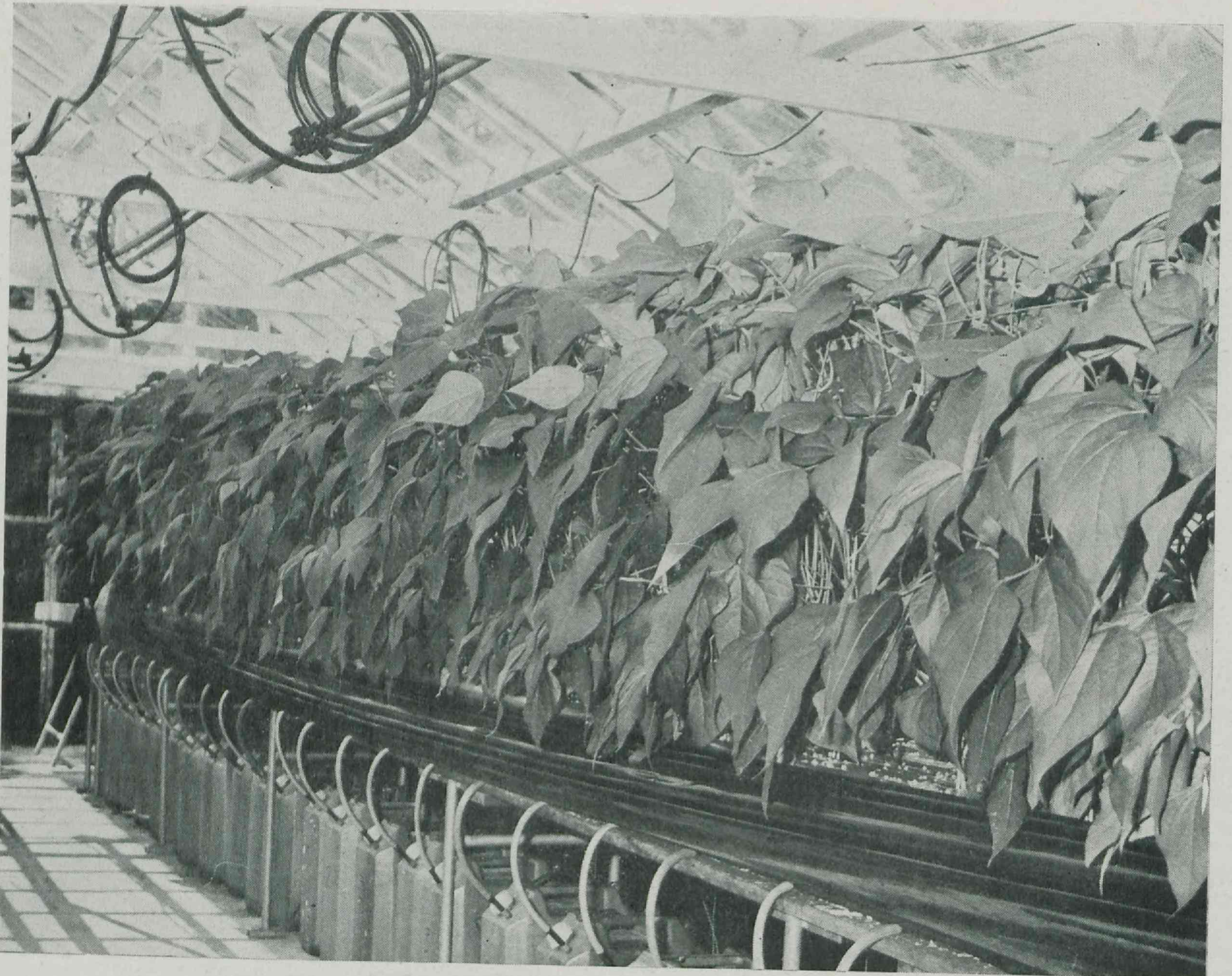
Preliminary studies have shown promise of a successful treatment of mangoes infested with the Queensland fruit fly.

Sporadic occurrences of the day-feeding armyworm in north Queensland areas built up to outbreak proportions in March. Crops of maize and grain sorghum as well as approximately 70% of pastures in the region were affected to some extent. Insecticides were applied with varying degrees of success depending on the state of development of the larvae and the extent to which infestation had become established. Despite advanced warnings of anticipated outbreaks, many infestations were not detected until well entrenched and causing obvious damage. Late season activity by insect parasites and infection of larvae with a fungal pathogen contributed significantly to the ultimate decline of armyworm populations.

#### PLANT BREEDING

The hybrid maize breeding project centred at Kairi Research Station in north Queensland has won world renown. The first hybrid released from this programme for commercial production was QK 37, and this variety has topped the International Maize Adaptation Trial conducted by C.I.M.M.Y.T., from Mexico. The trial tested 50 maize varieties and hybrids, bred in 16 countries, at 24 sites throughout the maize-growing areas of the world. One of these 24 sites was on Kairi





Bean nutrition studies with nutrient solutions at Redlands Horticultural Research Station.

Research Station, and it is interesting to note that another locally bred hybrid KTW 232, actually outyielded QK 37 (8430 kg/ha vs 7780 kg/ha). Third place was occupied by a Mexico hybrid H. 5B7, yielding 6080 kg/ha. The other Queensland entry in these trials was a local selection, Atherton Dent, which achieved 38th place out of 50. This indicates that the variety QK 37 has considerable adaptive capacity. A comparison of the relative performances of QK 37 and Atherton Dent provides a striking example of the bonus to be derived from scientific plant breeding. QK 37, in turn, has been largely replaced on the Atherton Tableland by the new Kairi hybrid, QK 217, which is performing better.

Kairi maize breeding continued to yield exceptionally good results, as shown by two new varieties, KTW 231 and KTW 232, which are being offered to the seed certification scheme as both had continued to perform meritoriously in the third year of testing. Both have given a remarkably high yield increase over previous varieties and should be ready for seed production in 1973-74, and release in 1974-75. Another new hybrid, KTW 324, was the first to indicate resistance to head smut and small acreages will be sown in 1973-74 for field assessment.

Following expansion of sorghum growing, a small plant breeding programme was begun in 1966, and later intensified in 1970 by the allocation of a plant breeder to the crop. Some of the early plant breeding material is now undergoing field scale testing, and three lines HR 1, HR 2 and 70/50 are at this stage producing yields comparable with the currently accepted commercial varieties from U.S.A.

Certified seed of a new tomato variety suitable for south-eastern Queensland is now available to growers. The variety, Strobelee, has good resistance to Fusarium wilt and grey leaf spot and some resistance to target spot and tobacco mosaic. It was selected at the Department's Redlands Horticultural Research Station, and is similar to two of the Florida varieties, Floradel and Indian River, already well-known to Queensland growers. The new variety has many qualities that will make it a valuable addition to the list of commercial varieties now available.

#### WINE PRODUCTION

Interest in wine production in the Granite Belt is increasing rapidly. A record 80 000 gallons were produced last vintage by established small vignerons. This was from

table grape varieties, but the area of wine grapes is increasing, and, with the relaxation of quarantine restrictions on the introduction of planting material, will increase sharply in coming seasons.

Three variety trials were established, one at Applethorpe, one at Ballandean and one at Inglewood, to assess the performances of a range of introduced wine grape varieties. In the first trial at the Granite Belt Horticultural Research Station, Applethorpe, all varieties cropped last season, and within the next three or four years useful information should be available from the three trials. However, it is likely that commercial interests will undertake substantial commercial plantings before this direct information is available.

#### PACKAGING RESEARCH

Throughout the year there was considerable interest in the use of refrigeration for the cooling of fruit and vegetables prior to consignment to market. Particular efforts were made with regard to tomatoes and specific problems with respect to rates of heat transfer between package and cooling air became apparent. Research into the problem will be commenced in the coming year, particularly in relation to the heat transfer characteristics of expanded polystyrene containers.

A pilot plant was constructed to carry out trials on the more efficient packing of bananas by mechanised tight fill with single fruit. Further work is being done in package design for mandarins.

#### METRICATION

The progressive changes brought about by metric conversion had some impact in certain areas of activity of Standards Branch. Restatement of directions for use in metric terms on labels of registered pest destroyers is expected to be completed by the end of 1973 or early 1974. In horticultural packaging, most industries commenced conversion to the metric system on July 1, 1973; an exception is citrus (where container dimensions are not yet finalised), which will change from April, 1974. Some rationalisation is naturally expected in the number of packages that will eventually appear on the uniform packages schedule. An interesting concurrent development is the apparent trend towards increasing use of solid plastic such as polystyrene as an acceptable packaging material for fruit and vegetables.



The Queensland herd recording system for dairy cattle converted to the metric system for measurement of milk and butterfat on July 1, 1973.

A departmental metrication committee, with representation on the inter-departmental metrication committee, and on the agricultural extension sector committee, has disseminated all available metric conversion information to every staff member of the Department. In addition, basic training courses in metric conversion have been conducted for all the Departmental clerical staff at all centres throughout the State. All officers have been alerted to identify problems in conversion requiring concerted action so that appropriate action can be taken. It has become apparent that the conversion is relatively simple when once tackled, and the progressive introduction of metric conversion is calculated to minimise any confusion that might arise.

#### ORGANISATION FOR FISHERMEN

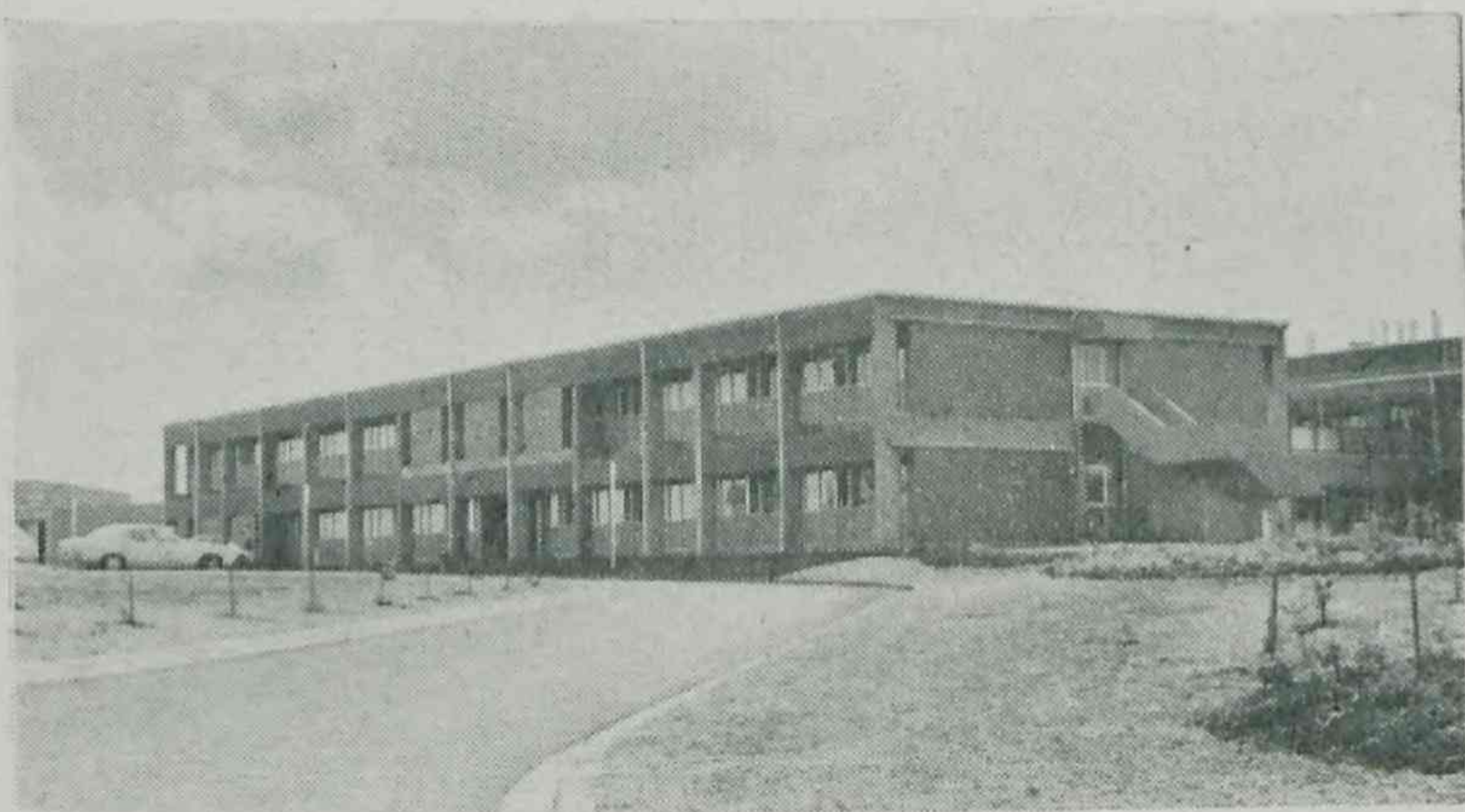
Provision was made for the setting up of a State-wide organisation for commercial fishermen. This was done through amendments to the Primary Producers' Organisation and Marketing Acts. The new body will comprise local branches, district councils, and a State Council, following closely the pattern of other successful producer organisations such as the Queensland Dairymen's Organisation. By this means, it is intended to ensure that all professional fishermen will be represented adequately on, and through, their organisation, and so will be enabled to present a unified view on any matter affecting their interests. One of the organisation's functions will be to assist in co-operation among fishermen, the Fish Board, and the Government in improving efficiency in the industry and in the conservation of fisheries.

#### BUILDINGS AND EQUIPMENT

A major building project officially opened by the Minister on June 28 was the Department's new complex at Toowoomba. These buildings, costing \$1.8m to construct, and containing \$300 000 of new scientific equipment, underline the importance of the Darling Downs in the work of the Department, as shown by the growth of staff from less than a dozen 30 years ago to almost 150 today.

The new Agricultural Chemical Laboratory Building completed at Indooroopilly at a cost of \$1 700 000 was occupied in September, 1972.

The metropolitan section of the Fisheries Branch moved into new office and laboratory premises at 76-86 George Street in May. Work commenced on a small fisheries research facility at Walkamin, where pond trials will be carried out to test the suitability of a number of species of freshwater fish for introduction into water impoundments in north Queensland.



Front portion of D.P.I.'s new complex of buildings at Toowoomba.

Economic Services Branch moved from Head Office into renovated premises in Korboots Building, 74 George Street, in April, 1973.

New quarters for fauna conservation research were occupied by staff at Pallarenda near Townsville and at the Hermitage Research Station near Warwick.

Construction of the new boar, dry sow and farrowing building was commenced at the piggery, Biloela Research Station.

Additional building facilities have also been completed at Kamerunga, Swans Lagoon, Biloela, Gatton, Redlands and at the J. Bjelke-Petersen Field Station, at a total cost of \$240 000.

#### STAFF LOSSES

Retirements during the year included that of Mr. Brook Rice, Director, Division of Dairying, and Mr. F. G. Chippendale, Director of Agricultural Chemical Laboratory Branch.

The sudden death of Dr. S. T. Blake, Senior Botanist, on February 24, 1973, was a very serious loss at both the official and personal levels. Dr. Blake was a plant taxonomist with an international reputation for the high quality of his work and for his outstanding contributions to our knowledge of Queensland plants. He was an acknowledged authority on the Gramineae, Cyperaceae and on *Eucalyptus* spp., in particular, and his recent paper describing a new plant family, Idiospermaceae, created world-wide interest.

#### STAFF TRAINING

Inservice training in farm management for extension officers was intensified, and three centralised schools were conducted during the year. Over 450 officers have now received farm management training since these schools were initiated in 1963, with the result that the Department is now better prepared to enter into the new system of regional wholefarm extension organisation.

Inservice training schools were held by many branches, and various officers attended schools, conferences and seminars in parts of Queensland and in other States.

Two officers attended the Commonwealth Dairy Farm Management Refresher course at the University of Sydney in July, 1972. An integrated approach was adopted in this course in reviewing the latest technology in dairy cattle husbandry and providing an economic assessment of improved management practices being recommended.

An interstate meeting was attended in Sydney to consider the implications of the A.C.C.R.A. (Australian Chart Coding Rural Accounts) code in State Departmental farm management services.

To gain a greater understanding of the application of the A.C.C.R.A. code in farm management accounting, regional agricultural economists attended a series of seminars conducted by the A.C.C.R.A. Secretariat from the University of New England in Brisbane, Toowoomba and major coastal centres.

This Department has played a very active role in moves towards standardisation in farm management accounting since the early 1960's. The A.C.C.R.A. code has been endorsed by Standing Committee on Agriculture and efforts to have the code adopted for rural accounting throughout Australia are being financed by the Commonwealth Extension Services Grant. Interest is now being fostered in A.C.C.R.A. particularly to encourage accountants to adopt the code and provide more management oriented services to their rural clients.

An Australian Wool Board Sheep and Wool Refresher Course in group extension programming was held in South Australia in September, 1972. Three officers from the Warwick district were exposed to this training as a group for support in the application of the principles they learnt from the course in their own region. A similar approach is to be adopted for the course in Western Australia in October, 1973, with a Departmental team from Roma.

Four officers attended the annual conference of the Australian Agricultural Economics Society held at the Australian National University, Canberra, in February, 1973.

The second Australian Farm Business Management Congress was held at Albury in February, 1973. The former Farm Management Section of the Australian Institute of Agricultural Science has now been disbanded as a purely professional body in favour of the new Australian Farm Management Society. Being broader based to include farmers and agri-business people the new society represents a major step forward in furthering the interests of farm management as a discipline in Australia.

Following a report to Standing Committee of the Australian Agricultural Council, highlighting the need for closer liaison between State Departments in the development of farm management advisory services, an interstate meeting of specialist officers was held in Sydney in October, 1972. Closer liaison is now being achieved and plans are underway for a National Workshop in Farm Business Management Extension to be held in Perth in November, 1973.

A workshop on Meteorological Data and Project Planning, convened by Development Planning Branch, was attended by officers of Agriculture, Economic Services, Biometry, Soil Conservation and Development Planning Branches.

The objects of the workshop were:

- (i) to examine current research techniques in relation to variability in (a) climate, (b) soil and (c) plant factors with a view to determining the desirability of adopting a system analysis approach and
- (ii) to discuss the implications arising from the foregoing examination.



A major conclusion of the workshop was that—"the adoption of a systems analysis approach to agronomic research is desirable. Having recognised this, it is also obvious that the ramification of implementing such an approach is far reaching. Adoption would necessarily be a gradual process and would logically not be limited only to agronomic research.

Officers from Development Planning Branch participated in an additional Branch Workshop at Head Office from July 31–August 3, and it was made possible for interested personnel from Agriculture, Agricultural Chemical Laboratory Branch and Soil Conservation Branches to participate in certain sessions of the workshop.

Recurring points debated during the workshop were (a) the nature and extent of involvement of Department of Primary Industries and particularly Development Planning personnel in broad spectrum land use studies that would be required in the future; (b) the significance of the demand for environmental and ecological impact statements to be prepared as an adjunct to the land use studies conducted by the Branch; (c) what constitutes the most appropriate organisation of Departmental specialists for a multi-disciplinary approach to land use studies.

Apart from the formal sessions at which papers were presented, officers were afforded opportunities for strengthening and better appreciating their own roles in relation to the wider role of the Division of Land Utilisation within the Department of Primary Industries.

A highly successful symposium organized by the Charleville Pastoral Laboratory and attended by 37 workers in the mulga lands of Australia was held at Charleville in August, 1972. The proceedings of this symposium have been reprinted in the March, 1973, issue of the Tropical Grasslands Journal.

Mr. R. W. Johnson, Senior Botanist, continued his post-graduate studies at the Utah State University, U.S.A. and will complete his work for the Ph.D. degree in August, 1973.

Messrs. W. J. Scateni (Uni. of California), E. K. Christie (Macquarie University, Sydney), D. A. Ivory (Uni. of Queensland), R. G. Henzell (Texas A. & M.), Miss J. A. Tommerup (Texas A. & M.) and Miss P. M. Pepper (Uni. of Southampton) complete studies towards Ph.D. degrees and return to duty shortly, while Messrs K. G. Rickert (Uni. of West Australia), I. F. Beale (Uni. of Colorado) and W. H. Burrows (Aust. National Uni.) have entered on advanced studies towards a Ph.D. during the year. Messrs R. P. Johnston and V. E. Mungomery returned to their plant breeding programmes at Hermitage and Biloela respectively, following higher training at Australian Universities.

## OVERSEAS STUDY TOURS

The Director of Dairy Field Services, Mr. W. D. Mitchell, undertook an overseas study visit to Indonesia, Britain and Europe for a period of eight weeks to study milk production, processing and distribution practices, and advisory services associated therewith. The visit was financed from C.E.S.G. funds and the Department of Foreign Affairs.

The Director of the Fauna Conservation Branch, Dr. G. W. Saunders, was selected to join the Australian delegation to the International Convention on Trade in Certain Species of Wildlife held in Washington, D.C., early in 1973.

The Senior Development Planning Officer (Livestock Resources), Mr. W. F. Y. Mawson, undertook a study tour of South Africa, the West Indies and the United States of America during the period April 26 to June 24.

Mr. I. D. Galloway, Entomologist, went on leave in June to the United Kingdom where he will work for a period of four weeks at the British Museum (Nat. Hist.) on the parasitic wasp family Scelionidae and other insects.

Mr. T. Rudder, District Adviser, Rockhampton, went on a five-week study tour of the U.S.A. A syndicate of central Queensland graziers paid a handsome compliment to this officer by instigating the tour and contributing substantially to the cost.

Miss M. L. Moffett, Senior Pathologist, visited New Zealand for two weeks with funds supplied by C.E.S.G. Not only was she able to observe the work being done by the eminent plant bacteriologist, Dr. D. W. Dye, but she was able to observe in the field the symptoms of important bacterial plant diseases not yet in Queensland. Such diseases are fireblight of pears and apples and bacterial wilt of lucerne.

Mr. W. Pont, Senior Pathologist, visited New Guinea and was able to observe symptoms of tropical and sub-tropical plant diseases not yet in Queensland.

Miss Jan McCulloch, Nematologist, left for 12 months post-graduate training at the Imperial College, University of London.

Miss J. K. Thompson, Agricultural Economist, was recalled from leave while overseas to study farm management recording systems in the dairy industry in England. Interest was centred on schemes to provide objective guidelines on farm performance through determination of efficiency ratios calculated with a minimum of farm recorded data.

Mr. I. J. L. Byford, Husbandry Officer, was able to undertake a three weeks study tour to examine the application of dairy husbandry research in England, Scotland and Ireland during a private overseas trip. Funds were provided by Commonwealth Extension Services Grant.



Sahiwal-Hereford crossbred heifer.



## II. Livestock Research and Extension

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

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

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

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

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

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

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

### BEEF CATTLE

#### Breeding Herd Trials and Surveys

A number of trials were commenced under field conditions to evaluate the performance of breeders and the growth of steers of different breeds, in particular of Africanders (Belmont Red) and Braford's in central Queensland. The performance of Brahman crossbreds and cattle of other breeds is to be studied in both the dry and wet tropics of north Queensland. Two trials were also commenced in north Queensland in order to assess the combined effects of recommended standard husbandry practices in increasing reproduction performance.

Other trials to examine breeder performance under various environmental conditions are continuing.

Although pregnancy rates of 75 to 90% have been recorded, estimated branding rates have varied from 50 to 80% suggesting substantial foetal and peri-natal losses in north-west Queensland. Accordingly a survey was commenced in 1970 on five properties to examine the reproductive performance of cattle in that area and to determine the causes of reproductive failures. Peaks in the conception patterns were evident during October-December and again during March-May, being associated with early storms and the beneficial pastoral effects of later rains.

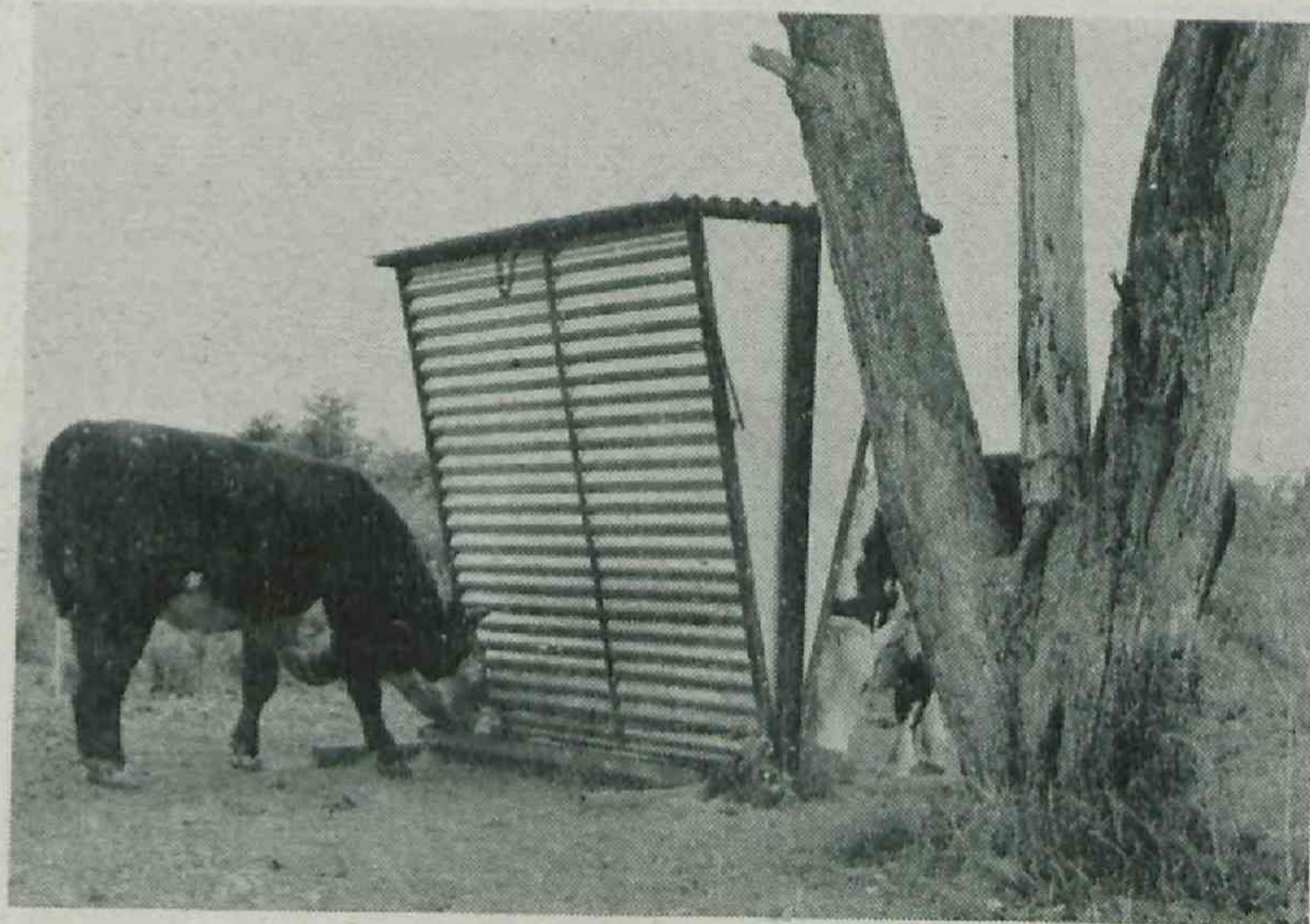
Investigations were initiated in two of the herds to measure the effect of vaccination against *Leptospirosis pomona* and *L. hardjo* in terms of branding rates.

The findings of another trial, in the Cloncurry district, showed that rainfall and conception patterns are very closely associated. The practice of weaning in May-June (early) in preference to September-October (late) means a liveweight advantage of 39-43 kg to breeders at the end of the dry season. Early weaning was shown to reduce liveweight losses during very dry and drought seasons. Although early weaned cows conceived earlier, their overall pregnancy rate by the end of the year was similar to that of the late weaned group. Early weaning overall added stability to the reproductive cycle, primarily by alleviating the stress due to lactation during the dry season.

Observations on breeders conducted from 1968 to 1972 on a property typical of the red forest country in the St. George district recorded average pregnancy rates of 88% for maiden 2-year-old heifers, 85.5% for 3-year-old heifers and 90.5% for mature breeders with a December to March mating period. The majority of breeders conceived during January, averages being 55% of all maidens, 65% of 3-year-olds and 59% of all mature breeders. Conception rates for any month within the mating period were directly related to rainfall. The reduction in pregnancy rates during the dry years was associated mainly with the failure of the older breeders (10-12 years) to conceive. Average weaning weights at 5-8 months of age of 182 to 209 kg for steers and 189 to 199 kg for heifers were recorded. The estimated losses from mid-pregnancy to weaning were 3.5 to 6.8% for all breeders, being mainly due to dystocia.

Phosphorus and NPN supplementary feeding trials were continued.

Following the finding of a sodium deficiency in grazing cattle on a property in the Pilton district, a trial is to be conducted to investigate the changes in liveweight, saliva Na/K ratio and faecal sodium when steers grazing native pastures are fed an *ad lib* salt supplement. This trial is being undertaken by Beef Cattle Husbandry Branch in conjunction with Biochemistry Branch.



With the current buoyant cattle market there is increasing interest in the use of grain supplementation in the paddock for topping-off steers. Grain self-feeders which allow intake control are being more widely used for this purpose.

The effects of feeding either a urea or grain supplement to cattle grazing sorghum stubble were studied in two trials at Toowoomba.

The role of supplementary grain feeding in improving productivity on buffel grass pastures was investigated on a property east of Emerald, while crop feeding trials were conducted at Auburn, Wallumbilla and Meandarra.

#### Performance Recording

The national beef recording scheme was launched during August, 1972. The scheme is being managed by the Agricultural Business Research Institute of the University of New England with general oversight and control vested in a committee of various state government and producers representatives. With the launching of the national scheme, the



previously existing "N.S.W. Scheme" was terminated and data stored in this scheme were transferred to the New England centre. To date a total of 150 producers, in all States, have enrolled in the national scheme. Of these, 31 are from Queensland and there are another 60 Queensland producers who have indicated an interest or an intention to join at a later date.

A new and important area of research was developed during the year at "Swan's Lagoon". Animal behaviour studies of experimental groups supplemented with urea/molasses in drum lickers revealed patterns of behaviour which varied as the nutritive value of pasture deteriorated and subsequently improved following rains. These studies have important implications in supplementary feeding and are to be extended.

Weaner supplementation experiments at "Swan's Lagoon" have been concluded. Conclusions from these studies include the finding that liveweight responses to urea/molasses supplements occur when faecal protein falls below 8%, the magnitude of the response does not exceed 0.25 kg per day regardless of whether the pasture provides a maintenance or sub-maintenance ration, and the remaining liveweight advantages at the end of the following wet season represents a substantial economic response to supplementation. Further evidence was obtained that commercial black phosphoric acid is an unsatisfactory source of supplementary phosphorus.

The first phase of a major breeder supplementation trial at "Swan's Lagoon" was concluded. Responses occurred in each of the three years to dry season urea supplementation in terms of increased weaning rates and weights. The fertility response to phosphorus supplementation was of a lower order in the marginally deficient environment. Only in the very dry mating period during the 1972-73 summer were any breed and pasture effects on fertility evident. Under these conditions lactating Shorthorn cows had a pregnancy rate of 60% in contrast to 32% in crossbreds. At double the stocking rate, the pregnancy rate was higher in cows grazing Townsville stylo than those on native pasture, and this response was more marked in Shorthorns. In every year, crossbred cows had higher milk yields and their calves had heavier weaning weights. This experiment was modified to test the effects of supplements on the reproductive performance of cows mated during the late summer period.

The responses obtained in growing stock to urea-molasses supplementation in the dry tropics are now under examination in two other environments, namely, the southern spear grass at "Brian Pastures" Research Station and the brigalow region as represented by the Brigalow Research Station. An attempt to assess response to sulphur supplementation on deficient spear grass at "Brian Pastures" met difficulties in supplementation techniques but there was no response during the short period when intake of supplement was at a satisfactory level.

Considerable progress was made in the investigation of grain supplementation of growing steers both at Brigalow Research Station and in field trials. While some promising results have been obtained, no firm conclusions and recommendations can yet be made.

Satisfactory breeding performance was achieved in cows grazing wallum pastures at Coolum Research Station with restricted mating aimed at calving during the third quarter of the year.

Ten Brahman bulls were performance tested between 250 kg and 350 kg liveweight. The average performance of the group was 1.0 kg liveweight gain per day and 7.0 feed conversion ratio. The two best bulls averaged 1.3 kg per day gain and 5.9 feed conversion ratio. These two bulls were also tested for resistance to ticks and had a slightly lower resistance than expected for the breed.

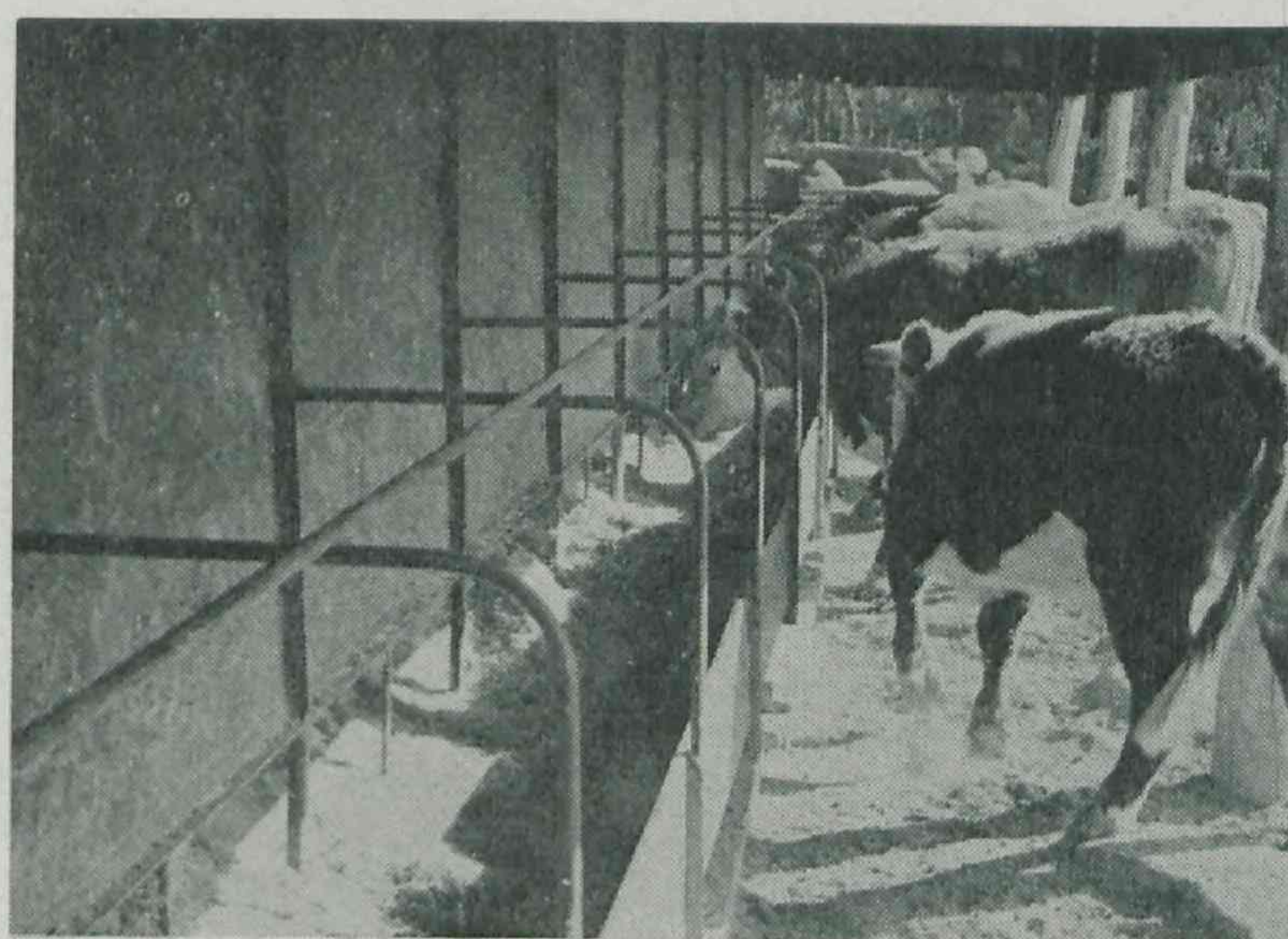
### Nutrition

Experiments continued on intensive finishing of steers on high grain diets, intensive feeding of calves, survival feeding, supplementation of grazing steers, nutritive value of reconstituted grain, the utilisation of urea by calves, and mineral deficiencies.

Oats is not a common grain for intensive finishing of steers but it has been used periodically when there have been cheap supplies. In commercial feed lots it has been fed at between 70-100% of the diet and generally the results have been poor, the animals experiencing digestive upsets. In experimental feedlots it was fed as the sole grain at 60-90% of the diet and compared with wheat at these levels or was fed at 30 to 45% of the diet with equal quantities of wheat. Changeover periods were either 20 or 5 days. No digestive upsets occurred. Liveweight gains were approximately 1 kg per head per day. Generally the liveweight gains of steers receiving the oats were slightly inferior to those receiving wheat.



Storage area and self-feeders are self-contained in this unit on the Darling Downs.



Close up of the self-feeder in the self-contained unit shown in the preceding illustration.

In Queensland, Brahman cross-bred steers have not been used as extensively as British breed cattle in commercial feed lots. The Brahman and its crosses are later maturing and consequently rapid fat deposition commences at a heavier liveweight. Hereford steers and  $\frac{3}{4}$  Brahman cross-bred steers of an initial liveweight of 220 kg were fed a diet of 85% rolled sorghum grain and 15% rhodes grass chaff. Steers were slaughtered at 350, 400, 450 and 500 kg liveweight. At all slaughter weights the Hereford steers contained more carcass fat than the Brahman cross-breds. The carcass fat percentages at 450 and 500 kg liveweight were 32.1 and 35.7 for the Herefords compared with 24.4 and 29.6 for the Brahman cross bred.



These 15 to 18 months old Hereford x Brahman crossbred steers are grazing a trial paddock grassed with green panic and buffel grasses.



In field trials with weaner cattle in north Queensland, commercial grade phosphoric acid in a supplement of molasses or molasses/urea lickers did not give increased liveweight gain compared with unsupplemented cattle during the wet season, and in the dry season resulted in a depression of liveweight performance. A pen-feeding trial using commercial phosphoric acid, pure phosphoric acid, M.A.P. and biophos was carried out to determine the cause of the lack of response and to compare the efficacy of the various phosphate supplements. The depressant effect of the commercial phosphoric acid was not demonstrated. All groups supplemented with the various forms of phosphorus had equivalent liveweight gains and phosphorus status.

Hereford calves weaned from their dams at 3 days were fed reconstituted milk replacer to 60 kg liveweight. From 60 to 200 kg liveweight the calves were fed pelleted diets containing combinations of sorghum grain, lucerne chaff, meat meal and urea. Six dietary treatments were compared. The diets were isonitrogenous, the crude protein content being 20% to 100 kg and 14% to 200 kg liveweight. The results indicate that a calf rearing system in which sorghum grain, chaff and meat meal are fed to the young early weaned calf, and a similar diet plus urea to the older calf, is viable.

A trial was undertaken to determine if early-weaned calves could utilise urea, and to examine the protein requirements of early-weaned calves. To 150 kg liveweight, even though biochemical tests suggested ureolytic bacteria were present, production results indicated that the calves did not benefit from urea addition to the diet. The addition of animal protein to the diet improved performance and suggests that calves unlike adult cattle are unable to provide this total initial amino acid requirement.

The optimum crude protein percentage of the diet of young calves lies between 16 and 20%.

#### Pests and Diseases

*Tuberculosis and brucellosis.*—Some of the larger pastoral companies are developing their own veterinary staff to tackle the problem of tuberculosis eradication on their own large and infected properties in the more remote areas. It is becoming evident that at least 75% of the State is in a position where eradication or "accreditation" can be achieved within about five years. Area surveying for tuberculosis in beef cattle herds is not likely to extend beyond the present boundaries of the protected area. In areas outside this, it is intended to rely primarily on back tagging of cattle sent to slaughter to monitor the overall position. The main problem of tuberculosis eradication is to be found in the far western areas. There are so many unknown factors upon which the volume of tuberculin testing depends that it is not possible at his stage to indicate when tuberculosis will be eradicated from herds in this area and it seems unlikely that it can be accomplished in less than 10 years.

At present, 18 Departmental staff are engaged full time on the eradication scheme while some Veterinary Services Branch field staff spend up to 25% of their time working on it. Practising veterinary surgeons participating in the programme have increased from 80 in the first year to 170 at present. They have recently become established in some of the more remote areas in centres such as Emerald, Moura, Taroom, Miles, Mitchell, St. George, Charleville, Longreach, Bowen and Ayr, while 16 additional veterinary surgeons have been employed as assistants to enter partnership with practitioners operating large animal practices in rural areas. Since the inception of the programme in November, 1970, almost 2 million beef cattle in approximately 10 000 herds have been tested and reactors were found in 274 herds. The overall disease incidence has been 0.1% compared with 2% in testing carried out in infected herds outside the protected area. For practical purposes tuberculosis can be considered eradicated in the dairy herds in the State, and these herds are now no longer levied for tuberculin testing purposes.

The current brucellosis eradication programme is concerned with two complementary activities, namely vaccination and surveying to locate infected herds. Approximately 500 000 beef and dairy cattle have been vaccinated with Strain 19 in 10 000 herds since 1970. At least 50% of dairy farmers are using Strain 19 regularly. In addition 70 000 heifers and cows have been vaccinated with Strain 45/20 vaccine on more than 200 properties. Bulk milk ring testing on dairy cattle in most dairying areas of the State has shown that up to 80% of herds are infected, according to districts. The prevalence of brucellosis in beef cattle in the protected areas is believed to be low and field surveys have recently commenced to determine whether this is so. Four testing teams located in the Brisbane, Toowoomba, Maryborough and Rockhampton areas commenced testing early in 1973, using the Rose Bengal Plate Field Test. It is proposed to employ a further four testing teams early in the next financial year.

*Cattle Ticks.*—A severe outbreak of cattle tick involving 13 properties was discovered at Kaimkillenbun and this involved another 55 surrounding holdings in restrictions. There are some 1 500 head involved in the quarantine area and 4 000 in the restricted area. The outbreak also involved the Dalby Saleyards. Ticks collected showed Biarra resistance and work is underway to control and eradicate this outbreak. One satellite outbreak occurred at Wutul and was associated with a severe outbreak of tick fever. Although Wutul is situated in Portion S, it is in a tick-free area and has been quarantined with a view to eradication. Evidence suggests that the outbreaks were the result of illegal movement(s) from the Kilcoy area. There are currently 32 properties quarantined for tick infestation within the Toowoomba Stock District. Also three outbreaks occurred in the Clifton area and two in the Oakey district. Tick fever occurred on a quarantined property with multi-resistant ticks at Goomburra. While the Columboola outbreak appears to be under control, treatments had to be intensified on the Darr Creek infested property. In the Maryborough division, three new quarantines were imposed at Kingaroy, one at Wondai and two at Yarraman, apart from the Wutul quarantine. During 1972 to 1973, a total of 667 tick samples were tested with the following results:—Mt. Alford strain 28, Biarra strain 251, Mackay strain 16, Gracemere strain 3, Ridglands strain 127, No resistance 242; Total 667. Further outbreaks of Mt. Alford strain resistance were detected in ticks from holdings at Beaudesert (1), Bundaberg (1), Goomeri (1), Gympie (3), Helidon (1), Innisfail (3), Ipswich (1), Maryborough (9) and Nambour (2). The three holdings affected at Innisfail included a Departmental Experimental Station. Further isolated single cases of Gracemere strain resistance were detected at Gracemere and Yeppoon, and isolated Mackay strain resistance was detected on two further holdings at Gladstone. Biarra strain resistance was detected on further holdings in areas outside of the Round Hill Head—Great Dividing Range administrative tick line, namely at Atherton (1), Biloela (9), Cape Tribulation (north of Cairns) (1), Dalby (1), Duinga (1), East Barron (1), Innisfail (9), Mareeba (1), Monto (1), Mt. Larcom (3), Mundubbera (5), Palmerston (1), Rockhampton (21), and Theodore (1).

The increase in outbreaks of resistance in areas north of the administrative tick line from Round Hill Head to the Great Dividing Range imposed a heavy burden on staff, who were so heavily involved with inspections of cattle before movement that in some areas they could devote little time to other duties.

With the spread of Biarra type resistance in the Rockhampton district, owners in that area became opposed to control measures relating to such movements and instigated approaches to have the administrative tick line moved north of Rockhampton.

This proposal also received support from local officers of this Department, but even so, movement of the line as requested would still have left over 100 resistant holdings in the area north of Rockhampton. In addition, with the availability of Promacyl and Chlorphenamide, both of which control strains of resistant ticks, it was felt there could be no certainty that all affected holdings in the northern areas had come under official notice. All in all it was felt a point in time had been reached in central and northern Queensland when the area and property concept of control might well be abandoned and reliance placed on an overall requirement that cattle be free of ticks to travel.

All control requirements imposed on individual properties infested with resistant ticks were therefore removed in 1973, and so at the same time the administrative tick line from Round Hill Head to the Great Dividing Range was revoked. Uniform conditions, therefore, now operate in regard to the movement of cattle in the tick infested areas of the State, as follows:—Slaughter cattle consigned direct to point of slaughter—treatment within 10 days prior to movement, to be free of ticks on yard inspection and be slaughtered within seven days thereafter. All other cattle—treatment within 72 hours prior to movement and to be free of ticks to travel.

A new carbamate preparation (Promacyl) was released for cattle tick control during early 1973. Observations have continued in field trials associated with the Ciba Geigy experimental chemical KC119. This dip has been providing a fast kill of all stages together with evidence of residual protection for up to seven days. It is anticipated that this preparation will be released for general use in several months time. Other observations are being undertaken with Chlorphenamide (0.1%) and also with Phosmet (Stauffer Chemical Co.). A set of dip moulds purchased with C.E.S.G. funds is being eagerly sought after by graziers and farmers wishing to install dips.

Scrub ticks were extremely active in the Range country especially in the area from Toowoomba to Nanango. In the Ravensbourne area over 30 head were lost in a group of four adjoining farms and few farms escaped without any deaths. Significant deaths were also reported from Yarraman, while one grazer in the Nanango district lost 40 head. The heavy



infestations did not abate until the heat wave conditions of mid December. There has been much speculation among the local population concerning the effect which 1080 baits have had in reducing the dingo population, which in turn has affected the ecological balance normally provided by dingo predation on bandicoots.

New Zealand cattle ticks were identified in cattle at the South Johnstone Research Station. Although they are known to occur in the Atherton Tableland, this is the first confirmation of them on the wet tropical coast.

*Miscellaneous*—In the northern parts of the State, buffalo fly numbers fluctuated but reached a peak during February. In the Gulf area, they spread south to Julia Creek, while in the central western region they spread as far south as the Arcadia Valley. The effect of dung beetles in controlling this parasite has been fairly closely observed in the field and to date the results have not been as encouraging as one would have hoped. Their numbers are greatly influenced by the prevailing environmental conditions and they decreased markedly either during very wet or dry conditions, while it appears that cane toads actively predate on them. Nevertheless it has been observed that when beetle activity rises, buffalo fly activity is cut drastically. Spraying trials using new chemicals supplied for testing by various chemical companies have been supervised at both Townsville and Mackay.

Numerous cases of death or sickness due to tick fever were confirmed from specimens submitted from over a wide range of the cattle tick infested belt of Queensland. One noteworthy feature has been the increasing incidence of anaplasmosis. As a result of this, together with the apparent dependability of *Anaplasma centrale* as an immunising agent, the introduction of Imidocarb as another therapeutic agent and the relative resistance of young cattle to the disease, producers are now being encouraged to actively immunise young stock under 12 months of age against anaplasmosis, by using bivalent vaccine.

While *Babesia bigemina* is not a problem on the whole, it can present a worrying problem to individuals. Losses due to *B. bigemina* were confirmed from Murgon, Crows Nest, Brandon and Gympie.

*Theileria mutans* infections were confirmed in cows at Calliope and Walkamin.

Further cases of haemolytic anaemia were reported in new born calves on a number of properties but the incidence would seem to be less than in previous years.

During early December, ephemeral fever was reported from Hughenden and later in the month reports were received from Black Braes and Oak Valley situated between Hughenden and Georgetown, and also from the western Peninsula. These outbreaks ushered in an epizootic which eventually covered most of the State by 1973.

Mostly animals up to three years of age were affected although there were exceptions to this and while losses occurred, these were not heavy. The greatest economic loss was caused by loss in condition and disruption of commerce by way of affecting cattle sales and movements. Co-operation was given to the University Veterinary School by way of locating suitable co-operators in which to carry out experimental vaccinations.

Surveys carried out by the University, as well as by officers of this Department, have indicated that the infertility trichomoniasis is more widespread than was previously anticipated. The organism has been isolated from cattle from a number of properties in the Mount Isa region while more recently a positive isolation was received from a property in the Mitchell district, as well as at Boulia and at Thargomindah.

Botulinum toxin Type D was isolated from a bovine post mortem carried out in the Croydon district. Although the disease is common in north-western Queensland, this is the first occasion on which this toxin has been typed from that area.

Developmental work by the Biochemical Laboratory on the residue characteristics of candidate acaricides selected on the basis of need has assisted in making available during the year two new acaricidal chemicals. One, in particular, is useful when required for dipping at short intervals before slaughter.

Field evidence of salt deficiency inhibiting productivity in beef cattle has been obtained on further properties on basaltic country on the eastern Darling Downs. Field trials to further investigate the problem are under way in collaboration with the Beef Cattle Husbandry Branch.

The long-term persistence of residues of the fungicide HCB in the milk of cattle following experimental feeding of HCB at the Animal Research Institute has been examined following a ban on the use of this seed dressing.

## Extension

The rapidly expanding beef industry with large numbers of new producers continuing to enter the industry is making increasing demands on the very limited Beef Cattle Husbandry Branch staff resources.

The beef industry has expanded rapidly during the last two years with a rise of 23% in total beef cattle numbers during the two years to 31-3-73. The heaviest increases during this period have been in the traditional sheep and sheep/beef areas. Each of the 27 extension officers of the branch has an average of 400 significant beef producers and 340 000 beef cattle within his district.

During the past year the two subjects which attracted a disproportionately large volume of interest in relation to their actual present importance to the beef industry were feedlot fattening and the introduction of the large European breeds of beef cattle. The requests for information on these topics were substantial, particularly in southern and central Queensland, and talks on both featured at branch workshops, beef schools and field days.

Extension activities generally continued to concentrate on better herd management aimed at improving reproduction efficiency and discrete supplementary feeding for survival, better breeder performance, and earlier turn-off. The advantages of cross-breeding have been advocated and prominence given to objective selection of breeding stock within or without the national performance recording scheme.

## Economics

Substantial increases in beef prices have stimulated many enquiries on the potential of land for beef development. With the high capital requirements to enter the beef industry there is need for some caution, particularly where the borrowing component is high, as the expected increase in cattle turnoff for slaughter could have a depressing effect on future prices.

Beef prices have now reached the level where returns from beef on improved pasture are comparable with crop returns, particularly in marginal grain growing areas.

Feedlotting is attracting considerable interest both as a side line and in specialist feedlots but high grain and store cattle prices leave little margin for profit unless a good premium price is obtained for the finished product.

The movement out of dairying has continued in favour of beef with considerable interest in vealers.

Research into management practices used by graziers in the spear grass region is continuing with field surveys in the Kolan, Miriam Vale and Calliope shires. The feasibility of integrating spear grass and wallum beef properties as complementary ventures is also being investigated with particular attention being given to property size, rate of development and overall profitability.

## SHEEP

A measure of confidence has returned to the wool industry with most growers having received at least one good wool cheque. Combined with favourable seasonal conditions, sheep in some areas are providing better returns than beef per unit area and per dollar invested. This trend has slowed down the movement from sheep to cattle. However, from past experience in the wool industry, graziers would be unlikely to move back entirely into sheep and would probably prefer to diversify where possible by running both sheep and cattle. The question of relative profitability arises mainly in the purchase of additional stock and expansion of existing enterprises.

The effect of the recent increase in wool prices can be demonstrated in returns from a flock of 3 000 sheep cutting 100 bales of wool in the Charleville district. In June, 1972, the gross proceeds from the wool clip might have been around \$15 000 compared with its present value of \$38 000.

Sheep and land prices have been slower to respond than wool prices. This reflects the contention that wool prices cannot be maintained at their present level.

Prices for contracts in the wool futures market are below current prices. With the prospect of a decline in prices considerable interest is evident in wool futures. This topic has been discussed by economists in western areas in the mass media, and a booklet is currently being prepared. Many graziers are uncertain how wool futures operate.

The profitability of sheep production in the traprock and granite areas on the southern border has been assessed as part of a land use and capability study.

Research on decision making in the pastoral zone is being undertaken at Charleville and Roma with financial support from the Australian Wool Board. A computer simulation model of a grazing property is being developed from field data taking into account seasonal changes in property management.



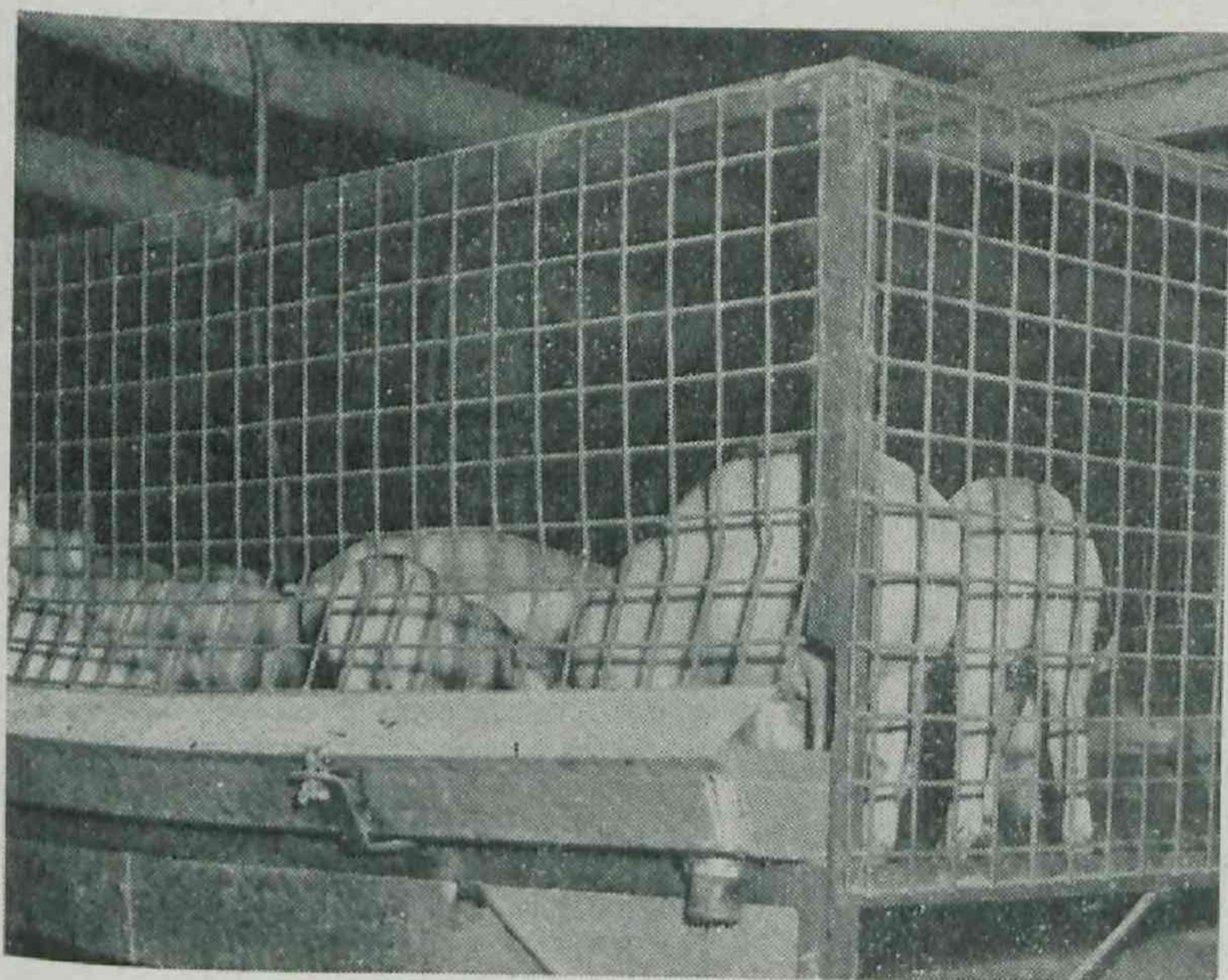
Late in the year the responsibility for the administration of Toorak Sheep Field Research Station, Julia Creek, and the Pastoral Laboratory, Charleville, was transferred from Sheep and Wool Branch to Husbandry Research Branch.

Wet summer conditions in central Queensland increased the incidence of blowfly in sheep while pneumonia associated with ill-thrift was diagnosed in lambs at Texas and Goondiwindi. One flock in the Booringa Shire had a 14% incidence of epididymitis in rams, compared with a more usual 1-2% incidence.

### PIGS

The critical situation whereby most quality protein meals were practically unavailable or priced above economic use caused many farmers to seek advice from Pig Section officers regarding the use of alternative sources of protein. Much of the extension work was directed to ration formulation using alternatives, or to investigating problems of reduced carcass quality due to changes in feed quality.

The economic pressure also increased the extension work related to improving management efficiency; demand for advice on building plans decreased, but there was a steady demand for information on economic aspects of the industry.



A comparatively new development to aid the early development of pigs is cage rearing from about 3 to 4 weeks.

The Section is also co-operating in the establishment of a pig A.I. Centre at Wacol, and development of an A.I. service for pig raisers throughout the State. Indications are that a considerable number of producers will use this service as a means of herd improvement.

Following an initial study, officers of the Section held joint discussions with Marketing Services Branch of the Division of Marketing and officers of the Commonwealth Bureau of Census and Statistics, leading to the development of a pilot survey to obtain more information on the industry at more frequent intervals. Regular surveys will follow the pilot trial. Financial assistance for the study of structural changes in the industry is being given by the Australian Pig Industry Research Committee.

The production recording scheme was continued and participants received useful "feed-back" information for the improvement of management practices and other factors. In north Queensland, several producers formed a group practising continuous performance recording.

In addition to providing finance for research projects conducted within the State, Australian Pig Industry Research Committee is supporting the survey of pig carcass measurements at selected abattoirs throughout Australia. Following an interstate meeting in Sydney, officers of the Pig Section have been responsible for the Queensland share of this work. The first two of four quarterly surveys were completed. These surveys, conducted at three metropolitan abattoirs, involve 11 measurements on each of 2 400 pigs every quarter.

Higher prices for feed ingredients were partially offset by rising prices for pigmeats along with other meats. Key factors affecting profitability include turnoff per sow, feed conversion efficiency, grading percentages, standard of housing and whether turnoff is sold as porkers or baconers. A detailed study on intensive piggeries illustrating the sensitivity of returns to changes in the above factors has been published.



Return of manure to the land as fertilizer is worth \$1 to \$2 a bacon pig a year.

Industry economics were discussed at a Pig Producers Conference in Rockhampton and a Convention in Atherton. Numerous pig discussion group meetings were addressed on the Darling Downs, the main topics being farm budgeting, records and the result of a pig specialist group recording in the farm management accounting service. A pig management recording scheme is being maintained on the Atherton Tableland to provide an assessment of piggery performance in terms of profit margin over feed costs/sow as a guide for improvement in production efficiency.

Experiments conducted during the year examined the differences in production between wheat, barley and sorghum grains, and the ability of synthetic amino acids to partially replace protein supplements in sorghum based diets. The biological evaluation of protein concentrates continued.

Feeding experiments in pigs and rats showed that the differences in production between wheat and barley were due to the different levels of available energy in these grains. When the differences in energy content were eliminated by the addition of other nutrients to the diet, production differences were eliminated. The inferior production with sorghum is not due to differences in available energy, nor does it appear to be due to simple amino acid deficiencies but may be due to imbalances of amino acids.

In sorghum based diets supplemented with soybean meal, optimum production occurred when soybean meal supplementation was 18%. Equivalent production was obtained with diets supplemented with 9% soybean meal and sufficient synthetic lysine to make the lysine content of the diet equivalent to that of the 18% soybean meal diet. Soybean meal supplements below 9% required the addition of methionine and other amino acids as well as lysine.

In the biological evaluation of protein concentrates, the concentrate under test is compared with a reference protein source, soybean meal with added lysine and methionine, in a diet containing 75% grain. Protein concentrates tested include: Australian full fat soybean meal, cottonseed meal, sunflower meal, meat and bone meal, whole meal, whole solubles, blood meal and Peruvian anchovy fishmeal. On an isonitrogenous basis only fishmeal resulted in productivity equivalent to that of the reference protein. Balancing for lysine and methionine resulted in marked improvement in production with all other protein concentrates. The percentage inferiority of the protein concentrates compared with the reference protein source was: full fat soybean meal 12% cottonseed meal 41%, sunflower meal 49%, meat and bone meal 30%, whale meal 21%, whale solubles 23%, blood meal 34%. The percentage inferiority of the protein concentrates balanced with synthetic lysine and methionine compared with the reference source was: full fat soybean meal 5%, cottonseed meal 16%, sunflower meal 12%, meat and bone meal 17%, whale meal 13%, whale solubles 10%.

At the boar testing station, Rocklea, 204 boars were tested (147 Large White and 57 Landrace) and 100 were approved (70 Large White, 30 Landrace).

After selection for two generations in the cross-bred pig herd at Hermitage founded on Large White, Landrace, Wessex Saddleback and Berkshire stock improvement was shown in the production traits of daily gain feed conversion ratio and back fat thickness. Boars are in demand by industry.

To assist plant breeders identify potentially useful barleys, for pig feed the amino acid spectrum of two varieties grown at both Dalby and Warwick were compared with the accepted malting variety. As the crude protein content of these grains ranged only from 13.9% to 15.4% there were only small



differences noted in the amino acid spectrum of these grains. It is interesting to note that the protein content of these barley grains (average 10.4%) was higher than published figures.

Oedema disease is commonly associated with losses in pig raising areas while the control of *E. coli* scours in young piglets constitutes a real problem in some piggeries. Other diseases diagnosed included Teschen disease, salmonellosis, erysipelas and swine dysentery.

### POULTRY

Poultry Section extension activities continued to emphasize the importance of investigational and survey work; an extensive survey of layer replacement programmes, housing and management was undertaken to identify problems which may be encountered when quotas are introduced.

Field investigations commenced during the year covered the following areas: reducing heat stress in summer; carcass damage in broilers; causes of failure of fertile eggs to hatch; pre-incubation egg storage; and chick quality assessment.

With the imminent introduction of "Demand-Supply Management" (D.S.M.) in Queensland, a comprehensive survey was undertaken to study its likely effects on farm flock size and production. This survey highlighted problems facing the egg industry under D.S.M.: (i) Farms operating an all-in-all-out system of bird replacement could be penalized when yearly flock averages were determined because they did not maintain a constant flock size, for example, for 2-3 weeks at replacement time, flock size could be nil. (ii) Disposal of spent hens is more difficult in some areas of Queensland than others. This prevents rapid disposal of spent flocks and producers are likely to either exceed their quota or fall below the permissible number during the period that the spent flock is being disposed of. (iii) Bird occupancy rates estimated by farmers vary widely.

The survey also provided a great deal of valuable information about management practices, housing and equipment.

Staff from the Poultry Section continued to investigate brooding area design and management using the section's automatic temperature recording unit, hot wire anemometer, and multi-gas detector. Farmers have been advised of improvements which could be made to effect a better brooding environment.



A poultry officer uses a hot wire anemometer to check air movement at floor level in a broiler shed.

A study on the effectiveness of various types of reflective roof paint will continue during the summer months of 1973-74. It is hoped that roof paints suggested as being suitable for application to poultry shed roofs can be graded according to effectiveness of heat reflection and durability of the paints concerned.

A comprehensive study of some of the factors affecting down grading of broiler carcasses due to bruising showed that the percentage of bruising was significantly reduced under correct management and proper placement of feeders and waterers.

Methods of catching and loading broilers were critically assessed and recommendations for improved methods were suggested.

Investigations concerning hatchery practice and hygiene included: (i) Studies of probable cause of failure to hatch of fertile eggs. So far results have shown that factors which cause early embryonic mortality and late hatching should be investigated. (ii) Investigation into the desirability of storing hatching eggs in plastic bags. This is a follow up to (i) and preliminary results have shown that eggs which have to be stored longer than 4 days hatch better if packed in plastic bags prior to storing. (iii) Chick Quality Studies into chick handling and culling procedures. The relationship of fluff sampling and other hygiene assessment techniques to chick quality is being studied. A programme of hatchery hygiene surveillance was maintained on a routine basis up to the end of 1972. This was done by periodically assessing bacterial loads on fluff within incubators at major Queensland hatcheries. The Microbiology Section and Poultry Section conducted this work as a joint project. Although regular monthly sampling has been discontinued, hatcheries have been encouraged to request fluff sampling whenever the need arises. Results of sampling in 1972 were used as a basis for advice to hatcheries on improvements needed in their hygiene procedures.

Poultry accounting schemes are conducted on a joint basis between the Poultry Section and Economics Services Branch. Two schemes are operating:

(a) *Downs Poultry Accounting Scheme*.—This has been operating in the Toowoomba area since 1969. Records kept by co-operating producers include physical and financial details concerning the more important factors involved in rearing replacement pullets. Records are now available for 63 batches of pullets reared on 22 farms. Wide variation in important factors such as deaths and feed cost continue to be the most interesting feature of the results.

(b) *Layer Accounting Scheme*.—This scheme involves analysis of physical and financial data in the laying stage. Co-operating producers supply information on egg sales, feed usage, deaths, etc. and receive a monthly economic analysis of the data in return. These reports allow producers to keep a check on the profitability of their laying enterprise and to compare their results with the average of the group.

The south-east Queensland Poultry Section staff seminars continued on a quarterly basis. This system allows for dissemination of up-to-date information on topics of interest.

Following the success of the first Poultry Science Seminar in 1972, another seminar was held at Queensland University on February 14, 1973. Approximately 60 people attended the afternoon session representing the industry, the D.P.I., the University and the Queensland Agricultural College.

The interest shown in this seminar suggests that this activity should be continued, probably on an annual basis.

The Eighth Poultry Industry Festival organized by the Poultry Section and the Husbandry Research Branch of the Department was held in Toowoomba on November 15. The Festival attracted 17 industry exhibitors as well as a display of technical equipment used by Poultry Section staff and well illustrated displays from the Biochemistry, Pathology and Husbandry Research Branches. Once again, the Festival encouraged free discussion between producers, industry, and departmental organisations.

The First Combined Conference—"Australian Stockfeed Manufacturers' Association and the Australian Chicken Meat Federation"—was held in September at Surfers Paradise. The idea behind this combined conference was that delegates could attend sessions from either field. Where a subject was of interest to both groups, a joint session was held.

With the general trend to metrication it was decided to amend the regulations pertaining to the grades for eggs, and this amendment became effective as from July 1, 1972. Accordingly, eggs were sold from that date as:

"Pullet" eggs having a weight of not more than 45 grams but being not less than 40 grams.

"Small Hen" eggs not more than 50 grams and not less than 45 grams.

"Standard" eggs not more than 55 grams and not less than 50 grams.

"Large Hen" eggs not more than 60 grams and not less than 55 grams.

"Extra Large Hen" eggs not less than 60 grams.

These amendments made it necessary for some modification of grading equipment but the changeover was made without reaction from the producer and consumer.



At the same time, attention was drawn to the faulty stamping of eggs which were appearing in retail shops and a survey was carried out. Further recommendations were made regarding the quality of the stamps being manufactured and it is pleasing to report that the standard of stamping has improved as a result.

The regulations were further amended on January 18, 1973, to provide for conditions under which egg pulp could be manufactured, and for the pasteurisation of egg pulp before sale in Queensland even though some pulp may be the product of eggs produced interstate.

The regulations are designed to improve the quality standard of pulp by having it manufactured under hygienic conditions and by the exclusion of all eggs likely to contaminate the product. They also provide for the immediate chilling of the pulp until it is forwarded for pasteurisation. The regulations also govern the pasteurisation plant equipment and provide for standards for pulp which must be met in order that high quality pulp suitable for home and export use may be manufactured. Furthermore it is provided that inspectors may sample and submit such samples for testing for bacterial contamination.

The fee for the registration of an egg pulping plant or an egg pasteurisation plant is \$10 per annum. This fee will assist to defray the cost of supervision, sampling and inspection.

For the year ended June 30, 1973, three organisations have applied for licences to manufacture and pasteurise egg pulp and 28 for licences to pulp. To date, two licences and one provincial licence to manufacture and pasteurise egg pulp have been issued while 20 licences to pulp and 8 provisional licences have been granted.

The Poultry Industry Acts were further amended on April 19, 1973 to meet changes in the administration of the Poultry Section since the appointment of the Director of the Pig and Poultry Branch. The Husbandry Officer in charge of the Poultry Section now becomes the Chief Inspector and in that capacity is appointed to the Poultry Advisory Board. The other amendments provide for additional finance from Government funds to meet increasing costs of providing advisory, diagnostic and regulatory services to the poultry industry.

Because of the grain's importance in poultry feed, authenticated samples of sorghum grain from 1971 varietal trials at three locations were analysed by the Biochemical Laboratory for their amino acid content. Location had a large effect on the crude protein content of the grains, and consequently, the amino acid content of the sorghum grain (on a D.M. basis) showed a considerable range, also the amino acid data from these sorghum samples, together with those of maize, are currently being compiled for statistical analysis.

Six outbreaks of avian encephalomyelitis in young chickens were recorded with most outbreaks occurring between October and April. Some 25% of the chickens in one batch showed symptoms. An experimental vaccine is being used in one breeding flock in which this condition has been troublesome. Appropriate tests and observations are being conducted in each group of pullets vaccinated.

Fowl pox was confirmed in several batches of chickens supplied to a grower of started pullets. Investigation showed the day-old chickens were derived from two hatchery sources and the chickens from only one hatchery came down with the disease. Signs were first seen at about two weeks and by six weeks, when the chickens were transferred, up to 30% were affected. Further investigation showed that the hatchery involved was using an unregistered vaccine which had been supplied by an associated company.

Eleven outbreaks of infectious bronchitis—nephrosis were confirmed. The virus was isolated in the main from tracheal and kidney tissues. Vaccination of young chickens now is not recommended prior to the second week of life because of the risk of permanent damage being done to the tissues of the oviduct.

On selected properties, vaccination for infectious laryngotracheitis is being practised as a routine prophylactic. The routes used are the cloacal and the drinking water method. Untoward reactions have not followed the latter method unless a long period of water deprivation preceded the vaccination.

There were 30 diagnoses made of Marek's disease—leucosis. Extent of lesions ranged from the classical form in which only the nerves were affected, through the whole gamut to tumours in proventriculus, heart, kidney, gonad, eye etc. which are characteristic of the acute form.

Field trials involving a turkey herpes virus (T.H.V.) vaccine in broiler chickens and potential breeder stock were conducted. The heat wave in late December had the unfortunate effect of not only killing 20% of the birds in that trial, but resulted in the salvage of the remainder by processing, before a team to record findings on slaughter could be

assembled. In trials with layer and breeder lines, there is evidence that losses in vaccinated stock during rearing are considerably reduced compared with the controls.

Eight outbreaks of fowl cholera were recorded. In turkeys, deaths in excess of 30% of the flock were reported. The condition in fowls tended to be lowgrade and be a component of a chronic respiratory disease. In one flock, this infection was finally identified as the cause of a long standing, dribbling mortality in pullets just commencing production. In this flock, cyanosis, diarrhoea and thirst were the main signs, and findings on post mortem consisted chiefly of peritonitis. The use of a fowl cholera vaccine on pullets about 3–4 months of age would seem to have given excellent results, although no control group was maintained.

Pullorum disease of chickens up to three weeks has been virtually eliminated from breeder flocks of fowls in Queensland. The infection was isolated from reactor hens in only two small breeding flocks. No field "breaks" in brooder chickens were recorded during the year.

Several outbreaks of salmonellosis (other than pullorum) occurred in young chickens characterised by perihepatitis, peritonitis or encephalitis, ataxia and paralysis. From these, Gp. B. salmonella was isolated. Salmonella Gp. B. organisms were also isolated from strong reactors to the rapid field test for pullorum.

Two outbreaks of caecal coccidiosis were recorded. In each case, the chickens were being fed the coccidiostat, amprolium, in the mash at the recommended level; this would suggest that some strains of *E. tenella* are resistant to amprolium.

Nine outbreaks due to intestinal coccidiosis were reported. Apart from a single case of *E. acervulina*, all were due to *E. necatrix*.

Apart from the odd individual flock fed mainly grain and therefore suffering gross deficiency of vitamin A, the year, particularly in the second half, was marked by a series of diagnoses of vitamin A deficiencies. Liver vitamin A levels of the order of 2–4  $\mu\text{gm/gm}$  were frequently found. Premixes, as supplied to farmers, were found to contain less than the amount stated on the label. However, in a number of instances, the directions for feeding the premix would have had the effect of providing an adequate amount. Other vitamin deficiency diseases (riboflavin, vitamin D, vitamin E) were also recorded sporadically.

Cage layer fatigue was recorded in one flock in which only 56 kg of total limestone for shell information was provided in 3360 kg mash. This amount would only supply about 25% of their requirement.

Botulism was suspected or confirmed as the cause of deaths in ducks, geese, turkeys and fowls. Losses of the order of 50–70% were commonly experienced.

Experiments conducted during the year examined fat metabolism in the laying hen, the influence of mineral nutrition in the layer diet, genetic selection for egg quality, the effect of various restrictive feeding methods on egg production and the feeding value of sorghum and maize grains grown in Queensland.

In laying flocks, deaths from fatty liver haemorrhagic syndrome and the high incidence of obese inefficient birds with high levels of liver fat lower egg production. It was shown that the deposition of liver fat was high at the onset of sexual development and had not increased significantly at age at fiftieth egg. Biochemical indices as possible diagnostic tools for these conditions were examined with limited success. The physiology and heritability of fat infiltration of the liver continue to be examined.

In previous experiments it was shown that high levels of phosphorus in Queensland diets based on meat and bone meal necessitate a calcium allowance higher than formerly recommended for good egg shell strength. Further experiments showed that young pullets tolerated higher levels of dietary phosphorus than older hens before egg shell strength was affected and they showed a greater response than older hens to added calcium.

After two generations of selection for shell strength and albumen (thick white) quality, responses to both traits were obtained.

Considerable interest is being shown by egg producers in the restriction of the feed intake of laying hens which results in feed savings, reduction in obesity, improved rate of egg production and improvement in egg size of pullets in the early stages of lay. Experiments examining the restriction of intake in both the growing and laying periods by limiting time of access to feed were in progress during the year. Another



experiment showed that growing period diets compounded from vegetable protein sources could be used to advantage under favourable price conditions.

Bioassays for metabolizable energy content of maize and sorghum grains showed that energy content varied due to district of production of the grains and these variations were large enough to warrant their consideration in feed formulation.

### BEEKEEPING

Initial surveys of honey floras have been undertaken, one in central Queensland and the other near Cooktown, where an improved road system has opened new potential honey producing regions.

The first Australian Bee Congress was successfully staged at Broadbeach. Several talks were presented to the conference by Departmental officers, who were also prominent in the planning and running of the Congress.

The serious brood disease (*Bacillus larvae* (White)) outbreak at Goondiwindi appears to be under control. The effects of pesticides on honeybees presents a continuing problem in horticultural and agricultural areas.

The long-term research project on the longevity of worker honeybees is revealing interesting seasonal differences in average longevity.

Mr. C. Roff, Chief Adviser in Apiculture, was awarded Apimondia Diploma, the highest international award of the International Federation of Beekeepers Association, for his significant contribution to beekeeping.

### MEAT INSPECTION

Considerable ground excavations have been carried out on the site of the new Metropolitan Public Abattoir at Cannon Hill. Improvements are continually being undertaken at practically all abattoirs, dictated in most instances by overseas requirements. It seems likely that additions, in the form of a small sanitary abattoir for the slaughter of suspect stock only, may have to be constructed at all meatworks desirous of exporting meat to E.E.C. countries.

Considerable industrial unrest occurred at many of the large export meatworks causing considerable disruption and interference with normal operations.

Slaughtering procedures have generally been satisfactory.

Further extension of centralized killing, which has the support of this Department and the Queensland Meat Industry Authority did not materialize during the year. It is hoped, however, that draft Meat Industry Regulations, when approved, will continue to improve standards at all country slaughterhouses substantially.

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

However the lack of involvement on the part of the Commonwealth inspection service, generally, in obtaining and collating disease information obtainable on the slaughter floor makes necessary the stationing of additional State staff at export works where there are no State staff at present. Temporary cadets under NCPP funds have been appointed to Cairns, Townsville, Bowen, Rockhampton and Brisbane to carry out monitoring in relation to B.C.P.P. Their services have also been utilized for the collection of as much disease information as possible, particularly with regard to tuberculosis and brucellosis. These officers collect blood samples and submit specimens when required to diagnostic laboratories.

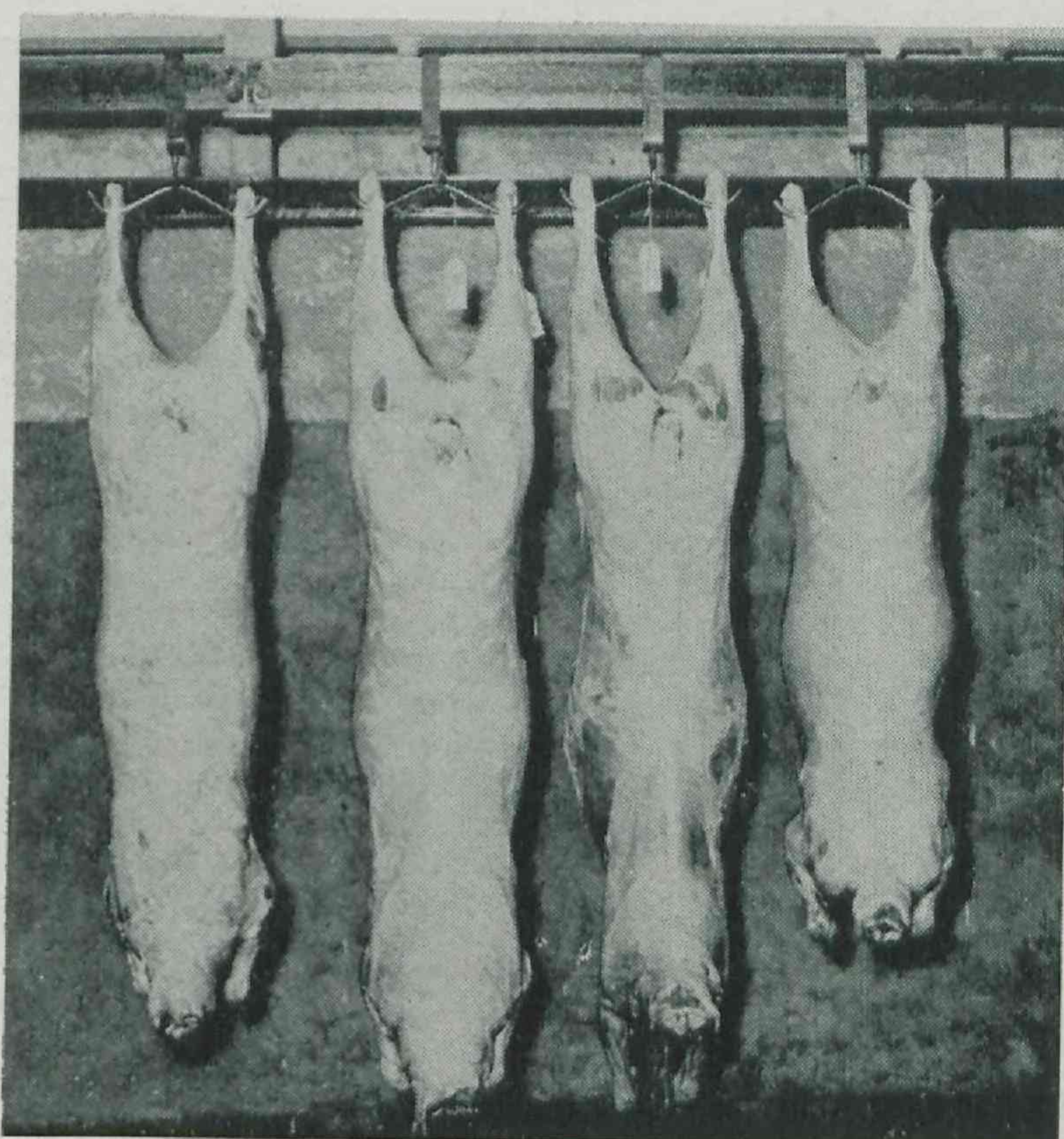
Further increased attention was given to sanitary aspects of meat processing.

More early morning inspections of butchers' shops were carried out because it is considered that this is the only way to discover whether an adequate method of cleansing and sanitation is employed.

The number of licensed poultry slaughterhouses decreased to 87. The smaller operators just cannot compete with larger processors, particularly in the field of frozen poultry. The demand for fresh killed poultry still seems to be increasing, in preference to frozen packaged carcasses.

Grading of beef was undertaken at Cannon Hill, Toowoomba, Ipswich and Townsville public abattoirs and at Borthwicks (Brisbane) and Bremer River Abattoirs.

Lamb and hogget classification marking was also carried out at the major abattoirs slaughtering for the local trade.



Grading and classification of sheep carcasses at the Metropolitan Public Abattoir Board is one of the important functions of the Department's Slaughtering and Meat Inspection Branch. The two centre carcasses are those of rams.

A trial to assess the effect of carbon dioxide pellets on the keeping quality of mince has been completed. Bacteriological results of the first trial indicate no significant diminution in bacterial population between untreated and carbon dioxide treated mince. However, there appears to be ample room for more work as bacterial populations were exceedingly high.

Some casings have shown high counts of *Staphylococcus aureus* and *Salmonella* species.

An Australian Meat Board meeting on judging was attended in Sydney. At this meeting it was recommended that no additional carcass competitions using visual appraisal methods would receive A.M.B. financial support. It was further decided to recommend that visual appraisal be phased out in about two years when the Australian Beef Carcass Appraisal System is given further trial and modified as necessary.

In collaboration with C.S.I.R.O. and the Australian Meat Board, a series of trials to evaluate the influence of horns on the bruising problem has been planned.

Discussions took place with officers of Pig and Poultry Branch, management of local bacon factories and C.S.I.R.O. concerning an extensive Commonwealth-wide survey of various methods of pig carcass measurement with a view to the possible introduction of a uniform Australia-wide system of pig carcass measurement in the future. The survey commenced during the year and Slaughtering and Meat Inspection Branch officers are collaborating with officers of Pig and Poultry Branch.

Investigation into the suitability of back tags for identification purposes continued. A large-scale trial conducted to test the durability of the back tags during the dipping process proved that tagging was best done after plunge dipping.

Back tags were used successfully to identify cattle at the R.N.A., Brisbane, and Ipswich Exhibition carcass competitions.

Manual recording devices in meatworks are continuing to provide information on disease conditions. Although Queensland was officially declared a pleuropneumonia-free area on June 2, 1973, lung palpation of cattle from suspect areas is to continue.

Surveys still indicate that inspection of introduced meats is necessary. Considerable contamination can and does occur during transit and this often necessitates considerable trimming of carcasses before they can be passed for human consumption. Consignments from some Victorian establishments were particularly unsatisfactory.

Breaches were detected on a number of occasions and evidence was directed to appropriate abattoir boards for necessary action.



### III. Dairy Research and Extension

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

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

#### FIELD SERVICES

A major feature of the Dairy Field Services Branch activities has been an upgrading of the technical competence of the staff through a continuing series of subject matter training schools. It is obvious the industry is in the throes of major changes in the systems of dairy farm production and in the product manufacturing sphere and it is important that advisory and regulatory activities be maintained at a level to adequately service the changing demands. Training in animal breeding, systems analysis, mastitis detection and control and more effective communication has been provided.

Service to the Dairy Pasture Subsidy Scheme continued to be an important contribution by Branch field staff.

The issue of a Dairy Products Bulletin on a quarterly basis to dairy product processors was commenced during the period. This has been released in collaboration with the Institute of Dairy Factory Managers and Secretaries and should prove a useful tool in effecting improvement in product manufacture and quality control.

A total of 22 150 visits were undertaken to individual farms and approximately 1 000 surveys/visits to processing plants were provided by specialist advisory staff. Officers reported an increasing interest in feed planning and utilisation, and this has been fostered by the conduct of nutrition schools in many districts.

With the continuing introduction of bulk milk cooling, storage and collection, officers were able to assist in orderly conversion. A total of 161 new buildings and 495 renovations were supervised during the year and an additional 545 bulk milk vats were installed. The total number of bulk vats in operation are listed at 2 589 which represents 70% of those producers handling milk. This is considered very satisfactory

as certain plants are now receiving all supplies in bulk and several others are nominating a date by which this will be achieved.

On a request basis, 869 milking machines were examined and faults notified for correction. This service is considered an important adjunct to the mastitis control programme.

Supervision of milk distribution agencies throughout the State is a regulatory function co-ordinated by branch staff. Control of shop vending licences and retail vendor licences is a constant and very time consuming task for officers in large provincial centres. Milk Advisory Committees, where operating, continue to provide a valuable form of Industry-Departmental liaison.

In several regions the liaison which Dairy Extension Advisory Committees foster between Departmental staff and industry personnel has proved mutually beneficial. When operating as planned the committees are extremely useful in developing programmes. Unfortunately in some regions optimum use is not being made of Departmental services by industry representatives. The concept of the committee activity is too valuable to discard and improvements can be introduced through wider industry representation. This will be effected in the coming year.

This is the third year of Whole Farm Development Demonstrations which receive nominal financial assistance from C.E.S.G. funds. As foreshadowed, increasing extension benefit is being derived from the 17 properties which are implementing a planned programme of development under this project. In almost all cases successful farm walks have been conducted and there is constant individual enquiry of the co-operators. Through repeating the original neighbourhood survey in the coming year, it is hoped to establish the value of this demonstration programme in three pilot study areas. Again excellent team work was achieved by district staff and nominated farmer panel members.



Dairy cows in a circular cow yard built in the interests of milking hygiene and efficiency.



Schools for small groups of producers on the subject of Animal Nutrition continue to gain excellent support and provide field staff with opportunities to carry through feed year planning on individual properties. Valuable assistance has been given to public community groups in cheese promotion.

Factory advisory staff presented a small number of group discussions for factory employees during the year.

The following summary of activities indicates a variety of extension functions and a satisfactory level of contact with producers:—

—	Number Held	Total Attended
Farm Walks .. .. .	32	839
Field Days .. .. .	30	2 352
Tours .. .. .	34	644
Method Demonstrations ..	10	60
Film/Illustrated Talks/Lecture Evenings .. .. .	58	1 998
Project Clubs .. .. .	9	419
Rural Youth Meetings .. ..	6	116
Farm Schools .. .. .	41	645
D.E.A.C./Discussion Group/Q.D.O. Meetings .. .. .	148	2 614

A protein payment evaluation investigation was programmed in four commercial plants using the recommended procedures of the special Commonwealth study report and a New Zealand Dairy Research Institute formula. As difficulties were experienced in meeting the minimum standards for freezing point and solids-not-fat, a monitoring programme was commenced for herd milks in 6 commercial plants, and field investigations made on 12 properties in West Moreton and the Darling Downs. These will be continued for a period of two years at least.

Assistance was given to Warwick, Maryborough and Malanda in the manufacture of yoghurt. As an initial phase of product development, a small group of specialist officers have initiated consumer surveys to evaluate milk products prepared on a pilot scale. Additional products will be examined.

Lipase deterioration in raw milk supplies was again examined following problems encountered in bulk milk supplies from Mt. Tyson, Caboolture and Southport.

A series of stirred curd cheese trials using a vacuum press were commenced at Woodford factory.

Analysis of the data from the survey of the Marginal Dairy Farm Amalgamation Scheme participants continued. As an initial result of the information additional financial assistance was made available by the Lands Department for stock and building improvements under certain conditions.

A total of 194 samples of pat butter supplied for local sale throughout the State were examined for grade score, and chemical and bacteriological quality; 92% of butters satisfied the minimum grade score of 91 pt. or greater. All samples satisfied the maximum moisture limit.

Inservice training programmes were given prominence in branch activities. The following workshops/group activities were presented to selected staff: International Training Course in Dairy Husbandry; Regional Supervisors Conference; Artificial Breeding Refresher Course; System Analysis Workshop; Regional Supervisors Workshop—Mastitis & A.I. and individual participation in Departmental programmes on nominated basis.

Arrangements for specialist officers to work in subject-matter groups were made. This is expected to be an extremely valuable means of building on individual skills and enhancing inter-branch co-operation.

## BREEDING

In June, 1973, there were 109 bulls and three steers held at the Wacol A.I. Centre and the Redlands A.I. Export Centre. Charollais and Bradford bulls entered the centre for the first time by agreement with private owners. Bulls from 16 breeds of dairy and beef cattle are represented. In addition, semen is available on consignment from many breeds of cattle from the centres in the United Kingdom and Canada.

During the year, increased emphasis was placed on health testing requirements and quarantine procedures. The annual health testing programme commenced in January, 1973. All bulls and steers were tested for *Brucella abortus*, *Leptospira* (hebdomadis, icterohaemorrhagica, pomona, tarassovi), pleuropneumonia, Johnes disease, "Q" fever and tuberculosis. Testing for leucosis commenced in May, 1973.

Six bulls returned positive (> 25 international units) serum agglutination titres for *Brucella abortus*. Five of these bulls were removed from the centre in accordance with standards for A.I. centre laid down by the Commonwealth and States Veterinary Committee.

None of the bulls gave a positive complement fixation reaction. There appears to be some basis for questioning the validity of imposing an arbitrary level of 25 international units because it undoubtedly leads to culling of bulls which are not necessarily affected with the disease. 166 910 doses of semen were produced at Wacol in straws during the year. This compares with 132 969 doses in 1971-72, and 113 482 doses in 1970-71.

With the capacity to produce up to 30 000 doses of semen per month, a proposal to suspend the collection and processing for a trial period of three months is currently being investigated. This could result in more efficient utilisation of staff, with increased time for other projects, and improvement in fertility as a result of avoiding collections during the months when heat stress is a problem.

On May 31, estimated straw stocks were 88 239 doses representing 103 bulls, compared with 36 227 doses from 69 bulls on May 31, 1972. A target for storage of at least 600 doses from unproven bulls and 2 500 doses from proven sires has been set.

A total of 113 926 doses of licensed semen were distributed from all sources in 1972-73 compared with 97 120 doses in 1971-72. Semen from privately owned bulls and from stocks held on consignment accounted for most of the increase. 69.1% of the semen supplied from Wacol sires was from dairy bulls and 30.9% from beef bulls. The proportionate distribution of dairy semen was: A.I.S. 26.1%, Friesian 55.1%, Jersey 11.8%, Guernsey 2.9%, Australian Milking Zebu 3.7%, Ayrshire 0.24%, Sahiwal-Friesian 0.12%.

In the beef breeds the major contributions were Poll Hereford 44.2%, Brahman 14.5%, Sahiwal 10.6%, Angus 7.6%, Droughtmaster 4.8%, Charollais and Charollais cross 7.1%.

The usage of custom-freezing service has shown a marked decline. Only 13 425 doses were processed in 1972-73 compared with 37 176 in 1971-72, which again showed a considerable decline from the peak year 1970-71 in which 47 157 doses were processed.

Introduction of privately owned bulls to the centre and the provision of a service by a commercial organisation are regarded as the major reasons for this decline.

A number of research projects are under consideration and it is expected that future activities of the centre will be oriented more in the direction of A.I. research. The necessary graduate staff to undertake these investigations is available.

Altogether, 77 persons were trained in A.I. techniques during the year. Training courses are now being offered by three organisations outside the centre; 74 trainees from the Wacol course were examined during the year with one failure, and 35 trainees from other courses were examined, with four failures.

The semen export centre was completed to the stage of housing bulls and is now almost fully operational. Five bulls have been introduced following exhaustive health-testing, and two of these, an A.I.S. bull and a Sahiwal, qualify for the American market. The others are awaiting certification relating to their herds of origin, although they have passed all necessary disease tests and qualify for entry to the centre. It is expected that the first shipment of semen to the United States from the centre will take place early in the 1973-74 financial year.

The 1972-73 year was one of major changes for bull proving in Queensland. Such changes were largely due to the withdrawal of C.E.S.G. funds. Commencing with the 1973 insemination season all future progeny will cease to attract the \$20 incentive payment. The only incentives to co-operators will be free semen for proving purposes and an allowance of semen from a panel of selected bulls at the rate of 12.5% of cows used in the scheme.

Improvements have been effected in communication with co-operators. Sets of pedigrees, rules and photographs are distributed to give complete information about the scheme and this will be repeated in each year.

Teams have been increased from four to a minimum of five, and some changes were made in the method of selecting bulls for the teams.



## HERD RECORDING

The average production yields for cows recorded under the Pure Bred, Group and Bi-monthly Production recording schemes for the herd recording year completed in 1972 are given below for comparison.

Scheme	No. of Herds	No. of Cows	Average Milk Yield/Cow (kg)	Average Butterfat Test (%)	Average Butterfat Yield/Cow (kg)	Average Days
Pure Bred .. .. .	157	4 595	3 170	4.2	134	..
Group .. .. .	797	35 522	2 454	4.1	101	263
Bi-Monthly .. .. .	63	2 702	2 206	4.1	91	253

For comparison, 162 pure-bred herds, 821 herds in the group scheme, and 64 herds in the bi-monthly scheme were recorded in the previous year. There was a decline in the total of cows tested from 46 772 to 43 819, approximately 6%. Approximately 16% of herds presently engaged in dairying are recorded.

From March 1, 1973, the bull proving scheme became part of the duties of the herd recording sub-section. A concentrated effort to obtain co-operators for the A.I.S., Friesian and Jersey breeds was undertaken and the response by dairy farmers has been excellent; 1 450 cows were enrolled in the A.I.S. scheme, 1 725 in Friesian, and 1 425 in Jersey.

Trials related to the introduction of centralised herd testing were conducted during the year. Trials in Beadesert and surrounding areas proved very encouraging.

The time-temperature interactions in travelled milk samples are still causing problems but it is expected that further work will reduce the difficulties associated with the testing of churned and oiled samples.

The change to the metric system was scheduled for July 1, 1973, and the necessary equipment was made available. Consideration was given to necessary changes in the computer programme and to standards for entry into the Advanced Register as well as various other standards incorporated in the Group and Pure Bred recording schemes.

Some outstanding production performances were recorded during the 1972-73 herd recording year. That outstanding A.I.S. cow, "Sunny View Little Princess 30th", owned by J. Phillips & Sons, completed her 12th lactation to bring her lifetime production to 124 613 kg (274 477 lb.) milk, 5 217 kg (11 491 lb.) fat.

The protein content in milk samples has been examined over a three-year period. The average protein production from all breeds per lactation was 74.0 kg (163.1 lb.) at an average of 3.15%.

In order to provide a service to farmers in which herd recording can be integrated with management information in the pursuit of managerial efficiency, a system is presently being developed to examine the comparative ratio of inputs in physical terms to production. At present most emphasis is being placed on responses obtained to supplementary feeding but it is envisaged that this will be extended to other important factors. This system is being developed on a trial basis parallel with herd recording and has already created considerable interest.

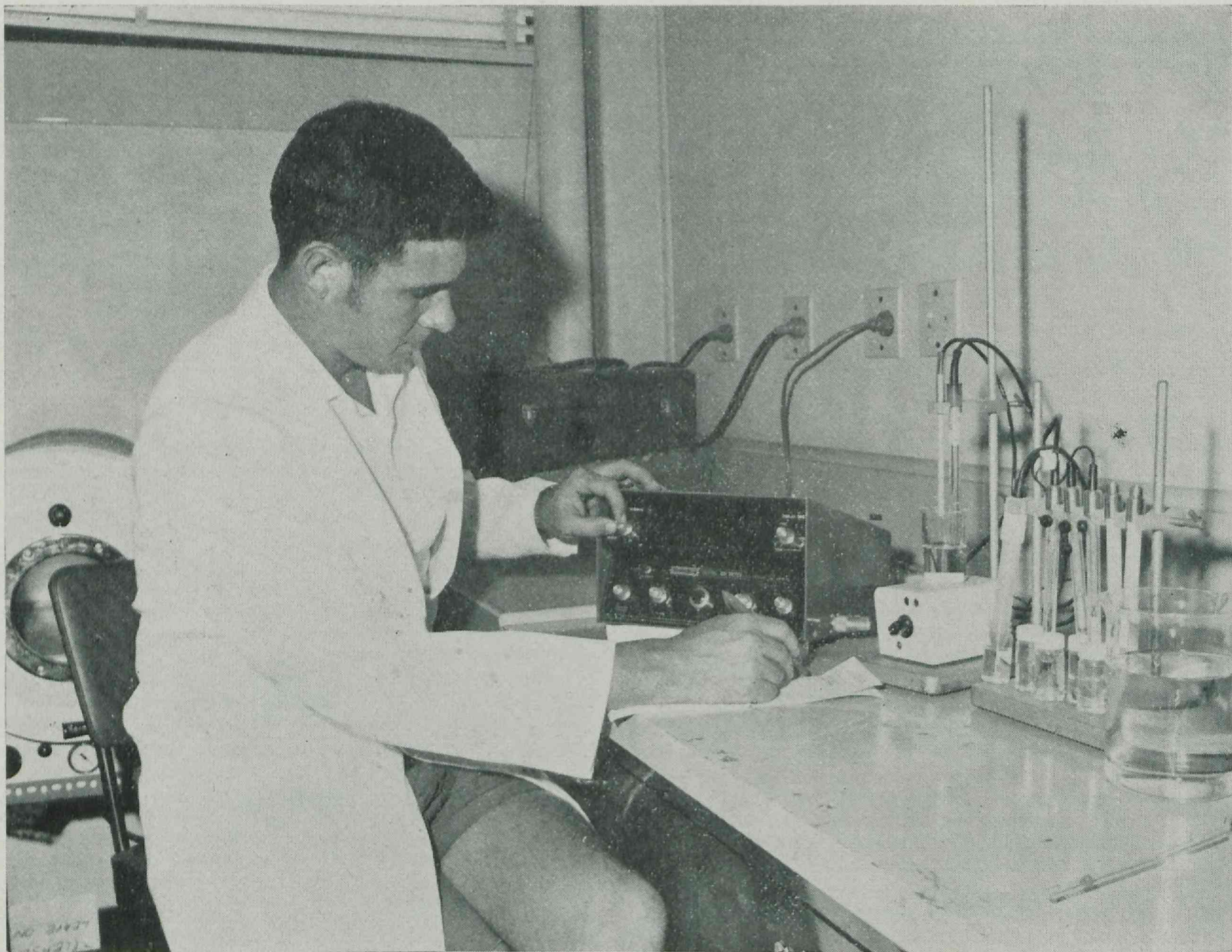
## NUTRITION

Stocking rate trials on Kairi Research Station on glycine-green panic pastures have demonstrated that production of milk can be as high as 8 000 kg/ha. However, production of this order is dependent on some feed supplement over the annual dry period, and a further trial was designed to evaluate the effect of nitrogen fertilizer in boosting pasture-growth in the autumn-winter period and providing standover feed for the dry spring weeks. Present indications are that nitrogen has given a considerable production response particularly in the heavily-stocked treatments, the effect becoming noticeable in April. This may be a result of increased pasture growth or improved quality of diet. A trial was set up to examine the productivity of cows from a pure grass system, under dryland farming, where the legume has been replaced by fertilizer nitrogen.



Restraint stalls for multiple suckling projects at Biloela accommodate 2, 3 and 4 calves per cow.





New analytical techniques for testing dairy products make use of ion selective electrodes.

In the Friesian-Sahiwal project, 54 Sahiwal calves were born at Kairi, consisting of 30F1, 18F2, 6F3. Four male F3 calves were born to nucleus cows and these should be of great value in the breeding programme.

Production of nucleus cows in the project completing lactations at Kairi averaged 2 648 kg of milk and 106.8 kg of butterfat at an average test of 4.2%, and total solids at 12.7%. Nucleus cows from Ayr averaged 2 376 kg of milk for 96.4 kg of butterfat at 4.2% fat and 12.8% total solids. Highest production recorded was 5 454 kg of milk and 167.2 kg of butterfat.

In multiple suckling trials, calves fed once daily gained approximately as much weight during the suckling period as calves suckled in a continuous system. In continuous suckling, supplementation of cows only slightly favoured calf growth.

A trial to measure differences in growth rate and resistance to internal parasites between Friesians and Sahiwal cross calves was commenced in December. At this stage no differences in faeces worm egg count can be attributed to breed or grazing system. A three-week rotation did not reduce the worm burden as compared with continuous stocking. The Friesian calves gained more weight than the cross-breds.

An investigation was carried out at Biloela Research Station into the techniques of twice daily restricted access suckling and into calf performance when suckled at various stages of lactation, the number of calves per cow being regulated according to expected milk yield at the different lactation periods. The trial was completed successfully and data will now be analysed. The ability to interchange cows between suckling and lactation opens up possibilities of new management applications not only with relation to dairy beef production but also to the rearing of herd replacements.

It is intended that a similar trial will be conducted in 1973-74 except that calves will have free access to suckling instead of being restricted to twice daily access.

Research at Ayr continues to be concentrated largely on the productive capacity of nitrogen-fertilized pangola grass under irrigation. The efficiency of different forms of nitrogen at different levels of application in promoting growth of pangola grass was investigated during the year. At this stage there is little difference in growth with the three types used, that is, urea, sulphate of ammonia, and ammonium nitrate. The response to higher levels of nitrogen was mainly in the

spring-early summer period, indicating the possibility of conservation during this period for feeding back during the winter.

The ability of Jersey and Friesian cows to produce milk from irrigated nitrogen-fertilized pangola grass is still being examined. Associated with this is an evaluation of a molasses-urea supplement for milk production. Increasing the stocking rate decreased the daily milk yield. The addition of the supplement markedly increased the yield. The effect of the supplement is obvious over all periods of the lactation.

In a heifer growth rate project on irrigated, nitrogen-fertilized pangola grass the effect of stocking rate over the whole period was quite marked, with gain per hectare increasing with each increase in stocking rate. At 12.4 heifers per hectare (5 heifers per acre) 2 022 kg of grain per hectare (1 805 lb. per acre) was achieved in the 315-day period. There may be a breed-stocking rate interaction in that the Friesian-Sahiwal cross is superior at the high and medium stocking rates but not at the lowest stocking rate.

Again there was a lack of response to anthelmintic treatment. This is of great interest since heavy worm burdens would be expected in the irrigated situation. Whether this is related to the growth habit of pangola as distinct from more upright species such as setaria will form the basis of a future experiment.

An intensive feeding project involving Friesian and Sahiwal cross calves is aimed at the possibility of developing specialist feed lots on dairy farms to take male cross-bred calves to approximately 270 kg liveweight.

An experiment designed to provide information on the nature and extent of pH variation in the bovine rumen is now in its second year.

The dairy beef trial at Millaroo Research Station is aimed at evaluating the effect of stocking rate and supplementation on beef production from irrigated pangola grass, using cows of two dairy breeds, Jersey and Friesian.

Grazing trials were established on private farms at Maleny, Eungella, and the Atherton Tableland, to find the optimum stocking rates for dairy production from kikuyu pastures in these areas; a trial to test the productivity of irrigated pangola grass in a commercial situation is being undertaken at Toogoolawah, and a molasses supplementation trial is in progress at Beechmont.



### MISCELLANEOUS

The development of a regular supply of 14 000 gal. milk weekly from the Atherton Tableland to the Northern Territory has been a highlight of the industry. The initiative of the Millaa Millaa Association (now merged) and the transport company is commended in this difficult venture.

Freshly pasteurised milk in sachets or cartons was sent from the Atherton Tableland in far north Queensland to Darwin and New Guinea (397 399 gallons to Darwin and 24 070 gallons to T.P.N.G.).

### ECONOMICS

In studies of factors affecting the future supply of whole-milk, it is evident the main supply will come from intensive suppliers close to the main population centres. Cream producers will continue to decline in numbers particularly in outlying marginal dairying areas and on city boundaries where small properties have been taken up in the present real estate boom. These trends have been confirmed in a survey of 800 suppliers in the West Moreton region. Expertise has been developed to handle surveys of this magnitude on a fully computerised basis.

The future profitability of dairying in the Callide Valley will be studied in a field survey later in 1973. The potential for dairy expansion and alternative avenues of production (and associated adjustment problems in any move out of dairying) will be examined.

Further evaluation of the change over to bulk milk has been undertaken at farm level. A partial budgeting approach in assessing the change was demonstrated to a meeting of over 200 dairy farmers at Boonah, at subsequent field days, and through the press.

Economic aspects of calf rearing in terms of once-a-day feeding, early weaning, and least cost feed mixes are being studied. Advice has also been sought on comparative costs of alternative sources of feed in feed year programmes for dairy herds.

### DAIRY PASTURE SUBSIDY SCHEME

The number of applications received this financial year, 2 352, is the lowest since the inception of the scheme in 1966 when 2 354 applications were received. Improved seasonal conditions, combined with the build-up of acreage under subsidized pasture, undoubtedly contributed to the reduction in applications. It is probable also that the Marginal Dairy Farm Reconstruction Scheme, with some 400 amalgamations, involving areas laid down under the scheme, had some bearing on the fall off in numbers. In each of Wide Bay and South Burnett districts where the reduction is most noticeable, over 100 amalgamations were recorded.

There was a significant drop in the number of new applicants from an average around 10% over the last two years to less than 8%.

TABLE 1  
APPLICATIONS APPROVED FOR THE NINE REGIONS SINCE INCEPTION OF THE SCHEME

Region	1966-67	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73
North Queensland .. .. .	283	288	311	255	233	232	186
Central Queensland .. .. .	80	131	101	128	98	118	68
North Burnett .. .. .	191	261	247	354	311	319	233
South Burnett .. .. .	187	382	440	374	305	360	260
Wide Bay .. .. .	754	1 022	829	980	642	627	462
East Moreton .. .. .	350	489	404	477	346	386	304
West Moreton .. .. .	250	673	713	556	570	591	456
Eastern Downs .. .. .	228	391	335	417	290	477	331
Western Downs .. .. .	31	63	52	45	25	70	52
Totals .. .. .	2 354	3 700	3 432	3 586	2 820	3 180	2 352

Applications and claims, approved during the year were:

No. of applications approved .. .. .	2 352
No. of claims approved .. .. .	2 226
Subsidy approved for payment .. .. .	\$389 730.03
Area approved for payment .. .. .	34 553 acres

The following are totals since the inception of the scheme:—

Total No. of applications approved .. .. .	21 424
Total No. of claims approved .. .. .	17 176
Total subsidy approved for payment .. .. .	\$3 428 631.11
Total area approved for payment .. .. .	239 447 acres
Average subsidy paid per acre .. .. .	\$11.86

At the end of the year, 78 dairy farms, including 26 on the Atherton Tableland, had reached their maximum entitlement of \$2 000. The Wide Bay and Beaudesert areas cover most of the remainder with only two dairymen on the Darling Downs, one each at Warwick and Dalby, with a maximum of \$2 000.

No alterations in procedure were introduced during the year and administration presented no major problems. It is difficult to forecast likely participation in the scheme for 1973-74. With the continued reduction in the number of dairy farms, any large increase in the number of applications seems unlikely.

### PRODUCTS RESEARCH

Experimental cheeses were produced in the pilot plant at the Otto Madsen Dairy Research Laboratory throughout the year under a wide variety of manufacturing conditions, and the effects of various enzyme activities responsible for flavour development were studied. Dairy Research Branch also studied fatty acid production in cheese during maturation and found that with the exception of acetic and butyric acids,

which can be produced by means other than lipolysis, there was little increase in fatty acid levels. These results, together with results showing that the absolute lipase activity in cheese is very low, indicated that lipolysis may not be important in cheddar cheese ripening.

Sulphur compounds have been strongly implicated in cheddar cheese flavour and an enzyme oxidising the sulphur-containing glutathione has been studied in milk and cheese. This enzyme has been partially purified and its properties studied.

A survey of the incidence of spontaneous lipolysis in individual cows was completed and a statistical analysis of factors influencing it such as stage of lactation, level of production, and stage of pregnancy is in progress. Spontaneously lipolytic milk was also more susceptible than normal milk to induced lipolysis caused by agitation. Delayed cooling of spontaneous milk reduced the level of lipolytic breakdown occurring. Normal milk was found to contain an inhibitor of spontaneous lipolysis. This factor was present in the skim-milk and resisted both pasteurisation and more severe heat treatment. Work is in progress to attempt to identify this inhibitory factor.

Dairy detergent and sanitizer residues have been shown to have little or no influence on lipolysis. Any effects that do occur are primarily due to pH changes produced by such compounds.

The occurrence of "oxidised" flavour defect in butter, particularly from the Beaudesert factory, has been investigated. While lipolysis may contribute to this defect, it was not its major cause. Pilot plant studies have indicated that use of the Major UHT cream pasteuriser reduces or eliminates the "oxidised" flavour in butter.

A project was commenced with the aim of developing sampling and analytical methods suitable for factory laboratories to enable factories to select with a high degree of assurance produce which will meet market requirements. Considerable progress has been made with phase 1 involving coliform contamination in unsalted butter. It will be followed by phase 2 involving coagulase-positive Staphylococci, and phase 3 involving Salmonella.



Initial research has involved a statistical assessment of the microbiological methods of analysis to assess both within-sample and between-sample variations. Pilot plant work indicates that it is quite practicable to obtain butter and buttermilk free of coliform organisms. This has also been verified at the Malanda factory of the Atherton Tableland Butter Association using a Major pasteuriser and a Westphalia continuous butter-maker. These butters are micro-biologically analysed when one day old and again after one month and two months storage at 5°F.

Fractionation of milk fat was undertaken as part of an Australia-wide project supported by the Australian Dairy Produce Board. In addition to fractionating fat for pilot plant use, the Otto Madsen Laboratory is participating in the project by investigating uses of the hard fat fraction with a view to providing additional outlets for surplus butter.

Although most work is conducted on a pilot plant scale, several series of trials were successfully conducted using industrial separators on a commercial scale for fractionating milk fat. Experiments were conducted using hard milk fat fraction to replace various set percentages of normal fat in milk for cheesemaking. Satisfactory results have been obtained using 20% hard fat in stirred curd cheese.

Some problems were experienced with floating curd in cheddar cheese manufacture when hard fat was homogenised with the milk. Upon homogenisation the fat globules become covered with a layer of partially spread out casein particles. The effect is attributed to the casein particles breaking down into small sub-units which may adhere to the surface fat globules. This effect increases with homogenisation pressure. At 50 atmospheres most of the fat globules are covered by protein but at homogenisation at 350 atmospheres conglomerates of fat globules stuck together by casein are formed. It was concluded that the internal structure of casein particles can be broken down during homogenisation, thus providing possibility for the casein sub-units to adhere to the surface of the fat globules.

Butter cakes, fruit cakes, shortbread fingers and Danish pastry were made using hard milk fat fraction. There was a tendency for cakes to be dry as the percentage of hard fat was increased but the Danish pastry was crisp and highly acceptable. In using hard fat for this purpose it was evident that it should be free of low melting point fat to avoid oiling off at room temperature. As part of this project, members of a taste panel were asked to evaluate baked products made with hard fats as well as those made with normal butter. Panellists preferred butter cakes made with "normal" butter as these cakes were moister than those made with the hard fraction, but they could not distinguish between fruit cakes made with different fats. It was found also that the hard fat fraction could not be used in shortbread because the mixture would not bind.

Experiments using hard milk fat fraction in recombined cream are in progress and promising results have been obtained. Detailed chemical analyses are performed on all samples of fat and manufactured products to evaluate efficiency of processing as well as quality and acceptability of product. By this group co-operation from chemical, technological and bacteriological sections, the very good work by Dairy Research staff can be combined for wide and practical industry application.

When milk is chilled to form ice crystals and these crystals are removed from the partly frozen mixture, the remaining unfrozen portion is a milk concentrate. Normal centrifugal separation will produce a concentrate containing 48-50% solids. Freeze concentration of skim-milk or whey

will produce a concentrate with 18-20% of solids. These products may be reconstituted to milk composition by adding water, producing a drink which is indistinguishable in flavour and texture from the original milk.

Considerable difficulty has been experienced in separating the ice from the non-frozen concentrate and in reducing the entrainment of milk solids within the ice. Several methods of separation were investigated but none were wholly successful. Column back washing methods were investigated on a laboratory scale. The necessary control facilities, however, involve finance resources.

For many years, considerable difficulties have been experienced by processing factories due to bottles which are not adequately cleaned by normal bottle washing. Milk delivered in dirty bottles brings serious consumer complaints. In an attempt to devise a means of cleaning suitable for industrial use, Queensland United Foods have available at their Peters depot a small bottle washing machine with which hard to clean bottles can be given various experimental treatments. Current work with mould mycelia and algae deposits is in its early stage but it promises to give useful results.

Laboratory staff were involved with two aspects of freezing of milk during the year—freeze concentration and variation in the freezing point of genuine milk. In some respects this work is interrelated.

As part of the project "Variation in the Freezing Point of Genuine Cow's Milk in Queensland", analyses of milks from selected herds were undertaken with a view to establishing the extent to which individual constituents of milk influence freezing point variation.

In addition to constituents previously studied, it was found that marked variations in citrate levels, in response to specific environmental changes, cause significant variations in freezing point level.

Work on freeze concentration was restricted due to shortage of staff and need to divert staff to routine analytical work. However, investigations into the influence of processing variables on the colloidal instability of frozen milk provided some interesting results.

Several milk composition projects were conducted. A State-wide investigation continued to provide valuable information on the production of milk constituents and trends in each dairying region of the State.

Trials were conducted at Kairi Research Station to study the effect on milk constituents of various stocking rates on a dryland pasture of glycine green panic. Results revealed that with stocking rates of 1 cow:1.9 acres and 1 cow:1.6 acres, problems were experienced with butterfat content during summer periods corresponding to flush pasture growth, while herds at 1 cow:1.3 acres and 1 cow:1 acre experienced problems with low S.N.F. and low protein as well as low butterfat levels.

Milk samples from Ayr Research Station were also examined regularly to determine the efficiency of production from a given pasture by groups of Jersey and Friesian cows at set stocking rates. Additional analyses of milk constituents are performed with a view to comparing the suitability of the different milks for manufacturing purposes.

The Field Services and Cattle Husbandry Branches are currently planning milk composition trials in co-operation with Dairy Research Branch.



Glasshouse facilities for plant breeding and crop testing at Kairi Research Station, where many trials are conducted, including ones on the effects of nutrition in milk constituents.



## IV. Pasture Research and Extension

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

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

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

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

### PASTURE SPECIES EVALUATION

In the dry tropics, species evaluation work is spread over three separate areas, the Peninsula, the Gulf and the hinterland behind the wet tropical coast.

*Stylosanthes hamata* CPI-38842 has continued to show promise but it remains to be seen how completely it is adapted to the region. However, the wider it is tested the more promising it appears, especially on poor quality soils. Within the drier areas, *S. mucronata* continues to impress, and at Normanton and in the Peninsula the shrubby *S. scabra* has been persistent and productive. It has held its quality later into the season than Townsville stylo. It also produced a flush of growth suitable for grazing much more rapidly after the break of the season.

During the recent wet summers at Emerald, a number of grass species and cultivars have established readily with a range of techniques in the open downs soil. This suggests that inadequate moisture is one of the major limitations to pasture establishment on these soils. It remains to be seen whether, with a return to drier summers, species such as *Bothriochloa insculpta* and Nunbank buffel grass, which have shown recent promise, can continue to impress.

Much of the pasture work within the southern and central brigalow regions has now been concentrated on lucerne as this is the only pasture legume showing any adaptation to these soil and climatic conditions. It is noticeable that at Biloela, lucerne associated with green panic or Molopo buffel grass continues to give major stimulations in grass yields at harvests where moisture is not limiting. At drier sites, there appear signs of competition between the grass and lucerne for moisture although grass nitrogen content remains higher where lucerne is present.

Siro Peruvian lucerne continues to show initial promise in the early years of all tests. Lines from seed harvested from residual six-year-old plants are showing better persistence. It is likely that these plants were outcrossed to the Hunter River variety before harvest. This suggests the possibility of purposeful crossing of Siro Peruvian and Hunter River during seed production to produce a superior line of hybrid seed.

A start is also being made to assess the likely value of creeping rooted lucerne material now coming forward from C.S.I.R.O.'s Cunningham Laboratory. These could well be more persistent under grazing than existing material and so expand the zone of usefulness of lucerne to extensive grazing areas. Presently it is only of value as a rotation legume on arable lands, and there is no means available of restoring fertility to the extensive areas of pure grass pasture developed on pulled brigalow should these decline with use. A start is being made to measure the rate of run-down of fertility on such areas.

Leucaena has continued to grow well at Brigalow Research Station although susceptible to winter frosting. However, it recovers rapidly with the first spring rains, and provides added dietary protein for much of the year.

The programme from South Johnstone is mainly directed toward filling in the dry season production trough. More winter-vigorous cultivars have been developed and are now entering commercial use, while further work has shown that very useful responses to nitrogen fertilizer can be obtained over the so-called dry season. The cumulative role of these techniques is now to be assessed in a major grazing trial. Belalto centro and CPI-37910 guinea grass will be compared with the conventional centro and common guinea with and without pure grass/bag nitrogen to take winter/spring pressures.

Pangola grass has shown severe reaction to a range of insect pests, especially aphids, over the last two summers on the wet tropical coast. A search has been commenced for alternate cultivars. *Brachiaria decumbens* is already available while collections of lines of *Digitaria* and *Cynodon* suggest that other useful alternatives with some degree of aphid tolerance will be available.

*Dairy Pastures.*—The tropical species evaluation programme takes the following form:

- (i) Initial species assessment in small, strategically located field plots with the aim of selecting promising species;
- (ii) Detailed quantitative assessment of selected species in comparison with existing commercial cultivars;
- (iii) Special purpose studies aimed at manipulating the use of species to achieve greater productivity, for example, through use of nitrogen, irrigation, etc.

The programme is concentrated in four main dairying areas, namely, the Atherton Tableland, Wide Bay, East Moreton and West Moreton. Increasingly, the programme is oriented towards selection of grasses and legumes either with specific attributes such as long season growth, cold tolerance and drought hardiness, or for specific situations such as wet, poorly drained soils, sandy soils, or low rainfall areas.

In the 50 in. rainfall belt of southern Queensland and the Atherton Tableland, *Desmodium intortum* cv. Greenleaf has shown the greatest adaptability to a wide range of soils and exhibits good spring, summer and autumn growth. However, at Cooroy an F<sub>1</sub> hybrid (*D. intortum* x *D. sandwicense*) bred by Dr. K. McWhirter, Sydney University, has consistently outyielded Greenleaf. From June, 1968, to March, 1972, it yielded 22 150 kg/ha of dry matter compared with 15 478 kg/ha from Greenleaf over the same period.

At Cooroy, Mt. Mee and Gatton two strains of cold tolerant setaria, *Setaria sphacelata* CPI-32930 and cv. Narok have proved superior to all other tropical grasses as a source of standover, partially green fodder. Although their winter growth is slow they are only slightly affected by severe frosts. Their summer performance is also comparable with other grasses.



Investigations into species suited for poorly drained soils have shown *Digitaria decumbens* cv. pangola, CPI-32930 setaria, *Lotus major*, *Vigna gracilis* and possibly strawberry clover to be best suited to such conditions.

The greatest weakness in the range of species available is their inability to handle extremes of wet or dry. Under relatively low rainfall (28–35 in.) on the shallow sandy podzolics of the West Moreton area only Siratro and *Lotononis bainesii* have proved persistent and reasonably productive. Improved strains of Siratro are being bred by C.S.I.R.O and have shown promise for increased productivity under marginal moisture conditions. In these situations irrigated pastures are generally essential for intensive dairying.

For the more extensive situations, it has been shown that Siratro and *Lotononis* can be oversown into native pasture with minimum tillage. In the West Moreton and also on a solodic soil north of Gympie, animal production is being measured from such pasture. As a result of above average rainfall over the last two years, extremely good milk production has been achieved from tropical pastures as compared with the unimproved situations.

Particularly in the better watered situations tropical pastures have shown that tremendous improvement in per acre and per cow productivity is possible. The programme has resulted in the experimental testing and subsequent commercial release of several cultivars. There is now a range of species that are capable of giving high milk and meat production in otherwise unimproved situations. However, problems of persistence under adverse environmental and/or managerial conditions still exist.

It has been demonstrated that the total yield and seasonal distribution of yield can be greatly influenced by nitrogen fertilization. Both at Cooroy and Gympie, consistent use of nitrogen drastically reduced the percentage and yield of legume in mixed pasture.

Climatic conditions in south-east Queensland and the Atherton Tableland strongly favour tropical and subtropical species as the main constituents of permanent pasture. Despite the selection and development of species which have greatly reduced the period of inadequate quantity and quality of feed throughout the year, there is still a vital need for species which grow and/or provide feed of reasonable quality in the normally dry winter-early spring period. Both temperate and tropical species are being evaluated for this period under irrigated and dryland conditions.

The selection for cold tolerance in tropical species must remain one of the most potentially profitable approaches. As well as the setaria strains there is considerable scope for judicious management of kikuyu, especially now that seeding strains (cvs. Whittet and Breakwell) are being released commercially. An intensive evaluation of these strains for year-round productivity and establishment vigour is being initiated.



Seeding strains of kikuyu have been released in New South Wales. This is the Whittet variety becoming established in a trial plot on the Darling Downs.

Without irrigation, yields from temperate grasses are disappointing. At Cooroy, a range of varieties of ryegrass is being evaluated and fair growth has been obtained from Wimmera, Grasslands Manawa (H1), Ariki, Kangaroo Valley and Grasslands Paroa (Italian) in descending order.

Of the temperate legumes, lucerne and white clover are still most widely used but a number of relatively untried perennial and annual clovers and other legumes are showing promise. Of the white clovers, Haifa has yielded best at Mt. Mee and, in a nursery at Cooran, exhibited excellent winter and spring growth. At this site, Dixie Crimson clover and Sirint rose clover yielded heavily in the spring. At a Cooroy site, a range of subterranean clovers is being evaluated for annual oversowing.

An intensive evaluation of *Trifolium semipilosum* is being conducted at all centres. This work is being co-ordinated with C.S.I.R.O. and the New South Wales Department of Agriculture. At Mt. Mee, it failed to nodulate. However, on the Evelyn plateau in north Queensland (during the March–May period in 1972), three *T. semipilosum* strains produced between 5 500 and 5 900 kg/ha dry matter compared with only 234 kg/ha from Louisiana white clover.

Undoubtedly some temperate legumes are extremely promising. However, until their productivity and general adaptability are more clearly understood there is still a role for grazing oats and other winter cereals. A range of oat varieties has now been evaluated over several years at three centres and under a range of moisture and nitrogen regimes and at various seeding rates. A considerable amount of knowledge has now been accumulated and more reliable commercial recommendations can now be given.

The work on cool season pasture species has advanced to the stage where their integration with warm season species in whole farm systems may be feasible throughout most of south-east Queensland.

*Irrigated Pasture.*—Irrigated pasture research in dairying areas of Queensland is directed towards one main objective. This is to provide high quality feed during the winter months when raingrown forage is of low quality and short supply, and rainfall is low, and unreliable.

Two types of pasture are being investigated. First, investigations are proceeding on an assessment of species, both grasses and legumes, for use in permanent irrigated pastures. The species being assessed include newly released temperate cultivars as well as tropical species (to provide a summer component in a mixture with a cool season species). Second, research is being conducted on winter fodder crop and annual pastures. This latter work involves both varietal assessment and the effect of variable seeding rates and nitrogen levels.

The performance of some of the more promising cool season species has been mentioned previously. Irrigated annual species rarely outyield oats, although some strains of ryegrass and some temperate legumes have almost comparable yielding ability. Many of the experiments have not been progressing long enough to assess long-term persistence. A high-yielding permanent pasture mixture is obviously most desirable.

In an investigation recently completed at Gatton which compared dry matter production and feed value of both tropical and temperate irrigated pasture, the temperate grasses (Priebe's prairie and Grasslands Manawa ryegrass) persisted poorly on the heavy clay soil. Tropical grasses were both persistent and productive under conditions which included heavy frosting. On the other hand, Ladino white clover outyielded the tropical legumes, Tinaroo Glycine and Green-leaf Desmodium, and had a much longer growing period.

Protein and soluble carbohydrate content of tropical legumes and grasses were significantly lower than for the temperates. However, tropical species had a higher efficiency of water use during summer and autumn, and pure tropical grass stands (fertilized with 300 lb N/acre) were more efficient than temperate pastures over the entire year.

The result of this investigation suggests the value of a cold-tolerant tropical grass (Narok or CPI-32930 setaria) combined with white clover under irrigation. Other experiments have confirmed the ability of these grasses to combine with white clover and to have some winter growth component.

With winter fodder crops, investigations at Gatton have shown that, under irrigation, there is advantage in increasing planting rates of oats above the normally recommended 1 bushel/acre. Maximum yield was obtained with 3 bushels/acre in two consecutive years, although the most economic increase would be likely at the 2 bushels/acre level.

With the use of nitrogen on irrigated oats, the most economic responses appear to be between 150–175 lb N/acre applied in split dressings at planting and after each defoliation. If through inadequate watering schedules moisture becomes limiting, high seeding rates and heavy nitrogen applications give very little yield increment.

*Sheep Pastures.*—Screening and evaluation of introduced pasture species in the search for higher production and for specific seasonal productivity of pasture grasses and legumes



is continuing. On mulga soils, several introduced species from South Africa have considerably out-produced native grasses and legumes as illustrated in the following comparison of *Schmidtia* 5 500 kg/ha, *Antheophora* 3 800 kg/ha and *Cenchrus* (buffel grass) 3 000 kg/ha with the native *Thyridolepis mitchelliana* (formerly *Neurachne mitchelliana*) 500 kg/ha. Requirements for paddock establishment of the first three together with the annual *Dactyloctenium giganteum* are receiving attention. It has been found that a base dressing of 125 kg superphosphate/ha will greatly enhance *Cenchrus* establishment on mulga soils. At Barcaldine, native pasture paddocks oversown with *D. giganteum* were grazed in the second year (1972) from April to November. The actual contribution of *D. giganteum* to the forage yield has declined from approximately 600 kg/ha in 1971 to 100 kg/ha in March, 1972. Further attempts were to be made to promote regeneration during 1972-73 summer months by surface soil disturbance following which the paddocks were to be oversown with buffel grass. The value of *Dactyloctenium* litter in assisting buffel grass germination and establishment will then be investigated.

On a sandy solodic soil near Warwick, the most promising annual winter legumes were *Pitman serradella* and Jemalong medic. Production over the last four years has been highly variable and considerably influenced by winter rainfall. In this situation lucerne is a highly productive legume during the summer months only.

On acid granite soils in the same area, nutrition trials now show that superphosphate is necessary to grow lucerne. Maximum yield is achieved, however, where lime is used also at about 2 000 kg/ha, or by using lime pelleted seed. In this environment, lucerne can provide a very valuable protein supplement to native pastures.

#### PASTURE ESTABLISHMENT

The area of land carrying introduced pasture plants continued to expand rapidly and by August, 1972, covered almost 7 million acres. This included an estimated 1.3 million acres under sown or naturalized Townsville stylo. The increase of all types of pasture for the year was in the vicinity of 650 000 acres. The largest acreages of sown pastures are in the Central Highlands (1.4 million), Dawson-Callide (750 000), Near South Western (600 000) and Far South Western and Central West (650 000) regions where most plantings are of pure grass stands.

However, substantial legume-based pastures were planted in areas where suitable legumes are available. This particularly applies to regions where Siratro and the *Desmodiums* are adapted, such as the Central Coast where the total is now nearly 600 000 acres, Near North Coast (300 000) and Brisbane Moreton (350 000).

The Townsville stylo areas are essentially in north Queensland. However, major new plantings are not occurring at present due to other property development priorities and certain unsatisfactory features of Townsville stylo, especially rapid broadleaf weed invasion. In this regard the work of the C.S.I.R.O. Plant Introduction officers and our own dry tropics research unit is beginning to bear fruit, and there are a range of quite promising alternatives to Townsville stylo emerging for north Queensland. Other species of the genus *Stylosanthes* are showing considerable promise. Further very interesting material is in the early stages of testing.

The major areas where the pasture legume position is unsatisfactory comprise the heavier-textured, higher-fertility soils on or immediately below the tropic and with less than 35 in. average rainfall. These areas can carry pure grass pastures at present but without some source of nitrogen input may not always be able to do so. A strong legume introduction programme for these areas is required.

On the heavy soils in the Central Burnett, reliability of establishment of sown pastures is particularly low. At "Brian Pastures" since 1962, about 50% of sowings have failed to establish while efficiency of establishment of viable seed sown is also low even in a successful stand. Conventional establishment techniques give only 1% to 5% of viable seed establishing. This indicates a substantial wastage of seed as high sowing rates and hence high costs are necessary.

Work at "Brian Pastures" showed that sowing beneath a straw mulch gave increased efficiency and reliability of establishment. The mulches reduced soil drying rates, resulted in a more even temperature in the soil seed zone and reduced crusting of the soil surface. Average days to wilting point in the 1-2 cm horizon after 30 mm rain were 4.0, 5.8, and 8.3 for bare soil and mulch at 2 500 and 5 000 kg/ha respectively. Sorghum, barley and native pasture straw all proved equally effective. *Dolichos* lab lab straw was less effective and no advantages were gained from chaffing any of the mulch materials.

Work with the establishment of *Leucaena* showed that sowing depth in these self-mulching soils and weed competition are the critical factors affecting establishment. Post emergence weedicides tested to date have given control of one group of weeds and allowed others to get away or have damaged the *Leucaena* at rates giving full weed control.

Within the mulga region, the emphasis of work at Charleville has now been placed on a study of factors affecting germination and establishment of pasture species. The main factor governing establishment appears to be the very slow growth rate of the seedling. Any factor contributing to the maintenance of an environment giving better moisture penetration, milder temperatures and higher surface soil moisture levels will provide a better opportunity for young seedlings to develop into mature plants. Seedling growth rate can also be increased markedly with phosphatic fertilizers. This applies particularly to buffel grass and to a lesser degree to native species.

#### PASTURE NUTRITION

The nutrient status of dry tropics soils continues to be assessed. On the red basaltic soils at Boomerang, significant sulphur responses were obtained for a wide range of *Stylosanthes* in their second year stands, 20 lb. S/acre giving maximum responses for most species. At the other centres, phosphorus appears to be the major limiting nutrient to legume growth.

Within the dairying areas, the need for establishment fertilization of pastures and fodder crops is now widely accepted but maintenance fertilization is often neglected. General recommendations for establishment fertilization appear quite adequate. Generally, the main emphasis in research is to determine maintenance requirements.

Since 1966 at Cooroy, a series of field sampling and fertilizer experiments have been used to evaluate chemical analyses of plant and soil samples for predicting pasture nutrient requirements. Results indicate that neither soil sampling nor plant sampling are completely reliable on their own, but they are useful diagnostic aids which preferably should be used in conjunction, not only with each other, but with the aid of visual deficiency symptoms and knowledge of soil type and paddock and fertilizer history.

A series of field fertilizer experiments are being conducted in all districts to determine the maintenance nutrient requirements of legume based, and in some instances, grass only, pasture. The main nutrients of concern are phosphorus, potassium and molybdenum. Some of this work is co-operative with C.S.I.R.O. and during the last year a series of these experiments commenced in south-east Queensland to investigate the residual effect of molybdenum and molybdenum source. Even at this early stage some different legumes apparently need different levels of molybdenum, but it will be necessary to run these experiments for several years before any reliable data on residual value are obtainable.

Experiments are also in progress to investigate the effect of nitrogenous fertilizer on grass yield, on legume establishment, and on the persistence of legume in a mixed sward. Other nutrient requirements are also being monitored under heavy nitrogen fertilization of grasses such as kikuyu.

It is obviously impractical to continue conducting large numbers of fertilizer experiments. However, they are necessary at this stage to provide base data for the necessary calibrations between nutrient extracted (from soil and plant) and soil type, plant and crop species. Without these calibrations, the plant and soil analytical facilities provided by the fertilizer industry will be of very limited value for providing reliable recommendations for pasture fertilization.

Under commercial conditions, there are numerous successful farmers in the State who follow current fertilizer recommendations. However, there are also obvious instances of inadequate recommendations and an inability to determine the most economic rate of fertilization.

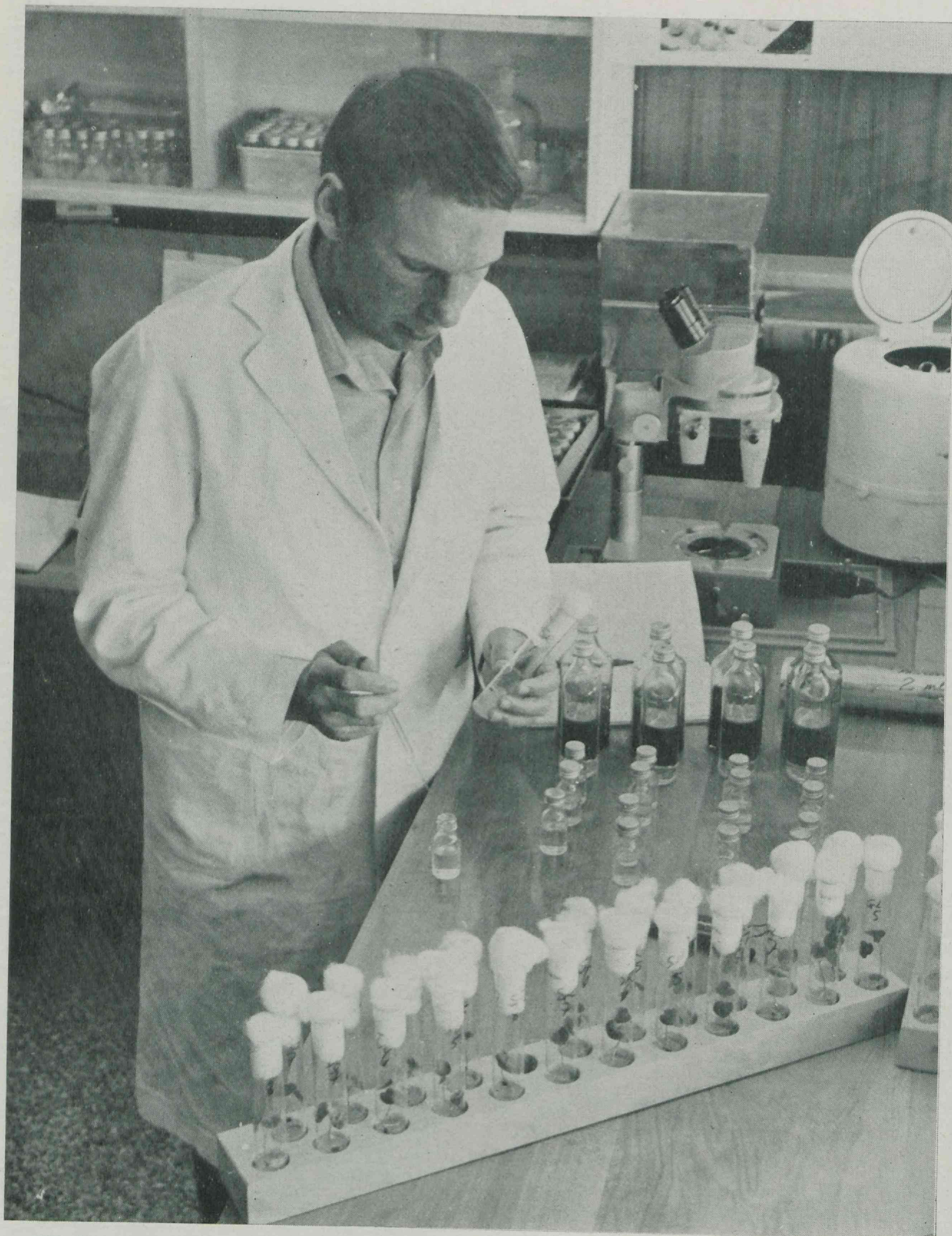
#### LEGUME BACTERIOLOGY

Trial work with *Leucaena* indicates that the use of inoculum strains which produce effective nodulation is the most efficient way of achieving early vigorous growth.

During the year, 108 cultures for 17 different legume species were supplied to agrostologists and farmers because no commercial inoculants were available.

Tests with 67 different strains of navy bean inoculant were carried out during the year. Eight of these were selected for closer study.





Rhizobium cultures are screened by Plant Pathology Branch to ensure that farmers obtain maximum benefit from seed inoculation of legumes.

#### NATIVE VEGETATION

Work in the field of native communities was concentrated in the mulga lands of south-western Queensland. Once ground cover of herbage and grasses has been depleted in these communities stock can be maintained for considerable periods on the leaves of mulga trees. Dry sheep have commonly survived for well over a year on such a diet but it is inadequate for animal reproduction.

Earlier results showed a close negative relationship between mulga tree basal area and herbage production, and that a small increase in tree density causes a drastic reduction in herbage yield. Work has now concentrated on determining reasons for fluctuations in density of the more important woody perennials; observations and measurements are being

made along permanently positioned transects open to grazing as well as in fully protected areas. Climatic conditions in the south-west appear to favour a continual increase in mulga populations, along with intermittent mass regeneration, but regeneration is suppressed in scrubs containing over 640 trees/ha and in totally cleared country subjected to stocking with sheep.

Sheep dietary studies were commenced. Initial results show that the animals can select diets of much higher digestibility and protein content than can be harvested mechanically. Species identification of the ingested material forms part of the post-graduate studies being undertaken by a Departmental officer in America.



Green turkey bush (*Eremophila gilesii*) is an inedible woody pioneer species which has shown its ability to invade disturbed mulga scrubs. Under present management conditions it is increasing in density and can reach such proportions that all herbage and grass growth is completely suppressed. This increase appears to be most rapid where stocking rates are low and in sites completely protected from stock. Although various mechanical treatments and hormone sprays will kill the plants, these are costly to apply, and the problem of revegetating such areas with desirable species still remains.

Work is continuing on moisture distribution and utilization under mulga communities to determine the role of soil moisture in the productivity of mulga scrubs. The initial phase has consisted of measuring the amount of rain intercepted (and thus prevented from reaching the ground) by mulga tree leaves, the amount which is channelled down the stem and the amount which passes through the foliage, for a number of different rainfall sequences. This was a necessary forerunner to additional studies on moisture balancing which partitions rainfall into water lost by evaporation and/or runoff, and water penetrating the soil which is available for tree and herbage growth. Initial results showed that intercepted water, which is mainly lost to the system by evaporation, can amount to about 13% of the total precipitation. This represents an annual loss of about 64 mm in an area receiving less than 500 mm annually.

After rain, soils under thick mulga scrubs contain less moisture than those under thin scrubs and where trees have been removed. Trees utilize available moisture at a far greater rate than grasses and to a greater depth. Five weeks after rain in May, 1972, plots containing about 3 000 trees/ha had utilized most of the available water whereas plots totally cleared of trees still contained water above the permanent wilting point. This is reflected in higher grass and herbage yields in the absence of trees.

#### FODDER CROPS

Although forage cropping under dryland conditions in semi-arid areas of western Queensland has limited application because of low and unreliable rainfall, investigations are proceeding to define the role of forage crops as an alternative fodder resource. The emphasis is on methods of improving the reliability of crop establishment. Rain in 1972 was insufficient to produce a crop but it was possible to monitor soil moisture content in a trial to study effects of prior cultivation on soil moisture storage.

Where multiple cultivations had been carried out, soil moisture was higher at all depths than in areas cultivated once or not at all, irrespective of when cultivation was carried out.

Feasibility studies on grain and fodder production from the shallow storage project at Richmond are still in the data collection stage. The object is to collect sufficient base information on factors controlling productivity so that a simulation model of the system can be developed.

The three main areas of data collection are:

**Runoff.**—Runoff characteristics of the 1 600 ha catchment were followed after each rainfall runoff sequence over the last five years. There were four runoff years which yielded a total of 2 600 000 m<sup>3</sup> (2 200 ac. ft.) of water or an average of 400 m<sup>3</sup>/ha/annum (1.6 inches/ac/annum). Because 1971 and 1972 were abnormally high runoff years it is anticipated that the long term average will be less than 250 m<sup>3</sup>/ha/annum (1 inch/ac/annum).

**Irrigated Crops.**—The grain sorghum research programme examines effects of time of planting, irrigation strategy, plant populations, varieties and soil fertility on moisture availability, crop growth patterns and grain yields. In 1972, most efficient water use resulted from a single irrigation just prior to flowering of the hybrid De Kalb E 57 at 70 000 plants per ha. The yield was 1 400 kg/ha. This stand was planted at 150 000 seeds/ha but poor establishment resulted in only 70 000 seeds/ha establishing. Indications are that the above yield could be doubled if a stand of 150 000 plants/ha could be achieved. Multiple irrigations almost trebled yield but the lower yield from a single irrigation is more than compensated for by the increased area that can be planted. There have been no crop responses to nitrogenous and/or phosphatic fertilizers in the fourth year, after three years cropping without fertilizer.

Performance of April/May planted winter cereals was encouraging. Similarly to grain sorghum, maximum yield resulted from multiple irrigations but maximum water use efficiency came from a single irrigation 42 days after planting.

**Ponded area.**—Emphasis here was placed on productivity of forage sorghums. A marked reduction in D. M. yield from 8 000 kg/ha in 1968 (the first crop) to 2 000 kg/ha in 1972 occurred. The reason for this is not clear and production was not influenced by nitrogenous fertilizers.

#### PASTURE MANAGEMENT AND UTILISATION

Pasture management in the sheep and beef cattle areas is still of a fairly unsophisticated nature and as yet only in the most intensely used areas is there need for knowledge on management techniques at the farm level. It is apparent in some areas such as the wet tropical coast and around Mackay that high stocking rates are leading to poor legume persistence. It has also been possible to drastically reduce buffel grass stands by extended heavy grazing in the Central West.

The buffel grass grazing trial at Blackall has now been grazed for five consecutive years. Under the two lightest stocking treatments, 1.25 sheep/ha and 2.5 sheep/ha, buffel grass showed no signs of deterioration and in May, 1972, dry matter yields were approximately 3 800 kg/ha and 2 500 kg/ha respectively. Even at the lower level this represents quite an adequate reserve of standing forage. At the heaviest stocking rate of 5 sheep/ha, available forage was drastically reduced and hand feeding for survival was necessary. Buffel grass deterioration is quite evident with ground cover being reduced from 4.10% in 1971 to 2.10% in October, 1972, under this heavy stocking rate.

At 1.25 sheep/ha, ground cover remained fairly stable at 7.90% and, at 2.5 sheep/ha, is slightly lower at 5.40%. Buffel grass in paddocks originally stocked for 3 years at 10 sheep/ha (4 sheep/ac) and then destocked for the following 18 months showed some recovery.

Performance of sheep at the two lightest stocking rates was the same in terms of bodyweight gains and wool production. At 5 sheep/ha final bodyweights were about 8 kg/head lighter but without hand feeding this difference could have been considerably greater.

Dairy pastures on the other hand, require much more sensitive management, and the Dairy Pasture Utilisation and Management Programme, (Dairy P.U.M.P.) was designed to investigate, by means of survey, the effect of management by farmers on improved pastures. The survey is being conducted in all areas of the State where dairying is practised.

The project takes the form of a continuing study on a series of randomly selected improved pastures. These pastures were chosen from plantings made under the Queensland Government's Dairy Pasture Subsidy Scheme. Single pastures are being studied, rather than the whole farm, so that the effect of management on particular species can be observed.

Tropical pastures, irrigated temperate pastures and lucerne pastures are all included in the survey which will continue for five years. A large number of factors directly and indirectly pertaining to management of the selected pasture is being recorded annually. At approximately the same time each year, an assessment team visits all pastures in the survey to determine changes in density and appearance of component species, along with certain other attributes. Local officers are also involved in this assessment.

The participating farmer is involved in two ways. First, he is asked to keep grazing records of the hours per day and number of days which animals have been on the particular pasture. Second, he involves himself by consciously or unconsciously observing the pasture more closely than he would otherwise have done.

Two years' data have now been processed, but so far are not sufficient to indicate trends in management. However, in terms of information about the farm practices, certain interesting features are already showing up. The number of pastures now being studied has increased to 175, about 75 of these having been studied for the first time in 1970-71.

Area of farm, number of stock carried on the farm, area of improved pasture and farm output showed little change from the first to the second year. When the survey pasture is considered, some interesting changes have taken place. There is an apparent increase in the percentage of pastures where the nitrogen status of the soil was considered by the assessing group to have improved noticeably.

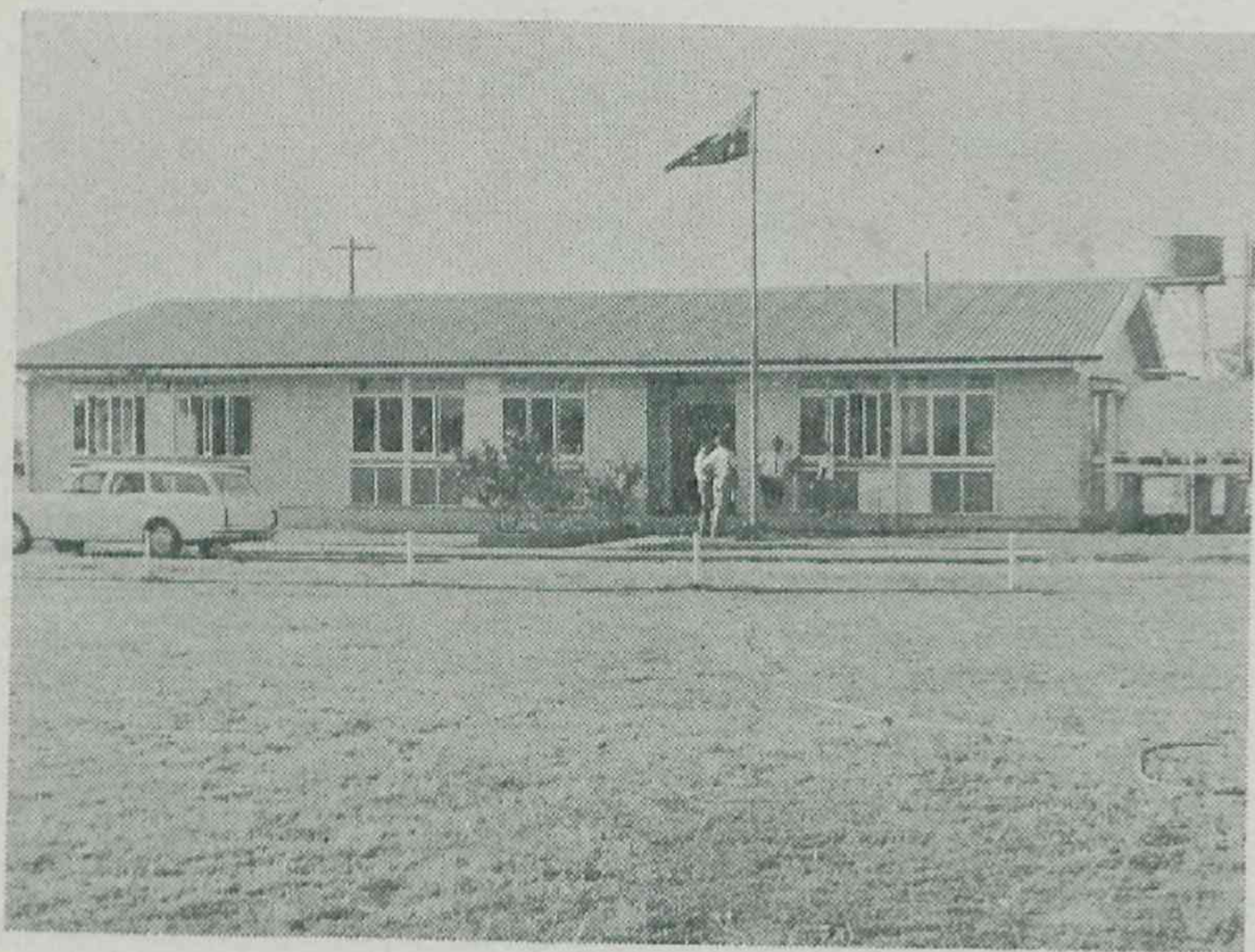
However, it is in terms of maintenance fertilizer that the survey showed greatest difference. Over all the pastures surveyed, only 37.6% had any maintenance phosphate fertilizer applied. In the drier areas (less than 35 in. annual rainfall), only 27.7% received any maintenance fertilizer, and the most of these pastures had less than 2 cwt. of superphosphate per acre. On the other hand, up to 8 cwt./ac. superphosphate was applied in the wetter areas and the proportion of users was also considerably higher than the average.

Only 12% of the pastures received maintenance dressings of nitrogen fertilizer and only 4.5% received potash fertilizer. As all these farmers would be fairly regularly visited by the survey officer, this is a remarkably low percentage considering that the majority of the soils on which these pastures were planted were of low fertility.



Further interesting information came from the grazing data. It is apparent from these data that pastures in wetter areas (greater than 35 in.) are grazed using a completely different system from those in the drier areas. In higher rainfall areas, tropical pastures are used fairly evenly over the year, with a somewhat lower pressure in winter. However, in low rainfall areas, the pastures are allowed to bulk up and are grazed for a longer period in autumn or winter. This is seen as a feed requirement factor. The drier areas rely on native pasture during summer and store feed in situ for periods of low pasture production.

Comparison of the species densities from the first to the second season suggests that in almost all cases there was little overall loss of specie density. Severe lucerne loss from flooding was the exception. Most tropical grasses maintained density although *Panicum* species appeared to lose density in wetter regions. Some reduction in Siratro numbers was also evident in the wetter areas. Only 34% of the pastures had increasing weed density. In fact, in general, most pastures appeared to have overcome weed problems.



**The Brigalow Research Station, Theodore, centre for investigation of pastures, crops and timber control for livestock production for the 11-million-acre Fitzroy Basin Development Scheme.**

The expected benefits of this survey in terms of the management necessary to maintain pasture vigour and productivity have not yet become evident. However, it already appears to have been successful in a number of indirect ways. Firstly, it has shown different patterns of grazing and fertilization in wetter and drier dairying areas. Also it has shown that in general in the dairying areas of the State, tropical pastures can be successfully established commercially and under grazing will improve in density and composition. Finally, the survey has benefited farmers, research workers and advisory staff alike by forcing them to study in detail pastures in their proper place—being well used in the farm situation.

### ECONOMICS

Economic projects have included an assessment of the role of buffel grass in the Maranoa region, and an estimate of pasture seed production costs in the Near North Coast region.

Further field data on beef cattle raising on irrigated pangola pastures under commercial conditions on the Atherton Tableland will be combined with trial results from Parada Research Station in a detailed report to be prepared on this fattening enterprise.

### PESTS AND DISEASES

During the spring and summer months of recent years populations of an aphid of the *Schizaphis graminum* group have built up on pangola grass pastures in north Queensland, causing a temporary loss of production. Eventually the populations enter a seasonal decline under the impact of natural regulatory factors such as predators. Control of the aphid can be readily obtained by spraying with demeton-S-methyl or parathion but these chemicals are relatively hazardous and also may have an undesirable effect on the ecosystem. In addition, the application of insecticides to

pastures may be of doubtful economic advantage so an investigation of the relative susceptibilities of pasture grasses to the aphid was initiated. Assessment of field infestations demonstrated the aphid's preference for pangola grass, *Digitaria decumbens* cv. Pangola. Two other related grasses, *Digitaria* sp. CQ 911 and *D. decumbens* CPI 18385 also supported *Schizaphis* populations but were less favoured host plants.

Intensive studies on the biology of the wingless grasshopper, *Monistria pustulifera* (Walk) which has occurred in large numbers on green turkey bush, *Eremophila gilesii*, an important weed on pastures in the Charleville area, commenced in January.

Present observations indicate that a one-year life cycle is involved with adult inactivity occurring over the February-May period.

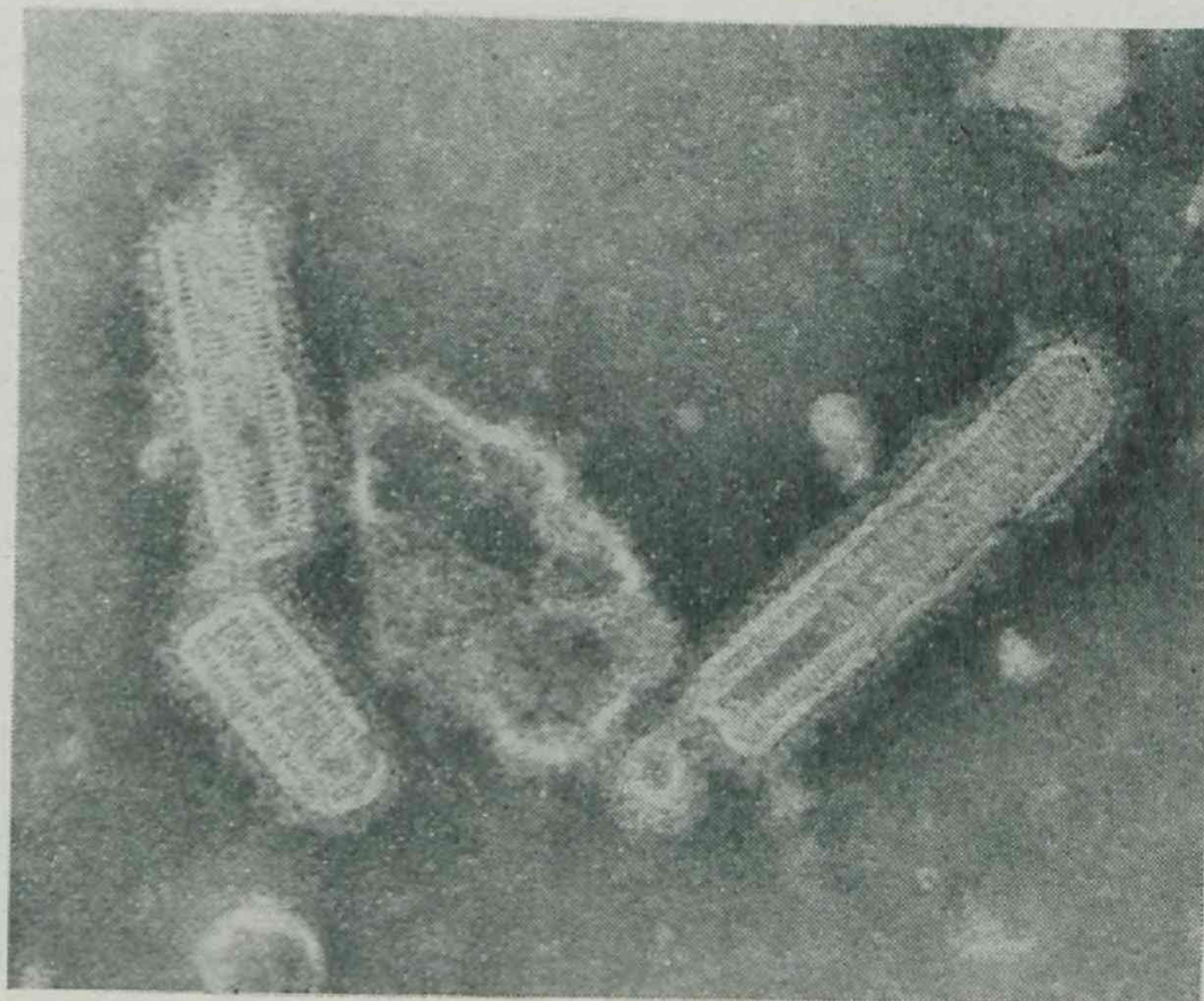
Together with population data, results of experiments on rates of food consumption by *M. pustulifera* individuals should provide a basis for evaluating the insect's potential as a biotic control factor for the weed.

Field studies have shown that lucerne plants can tolerate relatively heavy infestations of jassids without significant loss of yield. Thus, despite the occurrence of apparently large populations, specific chemical control measures for jassids on lucerne would be rarely warranted on economic grounds.

Temperature is an important factor in the population dynamics of the vegetable jassid, *Austroasca viridigrisea* (Paoli), a pest of lucerne in central Queensland. This fact was deduced from a study of the duration of the egg stage under heated glasshouse conditions where the average maximum temperature was 34.7 deg.C and the average minimum 24.2 deg.C. Minimum development time at these temperatures was 9 days with an average of 10 days. By contrast, the incubation period of eggs held at cool, ambient temperatures in the insectary in July was much greater, ranging from 27 to 34 days. Parallel work with nymphal jassids showed a similar, direct relationship between rate of development and temperature, and together these results partly explain the rapid build-up of jassid populations that occurs in summer.

Leaf blight (*Rhizoctonia solani*) was widespread and serious on many legume hosts. Among hosts on which the fungus was recorded for the first time this year were *Stylosanthes guyanensis*, *Calopogonium coeruleum*, *Desmodium adscendens* and *Cynodon plectostachyum*.

The striate virus of pangola grass has been shown to be due to a bacilliform virus transmitted by a leafhopper.



**Electron micrograph of particles from Pangola grass infected with striate virus.**

Further work during the year has confirmed the widespread occurrence of crown and root rots in lucerne. The most common and most insidious problem is that caused by *Colletotrichum trifolii* which has been found under practically all types of growing conditions. Normally a stem rotting organism, it possesses the capacity to enter the crown and kill the plant. Another crown rot disease, caused by the fungus, *Stagonospora meliloti*, was recognised for the first time in Queensland. The next stage of this work, the evaluation of cultivars for resistance, is now well under way. There is no doubt that much of the poor persistence reported for lucerne is due to these diseases.



## V. Field Crop Research and Extension

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

Field crop research is conducted on research stations at Southedge, Walkamin, Kairi, South Johnstone, Millaroo, Biloela, Theodore, Gatton and Hermitage, and at numerous field investigation centres. Wheat research is centred at the Queensland Wheat Research Institute at Toowoomba, built and financially supported largely by the Queensland Wheat Research Committee and staffed mainly by the Department. Sugar cane production research and extension are conducted by the Bureau of Sugar Experiment Stations, which is controlled by the sugar industry.

### WHEAT

Of 19 successful regional varietal trials conducted in 1972, 11 were in south Queensland and eight in central Queensland. The four commercial varieties tested, Gatcher (1 603 kg/ha), Timgalen (1 518 kg), Mendos (1 506 kg) and Spica (1 460 kg) were outyielded by the unreleased experimental lines WW15 (1 823 kg) and New South Wales Experimental line (1 679 kg). Average yield for the 12 varieties tested over the 19 trials was 1 564 kg/ha.

A yield component survey was made on the 12 varieties from 12 of the 19 regional varietal trial sites. Results obtained support the contention that the major cause of yield variation between varieties at a given site was closely correlated with the grain number per ear.

Performances of the seven varieties in four mid-season varietal trials were marred by poor seasonal conditions. The trials did, however, provide good evidence to support the recommendation of the recently released Tarsa (982 kg/ha) in place of Festiguay (1 064 kg). Although yield of Tarsa was down marginally on Festiguay, Tarsa has better rust resistance and grain quality.

The effectiveness of various methods of land management during the fallow period for wheat production on the black earth soils of the Darling Downs is being investigated in a continuing trial at Hermitage Research Station. In three of four seasons to 1971-72, treatments which were maintained weed-free with herbicides (zero tillage) encouraged build up of fallow soil moisture reserves to a greater extent than did mechanically cultivated treatments. Retention of stubble treatments showed a similar increase in fallow moisture build-up over burnt stubble treatments in the same three seasons. In combination, zero tillage and stubble retained treatments were most effective in increasing fallow moisture build-up. Major yield differences due to treatment occurred only in 1969-70.

The incidence of crown rot (*Gibberella zeae*) and common root rot (*Cochliobolus sativus*) was at a similar level to previous seasons. Programmes aimed at incorporating resistance to these two diseases into commercially acceptable cultivars is continuing.

Both stem rust (*Puccinia graminis* f. sp. *tritici*) and leaf rust (*Puccinia recondita* f. sp. *tritici*) were generally at a low level because of the unusually dry weather experienced. However, in some areas prolonged rain late in the season caused an upsurge in leaf rust and glume blotch (*Septoria nodorum*). Work with experimental fungicides showed that a single foliar application of RH124 gives good control of leaf rust.

### BARLEY

Barley grain production in Queensland to the present has quite rightly been based almost solely on the production of varieties capable of producing malting quality under favourable growing conditions. The industry recently transferred from Prior to Clipper, a superior malting variety under most conditions. During the period 1968-72, 59 yield comparisons were made in varietal trials between Clipper and Prior, in which Clipper outyielded Prior by 13% overall.

With the higher prices being paid for feed barley, it is appropriate that the Department should be investigating varieties suitable for this market. In this regard it is important that the grain of feed barleys should be readily distinguishable from that of the malting variety Clipper. Over the past five years, a number of lines bred at the Waite Agricultural Research Institute, Adelaide, and possessing a pale-purple seed

coat have been grown in varietal trials. The best of these outyielded Clipper by 18% in 12 comparisons. Testing will proceed with this material and if results continue in this encouraging vein it should be possible to release a feed grain variety in several years' time. The necessary arrangements can be made to ensure that the release will not jeopardise the orderly marketing of the malting variety.

### GRAIN SORGHUM

Texas 610, the yardstick against which other sorghum hybrids have been compared for the past decade, performed best of the medium maturing hybrids included in four regional varietal trials conducted at Hermitage Research Station, Kingaroy, Chinchilla and Lakeland Downs in 1971-72. It yielded 6 400 kg/ha. Best of the other hybrids were Yates NK212 (6 134 kg), the Department's Q5161 (6 066 kg) and Pioneer 846 (6 064 kg). Successful slow and quick maturing trials were conducted at Hermitage Research Station and Kingaroy in 1971-72. Yates NK133 (6 796 kg/ha) and Yates NK233 (6 779 kg) were the best of the quick maturing varieties. Of the slow maturing varieties, Yates NK275 (7 106 kg/ha) outyielded other entries including DeKalb E57 (6 284 kg) and the open-pollinated variety, Alpha (5 728 kg).



First crop of grain sorghum (F97 Millaroo) planted on flood plain soils in the Burdekin Valley evaluation programme.

Grain sorghum varieties resistant to the Johnson grass strain of sugar cane mosaic virus, a serious disease of grain sorghum in Queensland, were brought closer to reality by the release of four new crossbreds as breeding material. The crossbreds were produced from a co-operative Department of Primary Industries-University of Queensland breeding programme involving Krish, a forage sorghum which is the only known source completely resistant to the disease. The four releases have the appearance of grain sorghum. It should be easier to transfer resistance to parents of hybrids from these releases than from the grass-like Krish. Breeding work to transfer resistance to Alpha, R161 (Kansas 19), Sugardrip and Greenleaf Sudan has begun.



A recently completed survey has added considerably to the body of information on distribution and incidence of the sorghum midge, *Contarinia sorghicola* (Coq.) in Northern Australia.

In Queensland, the pest occurs throughout the southern and central regions, in the north coastal region from Townsville to Cooktown, and on the Atherton Tableland. Despite ample opportunity to extend its range through volunteer, roadside sorghums, the pest has not yet become established in the Richmond region or the Gilbert River-Normanton areas. Nevertheless, it is considered that in the absence of concerted efforts to prevent its spread, colonisation of these areas is inevitable.

An extensive native midge and parasite fauna was shown to exist throughout the northern region. However, a detailed taxonomic study of the species involved is needed before any conclusions could be drawn as to their potential usefulness in regulating midge populations in the major sorghum production areas.

Certain insecticides showing promise for control of sorghum midge, head caterpillar and spur-throated locust cause plant injury when applied to grain sorghum. The degree of damage sustained appears to depend on the stage of plant growth and also on the variety involved. Field trials and grower experience showed some of the varieties and hybrid sorghums grown commercially to be only mildly affected by the chemicals and others not at all. Alpha, however, is among the most susceptible. The reliability of Alpha and its capacity for producing a large bulk of foliage enabled this variety to retain its popularity, particularly in central Queensland where grain production is often combined with stubble grazing.

A joint project is being conducted by a plant breeder and an entomologist to produce a variety having all the desirable features of Alpha and also resistance to chemically induced damage. About 20 basic plant breeding lines have been tested for reaction to the injury-causing chemicals. About a third of these, mostly of the Kaffir group of varieties, were unaffected by the sprays and it is anticipated that incorporation of some of these resistant lines into a breeding programme will eliminate the chemical susceptibility character from Alpha progeny.

Sugar cane mosaic virus (Johnson grass strain) continues to be a problem in all districts in southern Queensland. A programme aimed at incorporating higher levels of resistance into hybrids is continuing satisfactorily. Meanwhile ratings in the field and liaison with seed companies have eliminated almost all the red stripe reactors from the recommended list of hybrids.

Seedling blight (*Fusarium moniliforme*) caused losses in some crops.

### MAIZE

A new hybrid, QK217, bred at Kairi Research Station, is being grown on over 70% of the Atherton Tableland maize area in its first year of release. In most cases it is performing better than its predecessor QK37.

Varietal testing in maize has assumed greater relevance in the past three seasons. Leaf diseases have become more prevalent and there has been an urgent need to monitor diseases for type, incidence and severity on commercial and experimental hybrids in trials at the five major testing sites at Gatton, Hermitage, Millaroo and Kairi Research Stations and at Kingaroy. These ratings are used along with other crop performance data to formulate regional and district recommendations. Possibly the most spectacular and consistent performance in these trials over the past three seasons was that of two new commercial hybrids, DeKalb XL81 and Yates PX50, in the Gatton Research Station irrigated early maturing varietal trials. DeKalb XL81 averaged 9 490 kg/ha and Yates PX50 9 186 kg/ha over the three years 1970-71 to 1972-73. These two varieties were quite the best of some 30 early maturing varieties tested over the three-year period at Gatton, and easily outyielded the older commercial hybrids PQ301 (6 935 kg), DK805A (6 357 kg) and Q739 (6 297 kg). Disease and/or lodging played a major part in the poor performance of the latter varieties.

Population studies of the corn earworm, *Heliothis armigera* (Hubner) on maize indicate that irrespective of infestation levels of eggs on silks, only one mature larva develops in each infested maize cob. As parasites were not active in the research area, the results demonstrate the importance of cannibalism as a density-dependent controlling mechanism for *Heliothis* in this crop. Complimentary observations determined that these final instar larvae are responsible for the greater part of the damage inflicted by *Heliothis* caterpillars of all ages in maize. The fact that no more than one larvae per cob will survive to maturity suggests that attempts to control corn earworm in maize is warranted only in exceptional circumstances.

The new leaf disease, now known as maydis leaf blight (*Dreschlera maydis*), reported last year for the first time in Queensland, was widespread again this year particularly in hybrids carrying "T" cytoplasm. This year, it was severe again in north Queensland, and, in south Queensland, crops in areas away from the coast such as Kingaroy were particularly affected. In such areas the disease was unimportant last year. The list of alternative hosts for the disease recorded in Queensland now includes 9 common grass species.



A plant pathologist examines the reaction of young maize plants to the new serious disease, Maydis leaf blight.

The other common leaf blight (*Helminthosporium turcicum*) was severe this year in all areas. Hybrids were rated for susceptibility to both diseases and recommendations were made to growers for next season.

Maize dwarf mosaic was again widespread. However, the recommended list of hybrids for the coming season will be almost entirely comprised of types with moderate resistance. This is the result of detailed ratings made over a period of years.

### SOYBEAN

The regional soybean varietal testing programme was continued during the 1972-73 season. All results are not yet to hand but early data show an average yield from 3 trials on the Darling Downs of 1 741 kg/ha, from 3 trials in the Moreton region of 2 495 kg/ha, from the South Burnett of 2 342 kg/ha, from 2 trials in central Queensland of 2 403 kg/ha, and from north Queensland of 2 543 kg/ha. The leading variety on the Darling Downs is 70/75 (1 941 kg/ha) followed by Bragg (1 904), Semstar (1 903), Davis (1 819), Leslie (1 812) and Pickett (1 809). In the Moreton region, Davis (3 048) gave the highest yield followed by Leslie (2 982), 70/75 (2 979), Wills (2 834), Pickett (2 698) and Hood (2 676). In the South Burnett, Hood (3 049) provided the highest yield followed by HR-1 (2 832), 70/75 (2 656), Davis (2 569), HR-2 (2 503) and Bragg (2 439). The best yield in central Queensland was from Davis (2 919) followed by 70/75 (2 771), Bragg (2 745), Hill (2 730), Leslie (2 686) and HR-1 (2 651). In north Queensland, Davis (3 039), gave the highest yield followed by Wills (3 000), Hardee (2 969), Leslie (2 792), Gilbert (2 643) and Improved Pelican (1 627).



A good crop of soybeans, a rapidly expanding crop in Queensland.



The lines 70/75, HR-1 and HR-2 were produced by the Department's soybean breeding programme which has been operating at Hermitage Research Station for the last 7 years and which was expanded in 1970. These lines performed very creditably in their first year of full-scale testing.

Fertilizer trials in the main growing areas showed phosphorus to be the element which most frequently limits production. Field nodulation studies over four seasons on the Darling Downs established that nodulation alone can provide an adequate level of nitrogen nutrition for high yields of soybeans. Small increases in yield can occasionally result from the applications of small quantities of nitrogen fertilizer to nodulated soybeans but mainly on new soybean land.

Evaluation of chemicals for weed control showed that trifluralin and chlorthal are suitable pre-emergence herbicides for the control of annual grasses and a number of broad-leaf weeds. Bellvine (*Ipomoea* spp.) and thorn apples (*Datura* spp.) pose problems in the Moreton and Darling Downs regions respectively, and their control is under investigation.

Wildfire (*Pseudomonas tabaci*) and bacterial pustule (*Xanthomonas phaseoli* var. *sojense*) again occurred in susceptible varieties (mainly Semstar) in commercial planting throughout south-eastern Queensland. The replacement of susceptible varieties with resistant varieties is one of the aims of the breeding programme. Rust (*Phakopsora pachyrhiza*) continued to be a problem in wet areas, but to date, no resistant genotype is known. Peanut mottle virus was recorded in soybeans in the South Burnett during the 1972-73 seasons but the varietal susceptibility situation is not clear.

Experimental out-of-season plantings of soybeans in north Queensland were not encouraging as the determinate varieties produced only small plants with pod-set too low to permit machine harvesting.

A wilt condition was widespread, and caused premature ripening of many crops. A fungus, *Macrophomina phaseoli*, was consistently associated with the condition. This fungus is known to be favoured by heat wave conditions particularly if moisture stress also occurs. This was the situation in the most severely affected areas.

Peanut mottle virus was found in this host but to date has not produced serious symptoms.

In a fungicide trial in north Queensland, rust was controlled by mancozeb and Daconil (R).

## SUNFLOWER

Varietal testing has not produced any variety significantly higher yielding than the current commercial sunflower types. The variety, Issanka, however, is more even in flowering, maturity and height than current commercial varieties, and being some 10 days earlier in maturity may have a place in less favourable environments. Preliminary studies of hybrid varieties show a trend to higher oil yields and more uniformity in height and maturity than current commercial varieties. Hybrid breeding will be facilitated when cytoplasmic male sterile lines obtained from the U.S.A. are released from plant quarantine.

Sunflower variety trials at three sites on the Darling Downs in the 1972-73 season produced an average yield of 2 033 kg/ha. The highest yield was 2 194 kg/ha from the variety Sunfola 68-2 followed by Smeena (2177), Sunfola 69 (2 149) and Peredovik 5605 (2 143).

A computer simulation model of sunflower growth is to be tested under field conditions at two sites on the Darling Downs and Biloela Research Station later in 1973. Particular attention is being given to economic and extension implications of this simulation study which could have wider application in predicting yields in other crops.

Rust, which caused considerable damage in sunflowers, particularly late planted crops, is receiving attention. Resistance to rust is available in two forms, specific gene resistance and physiological tolerance, of which the latter type would offer greater long-term resistance. Plant breeders are endeavouring to breed specific gene resistance into current commercial varieties, and varietal screening is being carried out for physiological tolerance.

With the heat wave conditions which existed this season there was a depression in sunflower oil quality. Oil quality in sunflower is measured by the ratio of linoleic to oleic acid in the oil and this ratio is related to temperature during the reproduction stages. The problem is being investigated and its final solution may be connected with obtaining rust resistant varieties in order that planting dates may be delayed.

Rust (*Puccinia helianthi*) continues to be a limiting factor particularly in late planted crops. Investigations into resistance are continuing. Head rot (*Rhizopus arrhizus*) was severe in crops flowering during January. Investigations into the relationship between insect damage and head rot are also continuing.

## PEANUTS

Variety and strain trials to test new introductions and advanced breeding lines are conducted mainly in the South Burnett which is the principal peanut producing area. In the 1971-72 season, good yields were obtained in these trials. The best yield from Virginia Bunch peanuts was 4 255 kg/ha (nut in shell) from the Mani Pintar variety while the best yield from Red Spanish peanuts was 3 236 kg/ha (nut in shell) from the line RS69/1.

Fertilizer placement trials show that fertilizer applied in bands gives better responses than broadcast applications irrespective of whether the broadcast application are incorporated in the soil or placed on the surface. Other fertilizer trials gave no yield responses in north Queensland to phosphorus or potassium when applied to planting or to previous crops.

Planting rate trials in north Queensland gave progressively increased yields from 22.5 kg/ha to 89.5 kg/ha under both raingrown and irrigated conditions as the planting rate was increased.

Rust (*Puccinia arachidis*) occurred for the first time in Queensland in April of this year. It was widespread on the Atherton Tablelands but at the end of the season had not been seen in the main producing areas in the South Burnett. Its occurrence in Queensland followed reports earlier in the year of outbreaks in New Guinea and in the Northern Territory. The disease caused severe defoliation in some crops and is a potentially serious problem to the peanut industry, particularly in north Queensland. Screening trials with fungicides established that fentin hydroxide and mancozeb could be useful in controlling this disease.

Peanut mottle virus was again widespread in the South Burnett, and was recorded for the first time in north Queensland. The virus is transmitted through the seed and its control is a difficult problem.

## POTATOES

The potato evaluation programme which is being conducted at Gatton Research Station in co-operation with research workers in southern States is continuing. Some 180 varieties from Tasmania, Victoria and New South Wales were obtained for testing in Queensland.

This year, 40 lines are in the first year of testing, 20 in the second year, and 9 lines are in the third year of test. To date no outstanding individual variety has emerged. This is not surprising considering the very large number of desirable characteristics which must be considered for a new potato variety. However, some individual varieties do show promise in particular circumstances, for example, winter growth performance or powdery scab resistance.

A major reason for undertaking this programme is the dependence of Queensland growers on southern States for seed supplies. Naturally, southern potato growers produce varieties which best suit the conditions but these may not necessarily be the best varieties to suit our Queensland growing conditions. If a promising variety does emerge, seed supplies may need to be grown in Queensland.

A programme to evaluate seed from various sources showed that seed produced near Killarney and near Wyreema compared very well with certified seed from the south and, at Gatton Research Station, has consistently given better results than New South Wales certified seed. Tasmanian "pathogen tested" and Victorian certified seed yielded well too, but contamination with powdery scab detracts from their value. The results of these source of seed trials over a number of years indicate that good quality seed potatoes can be grown in certain areas of Queensland.

The potato irrigation trials showed that the tuber formation stage is the most critical for soil moisture. If the available soil moisture at this stage drops below 70% the yield is reduced significantly. Prior to this stage the potato plant appears to be at its most tolerant stage. This work also showed that the tuber disorder called "Brown fleck" can be induced by leaving mature tubers in wet ground when temperatures are high.

Target spot (*Alternaria solani*) again was serious on the Atherton Tableland. Two newer fungicides, triphenyl tin hydroxide and Daconil (R) gave better control than the standard mancozeb in trial plots.

Autumn wilt, the cause of which is still under investigation was more serious in south Queensland than for some years. Seedpiece breakdown was effectively controlled with mancozeb dust applied to the seed. Because of the damage done in past years by powdery scab (*Spongospora subterranea*) the susceptible cultivar Sequoia has been largely replaced by the more resistant Kurrel and Exton.



## ONIONS

In recent years the agronomy programme on onions has been increased and the results are rapidly being accepted and the recommendations adopted by commercial growers.

As a result of several years of work on weed control techniques efficient chemical methods are now available which can control the common weeds of onions in the Lockyer Valley. Having eliminated the need for cultivation to control weeds, attention was directed to closer row spacings and higher plant densities. The standard row spacing has in the past been 30-36 cm but trials over the last 2 years showed that simply reducing the row spacing from 36 cm to less than 20 cm is worthwhile in increased yield and improved bulb shape.

Increasing the planting rate from 2.3 kg/ha to 4.5 kg/ha increased the onion yield by 31% and from 2.3 to 6.8 kg/ha by 48%. In each case the increase in yield was the result of a greater yield of No. 1 grade onions.

Unfortunately the closer spacing and heavier planting rates increase the susceptibility of the onions to downy mildew, and greater care must be taken in applying fungicide.

A trial to evaluate 26 onion varieties at a series of planting dates ranging from mid-February to mid-August was conducted at Gatton in 1972. Certain onion varieties require specific environmental conditions for satisfactory growth and bulbing. Interest in export and dehydration of onions has promoted interest in finding the best varieties for these purposes as well as for domestic use.

At the same time, an evaluation programme on seed from several different sources of the Early Lockyer Brown variety was commenced. Selections by different growers and organisations over a number of years have resulted in different strains being available, with some locally produced seed yielding 20 to 30% higher than other seed in late February plantings. These differences showed up in small observation plots and further more detailed work will continue.

## TOBACCO

Keen interest continues to be shown within the tobacco industry in developments which reduce dependence on hired labour. Departmental officers, including agricultural engineers, are involved in various aspects of tobacco mechanisation including studies on curing practices, assessment of tobacco machinery and the breeding and evaluation of varieties more adaptable to mechanical handling processes. In addition, a successful Field Day on mechanisation was held at the Inglewood Research Station in June, 1972, to promote interest in mechanical aids within the tobacco industry in south-west Queensland.

The Department's tobacco plant breeding programme was relocated at Beerwah in south-east Queensland. This co-operative programme with C.S.I.R.O. is directed towards developing tobacco varieties resistant to the strain of blue mould predominant in southern Queensland. Potential varieties are screened in north and south Queensland tobacco districts to assess performance in relation to resistance to soil and air-borne diseases as well as adaptability to a range of environments. The importance of a plant breeding programme including evaluation in various localities was emphasised recently by the appearance of new strains of blue mould in north Queensland during the 1972-73 season. At Southedge Tobacco Research Station near Mareeba, staff are engaged in a supporting role for Australian plant breeding programmes in assessing the potential of new tobacco varieties. This field of work includes not only assessment for disease incidence but also investigating varietal response to variations in nutrition, planting time and other agronomic practices.

The development of the tobacco industry in north Queensland has followed a system of monoculture broken by natural grass leys. In this situation land management practices are required to minimize adverse effects of potential soil erosion on a number of sloping soils and to counteract soil-borne diseases which are assuming increasing importance. Studies are in progress to define optimum cropping sequences and to demonstrate the potential of other crops in the tobacco land use pattern. A programme with similar objectives is being initiated in south-east Queensland where conditions are somewhat different in that tobacco is largely grown on the same land each year with volunteer weeds becoming established between successive tobacco crops.

Studies on the irrigation characteristics of soils of the Mareeba-Dimbulah area are being undertaken involving the measurement of a number of soil physical properties. This programme is aimed towards improving irrigation efficiency based on a clearer understanding of soil irrigation characteristics and factors which influence them. As part of the irrigation programme, spray distribution patterns are being investigated to examine water distribution near the plant. Detailed examination indicated that in a mature crop 30-40% of the water is applied to the hilled row of tobacco plants

while the remainder collects in the furrow where reduced infiltration occurs due to soil compaction as the result of traffic. An attempt to improve water infiltration into the soil, through modifications to cultivation practices and hill shapes, has given encouraging preliminary results.

Nutritional aspects of tobacco growing are being examined throughout Queensland. In south Queensland at Bundaberg, foliar-applied nutrients are being examined as a means of supplementing the nutritional requirements of tobacco grown on the readily leached sands of the district. In the Beerwah area, leaf quality is being examined in relation to potassium side-dressings and organic nitrogen release. At Southedge Tobacco Research Station in north Queensland, studies are examining the effects of continued fertilizer applications on the soil phosphorus and calcium status, and determining if the resultant levels adversely affect tobacco leaf quality.

Economic Services Branch completed a small labour utilisation study in the Bundaberg region to record man hours required to harvest, string, load and unload tobacco barns as a measure of labour input at harvesting and curing.

Chemicals recommended for control of the tobacco looper, *Pulsia argentifera* (Guen.), continue to be efficacious, but studies of the distribution of developmental stages of the insect on tobacco plants emphasised the importance of correct placement of insecticide in obtaining satisfactory pest kills. It was found that 90% of eggs and young larvae of the looper occur on the under surfaces of the leaves, and of the lower leaves in particular. Strategically-timed insecticide sprays applied to these leaf surfaces will provide effective control by eliminating the young larvae before they inflict significant damage.

The findings of these investigations parallel those of similar studies conducted in previous seasons on budworms, and illustrate the basic importance of biological studies to the development and refinement of control methods.

It has already been shown for other pests that the placement of eggs may determine the spatial distribution of larvae. This fact is important in control operations. Consequently, a study of the oviposition behaviour of the tobacco stem borer, *Scrobipalpa heliopa* (Low.) was indicated and preliminary observations were concluded. The leaf lamina was the preferred oviposition site and, in the case of young seedlings, more eggs were laid on the upper than the lower surface. Where plants were more mature, ranging from 90 to 150 cm in height, numbers of eggs on each surface were approximately equal. Regardless of plant age, few eggs were laid on leaf petioles or stems. Each moth produced several egg batches at different intervals giving distinct oviposition peaks of which the first was the largest. However, the number of eggs produced diminished as the time between emergence of the females and mating increased.

Understanding of the correlation between pest numbers and the degree of economic damage inflicted by them is of fundamental importance to the concept of strategic application of insecticides. An investigation seeking to determine these complex relationships for tobacco pests is in progress, and is expected to result in reduced pesticide usage that will benefit growers and the tobacco producing districts as a whole, both ecologically and economically.

It is apparent that components of the population of the blue mould organism, *Peronospora hyoscyami*, have undergone changes in north Queensland. Races virulent on the formerly resistant Sirone and 40T were detected both at Ingham and in the Mareeba-Dimbulah area. These changes are serious and will require a re-orientation of breeding programmes. It could well mean a return to the widespread use of foliage fungicides in north Queensland.

Soil fumigants reduced the incidence of black shank (*Phytophthora nicotianae* var. *nicotianae*) in trial plots.

In north Queensland, E.D.B. gave the best nematode control and highest yield and quality in tobacco when compared with 4 newer nematocides.

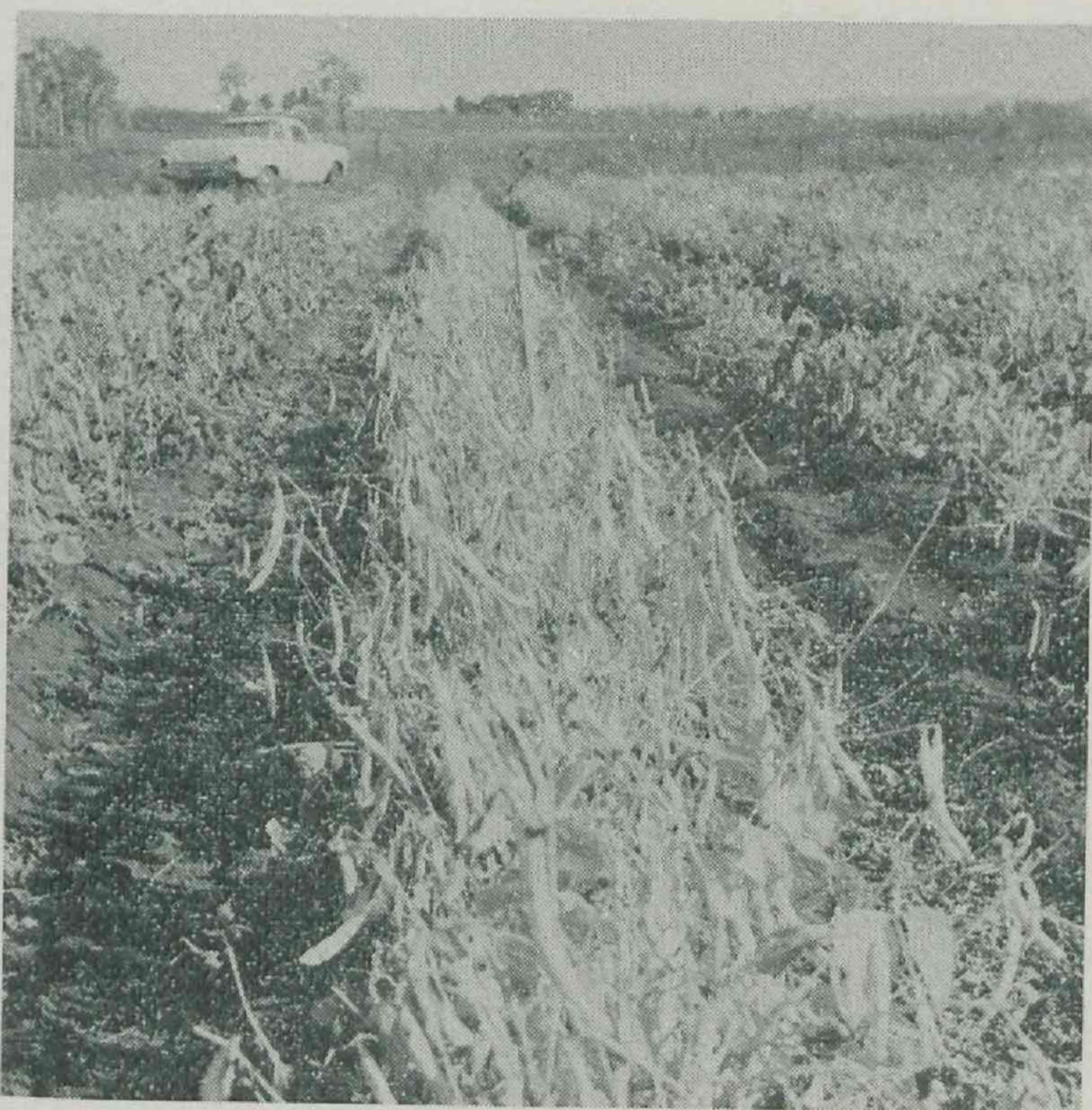
## NAVY BEAN

Navy bean variety trials were conducted in the South Burnett, on the Darling Downs and in central Queensland. Highest yields were produced by lines from the Department's breeding programme, and exceeded 2 200 kg/ha in the South Burnett and on the Darling Downs while, in central Queensland, yields exceeded 1 100 kg/ha.

Fertilizer trials in the main growing areas indicate that nitrogen fertilizer applied in the early stages of growth provides better total yields than if the fertilizer is applied at later stages.

The breeding programme is now additionally aimed at producing varieties resistant to rust. Crosses between Actopan and Sanilac were made, and the F<sub>1</sub> generation is being screened for rust resistance. Material should be available for testing and evaluation in the 1973-74 season.





**Gallaroy variety of navy beans approaching maturity and showing leaf drop that makes harvesting easier. This variety was bred by the Department.**

Other diseases are causing concern in the South Burnett region, the main navy bean growing area. Of particular significance is peanut mottle virus. Yield reductions of 30 to 40% can be expected from this disease in areas grown close to peanuts. Screening of varieties and selections is in hand, and there is some hope that material resistant to peanut mottle virus will be available.

A survey of navy bean crops in the South Burnett revealed that some plantings were heavily infested with root-lesion nematode *Pratylenchus brachyurus* and root-knot nematodes (*Meloidogyne* species).

#### COTTON

The cotton breeding programme is directed towards obtaining a suitable replacement for Deltapine Smoothleaf, and an earlier maturing variety for Darling Downs conditions. Deltapine Smoothleaf strains continue to give the highest yields but fibre quality is somewhat marginal in strength. Fibre strength tends to decrease with high soil moisture regimes and, as growers are applying water regularly to avoid moisture stress and ensure economic yields, the desirability of obtaining a replacement variety for Deltapine Smoothleaf is apparent. Two promising early maturing varieties are Riverina Poplar, which is suited to high population plantings, and Hancock, which is expected to produce fairly high yields.

Preliminary crosses were made with heliothis-resistant varieties from the U.S.A. but the intensification and development of breeding for insect resistance will depend on results of current screening of parental lines for resistance to the strains of heliothis found in Queensland. Very high infestations of heliothis were reported from all areas in the 1972-73 season and, despite good insecticide spraying schedules, yield reductions occurred.

In general, pest control requirements for cotton production hinge on the seasonal incidence and activity of these heliothis strains. Improved control is being sought through the development of a scouting technique to enable more accurate timing of insecticide applications. Precisely timed insecticide sprays are essential for protection of early squares which has been shown to be the major factor in obtaining good yields. Results indicate that relatively short-season, irrigated cotton based on a lower cost structure derived from comparatively low nitrogen use and timely pest control may be more attractive to cotton producers than present varieties and agronomic-pest control operations.

#### MISCELLANEOUS CROPS

The acreage sown to safflower, which is mainly grown in central Queensland, has decreased over the past four years. Dry winters have produced only low yields and given rise to loss of grower interest. The crop provides a desirable polyunsaturated oil for which demand is increasing throughout the world. Three new varieties were introduced from the U.S.A. last year, and seed has been increased to permit their inclusion in variety trials in the coming season.

A comprehensive time of planting x plant density study was conducted in central Queensland last season. Early indications are that highest yields are obtained from May plantings, and yield falls markedly as planting date is delayed. Moisture usage was greatest in the May plantings and although reductions in moisture usage were obtained in later plantings they were not in proportion to the reduction in yield.



**The Minister inspects a Toft tea plucker in the process of mechanically harvesting tea in north Queensland.**

Evaluation of cowpea varieties and introductions was carried out for two seasons at two sites on the Darling Downs. Grain yields of up to 1749 kg/ha were obtained in these trials.

In mung bean variety trials on the Darling Downs, four varieties exceeded yields of 1280 kg/ha despite being badly defoliated by *Ascochyta* leaf spot disease. A planting rate x inter-row spacing trial in the Roma area shows promise of providing reasonable yields while a commercial crop in the same area yielded in excess of 1000 kg/ha.

An evaluation of sesame varieties is being carried out in central Queensland, and seed increases are being made of promising varieties. Yields of 2200 kg/ha appear possible which could make this an attractive crop as recent enquiries for export indicate a value of around \$3060 per tonne. Research in the Roma area indicates that plant populations of 200000-300000 per hectare in rows, spaced at 30 cm intervals, will give satisfactory production.



**Shirohie, a promising new variety of millet.**

In a trial with lupins on the Darling Downs, indications were that deep cultivation is required during land preparation, and that adequate moisture at flowering is essential. The Unicrop variety produced a yield of 2397 kg/ha from 370000 plants/ha when sown in April.

Preliminary investigations with guar in central Queensland produced grain yields of 1100 kg/ha but it is anticipated that these yields could be greatly increased under good conditions of moisture and fertility.

Screening of varieties of Adzuki bean was commenced on the Darling Downs.

Economic Services Branch has maintained a watching brief on tea production costs and estimated returns under commercial conditions in the Innisfail district.

#### WEED CONTROL

In a sorghum-thornapple herbicide trial at Biloela Research Station, *Datura ferox* was controlled by post-emergence treatment with atrazine at 1.12 kg/ha. This could



be a useful alternative to the currently recommended 2,4-D/picloram treatment where there is a risk of damaging susceptible crops such as cotton either by spray drift or contamination of equipment.

On the Atherton Tableland, Narok setaria was protected from diuron damage by spraying a 1 in. band of activated charcoal slurry over the planting row; 168-336 kg activated charcoal per sprayed hectare is required and this is effective with rates of diuron up to 2½ kg a.i./ac. It is possible to get a seed crop of setaria within a few months after sowing by using this technique.

At Hermitage Research Station, an area which had grown a sorghum crop treated with herbicides in 1971-72 was sown to sunflower and soybeans in 1972-73 to determine any soil residual effects of the herbicides. Where atrazine had been applied at 2.24 kg/ha heavy deaths of sunflower seedlings and light deaths of soybean seedlings occurred. Where picloram had been applied at 0.07 kg/ha no residual effect on either sunflower or soybeans was noted.

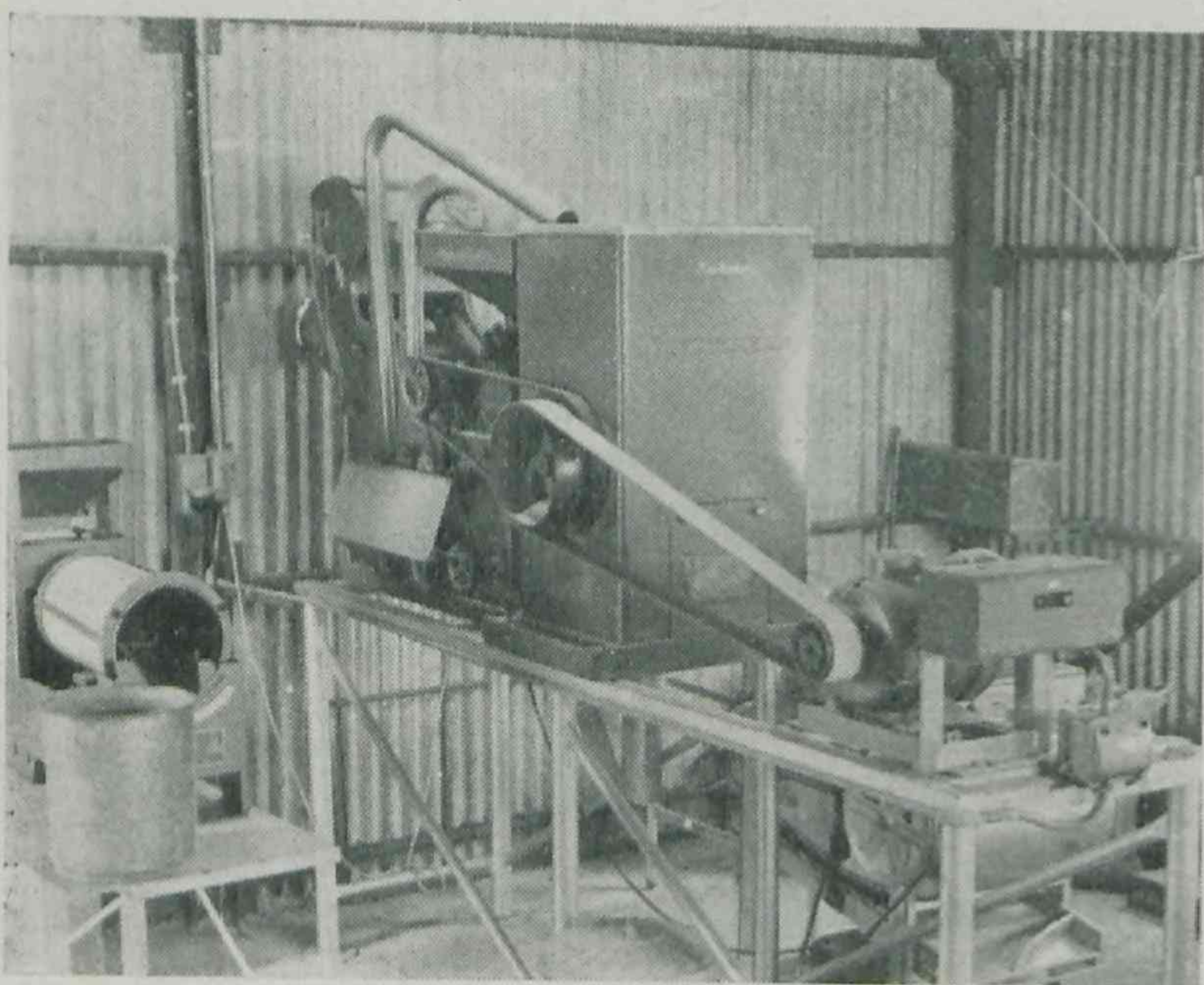
The wild oat control programme in the field was curtailed by the dry season which reduced stands of both crop and weed. An increasing bank of wild oat strain types has been built up, and this should enable reasonably comprehensive field physiological and dormancy studies to be undertaken. A number of field experiments examining seed dormancy were initiated. Wild oats were grown at various locations and the resultant seed was resown into the soil. The area will be continually fallowed and a close examination made of the depletion of wild oat seed from the soil.

### IRRIGATION PROJECTS

Research into irrigation water requirements continued on sorghum, wheat, potatoes and tobacco.

Three years' work investigating the effects of various irrigation schedules on tobacco at Southedge Tobacco Research Station showed that high soil moisture levels up to flowering increase leaf yield while high levels after flowering do not increase leaf quantity but can affect leaf quality. When tobacco is overwatered, however, both yield and quality decline.

In conjunction with this work, a project is in progress to determine various soil characteristics for a number of the Mareeba district tobacco soils. Compaction has shown up as a problem, the bulk densities of the coarse-grained soils of granitic origin, for example, being found to vary from 1.29 to 1.56 g/cm. Five years of production compared with 10 years of production did not show any major change on the soil tested thus far. Within the one season, however, increases in compaction and corresponding decreases in water infiltration rate were shown as the crop growth progressed. In a small observation trial, young tobacco plants grown in cores of soil at a bulk density of 1.67 g/cm had a plant weight only 57% that of similar plants grown for three weeks in soils of bulk density of 1.27 g/cm.



The small rice milling plant used at Millaroo Research Station includes hulling, polishing, cleaning and grading machinery for processing rice varieties.

Following an intensive programme of rice research over the last few years the major agronomic problems of rice production in the Lower Burdekin region have been largely resolved. Attention is now being directed towards alternative crops to rice for any future irrigation development projects in this region, with particular emphasis on the flood plain soils. On Millaroo Research Station, maize, grain sorghum, sunflower and safflower are being evaluated in commercial-sized plots during the dry season while soybeans, sunflower, maize and grain sorghum are used in the wet season.



The herbicide, Treflan, gives effective weed control in soybeans; the untreated area is on the left.

Yields from the dry season plots were disappointing. Average yield of maize did not exceed 4 400 kg/ha, due to suboptimal plant stand and rust, compared with 7 025 kg/ha harvested the previous year. Achieving an optimum plant stand on these soils is a major difficulty, and a poor sunflower yield of about 1 200 to 1 700 kg/ha resulted when an unexpectedly high emergence occurred.

Typical sorghum yields of about 3 000 kg/ha from several plantings may mean that the present commercial hybrids are not suited to these conditions.

At Emerald, the irrigation research effort is being devoted to fairly detailed investigations of individual crops, particularly grain sorghum (plant population and irrigation frequency trials) and soybean (time of planting, variety and population trial). Both these projects aim at establishing base lines as a guide to interpretation of future work in these crops.

### EXTENSION

The role of the agricultural extension worker continues to develop and broaden. The demand for technical advice to farmers, other organizations and local authorities has continued to increase. This advice covers the whole range of problems concerned with crop and pasture production, soil and management. Arrangements are made to introduce specialists who can advise on economic problems, estate planning and marketing. Problems concerned with plant protectants and weedicides are discussed. The role of the extension officer is becoming truly that of an educator in rural society.

Sown pastures are now having an impact on property output, changing the extension emphasis to management, utilisation, and systems of beef production. In the spear grass zone of eastern Queensland, there is a trend towards low-key development in the form of limited clearing and land preparation prior to the establishment of legumes.

For the third year in succession in south Queensland, improvement in soybean production techniques has led to acreage increases and satisfactory yields in spite of less favourable growing conditions. There were useful field days in the Lockyer, Fassifern and Darling Downs districts.

Considerable effort was put into sunflower production and its problems. Grain growers in the State are now better able to cope with alternate crops to wheat and grain sorghum, and have been assisted to more effectively diversify their operation.

On the Atherton Tableland, milk production continues to improve as a result of better pastures and better pasture management. Fertilizer requirements are better understood.

A considerable effort has been made to ensure that farmers recognize and use disease resistant varieties of maize and sorghum. Extension officers and the seed producers have achieved a close working relationship and agreement that only the best available varieties should be offered. Departmental varietal recommendations are made as a result of testing and observations under a wide range of conditions.

The importance of co-operation with research organisations, industry and commercial firms is understood and fostered by the field staff. Joint studies with the CSIRO Division of Tropical Agronomy have occurred in the Burnett districts to point to needs for further research, and currently the performance of the pasture legume, Lotonon, is being examined. Extension staff work closely with industry organisations and commercial enterprise to foster new crops for the oilseeds industry and with the fertilizer companies for better fertilizer practices.



## VI. Horticultural Research and Extension

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

Liaison with industry is maintained through a number of Horticultural Advisory Committees. Within the Branch informal research/extension committees are responsible for the definition of problems in production and handling and assist in the co-ordination of research and extension activities. Horticultural advisory activities are now being integrated on a regional basis under the new Extension Services Section.

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

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

### DECIDUOUS FRUITS

The apple crop for the year was estimated at 2 500 000 bushels, comparable with the record crop of the 1970-71 season, and representing the third good crop in a row, in response to better-than-average rainfall. The importance of adequate soil moisture is further borne out in irrigation trials at the Granite Belt Horticultural Research Station, where, even in these years of better-than-average rainfall, the well-irrigated plots of Delicious and Granny Smith gave twice the yields of the non-irrigated.

Irrigation research is to be extended as is also the work in close planting, another avenue which promises similar gains in yield per acre. The close planting trials at the Granite Belt Horticultural Research Station have done very well, and even though they have been established only a short time are giving useful information. It appears that the inter-row spacing of 12 ft. is quite satisfactory, while a suitable spacing in the row would be about 6 ft.

In the project to breed better early red apples, fruit from some 1 400 trees were assessed this season, and 50% of all fruiting trees matured their crop before the end of January. About 20 selections showed promise and have been marked for further assessment.

In earlier studies of apple measles, a widespread disorder in the Granite Belt, it appeared that toxic levels of manganese and a deficiency of boron combined to produce the trouble. By increasing calcium uptake, the harmful effects of excess manganese could be prevented. However, recent work indicates that the amount of calcium must be controlled, as excess calcium reduces boron uptake.

Work on apple dehydration at the Food Preservation Laboratory aims to develop a snack food product. From work to date, the high acid flesh of Granny Smith appears unsuitable, but Delicious shows promise.

Preliminary attempts were made to measure respiration rates and to determine a suitable temperature for the measurement of climacteric peaks in Granny Smith. Techniques which are adequate for bananas need to be refined.

A storage trial with Winter Cole pears indicates that the longest storage life (6-7 months) was achieved with harvesting on March 17. However, picking as early as February 26 was quite suitable where only short storage was required.

In response to a request from the Deciduous Sectional Group Committee, the Food Preservation Research Laboratory conducted trials with Williams pears to determine whether ripening with ethylene (gassing) had any adverse effects on fruit quality. The trials compared fruit from six harvest dates from January 16 to February 6, ripened with ethylene or after cold storage. These trials showed that the quality of the fruit ripened with ethylene was in no way inferior to that of fruit ripened after cold storage.

The combined effects of very hot weather in summer and infestations of two-spotted mite, *Tetranychus urticae* (Koch), produced extensive "leaf scorch" of pear trees in the Granite Belt. Pear varieties differed in their relative susceptibilities, Williams Bon Chretien being the one most severely affected. Research has shown that even two or three mites per leaf are sufficient to cause the disorder. The mite's feeding damages the leaf so that water loss is increased and under hot, dry conditions parts of the leaf die resulting in the leaf scorch symptom. The effects of the disorder can be lessened by effective control of two-spotted mite. High mite populations rarely develop on pears, but as even low numbers can initiate leaf scorch, thorough application of control measures during the susceptible period is required. Preventative sprays by one of the acaricides dicofol, tetradifon or plictran, will keep mite infestations in check.

Sex pheromones produced by female insects to attract males for mating are being increasingly used by scientists in investigations aimed at improving pest control methods. In past years some Granite Belt orchardists have used lure traps designed to attract codling moths as an aid to determining when to apply insecticides for control of the pest. Now, pilot observations are being carried out to compare a synthetic female sex pheromone with the standard lure of fermenting sugar for attractiveness to codling moth. During the recent summer activity period, on average 35 times as many codling moths were attracted to traps baited with the synthetic sex pheromone as were attracted to the standard lure traps. Although more detailed work is required, the



Bulk harvesting of apples in the Stanthorpe district.



results of these preliminary observations indicate the valuable potential of pheromones. Monitoring of pest incidence and activity by means of baited survey traps, however, is only one of the ways in which these compounds can be used in the development of integrated control programmes.

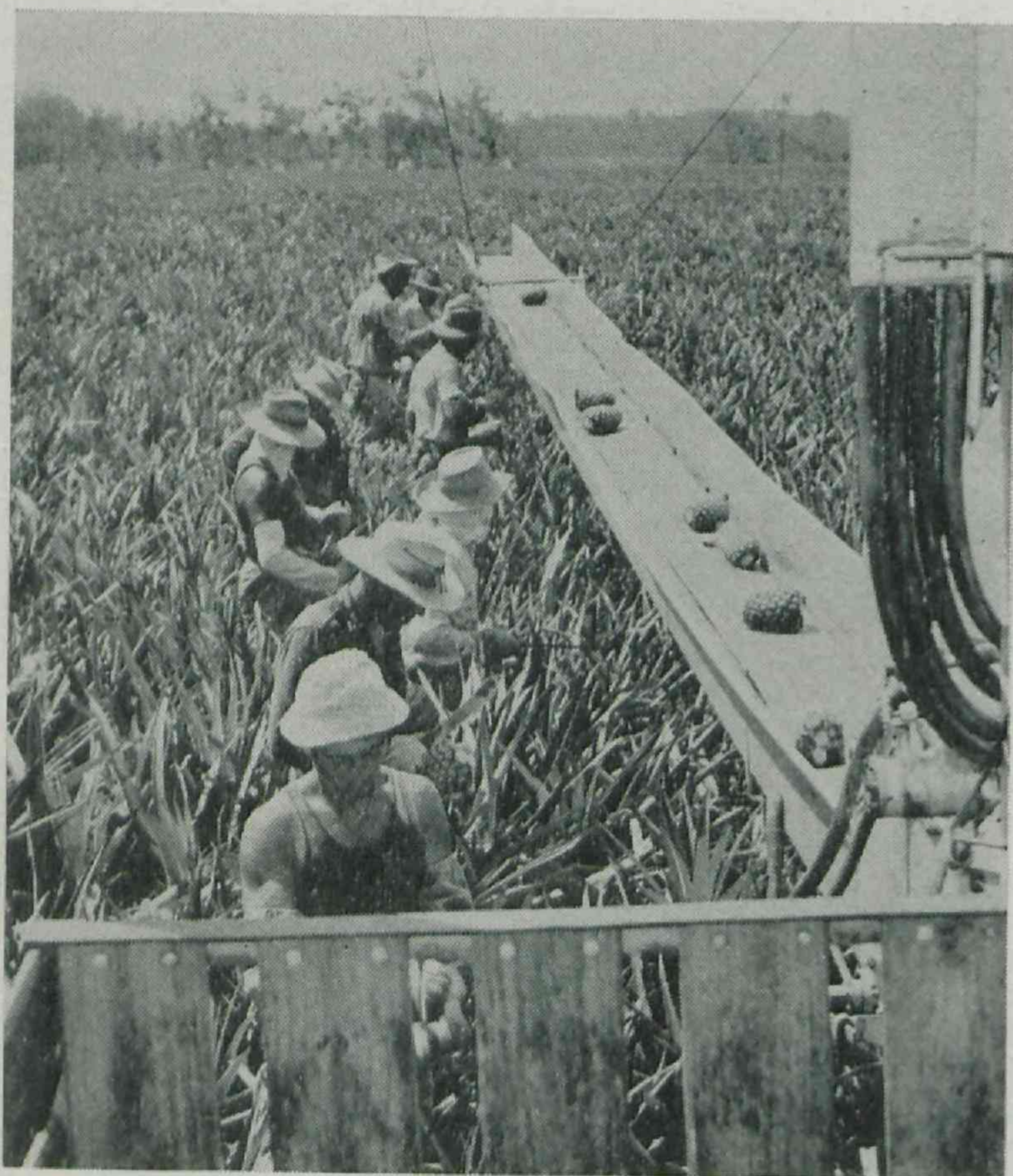
Moist conditions in late spring and midsummer favoured the development of diseases such as scab in apples and pears, bacterial spot in stonefruit and brown rot in peaches and nectarines. An apple scab warning service was introduced this year based on local studies of the epidemiology of the disease. Some new experimental fungicides gave improved control of apple powdery mildew and brown rot and transit rot of stonefruit.

Leaf scar infection of stonefruit by the bacterial spot organism (*Xanthomonas pruni*) was shown to take place in the autumn, particularly during the first half of leaf fall.

Treatment of bare-root apple trees on Northern Spy stock in hot water at 110 deg. F. for 20 min. to control root-lesion nematodes did not retard subsequent tree growth.

### PINEAPPLES

Soil fumigation has become a standard practice with pineapples, but paper and plastic mulches which are in general use in Hawaii have been tried here over the years with varying results. Recent trials in southern Queensland have given substantial gains from the combination of black polythene mulch and fumigation, and in one case where neither treatment on its own gave any appreciable advantage. However, the cost of mulch is such that substantial yield increases need to be assured before its use can be recommended.



Mechanical harvesting of pineapples.

In the induction of flowering, the chemical, ethrel, which slowly releases ethylene, appeared suitable for treating ratoon patches. It has now been found that the effectiveness of ethrel can be greatly increased and the cost reduced by adding 5% urea to the solution.

Although curing planting material effectively controls base rot (*Ceratocystis paradoxa*), protracted periods of wet weather often prevent proper curing. In trials, benomyl and captafol preplant dip treatments gave good control of the disease in these circumstances.

### BANANAS

As a result of two surveys of banana soils in the wet tropics, it has been possible to make some useful generalisations on the fertility and fertilizer requirements of the main soil type.

After several years of heavy applications of nitrogen, potassium and magnesium, there is no build up of these nutrients in any of the soils. This means that they are readily leached away and must not be applied beyond the plant's needs. Work is now planned to study the rate of leaching so that the available nutrients may be assessed and

adjusted as required. However, phosphorus builds up markedly in all soils, and work is under way to determine whether a basal application at planting may be sufficient. With regard to forms of potassium fertilizer, there has been found to be no build up of chlorides so that potassium chloride (muriate) may be used without any harmful long-term effect. Comparisons of three different sources of magnesium have shown that Granomag and dolomite have given better results than the standard magnesium sulphate, probably because the first two forms were not so readily leached and consequently were available for a much longer time.



Banana growth in the wet tropics.

In spite of the heavy annual rainfall of the wet tropics, general observations suggest that during most years dry periods considerably reduce banana yields. Trials are at present in progress to measure the effect of different irrigation regimes on plant growth and yield; and large differences are evident between irrigated and non-irrigated plots. At the same time, studies are being made on root depth and moisture characteristics of the main soils as a basis for more efficient water usage.

The possibility of more efficient packing of bananas by mechanized tight fill with single fruit is being investigated at Redlands Horticultural Research Station. A pilot, fully mechanized plant has been constructed. The bananas are cut as singles and dropped into water which cleans the fruit and helps to arrest sap flow. They are then carried along an endless plastic mesh conveyor past a spray section and dropped into cartons to be vibration filled.

A screening trial based on appearance of the canned product indicated ripening temperatures and ripeness levels which are suitable. Microbiological investigation is yet to be finalised but no treatment resulted in spoilage. Trials are continuing.

The growth/green life study undertaken in conjunction with Maroochy Horticultural Research Station produced indices capable of predicting green-life to within + 10 days. Heat unit data are still being processed. A de-belling trial from the same area showed an advantage in de-belling early in the life of the bunch—a second trial in the summer was not so conclusive.

An investigation into the effect of temperature of ripening on the shelf life of fruit was completed but results are still to be evaluated.



Results of a trial conducted recently in north Queensland showed that dieldrin sprays applied to the butts of banana plants control the banana rust thrips, *Chaetanaphothrips signipennis* (Bagn.). The thrips pupate in the soil at the base of the plant, and the spray kills the pest at this time. Feeding by the rust thrips on the skin of the banana creates a reddish-brown blemish that can reduce the market value of the fruit. Severe infestations sometimes result in cracking of the skin, a much more serious injury.

In the trial, dieldrin butt sprays markedly reduced the amount of thrips damage, bunches from treated plants averaging only half of one per cent. of fingers blemished. By contrast, bunches from unsprayed plants had 25 times as much blemish. Prior to commencement of the trial, the recommended control for banana rust thrips was treatment of bunches with a combined BHC and DDT dust or DDT spray. However, butt spraying completely eliminates the operation of applying a specific treatment to bunches. As the banana weevil borer is also controlled by dieldrin butt sprays, one insecticide suffices for two major pests. This represents a significant saving in production costs, and in addition the elimination of an insecticide bunch treatment may be important in developing an integrated control programme for other banana pests in north Queensland.

Field studies have thrown more light on the life system of the banana scab moth, *Nacoleia octasema* Meyr., in north Queensland. Male larvae were found to develop more quickly than females, and moths reared from larvae feeding in the throat of the plant emerged later than those reared from larvae collected from the bunch. The variation in development time associated with larval feeding site may be due to nutritional differences. Ecological studies suggest that insect parasites may be of little importance in regulating scab moth numbers. Detailed observations and rearing of field collected scab moth larvae have so far failed to detect a significant level of parasitism.

Laboratory studies on the influence of temperature on the development and death of immature stages of the scab moth complement the field investigations and provide essential information on the role of temperature in the population dynamics of the pest in north Queensland. The production of an artificial larval diet has greatly facilitated the rearing of banana scab moths for these laboratory studies. Although extensive tests still have to be carried out, larvae reared on the medium appear comparable in development with those reared on natural food.

Many fungicides were tested against the diseases of banana caused by *Colletotrichum musae* and this work has now been concluded with appropriate recommendations made to industry. Thiabendazole, benomyl, methyl topsin and bavitin all proved effective. Benomyl treatment is now being widely used in Queensland particularly for fruit being transported long distances.

#### PAPAWS

The papaw industry is suffering a series of severe setbacks with greatly reduced production. The yellow crinkle disease which took a heavy toll last year has been followed by severe mosaic and die-back, and crops are greatly reduced from Rockhampton south—which includes the greater part of the industry. In the absence of any satisfactory means of dealing with such outbreaks, plantings are likely to be reduced for some time. The cause of die-back is not known, but horticultural research workers believe there is much about it that suggests a calcium deficiency in the growing point of the plant, brought about by a combination of environmental conditions.

In past work to test this possibility, no means were found to get more calcium into the growing point, and also field trials tended to fail because die-back was not prevalent at the time of the trials.

A survey of plantation practices, problems and soil and leaf nutrient levels in 10 plantations from Gunalda to Caboolture disclosed a range of mineral deficiencies, and suggested some association with die-back which will need to be checked by further surveys and probably carefully controlled treatments.

Further attempts, by Plant Pathology Branch, to find a pathogen associated with die-back were not successful. As these attempts were made over many years it appears probable that the condition is non-parasitic and associated with periods of rapid seasonal growth.

#### CITRUS

On a sandy soil low in potassium, both soil applications and foliar sprays of potassium sulphate were effective in raising leaf levels of potassium in Joppa oranges. Where potassium levels in the non-fruiting terminals were raised from 0.7 to 1.3%, there was a 17% increase in fruit weight and a 17% fall in the total soluble solids/acid ratio. Where there is not a large premium for earliness, the higher leaf level with the higher yield is to be preferred.

Nitrogen nutrition trials with the Ellendale mandarin indicate that the mature tree should receive 2½ lb. nitrogen per tree per year, and that this fertilizer is best applied in August. Leaf analyses show that the highest yielding trees have a leaf content of not less than 2.5%.

Difficulties were experienced with mandarin export cartons in previous seasons, when fruit was damaged either from overpacking and consequent crushing, or from container collapse during storage largely due to reduction of compression strength as the fibreboard absorbed atmospheric moisture. A carton designed between seasons, to hold the necessary content without crushing, and with a waxed liner to prevent loss of strength from moisture effects, is reported to be performing very well this season. It has also been designed to palletize well and to give efficient stowage, with 1 287 cartons in O.C.L. containers.

Cartons selected subsequently from a much wider systematic range are to be tested this season to assess packing performance with a range of sizes of Ellendales. Those that pack efficiently are then to be packed and stacked in cool store to test for adequate strength.

A survey of the parasites and predators occurring in south Queensland citrus orchards has been started as the first step in a programme to expand the use of these natural regulatory factors in integrated control of citrus pests.

The minute wasps, *Aphytis chrysomphali* (Mercet) and *Comperiella bifasciata* Howard, are common in citrus orchards, but from experience in southern States it is expected that introduction of more efficient, exotic parasites will be needed to achieve effective control.

In trials being undertaken to find alternative chemicals to sulphur for citrus rust mite control, the dithiocarbamates zineb, mancozeb and bromopropylate showed considerable promise. Although efficacious and economical, sulphur often causes burning of fruit when applied during periods of hot weather which are also the times when mites are most troublesome. While all citrus fruits show some reaction to sulphur application under these conditions, mandarins are particularly susceptible.

In a black spot experiment, benomyl, mezineb and mancozeb gave good control. This trial highlighted the necessity for using white oil with dithiocarbamate fungicides for satisfactory disease control.

#### AVOCADOES

Promising control of anthracnose (*Glomerella cingulata* var. *minor*) was obtained by field spraying in an avocado trial in the Nambour area. Copper oxychloride supplied at 14-day intervals reduced infection from 100 to 40%.

Meanwhile, detailed experiments demonstrated that relatively low ripening temperatures (15-18 deg. C) will effectively reduce anthracnose and stem end rots.

Results from a survey of plantations in south Queensland suggest a relationship between soil fertility and tree decline caused by *Phytophthora cinnamoni*.

Preliminary investigations at the Food Preservation Laboratory established possible formulations of onion, lemon juice, salt and avocado pulp to make an avocado paste. Using these results, a main trial was undertaken; the paste is to be stored for six months before assessment.

High density polyethylene wraps for avocados were evaluated but although the film reduced weight loss, it increased anthracnose activity and its use cannot be recommended.

A project to evaluate the properties of avocado seed oil has been commenced.

#### STRAWBERRIES

A new strawberry variety, Earlisweet, bred at Redlands Horticultural Research Station, was included in the approved runner scheme but plants will not be available in commercial quantities until the autumn of 1975. This variety gave considerably higher yields than Redlands Crimson for both the early crop (June-July) and the whole crop, and its crop is well distributed through the season.

Work on strawberry herbicides indicated the effectiveness of post-emergence herbicides Chloroxuron at 2.3 kg/ha or Phenmedipham at 0.75 kg/ha applied twice a week after planting. Chlorthal which alone showed good grass control at 6 kg/ha is suggested as an immediate post-planting treatment.

The strawberry runner approval scheme continues to keep the incidence of viral diseases at a low level. Strawberry mottle virus, once universally present in strawberry plantings, is now almost totally absent from local crops. Unfortunately, the lethal yellow type of disease does continue to be a problem, particularly in warm, dry autumns.

In field trials, black spot (*Colletotrichum acutatum*) was severe but grey mould (*Botrytis cinerea*) was relatively unimportant. Both captan and captafol gave good control of black spot.





Harvesting the Redlands Crimson strawberry crop.

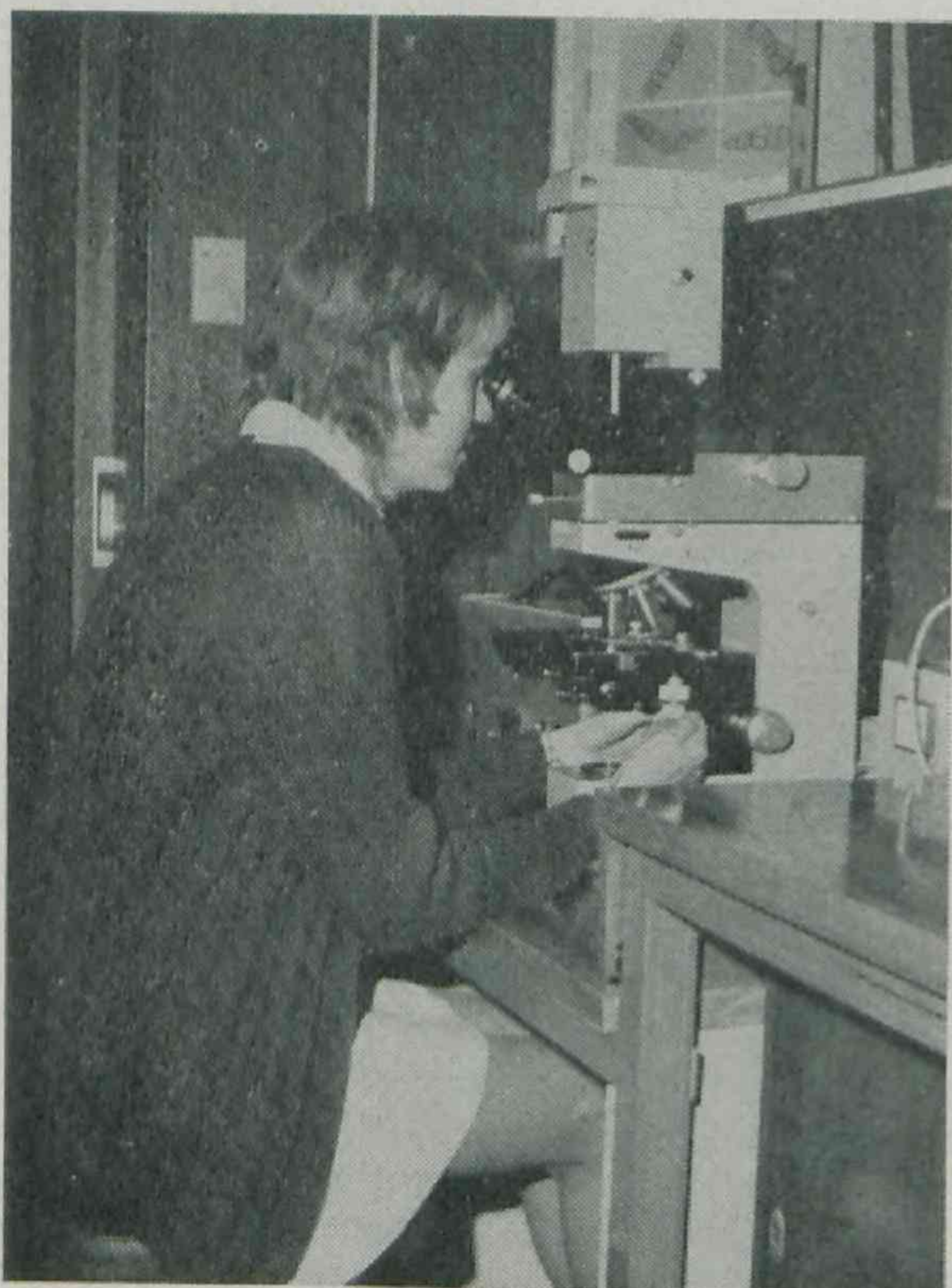
The increased importance of strawberry "crimp" caused by the bud nematode, *Aphelenchoides besseyi*, was noted.

Six varieties of strawberries were assessed for their potential for canning and/or freezing. Of these, Earlisweet (MT4) and MT11, together with the existing variety, Redlands Crimson, will be further assessed during the 1973 season.

#### MISCELLANEOUS

**Macadamias.**—Hawaiian experience with macadamias has shown the great superiority of select grafted varieties over average seedling stands, an advantage of about 5 to 1. With this potential it is very desirable to know what varieties are likely to be best for Queensland conditions. Work towards this end is in its comparatively early stages, but in a 9-year-old trial, the Hawaiian variety Keauhou at present appears the most promising. However, some of the latest introductions from Hawaii are not represented in this trial.

Field trials demonstrated the efficacy of carbaryl sprays applied at 2 to 3 week intervals during the susceptible period of December to February as a means of protecting nuts from attack by the macadamia nut borer, *Cryptophlebia ombrodelta* (Low.). Yield of nuts from treated trees exceeded that from unsprayed trees by as much as 35%, and carbaryl has now been adopted as the recommended chemical for nut borer control.



The identification of fungi which cause plant disease is an important part of the work of Plant Pathology Branch.

The successful conduct of many biological studies on the macadamia flower caterpillar, *Homoeosoma vagella* Zell. depends on the ability to rear the insect in the laboratory. This is facilitated by the use of an artificial food medium, and several diets were tested. Larvae were successfully reared

from the second instar to the adult moth on a wheat germ/casein medium, but some difficulty was encountered in attempting to rear newly hatched larvae on the diet. Chemical analysis identified sugars in extracts of macadamia flowers as sucrose, glucose, fructose and arabinose. A combination of synthetic sugars in the proportions of their occurrence in macadamia flower buds was prepared, and its incorporation in artificial rearing media should reproduce more closely the dietary requirements of the caterpillar.

**Passionfruit.**—Propagation of the hybrid passionfruit varieties by grafting requires careful maintenance of flavicarpa rootstocks, which may otherwise be contaminated by cross pollination.

To obviate this risk, propagation by cutting instead of grafting was tried at the Maroochy Experiment Station. Cuttings struck readily with bottom heat, and at present, at six months after planting out, are performing as well as, if not better than, grafted plants.

**Watermelon.**—With watermelon wilt a serious problem, trials with wilt resistant varieties have been going on for some seasons, and now the standard variety, Candy Red, has been replaced to a considerable extent in northern areas by the wilt resistant Calhoun Grey.

**Fijian Ginger.**—In trials in the Maroochy shire with several different varieties of ginger, a variety introduced from Fiji outyielded the standard local variety by about 16% in an early harvest trial. The Fijian variety also had a 30% larger knob size which is particularly desirable. Tests are being made to determine its suitability for the dehydrated and the syruped products.

#### VEGETABLES

**Tomatoes.**—It appears from tomato nutrition work that, in the Redlands area, nitrogen applications have much greater effects on yield than phosphorus and potassium. However, the findings were also in keeping with the general experience that high nitrogen before fruit set can delay cropping and reduce early yields.

A range of planting distances giving from 2 900 to 3 500 plants per acre were compared in terms of yield of green-mature fruit of commercially acceptable size in a late season trial at Bowen. Highest experimental yields of 13 tons per acre from the variety Walter were obtained in single rows 5 ft. apart with plants spaced 2 ft. apart in the row, which is much closer than the district standard of 6 ft. x 3 ft. Denser plantings are also likely to reduce field heat and heat-blemished fruit, and to give better weed suppression. This promising work is to be given wider testing.



Bean varieties are screened for their reaction to foliage disease.

The tomato variety, Strobelee, selected from breeding lines from Dr. Strobel of Homestead, Florida, was released during 1972 and has been included in the tomato seed certification scheme. The variety, Walter, had the most consistent yields in mid- and late-season trials at the Bowen Horticultural Research Station in 1972. It also had better than average tolerance to transport damage and an acceptable ripening pattern in Station trials, and has been readily accepted in the Bowen district.

In detailed studies on tomato temperatures in the Bowen district, it appeared that, from the beginning of September, fruit temperatures at railing were always above 24 deg. C.



In a series of trials commenced on September 1, it was found that pre-cooling became effective early in October, reducing the amount of coloured fruit and resulting in firmer fruit.

**French beans.**—With large areas for seed production, processing and the fresh market, French beans continue to be a major vegetable crop. Because of their economic value and the widely differing and changing conditions under which they are being grown, they are currently receiving considerable attention, and recent research results promise worthwhile yield increases.

Surveys demonstrated the value of foliar analysis in diagnosing nutritional disorders. Among the important results, a severe stunting disorder appears to be due to a deficiency of boron, while in the Burdekin, zinc deficiency appears to be a major problem.

Further work has confirmed the response of beans in the Lockyer to high rates of nitrogen up to 120–160 lb. N per acre, while carefully controlled studies have supported earlier field work which suggested that shortage of nitrogen was critical early in the life of the plant. However, the current studies also show that shortage after flowering will seriously reduce yields.

Another significant finding is that in acid soils with pH appreciably below 6, sulphate of ammonia is a much poorer source of nitrogen than diammonium phosphate, urea or ammonium nitrate.

A leaf analysis survey in the Near North Coast indicated that manganese levels were above optimum in about 60% of the sites reaching toxic levels in 36%; boron levels were deficient in 29% of the sites, and calcium was low in 21% of the sites. The boron deficiency appears to be the cause of severe distortion which has been getting worse for some seasons.

Glasshouse tests indicate that the fungicide oxycarboxin and triforine are effective in retarding rust establishment in French beans over a longer period of the time than benomyl. A comprehensive screening programme for rust resistance is under way with bean cultivars and other *Phaseolus* spp.

Common blight (*Xanthomonas phaseoli*) was serious in some crops grown for processing in the Lockyer Valley. Seed source will need to be watched more carefully if this hazard is to be reduced.

No infection with the halo blight organism (*Pseudomonas phaseolicola*) was found in sirato plants in the Burdekin Bean Seed Quarantine area during an intensive survey.

**Brassicas.**—Emphasis in the brassicas is currently placed on variety trials to meet the rapidly changing demand. This new demand includes products such as coleslaw, frozen Brussels sprouts, frozen cauliflower, prepackaged pieces of cabbage and cauliflower, and small-type cauliflowers. As the manufacturing aspect of these crops becomes more significant, the scheduling of harvesting also becomes more stringent.

Among herbicides tried on cabbage, Alachlor at 3 kg/ha, and Trifluralin at 1 kg/ha + Alachlor at 0.75 kg/ha have performed well, and they are to be tried in other related crops.

Insecticides currently recommended for control of other cabbage pests are relatively ineffective against the budworm, *Heliothis armigera* (Hubner) and the cluster caterpillar, *Spodoptera litura* (F.) which have increased in importance as pests of cabbages in recent years. DDT generally provides satisfactory control of these insects but its use can not be contemplated in this instance because many growers in the Redlands area have developed a flourishing export trade with Japan. Under Japanese health regulations, importation of cabbages treated with DDT is prohibited. A suitable alternative to DDT, preferably one with potential for controlling other cabbage pests is needed and field trials were initiated to evaluate a number of newer compounds.

Included were formulations of the bacterial insecticide, *Bacillus thuringiensis*. One of these new formulations which is reputed to be more stable and reliable than older preparations of *B. thuringiensis*, and the organophosphorus compound, methamidiphos, both gave good control of budworm and cluster caterpillar. Chlordimeform, which is less costly to apply than either of the other two insecticides, also proved to be efficacious. However, a plant reaction that causes bleaching of the leaf edges with consequent loss of market appeal is associated with the use of chlordimeform on some cabbage cultivars. Further work to ascertain the relationship between application rates of this chemical and cabbage variety was indicated and is in progress.

An investigation was made into varietal and plant density problems in the production of "mini" cauliflowers. Both Snowball Y and Snowgen showed the ability to produce high yields of uniform curds at high density. Optimum yields were recorded at a 5 in. square planting pattern. Snowball Y yielded 90% of the curds in the required size range (1½ to 3½") at the 5 in. spacing. The average time to maturity was not influenced by plant density but maturity was more even at high densities.

The production of sweet corn for fresh market and processing is a rapidly expanding industry in south-eastern Queensland. As large numbers of varieties are available and very little is known of their suitability for Queensland production, variety trials have been initiated.

The unusually severe mosaic disease symptoms in cucurbits such as pumpkins, marrow and rockmelon in recent years have been shown to be associated with the occurrence of type 1 of the watermelon mosaic virus. Prior to this time, type 2 was the most prevalent strain.

## ORNAMENTALS

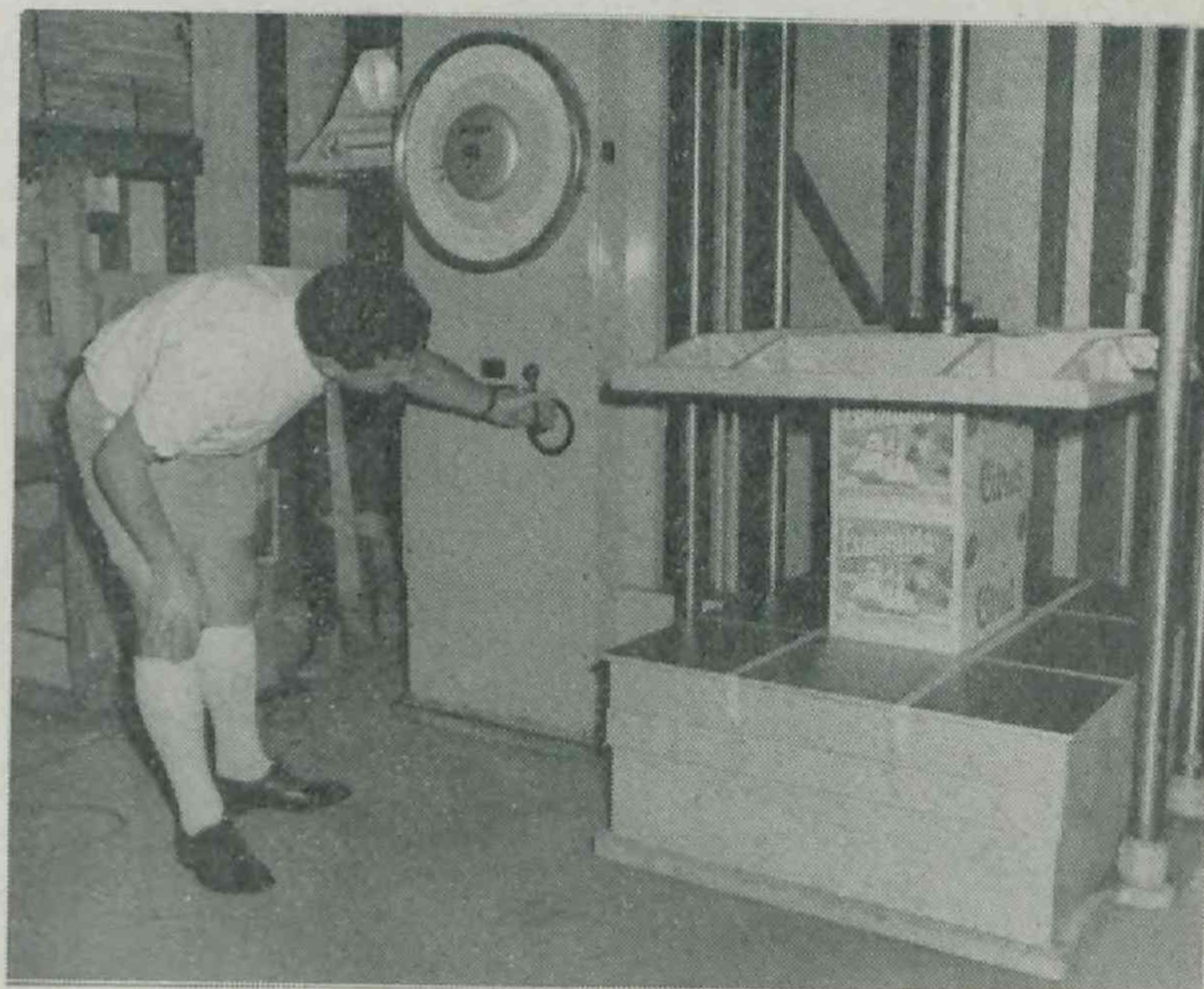
In the cut flower trade, the keeping quality of a flower has an important bearing on demand. With carnations, the ability of unopened buds to open after cutting is also important, as it would permit a lot of buds to be marketed which would otherwise be wasted at the final picking of a patch.

In trials at the Redlands Horticultural Research Station with Aadural-AK, 8 hydroxyquinaline and sucrose, and lemonade, all three treatments improved the vase life of the flowers. All three treatments also had appreciable effects in forcing buds, but Aadural-AK which forced tight buds and did not discolour the stems was considered the best treatment.

With upward of 300 acres in production, the gladiolus is one of the leading crops of the Redlands area. It is known that corm size has an appreciable bearing on flower quality, and trials are currently in progress with 5 grades of corms, both whole and cut in half, to determine the optimum size.

## PACKAGING

Previous experimental work demonstrated the reductions in transport injury which can be obtained by the use of the tight fill method of packaging. This system also has potential for mechanized packing, and could greatly reduce the manual labour which is currently involved in the precision packing of many of our fruit crops.



Testing the compression strength of fruit cartons at Redlands Horticultural Research Station.

Projects are in progress to encourage the adoption of this practice in the citrus, tomato and banana industries by the use of farm demonstrations. For tomatoes and citrus, equipment is being made which will enable a temporary conversion to be carried out on a farm grader. This equipment includes a grader "by pass" conveyor, a weight-filling unit, and a vibration settling unit.

When it is considered that a carton may cost several times as much as the field cost of growing the fruit it contains, the expense and waste involved in cartons which are used for only one trip are obvious. With a view to markedly reducing the high costs of fruit and vegetable packaging, attention is now being given to the design of a returnable container.

## ECONOMICS

A detailed study of production methods, costs and returns for beans, cucumbers, pineapples, bananas, strawberries and zucchinis was completed with the co-operation of specialist growers in the Gympie region. Similar studies are well advanced in avocados, passionfruit, rockmelons and watermelons.



## VII. Development Planning and Land Use

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

The Agricultural Chemical Laboratory Branch carries out much independent as well as joint work by way of soil and water surveys. The Botany Branch has a particular interest in the destruction and control of trees and other woody plants as factors in land development. The Economic Services and Marketing Services Branches have an important role in studies of the economics of production and marketing.

### DEVELOPMENTAL PLANNING

*Brigalow Scheme.*—The past year was a most favourable one for settlers in the Fitzroy Basin (Brigalow) Land Development Scheme. Rainfall was more than adequate for the establishment of new pastures and the reseeded of existing pastures in Area III. However, surface stock water supplies are causing concern particularly in Area I where the light nature of the falls on well-grassed paddocks resulted in little surface run-off into dams and tanks.

Officers continue to work in close liaison with Lands Department and the settlers in achieving the most suitable property development proposals.

Land unit mapping activities in this region have been completed by Development Planning Officers and 11 land use property plans were prepared for incoming settlers.

To date, some 54 blocks of land have been allocated by ballot in Area III, while a further 28 blocks have been sold at public auction for \$2 288 500 compared with an upset price of \$1 124 017.

Since the inception of the scheme in late 1962 to April 30, 1973, the following developments have been undertaken on settled ballot blocks in Areas I, II, and III, or as pre-development activities in Area III.

Area of Scrub Pulled 755 479 (acres)

Area Burnt and Seeded 649 671 (acres)

Sucker Control and Ringbarking 165 475 (acres)

Water Facilities, 148 Earth Tanks or Dams, 86 Bores,  
34 Reticulation Schemes

Yards and Tick Control Facilities 130 units

Fencing 1 547 miles

Pasture seedings for the year amounted to 126 734 acres.

*Coastal Lowlands Technical and Land Use Studies.*—Following a report of a Departmental Committee on the establishment and maintenance of beef cattle pasture along the coast from Caboolture to Bundaberg, an Inter-Departmental Committee representing the Departments of Lands, Forestry, and Primary Industries, under the lead of the Director of the Division of Land Utilisation, was set up in January, 1973, to study aspects of land use for some 147 000 acres of vacant Crown land in the northern wallum region. Investigation of technical and economic issues of the beef industry, softwood forest production, environmental issues, and suitability of vacant Crown land for various uses is envisaged.

*Western Arid Land Use Study.*—The project, which has been in progress since 1968, is a co-ordinated multi-discipline one involving officers of the Development Planning Branch, Botany and Agricultural Chemical Laboratory Branches. Other organisations such as the Department of Lands, Irrigation and Water Supply Commission, the Bureau of Agricultural Economics, the Department of Northern Development and the C.S.I.R.O. Rangelands Research Unit co-operated in this study.

Field activities were completed in Part 1 of the project comprising 36 million acres, and reports covering vegetation, soils, climate, geology and physiography, hydrology, fauna, economics, pests, land tenure, present land use, and transport are being prepared for final editing.

A map delineating the 53 component land systems was published at a scale of 1:500 000, while vegetation and soils maps at a scale of 1:1 000 000 are currently being printed. Ninety-three land units were identified, and these are being described in terms of their geology, topography, soils and vegetation. Assessments of land use limitations, special use and livestock carrying capacity were completed for each of these land units.

Detailed soil analyses were completed on over 100 soil profiles and this information together with the soil and vegetation data was recorded in a computer data bank. These data are being processed to establish relationships between soils and vegetation and soil nutrient levels, soil salinity levels and soil moisture, and to indicate likely future soil problems.

Soil erosion, condition and trend of the different land types were also investigated to pin-point those areas where degradation is occurring so that programmes may be commenced to halt these processes.



Dense regeneration of sandalwood.



The same area of sandalwood shown after stickraking.  
Note good stand of buffel grass.



Approximately 580 plant species were recorded in Part 1. The distribution and characteristics of these species, their use, poisonous properties, fodder value and their hazard as weeds were studied.

Part 2 of the project comprising 24 million acres is advancing along similar lines. Photo-interpretation in this area is now well advanced and field sampling is nearing completion. Survey work was also commenced on a further area of 12 million acres in the Charleville-Cunnamulla district so as to complete this work in south-western Queensland. This latter study is being conducted by Development Planning Officers and a Lands Department Agronomist with assistance from specialist officers of the Botany and Agricultural Chemical Laboratory Branches.

*Pastoral Ecosystem of the Arid Zone of Australia.*—Subsequent to the Third Australian Arid Zone Research Conference held at Broken Hill in May, 1970, Standing Committee on Agriculture, acting on the report of the organisers of the Conference, established a Working Party, convened by C.S.I.R.O., "to report to Standing Committee on ways and means for developing a rapid inventory, using all sources of information, of the pastoral ecosystems of arid Australia and assessing their present physical, biological and economic status and trends, and their future potential for various agricultural and non-agricultural types of land uses with the objective of providing a basis for determining future management and control measures".

This Commonwealth/State Working Party, to be known in future as a Co-ordinating Panel, held an initial meeting in Canberra in March, 1972, and requested the relevant States to establish a Working Group, headed by a convener who would then become State representative to the Co-ordinating Panel. The functions of the State Working Group are to:

- (i) gather, collate, standardise and interpret all the existing information;
- (ii) determine the need for additional information for the inventory;
- (iii) determine how any mapping required could be done and what this would involve in terms of manpower, expertise, facilities and any outside assistance that may be required.

The State Working Group considers that the most productive approach to the assignment is to proceed as quickly as possible with the current Western Arid Study and extend this type of survey to adjoining unsurveyed areas when possible. The present Western Arid Study is considered by the Co-ordinating Panel to be well suited to the objective of the Commonwealth-wide proposal.

*Sheep Industry Climatology Study.*—This study of the Northern Sheep Zone embracing the Shires of McKinlay, Richmond, Flinders, Winton, Longreach, Aramac and Ilfracombe is essentially of an integrating and regional nature, with the basic aim being an exposition of land utilisation in a relatively homogeneous region. The study has particular relevance in view of recent instability in the principal enterprise (wool production), and questions raised concerning the nature of long-term productivity trends of this particular type of pastoral land. The chosen technique is one of simulation using a mathematical model to integrate climatic, biological and economic data. The model simulates soil moisture, plant growth and dry matter levels, sheep intake, energy balance and liveweight. The model is driven by historical weekly rainfall and sheep stocking rate was assumed constant.

*Wallum.*—A production ecosystem model approach was adopted by a group of specialist officers attending a wallum workshop held at the Coolum Research Station in February. This approach provided a means of integrating existing knowledge of livestock and pasture performance in this region for advice to beef producers on the economic development of this coastal country.

*Cape York Peninsula Study.*—Field data are being collated on existing land use systems on holdings in the Peninsula. To gauge the potential for future agricultural development, assessments are being made of the extent of more intensive land use systems on different land types taking into account the main deterrents to further development as viewed by graziers in the area.

*Comber Project.*—This project to assess the availability and utilisation of resources in the Condamine-Maranoa region is nearing completion, and a detailed report providing guidelines on future research and extension needs in this region will be published in late 1973.

*Fitzroy Region.*—A brief history and discussion on the development of agricultural and pastoral industries in the Fitzroy Region (focusing on Rockhampton as its nodal centre) is contained in a publication entitled "Fitzroy Region Agricultural Resources Utilisation" released during the year. Data were collated as part of a thesis study in which recursive programming is used to predict future patterns of agricultural development.

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## LAND USE

*Gin Gin Land Use Study.*—Restructuring proposals contained in the Report prepared by the Gin Gin Land Use Committee were adopted by State Cabinet on June 27, 1972. Highlights of the report included the identification of the need for early implementation of irrigation proposals to stabilise and improve production from a large proportion of the cane farms in the area; the identification of the eroded steep lands and of suitable substitution areas; and the recommendation to have the area declared an "Area of Erosion Hazard" under the Soil Conservation Act of 1965.

*Granite-Traprock Study.*—The inventory side of this regional survey, covering the shires of Rosenthal, Stanthorpe and Inglewood, east of the town of Inglewood, has progressed significantly during the year. Initial photo-interpretation work was completed early in the year, and field work for the first stage of the study was completed in March, with a total of 204 sites described. Analysis of field data is now well under way, and a draft land systems report and map should be available in August, 1973.

Preliminary work has started in climatic analysis, multi-purpose use of computer-drawn block diagrams for illustrations and in land use mapping. Although no deadline is set for completion of the report, projected work programmes are becoming regularly extended. To date, the Central Drafting Office has been able to cope satisfactorily with the project's drafting requirements.

*Eastern Downs Land Use Study.*—This joint project between Land Development and Soil Conservation Branches was continued. The task of mapping the Basaltic Uplands was taken to a stage when the major part has been completed. The declaration of five shires as areas of erosion hazard brought some new priorities to this work and some major re-organisation of responsibilities. The report on the Wyreema study area was compiled.

## IRRIGATION

*Condamine Irrigation Project (Leslie Dam Stage II).*—A joint report by the Irrigation and Water Supply Commission and the Department of Primary Industries on the Upper Condamine Irrigation Project, embracing Stage II construction of the Leslie Dam located at Sandy Creek near Warwick, was submitted to Cabinet in August, 1972.

The economic analysis undertaken by Economic Services Branch was based on the following assumptions:—

- (a) That an additional supply of 7 500 acre feet of water is effectively utilised annually.
- (b) The whole cost of the diversion works is charged against the current scheme, but it is accepted that this will reduce to about 10% in the event that the recharge operations are feasible.
- (c) Without the scheme, current use of water both from surface and underground supplies would decline to 23 000 acre feet of water annually in 10 years' time, but with the scheme the available supply would decline from current use to 33 000 acre feet per annum in this period and the life of the project is taken as 50 years.

In this analysis net benefits have been taken only as the farm net return which would otherwise be lost but for the additional water supply. This has been evaluated at \$187 000 per annum. On the set assumptions the Internal Rate of Return for the scheme has been determined at 6.29%, but increases to 7.39% if recharge operations are feasible.

Alternatively, the benefit-cost ratio, using an interest rate of 6% to discount benefits and costs of the scheme over 50 years, has been determined as 1.05 but increases to 1.24 if recharge is feasible. On the basis of these analysis the scheme is economically acceptable.

Cabinet subsequently directed that the Report be submitted to the Federal Government for financial assistance amounting to \$2.356 million under the National Water Resources Development Fund.

*Bundaberg Irrigation Project.*—A joint report by the Irrigation and Water Supply Commission and the Department of Primary Industries on Phase 2 of the Bundaberg Irrigation Project was submitted to Cabinet in August, 1972.

The report sets out proposals for Phase 2 of the Bundaberg Irrigation Project estimated to cost \$30.54 million. This phase is required to complete the Bundaberg Irrigation Scheme, the establishment of which was approved by Parliament in 1970.

Phase 2 comprises works to supply the Gin Gin, Bingera and Isis sections comprising 567 existing assignments with a gross assigned area of 50 467 acres. Only 6 200 acres of this area at present have irrigation and are therefore





Clearing excessively large areas at one time can result in this.

more subject to severe drought losses than the rest of the region. The main objectives of the scheme are to eliminate the hazards of ever-present drought, thus stabilising and improving efficiency of production, and to increase production from existing assigned areas as opportunities occur. No provision is made for increasing assignments.

The benefit/cost ratios for a sugar price of \$100 per ton and a discount rates of 6% range from 1.38 to 1.47 respectively for the 50 years' and 75 years' life of the project. At a sugar price at \$90 per ton (which is well below the current figure) the benefit/cost ratios at the 6% discount rate range from 1.10 to 1.23 respectively for the 50 years' and 75 years' life of the project.

Cabinet subsequently directed that the report be submitted to the Federal Government for financial assistance under the National Water Resources Development Fund.

Other projects in which the Development Planning Branch is involved include:

*Lower Mary River—Tinana Creek.*—A study of present land use and future potential of an area of about 70 000 acres of land adjacent to and between the Mary River and Tinana Creek (between Tiaro and Maryborough) is being undertaken.

*Wivenhoe Dam Land Use Study.*—A comprehensive Report on the Wivenhoe Dam Catchment, containing proposals for land acquisition and land use controls, was compiled in November, 1972, in collaboration with officers of the Local Government Department. This report was then submitted through the Wivenhoe Dam Co-ordinating Committee to the Co-ordinator-General's Department.

*Barker Creek.*—Re-examination of the original Barambah-Barker Creek Irrigation proposals is being undertaken by officers of Economic Services and Development Planning Branches, following a decision by the Irrigation and Water Supply Commission to firm up their studies on one dam site on Barker Creek (near Cherbourg). The economic implications of the possible conjunctive use of water from the proposed dam with underground water in the Byee area for the irrigation of a range of fodder and grain crops for the lot feeding of beef cattle are being closely examined.

*Three Moon Creek.*—A joint report by the Irrigation and Water Supply Commission and the Department of Primary Industries on "Water Resources Investigation—Three Moon Creek", embracing the construction of a dam on Three Moon Creek near Monto, was submitted to Cabinet in September 1972. The estimated cost of the scheme is \$6.38 million.

The economic analysis indicated that the net annual value of production was in the order of \$346 500 and when taking this increase as being achieved over 10 years and a discount rate of 6% the benefit/cost ratio is determined as 0.70. As this is less than 1.0, the scheme could not be justified by the usually accepted criteria which do not evaluate social or other factors. Cabinet subsequently directed that the Report be submitted to the Federal Government for financial assistance under the National Water Resources Development Fund.

*Burdekin Basin Re-Appraisal.*—A report by the Burdekin Working Group, which outlined a proposed 5-year study programme for the Burdekin River Basin comprising some 50 140 sq. miles was submitted to the Commonwealth through the Department of Northern Development in March, 1973. Financial and timing requirements for the proposed study programme embraced among other things a broad spectrum of investigations to be undertaken either by, or under the supervision of, the Department of Primary Industries or the Irrigation and Water Supply Commission.

### WOODY PLANTS CONTROL

Woody plants control work is gradually being wound down by Botany Branch and it is intended that Agriculture Branch take it over next year. Trials which were finalised during the previous year are still being prepared for publication. The work on Dawson Gum (*Eucalyptus cambageana*) was published and papers on several brigalow trials are in press or in an advanced stage of preparation.

Trials are still current on brigalow-Dawson gum regrowth control and on Leichhardt bean (*Cassia brewsteri*) regrowth control. These trials will be finalised next year.

Periodic assessments of quadrats on areas of brigalow treated with 2,4,5-T as an ultra low volume spray should be available shortly. To-date, results with this technique do not look promising.

A system for the collection and retrieval of plant ecological data was developed in co-operation with the C.S.I.R.O. Woodland Ecology Unit. Using this system, extensive data were collected in central and southern Queensland, and analyses of these are now underway. Good correlations between land clearance techniques, management practices and sandalwood densities have been obtained. Correlations between floristic composition of original vegetation and subsequent sandalwood populations are also apparent.

### FARM MANAGEMENT ACCOUNTING SERVICE

Membership was maintained at approximately 250 producers at the limit of the processing facilities.

The annual printout service introduced last year has found favour with those producers who already have a good set of records and are interested only in an annual statement of their financial performance. The monthly mail-in recording scheme is being maintained particularly for members who have limited records and are interested in the quarterly cash flow statements for financial control through comparison of actual results with budget estimates.

Membership is now being geared more to the extension and research requirements of regional economists through selective recruitment of members. Apart from assisting individual producers, this accounting service provides a valuable source of continuous on-farm recorded data, and group averages are particularly useful as a factual basis for farm management advisory work. Departmental extension officers with previous training in farm management have become more involved in the service in the technical interpretation of results and in preparing budgets for members on request.

An evaluation study was undertaken in the Moreton region seeking views from members for further improvements in the accounting service. Their comments, along with recommendations from a special branch review committee, were taken into account in the design of new forms and folders prepared for use in 1973-74.

A seminar sponsored by the Education Department on rural financial management systems was attended in May, and the leading educational role of the Department of Primary Industries in this field was outlined. A further seminar organised by the Bureau of Sugar Experiment Stations in July, 1973, will consider in detail the three computerised farm management accounting services now processed in Queensland by the Bureau of Sugar Experiment Stations, Queensland Institute of Technology and this Department.



## VIII. Special Field and Laboratory Services

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

### SOIL CONSERVATION

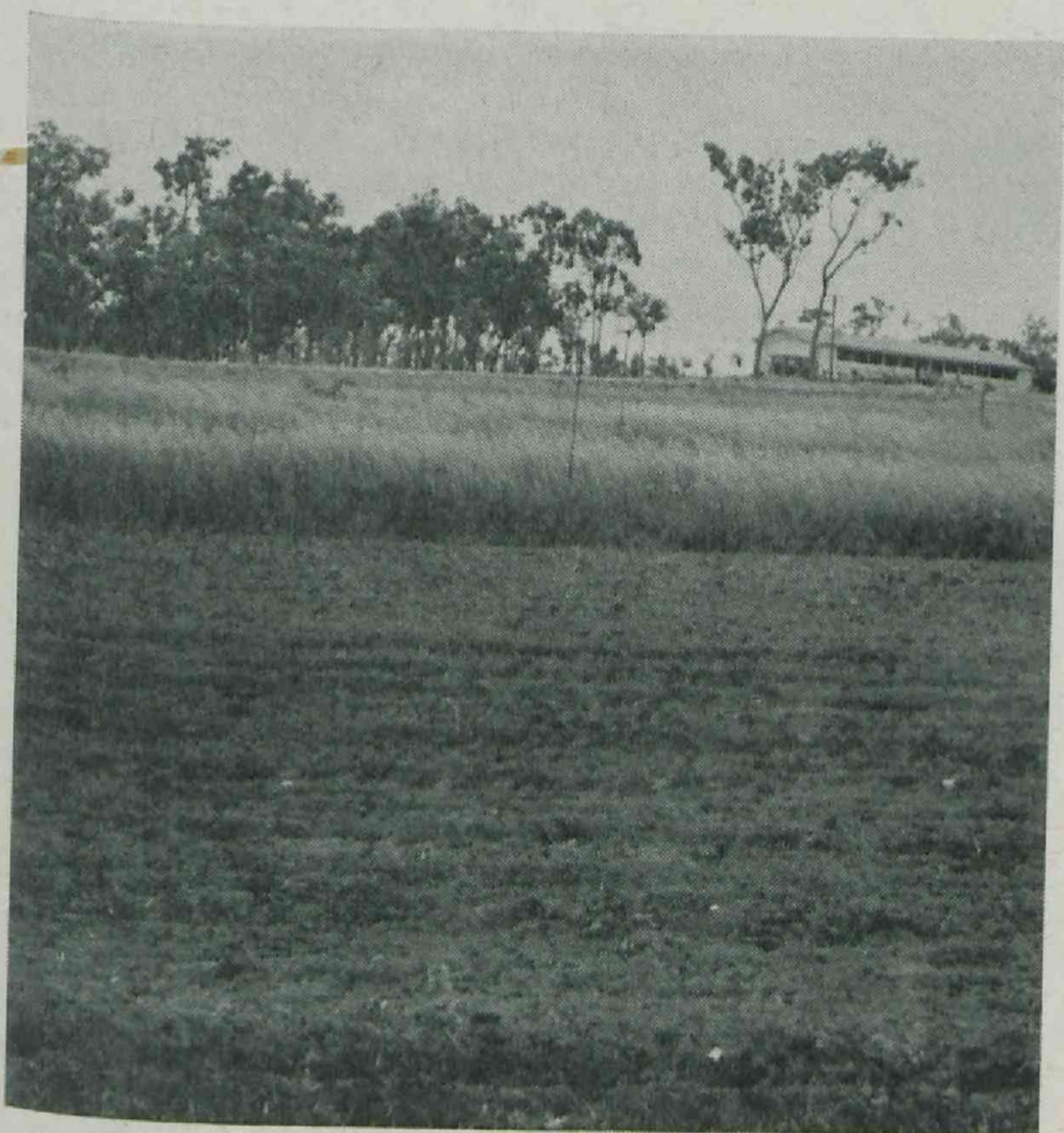
The northern sector of the Eastern Downs experienced the worst sheet and gully erosion for many years in late October and early November, 1972. The experience was repeated in the December-February period in the southern sector.

The relationship between ground cover and erosion was again very marked with erosion occurring on the bare areas, and areas carrying winter crops suffering little damage. Unfortunately, in the Warwick, Allora, Clifton, Pittsworth and Oakey districts less than 20% of the cultivations were planted to winter crop owing to dry conditions at planting time. This factor as much as the rains, which were earlier and bigger than normal, was responsible for the unusually heavy damage on the Darling Downs.

Moderate erosion was experienced in the Burnett and the South East Coast region. In the west central Queensland region, erosion in cultivation lands occurred in isolated instances where finely worked paddocks coincided with high intensity falls. Gully erosion further progressed in the grazing lands of the Nogoa River catchment, particularly in areas of texture contrast soil. On one occasion, runoff was observed to commence after only 30 points of rain had fallen in a three-hour period. The rest of the State had in general low intensity rain, very little runoff and minimal erosion.



Same area as adjacent after two inches of rain in two hours caused rilling in young soybeans.



Southedge Tobacco Research Station land ready for the planting of a summer crop.

Interest in the utilisation of crop residue for erosion control continues to grow both in the farming community and in the machinery trade. At this stage, however, it is felt that continued effort is required to promote true stubble mulching that is not just stubble retention after harvest with subsequent cultivation designed to destroy the stubble completely by planting time; but true stubble mulching with the stubble worked so as to retain a mulch right through until after planting.

This year has seen a big swing towards stubble retention as defined above but stubble mulching is not so widely accepted. The reasons for this are difficult to determine.

Most farmers will blame the general unsuitability of planting machinery to work through stubble. This is still a factor, but it is probable that there are still many farmers who under-rate the erosion hazard in the May-June-July period and take a chance that erosion will not occur rather than meet the extra expense of modifying planting machinery and the difficulty of planting under a stubble mulch.

On the Darling Downs a more rapid adoption of the practice may follow in the declared areas of erosion hazard. Stubble mulching will be a specified requirement for most areas included in project plans and the subsidy scheme covers machinery modifications needed for effective stubble mulching. Consequently, a more rapid adoption of the practice is expected.

With high cattle prices continuing and prospects good and with several years of disappointing results from both winter and summer grain crops there is a marked swing to cattle raising and a consequent retirement of areas from cultivation for pastures establishment. This trend is especially evident around Biloela and to a lesser extent around Moura and Theodore in the east central Queensland region. It is also reported from the Western Downs region.



Cultivation for crop fattening in the Western Downs is likely to continue with the associated high soil erosion hazard but if the swing to pasture in lieu of cultivation continues it could greatly lessen the erosion threat in the region.

In order to provide an adequate soil conservation technical service in rural areas, 53 field extension officers are available at 28 centres throughout the State and free services are provided for the planning and marking out of areas for contour banking and contour working, the preparation of land capability and land use plans, surveys for parallel contour bank systems, surveys of contour guidelines for pasture furrowing and pasture ripping, and air photo interpretation to assist landholders with property development or re-development.

During the year 2 853 requests for assistance were received and 5 543 property visits made to assist with the development of soil conservation programmes.

A further 367 landholders commenced contour farming programmes for the first time, bringing the cumulative total of co-operators to 8 069 which is 20% of the total number of rural holdings in the State.

The highest percentage of co-operators is 38% on the East Darling Downs closely followed by the Burnett which has 36%. Since the totals include a substantial number who do not need to practice contour farming either because the property is flat or because none of it is cultivated, the actual percentages of co-operators are substantially higher than those quoted.

Assistance with the planning of land use based on land capability was provided to individual landholders on request. During the year 50 farmers availed themselves of this service and they were issued with land use plans covering a total of 144 069 acres.

This work will receive greater recognition and be more widely applied as conservation planning progresses in the areas of soil erosion hazard on the Eastern Downs. Assessment of land capability and the use of land in accordance with land capability will be mandatory in these areas i.e. maximum intensity of use will be specified and actual use will be at this level or at a lesser intensity. Landholders will have a freedom of choice but not a choice to use the land at an intensity greater than its assessed capability.

Some 96 500 acres of erosion prone cultivation land were marked out for contour farming bringing the total area of land worked on the contour in Queensland to 1 387 000 acres. This represents about 30% of the 4.8 million acres of erosion prone cultivation land. On the East Darling Downs the proportion is 23%. On the West Darling Downs it is 25%, and in the Burnett it is 40%.

Contouring practices applied to 96 522 acres of erosion prone cultivation land during the year represent the lowest annual achievement in this category of work since 1963-64.

It is not possible to find any one reason for this fall. Among the probable contributing factors the low wheat harvest and adverse financial conditions in the grain growing industry must rank high. Other factors could be:

- (1) The already high percentage of area treated in some catchments, for example, the Kingaroy area in the Burnett region.
- (2) The swing to pastures which in many situations constitute a form of land use not requiring contour banking.
- (3) Over-expectation of the performance of contour banking in erosion control and consequent disenchantment when bank systems fail under some conditions.
- (4) Neglect of waterway stabilisation procedures and consequent disenchantment with gullied waterways.
- (5) The development of bigger and bigger farm tractors and machinery which by its very size is ill-suited to working between contour banks.
- (6) Reliance on stubble mulching as an alternative to contour working when it should better be regarded as a complementary measure.

The Advisory and Co-ordinating Committee on Soil Conservation met twice during the year. The most significant issues discussed were control of erosion on the Eastern Darling Downs and control of erosion in the Upper Nogoa catchment which is the catchment of the recently completed Fairbairn Dam.

*Areas of Erosion Hazard Eastern Darling Downs.*—A significant event during the year was the declaration of the shire of Allora as an area of soil erosion hazard on January 18.

This was followed by a Cabinet decision on March 12, that all shires on the Darling Downs would be declared areas of soil erosion hazard by 1978 and that within such declared areas a subsidy of \$1 for \$1 would be paid on

expenditure by farmers on on-farm soil conservation measures, applied in accordance with an approved project plan. The maximum Government contribution will be \$1 000 per farm.

Subsequently, four more shires have been declared, namely Cambooya, Clifton, Pittsworth and Jondaryan.

Officers of Soil Conservation Branch are now engaged in the preparation of project plans covering parts of the declared areas. These plans are being prepared in consultation with landholders and shire councils. They will contain detailed specifications of both permissible land uses and soil conservation measures necessary for each land use, together with co-ordinated drainage design for the whole area, including requirements on road and railway reserves.

To co-ordinate activities on the broad front, a Regional Soil Conservation Committee has been set up. This comprises representatives of shires, river improvement trusts, industry organisations and all Government departments likely to be involved with the programme. The Committee will co-ordinate planning activities and ensure close working contact and understanding between participants. It will also be responsible for collating data and formulating a policy on off-farm works such as stream bank erosion, gully erosion in public lands or marginally productive lands and major road works, which, owing to a lack of authentic information, it was not possible to include in the original proposal.

*Erosion—Upper Nogoa Catchment.*—The erosion situation in the Upper Nogoa catchment reported last year was put before the Advisory and Co-ordinating Committee on Soil Conservation in February, 1973. The Committee agreed that the situation is serious but the decision was taken to defer imposition of statutory control under the area of erosion hazard provisions of the Soil Conservation Act.

In the meantime, all landholders in the catchment have been sent a copy of the erosion report with a covering letter advising them of the gravity of the situation and reminding them of the responsibility to conserve soil that goes with the "ownership" of land.

A limited amount of experimentation into revegetation of denuded areas has been commenced, but basically the answer to the problem is already known. It lies in controlled destocking to meet minimum cover standards. There is room for experimentation as to the most efficient supplementary measures such as seeding and cultivation prior to seeding but the research programme does not include any suggestions of testing whether or not destocking will be beneficial—this is obvious enough from experience in other districts, states and countries.

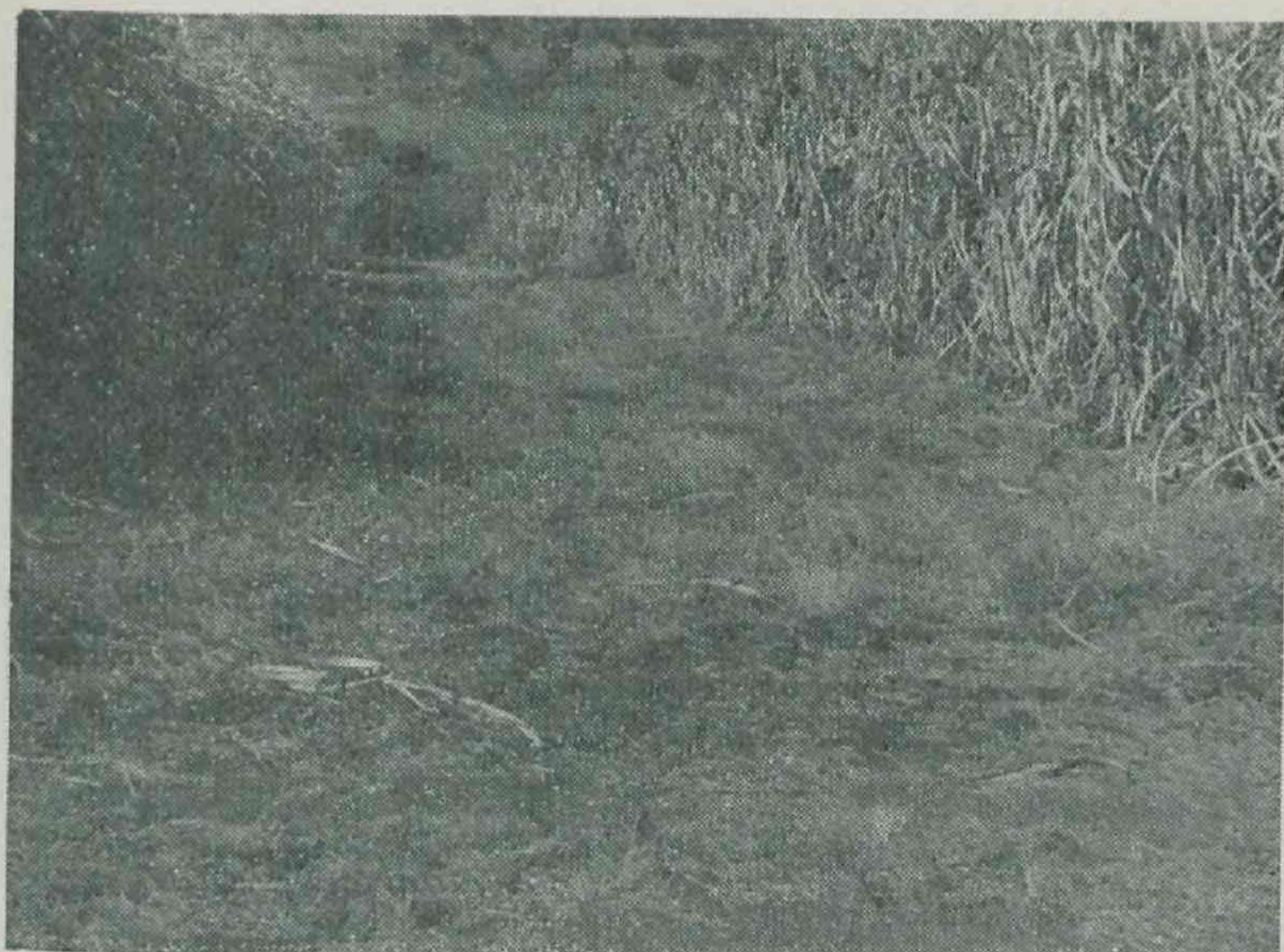
The main problems are procedural ones. What compensation, if any, should landholders get for fencing so that stocking can be controlled? And what compensation should they get, if any, for spelling eroded areas while vegetation recovers? Now that the problem has been brought into the open, can landholders be relied on to take erosion control measures voluntarily? Or will compulsion under the soil erosion hazard provisions of the Act be necessary?



Young plant cane between parallel contour banks after heavy rain. Gradient in the plant drills was adequate to ensure good surface drainage on this soil.

During the year two applications for financial assistance together with four applications for additional finance were received totalling \$3 645. The total of effective applicants now stands at 43.





**Well-grassed subsurface waterway in cane field ready for burning and harvesting. On this red clay loam, kikuyu grass was used to achieve a good cover.**

Approvals during the year totalled \$2 876 and advances totalling \$3 952.20 were cancelled. The amount of effective approvals is now \$63 765.02. Payments made by the Agricultural Bank amounted to \$2 766.60 and the total payments made in the eight years since the scheme commenced are \$58 547.42.

New quarters at Long Pocket in Brisbane and in Toowoomba with very much improved laboratory facilities were occupied by the research section. The Long Pocket facilities include a rainfall simulator. It is not yet functioning in spite of alterations made by the contractor but it will be an invaluable aid in studies of soil erodibility and factors affecting soil erosion under rainfall when the installation problems are overcome.

Progress has continued to be made with land system mapping for areas to be covered by a technical guide to conservation land use and significant progress can be reported at last concerning the quantification of soil erosion loss rates and quantification of the cropping and practice factors in the soil loss equation. We are now in a position where estimates of losses under different land use can be made for each land type and where specification can be made of practices required to reduce erosion losses to acceptable levels for each land use. The techniques serve as a guide which can be used both to determine suitable land uses and to specify the practices needed to ensure permanent production under any chosen land use. The techniques are already being applied in the field and are being written up for publication in conjunction with the land inventory surveys.

A paper has been accepted by the International Society of Soil Science for inclusion in the 10th Congress at Moscow 1974. The topic of this paper is "Disruption of the Surface Layers of Soils under Rainfall". This paper deals with the changes in aggregate distribution in the surface layers of a krasnozem and brown clay under rainfall (using a C.S.I.R.O. rainfall simulator). It was found that high rates of wetting were responsible for two-thirds of the total breakdown of the brown clay compared with about one-third for the krasnozem. Impact appears to be responsible for the remainder of the breakdown. This is the phase that stubble will affect the most.

A working party on soil salinity was set up within the Department to study salinity levels in soils, west of the Main Range, east of the Maranoa River and extending northwards from the New South Wales border to the Great Dividing Range. Soil Conservation Branch is a member of this working party. The last meeting was held in September, 1972.

Published soils data were collected for processing. A computer programme was prepared to transfer the data to a similar basis and sample depth interval.

A study of the relationship between electrical conductivity and moisture content at time of solution extraction was made.

Satellite photographs of the Western Downs area were provided by National Aeronautics Space Administration. These were examined in detail and photopatterns were related to different land use areas covered by the photographs. Various filters were used in taking these photographs.

Results of the interpretation of Earth Resources Technological Satellite space imagery were encouraging if not spectacular. Differences in land use show up well and the boundaries between major land systems can also be picked out. At this stage, it appears feasible that space imagery could serve as a useful aid in land inventory mapping work.

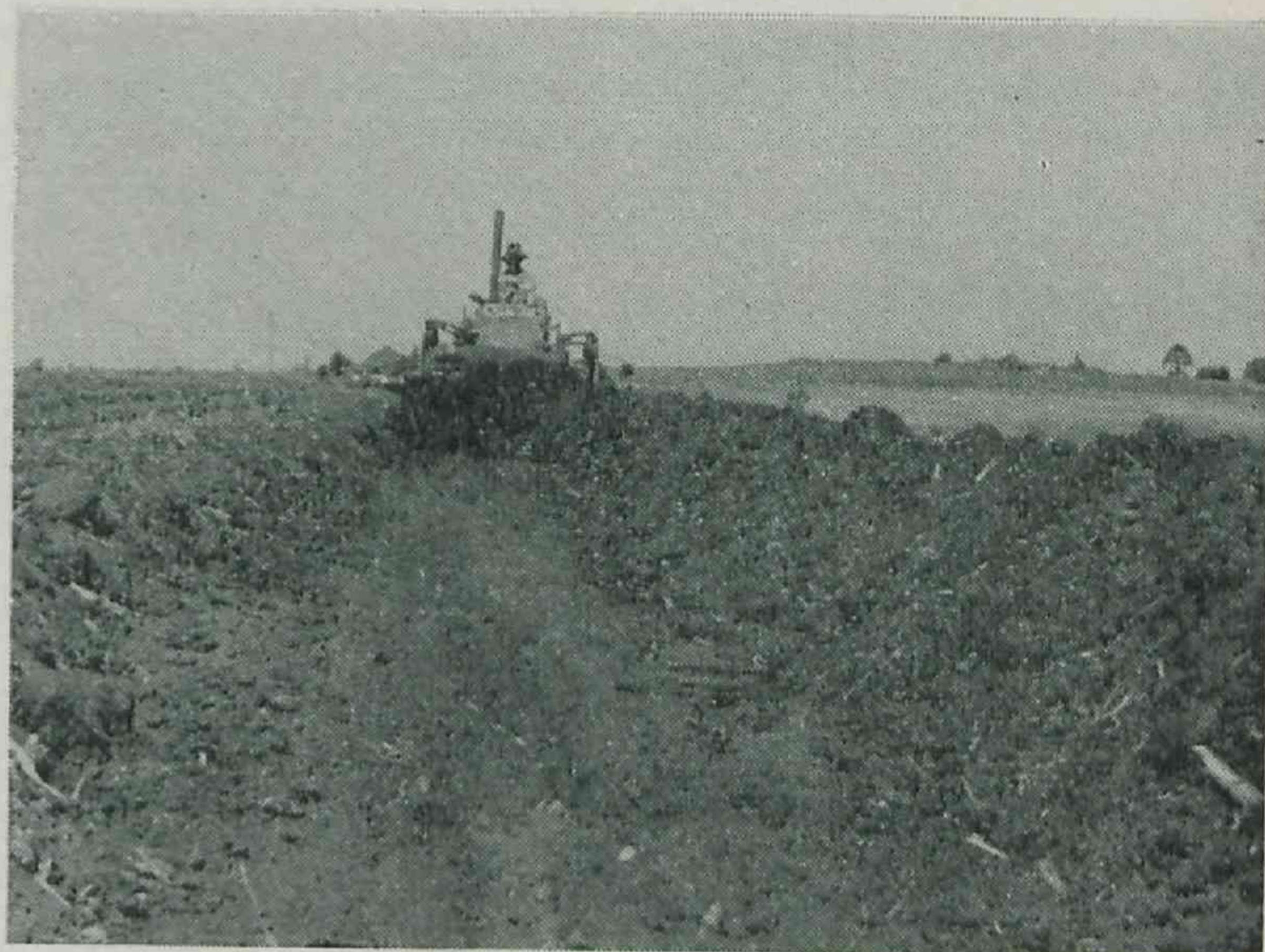
To enable the research findings of the soil erodibility investigations to be applied to the field situation, a study was made to determine the effect of the soil profile on the behaviour of the surface layer of a soil. This study involved an examination of soluble and exchangeable cation levels down the soil profile and to compute from this water entry distribution patterns.

Four alluvial clays at Emerald were chosen for examination. Analytical information was kindly made available on these sites by Agricultural Chemical Laboratory Branch.

It appears that water penetrates these soils most frequently to 60 cm with limited movement to 100 cm. The surface layer of these soils appears to have considerable effect on the rate at which water enters the profile while the properties of the 60-90 cm layer appears to affect water redistribution. Soluble salt and exchangeable cation levels in the profiles reflect these differences.

Field sampling for the soil moisture investigations was completed. The three runoff recording sites were discarded following the damage caused by the above-average rainfall towards the end of 1972.

American class A evaporation figures are now accepted as the world standard and these differ from the available Australian tank figures. A method of estimating American class A evaporation figures was determined.



**Contour bank construction in a deeply tilled, red clay loam of a cane field with slopes varying from 5 to 8%.**



**A cane field treated with parallel banks. Before contouring, uniform growth as shown was never achieved under straight row planting on this area of soils varying from greybrown to red sandy clay loams to loams.**

Most work for the year was concentrated on model development. Model development and validation were restricted to the fallow segment of the system. Work to date with the current single layer model is encouraging in that the simulation is quite reasonable under both extremely wet and dry conditions.



A two-layer model was developed, validation of which is not completed.

The first samples provided from a speed of cultivation trial were subject to examination. In this trial aggregate changes brought about by cultivation at 3, 5 and 7 miles per hour at two moisture levels, namely after rain and dry, were investigated. A clay soil from Theodore was chosen for examination.

Measurable differences in aggregate size were not produced by the different speeds when this clay was cultivated moist.

When cultivated dry, the 7 mph treatment resulted in a higher proportion of finer aggregates. The increase, however, was not large enough to suggest an effect on the erodibility of these soils.

In the upper Nogoia catchment, further studies on techniques and costs of erosion control and reclamation were carried out by Soil Conservation Branch, assisted by Agriculture Branch. A new erosion survey at a more detailed scale was carried out in the worst eroding portion of the catchment. It was prepared on a form suitable for computer processing and programmes for erosion control costing were developed.

It was concluded that erosion is proceeding very rapidly and that the principal erosion control measure needed was destocking of the most hazardous areas for a number of years, supplemented by seeding of selected areas. Equal emphasis needs to be given to development of native scrub and pastures into improved pasture, as this is considered to be the best way of preventing new areas of erosion.

At the request of the Commissioner, Irrigation and Water Supply Commission, Soil Conservation Branch carried out an erosion survey of the Pike Creek catchment, in which a dam is being built. Owing to staff commitments to projects on the Darling Downs, the survey was carried out at a reconnaissance level only.

Rates of erosion are not high, but they are a cause of concern from the productivity point of view because most of the soils in the catchment are very shallow, skeletal types. As a source of sediment in streams, however, soil erosion is not considered to be serious at present.

Trials were conducted at Kingaroy into sod seeding of pastures with the aid of herbicide.

Where favourable grazing conditions exist during the spring and summer months, an area is set aside and sod seeded with *Dolichos* lab lab in December. Grazing is terminated at this stage.

The *Dolichos* is sown directly into the sod in rows with the use of specialised equipment and a herbicide to suppress the regrowth of grasses for a period of 6-8 weeks.

During the past two summer seasons very favourable results were obtained, the most spectacular being in the 1972-73 season on a soil of low fertility. The trials were harvested in March-April. Four treatments are being evaluated.

- (1) Control—grass without *Dolichos*
- (2) *Dolichos* sown into sod without herbicide
- (3) *Dolichos* sown into sod with 45 cm wide band of herbicide
- (4) *Dolichos* sown into sod with 100% cover of herbicide.

Results showed that the 50% cover of herbicide gave the most economical and beneficial results: total costs/ha were approximately \$35.00 including fertilizers (\$12.00/ha).

Three alternative primary tillage operations for peanuts were compared.

- (1) Control—Stubble tillage 10-12 cm deep
- (2) Deep primary tillage with a tine implement 20-25 cm deep.
- (3) Deep primary tillage with a reversible disc plough 20-25 cm deep.

The reversible disc treatment yielded approximately 15% more than the control, and the deep tine treatment yielded approximately 8% more than the control. Reasons for the increase in yield have not yet been fully established.

Average yields in kg/ha were:

- (1) 2 133.55, (2) 2 308.50, (3) 2 427.15.

Stubble mulch machinery evaluations were continued in the Western Downs region. A detailed bulletin covering the work to date is under preparation and will be released shortly. Equipment has been acquired and modified for the introduction of stubble mulching evaluations in the Burnett.

A study by Economic Services Branch to assess the economic benefits of soil conservation measures being applied in the South Burnett region is nearing completion. Technical and financial assistance combined with statutory provisions appear necessary to ensure that soil resources are maintained.

## ENVIRONMENTAL STUDIES

Care for the protection of the environment was continued in many ways during the year, and apart from the normal conservation activities by extension officers, special services were provided by various branches, including Botany. The work of this Branch's Ecology and Economic Botany group concerns (a) Vegetation Surveying and Mapping; (b) Ecological Studies; (c) General.

*Vegetation Surveying and Mapping.*—The Western Arid Zone land use survey is a joint project with the Development Planning Branch of the Division of Land Utilisation. The survey is being undertaken in south-western Queensland west of the Warrego River catchment. The vegetation account has been finalised. The land systems map has been printed and the map of the major vegetation groups is at the printers. Photo interpretation of the region is well advanced, and many of the sites have been sampled for vegetation.

The land capability study of the Moreton Statistical Division is a joint interdivisional project being co-ordinated by Soil Conservation Branch, Division of Land Utilisation, in response to a request from the Co-ordinator General for information on land capability for agriculture, wildlife and flora reserves. Work so far brought to completion included a vegetation description for each land system, a broad vegetation account, an assessment of potential for flora conservation, and an interim account of the vegetation.

An account of the vegetation of the Wivenhoe catchments, and an impact statement on the proposed Cooyar Creek Dam, were proposed, also statements on several mining lease applications and canal proposals.

In the Brisbane Airport Development environmental study a first draft of the report on the mangrove and terrestrial flora and the accompanying vegetation map was completed.

An account of the Mayvale Land System in the Normanton-Croydon area of north-west Queensland is being undertaken jointly by Botany and Agricultural Chemical Laboratory Branches. The account of the soils and vegetation of the area and an accompanying map were prepared for publication.

A woody plants survey involving sandalwood was continued in co-operation with C.S.I.R.O.'s Woodland Ecology Unit, and this is described in the general comments section of this report.

*Ecological Studies.*—As part of a joint project with the Beach Protection Authority of the Department of Harbours and Marine, ecological studies of plant communities on coastal sand dune systems were continued. These studies are being undertaken north of Yeppoon, and in the area between Point Cartwright and Currimundi. Intensive vegetation sampling is being undertaken together with topographic and soil surveys. These studies are designed to give information on the various communities which make up the sand dune vegetation.

A field trial, designed to study the life cycle of beach spinifex (*Spinifex hirsutus*), has been in progress for some time. Measurements of growth of plants in both fertilized and unfertilized plots are being undertaken. At present analyses of the results of this work are underway.

Permanent quadrats have been established in various parts of the Brigalow Scheme Area. These quadrats are recorded periodically and are designed to study the fate, principally, of brigalow (*Acacia harpophylla*) and sandalwood (*Eremophila mitchellii*) after clearing.

*General.*—The Department was represented on joint inspections (with officers of the Department of Mines, Department of Lands, and the Beach Protection Authority) of revegetation on sand mining leases in southern Queensland. The standard of work carried out by the companies is generally good in most areas. However, there is room for improvement in some high dune areas.

During April a Botany Branch officer accompanied the Rutile Zircon Development Association's Conservation Committee on an inspection of sand mining revegetation in New South Wales and southern Queensland. This afforded the opportunity for contact with other workers in this field and will be of benefit in improving the standard of revegetation work in Queensland.

A committee has been formed, with the Director of the Division of Land Utilisation as chairman, to advise on the revegetation of coal mine spoil heaps in central Queensland. Botany Branch is represented on the committee which is at present planning the revegetation of a test area at the Moura mine of Thiess Peabody Mitsui Coal Co.

## FAUNA CONSERVATION

A deepening involvement in problems concerned with the conservation of fauna within the context of environmental conservation marked a new trend in the activities of the Fauna Conservation Branch.



Staff at all research and regulatory centres reported regularly on environmental matters. Knowledge gained from these reports and from complementary land use studies proved to be invaluable in formulating fauna conservation programmes for the various districts throughout Queensland.

New quarters for research at Pallarenda near Townsville and the Hermitage Research Station near Warwick were occupied by Branch staff.

Increased staff at Townsville enabled more detailed studies of the fauna of the Cape York region to be undertaken. A number of previously rare or little known species were discovered during these investigations including the uncommon rock rat (*Zygomys argurus*).

Hermitage staff completed fauna surveys of southern and western Darling Downs areas and have made progress in their investigations of koala biology.

The monitoring of the effect of harvesting on kangaroo populations was continued. A Commonwealth Government ban on the export of kangaroo products involved Branch staff in numerous committee meetings in an attempt to rationalize the question of kangaroo conservation.

The stationing of a Fauna Ranger at Cairns has had an importance influence on fauna conservation in far north Queensland. The activities of the fauna rangers have done a great deal towards curtailing the illegal trade in protected fauna in Queensland.

### STORED PRODUCTS

Laboratory screening tests and trials in bulk storages have demonstrated the potential of the chemicals pirimphosmethyl and "Dowco 214" in protecting grain from infestation by the major stored product pests. The advantage of laboratory tests involving filter paper assays and exposure of pest insects to samples of treated grain is that they enable rapid selection of the most promising materials from a wide range of insecticides. However, experience has emphasised the need for field bulk storage tests as a check on the results of laboratory screening trials.

The search for new insecticides, although not yet critical, has assumed greater importance with the emergence of insect strains resistant to maldison, the currently recommended grain protectant. Resistance levels are such that while maldison treatment produces some benefits, the effective length of residual protection is shortened.

Pre-filling treatment of storage structures with insecticides forms an integral part of the control programme aimed at minimising loss of stored grain through insect infestation. In this context, the residual efficacy of the chemicals used is of great importance but may be affected by the nature of the materials of which storage buildings are constructed. This aspect requires investigation, and the residual activity of appropriate insecticides on various types of building materials is being evaluated by Entomology Branch by means of bioassay tests with susceptible insect strains.

In the treatment of dressed timber, "Dowco 214" gave pest kills equivalent to those produced by the standard maldison application. Both compounds were more persistent than the other insecticides tested and were still active 13 weeks after application. When applied to concrete and asbestos cement all insecticides, maldison and "Dowco 214" included, were rendered ineffective within a month of application. It is suspected that the loss of insecticidal activity may have resulted from hydrolysis of the pesticides by the alkalinity of these construction materials.

An experimental system based on space treatment by means of timed release of dichlorvos was devised to improve control of the tropical warehouse moth, *Ephesia cautella* (Walk.) in grain storages. Discharge of the dichlorvos is timed to coincide with peaks of moth activity determined from earlier behavioural studies. The system which has performed well in small-scale trials is now undergoing further tests for the State Wheat Board in bulk grain storages and giving good results.

Control of the tobacco beetle, *Lasioderma serricornis* (F.) by phosphine fumigation is hampered by the high degree of tolerance for the gas possessed by very young eggs. Experiments showed that the gas concentration x time product required to produce a 99% kill of young eggs is approximately 100 times greater than that needed for adults and larvae. Thus all stages except young eggs were killed by fumigation under reasonable conditions. Because of the greatly increased health hazard, it would be inadvisable to increase the treatment rate to a point where complete control of young eggs is achieved. Where complete elimination of insects is desired, separate fumigations 2 weeks apart would be effective. Larvae developing from eggs that survived the first fumigation would be killed by the second.

### DIAGNOSTIC AND IDENTIFICATION SERVICES

There is a pressing need for accurate and reliable information on the nutritional requirements of Queensland crops and pastures. Although some piecemeal data are available, much remains to be done. The Agricultural Chemical Laboratory Branch will be increasingly involved in studies of this kind, which are essential for the efficient functioning of advisory services in these fields.

Soil physics studies in the laboratory were aimed at developing new techniques of measuring soil physical properties and at improving the interpretation of existing determinations.

One such investigation studied the effect of particle size distribution on the aggregation properties of soil.

Plant nutrition studies include the evaluation of soil tests for copper and zinc, a survey of the potassium and phosphorus status of pasture soils of the Gympie district and a study of the plant nutrient requirements and interactions of soybeans.

Soil surveys carried out by Brisbane-based staff included areas in the Bundaberg and Maryborough districts. A soil survey was also undertaken as part of the Brisbane Airport Development Environmental study.

The Tobacco Laboratory at Northgate handled soil analyses for Departmental experiments and for growers. As in previous years, all grower samples were obtained by extension officers and thus a more useful interpretation of soil tests can be made. The main plant analytical work was for Departmental experiments. Many of the leaf samples were analysed for alkaloids in studies on the effect of chemical desuckering agents.

Following the previous detailed soil survey of the Brigalow Research Station, a number of representative type profiles were sampled and analysed. Additional surface samples were obtained for laboratory and glasshouse assessment of soil fertility.

A Biloela officer with previous experience in the area has participated in a programme of soil survey and soil fertility assessment for the Normanton-Croydon area of north-west Queensland. The soils are various sandy gradational earths and podzolics, of low fertility. In pot nutrient studies, plant responses were obtained from P, S, K, Zn, lime, Mo and Cu.

In the Emerald Irrigation area, the major part of the detailed mapping of the left bank soils was completed in the previous year. The majority of these soils are cracking clay soils derived from basalt, and local cobble and stone is a problem in some areas. Distribution of stone was delineated and average stone tonnage per acre calculated. For farm design purposes, it is considered at present that up to 50 tons per acre can be removed economically.

The major resources of the Biloela group were associated with Emerald staff in a study of various factors which may be used to assess the suitability of soils for irrigation.

Data were obtained from small irrigation bays at 10 sites on cracking clay soils. Fodder sorghum was grown and irrigated every 14 days. Soil and plant water parameters were measured over a 10-week period, and meteorological data collected.

At Millaroo, studies continued on the nitrogen status of flood plain soils under various cropping regimes. There was satisfactory release of mineral nitrogen under anaerobic conditions where rice was grown on virgin soil or previous pangola areas. The active decomposition of the high amount of organic matter in the later situation resulted in low soil redox potentials but this appeared to have no adverse effects on the rice. Soil nitrogen levels were lower in soils previously cropped to rice.

Soils from areas of pangola grass fertilized with high rates of sulphate of ammonia are strongly acid in surface horizons and show low nitrate nitrogen and high ammonia levels.

Losses of applied nitrogen in irrigation water runoff from pasture areas are considerable in many instances.

The various soil improvement field experiments were sown to maize in the 1972 dry season. Plots deep-ripped in 1967 showed higher yield than those not ripped. In the gypsum rate area, there was no response to previous gypsum for maize immediately following rice.

Previous work at South Johnstone showed the establishment fertilizer requirements for pastures on a number of different soil-vegetation associations and work is now directed more towards determining maintenance fertilizer requirements.

In a field experiment, the residual value of Christmas Island rock phosphate on a poor alluvial soil is becoming apparent after four years in a guinea grass trial.

A routine analytical service is now provided for other sections at the Queensland Wheat Research Institute.

The nutrient screening programme for Queensland cereal soils was continued in association with Agricultural Branch. To date, glass-house and laboratory data have been obtained for 70 soils.



The main soil chemistry studies were on the movement and residual value of zinc and the assessment of soil tests for copper and zinc.

For a field experiment on a Waco Black Earth, most of the applied zinc remained in the top 7.5 cm of soil and fixation of fertilizer zinc does not appear to be a significant problem.

The number of samples received during the year were:

General Analytical Section . . . . .	16 000
Plant Nutrition Section (Soils) . . . . .	8 000
Waters . . . . .	700

Each sample in general has more than one determination made on it so that the number of analyses performed is considerably greater than these figures show.

In addition, comments on the suitability of waters for irrigation and stock were made on 3 600 samples analysed by the Government Chemical Laboratory for the Irrigation and Water Supply Commission.

During the year the insect identification service of Entomology Branch identified approximately 2 500 insect specimens for field staff, other branches, quarantine authorities, farmers and members of the public. Among the many identifications of value to the State some of the more important were of insects in timber intercepted by Plant Quarantine. These included a species of *Cryptotermes* from Brazil which was intercepted on several occasions and also a number of Bostrychid borers from south-east Asia.

Contact with specialists overseas and in other Australian States was maintained through the exchange of insect material for taxonomic study.

Extensive taxonomic studies have enabled the description of 162 species of fruit flies from the South Pacific region, thereby providing a sound basis for decisions on quarantine matters involving these pests. Specimens of the Queensland fruit fly *Dacus tryoni* (Frogg.) have been identified from Papua, New Caledonia, Tahiti and Easter Island. The melon fly, *Dacus cucurbitae* Coq. of Asian origin was identified from Papua, New Guinea, New Britain, New Ireland, Lihir Island and Bougainville Island. It is a serious pest of cucurbits and other commercial hosts elsewhere, and would be a destructive insect should it become established in Australia.

Taxonomic research on insects with potential value as biological control agents continued with attention being directed to the wasp family, Scelionidae, and also to specimens of micro-hymenopterous insects collected from heads of *Sorghum* sp. in north Queensland.

The taxonomic work carried out by Botany Branch brought to a conclusion a detailed study of one group of *Solanum*, and considerable progress was made in the revisions of *Acacia* and *Polycarpaea*. Dr. Blake had, at the time of his death, completed manuscripts on the taxonomy of grasses, the revision of the Australian species of the grass genera *Cymbopogon* and *Schizachyrium* and the description of a new genus and species of a timber tree, *Allosyncarpia ternata* (Myrtaceae).

The production of labels and the coding of data continued and 6 693 entries were forwarded to the Treasury E.D.P. Centre during the year, and 14 703 specimens were processed and incorporated in the herbarium.

The Police Department made very heavy, time-consuming demands on the Branch mainly for the identification of *Cannabis sativa* material and for consequent court appearances. Sixty-three court cases were attended, mostly in and near Brisbane.

Work continued on Lantana, being financed by the Commonwealth Science and Industry Endowment Fund, and material on the *Lantana* complex in Eastern Australia is currently being prepared for publication.

The Executive Committee of the Flora of Australia project put into operation the plan to prepare a check list of Australian plant names as a preliminary to the preparation of a Flora of Australia. Work has already commenced, under the auspices of the Australian Academy of Science.

Approximately 10 000 specimens received from outside Botany Branch were dealt with during the year. It was possible, because of the appointment of additional staff, to reduce the backlog, reported last year, to approximately 430 specimens. Identification of specimens associated with research projects amounted to approximately 4,000 but there are older collections still requiring attention.

Samples of stomach contents examined for the suspected presence of poisonous plant material numbered 136, an increase on the previous year. Sixty-three samples were submitted by the police and involved 46 hours of laboratory work and 228 hours spent in attending court.

Nine named species of plants not previously recorded as growing in Queensland were received for identification and are worthy of note. Five are known from other States, three

are probably new records for Australia and one is a cultivated ornamental, introduced from South America, and now recorded as being naturalized in Queensland. The nine newly recorded are:

*Cyperus eragrostis* (Cyperaceae), collected from Upper Mt. Gravatt, Brisbane. It is a native species, previously recorded from Victoria to the northern New South Wales coast.

*Paratephrosia lanata* (Leguminosae), collected from the Gunpowder-Quamby road. A common native plant in the Northern Territory.

*Goodenia ramelii* (Goodeniaceae) collected from the Gunpowder-Quamby road. Common in the Northern Territory.

*Prasophyllum trifidum* (Orchidaceae), collected from the Pine Ridge Reserve, Southport. A native species previously known from Sydney to Port Macquarie.

*Ruellia graecizans* (Acanthaceae), collected from near Nambour and reported as a weed in kikuyu pasture. This is the first record of this South American plant, known previously only from gardens, as being naturalised in Queensland.

*Porana sericea* (Convolvulaceae), collected from the Cunnamulla area. Recorded from Western Australia but not previously known from Queensland.

*Lepidopetalum* sp. (Sapindaceae), collected from Murray Island in the Torres Strait. A new record for Queensland and, probably, for Australia.

*Kaempferia* sp. (Zingiberaceae), collected from Murray Island. A new record for Queensland and, probably, Australia.

*Margaritaria* sp. (Euphorbiaceae), collected from the Mayvale Land System (Burke District, about 25 km SSE of Normanton and 48 km SE of Normanton) is a new record for Queensland and, possibly, Australia. This tropical genus of 10 to 12 species is related to *Phyllanthus*.

Mr. Andrews has assumed full responsibility for producing a handbook to the ferns of Queensland.

Mr. Pedley's work on *Acacia* progressed well, though little work on this project has been able to be done in the last quarter of the year. Concurrently with the preparation of these papers, work has proceeded with a major taxonomic work, "A revision of *Acacia* in Queensland". An investigation of the taxonomy of *Polycarpaea* (Caryophyllaceae) is almost complete. It appears that changes in nomenclature are inevitable and that there are two undescribed species. Some preliminary work on the taxonomy of *Trepshrosia* was done, but this genus presents considerable difficulties which will probably not be solved without further collecting in northern Australia.

During the year 14 703 specimens were prepared and incorporated in the herbarium. Officers prepared 136 rumen samples, mostly from the Animal Research Institute at Yeerongpilly.

Diagnostic services of the Biochemical Laboratory available to the Division of Animal Industry, to Dairy Cattle Husbandry and to Fauna and Fisheries continued the yearly increase of about 5%. In the total of 13 762, however, the 5 884 diagnostic analyses, 2 996 dipping vat analyses and 4 732 service analyses to Departmental trials reflect a trend away from servicing trials. This in turn reflects increased use of the dipping vat analysis service due to the decreased stability and the use of mixtures of new acaricidal chemicals. A further factor in this trend is the broadening of service responsibility and the increasing complexities of services demanded. Against a background of fixed resources this has caused a reduction in internal servicing.

#### AGRICULTURAL ENGINEERING

With the retirement of the Agricultural Engineer in Brisbane, essential services are at present being provided from the Branch's engineering group at Toowoomba, where there are three engineers.

The move to the new workshop at Toowoomba means that good facilities are now available for the construction, modification and testing of equipment. The improved facilities will make a difference not only to the amount of work done but also to the type of work undertaken.

Projects undertaken during the year included design and construction of: (1) a seed scarifier for pasture seeds, (2) a friction drive disc cutter for navy beans, (3) a prototype automatic grain sampler for the bulk grain terminal at Pinkenba, (4) a precision seeder for horticultural crops, (5) a press wheel seed drill, (6) a Siratro seed cleaner, and construction of a press wheel for 3-point linkage mounting. In addition, an examination of peanut harvesting efficiency and of tobacco mechanisation needs was undertaken. A seed "drought hardening" pilot plant and an experimental seed and fertilizer drill for field trials are also being planned.



## IX. Agricultural Standards

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

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

### AGRICULTURAL CHEMICAL CONTROL

Four meetings of the Agricultural Chemicals Distribution Control Board were held during the year and 75 notifications of complaint on damage or injury were received, of which four were withdrawn or cancelled.

Noteworthy among the 75 complaints were 30 notifications in August, 1972, from 29 small crop growers within the general area of Deception Bay. Most of these were lodged in respect of alleged damage to horticultural crops, especially tomatoes, bananas, strawberries, pumpkins and pineapples, while six notifications were received from beekeepers in this area. Residues of 2,4-D and/or 2,4,5-T were found in samples taken on 17 of these 35 properties, and suspected causal agencies included aerial spraying of phenoxyacetate herbicides onto groundsel bush and other woody weeds in nearby pine forests, and similar ground spraying activities by a commercial weed control operator, the local authority, and a private landowner. It is doubtful whether all cases of alleged damage could be ascribed to the distribution of weedkillers; other factors such as frost, insects and nematodes probably also contributed in some instances.

In late November, 1972, there were eight notifications from property owners in the Cecil Plains district, in respect of damage incurred by some 3 000 acres of young cotton. Four agricultural pilots were known to have applied amine 2,4-D to broadleaf weeds in sorghum in the district at that time. However, the widespread distribution of affected plants, and the uniform pattern of symptoms of abnormal growth were considered to be more consistent with the effects of exposure to vapours of volatile ester formulations.

The experimental plot at Redland Bay was expanded by further plantings of indicator crops, and a small green house was constructed for use where confinement of spray material is essential. The reference library of colour transparencies was augmented by a number of paired photographs, which were taken by cameras mounted side-by-side in an aircraft flying low over areas of groundsel bush, pine forests, and small crop farms in the Deception Bay district. Natural colour and infra red films were used to help reveal the effects of herbicide spraying.

A modest project aimed at finding a solution to the spray drift problem was initiated in conjunction with the Biological Section of the Lands Department and a member of the Queensland agricultural aviation industry. Greatest interest at present centres in the addition of an inert polymer in the spray solution, as well as the use of certain nozzles, whereby the formation of small droplets is markedly reduced.

Licences were issued or applied for as follows:—95 unrestricted commercial operators licences issued; 123 restricted commercial operators licences issued; 799 commercial operators licences renewed; 10 pilot chemical rating licences issued; 29 pilot chemical rating licences renewed; 88 candidates examined for commercial operators licences; 6 pilots examined for chemical rating licences.

Applications for registration or reregistration totalling 4 320 were received, chiefly in respect of pest destroyers (1 396), stock foods (1 310), and veterinary medicines (928), which together comprised approximately five-sixths of the total number of agricultural registrations submitted. In some areas it has been suggested that the recent increase in annual registration fee to \$5 per preparation could be responsible for the drop of 89 in the total number of applications from the 1971-72 figure of 4 403 (which was in turn a reduction of 733 below the record figure of 5 142 established in 1970-71).

Noteworthy this year is the discontinuation of cereal seed protectants based on mercury, and the substitution of mancozeb in this context.

Applications for the registration of pest destroyers with label directions expressed in metric terms are now being received, and it is expected that most firms will have effected appropriate changes in their labels by late 1973 or early 1974.

### DAIRY PRODUCTS

During the year, 187 178 analyses were performed by Dairy Research Branch on 67 414 samples of milk, cream and manufactured dairy products to provide information to farmers, factory managers and Departmental personnel to enable them to monitor product quality and correct defects as they arose.

Results obtained at all five laboratories indicate that milk quality has improved to the position where the methylene blue test and the thermoduric test are no longer suitable for assessing raw milk quality, as over 95% of the samples analysed complied with both advisory standards. However, only 50% of raw milks tested at the Otto Madsen Dairy Research Laboratory at Hamilton contained total counts of less than 50 000 organisms per ml, whereas at Murgon and Malanda where total counts have been used to assess milk quality for some years, approximately 80% of all milks contained fewer than 50 000 organisms per ml, and at Murgon, 81% of all raw milk samples tested contained less than 30 000 organisms per ml. High quality raw milks regularly contain less than 10 000 bacterial colonies per ml on delivery to a processing factory. It is therefore time to change to a total plate count of 50 000 colonies per ml as the advisory standard for raw milk.

Incidence of milks containing antibiotic residues is low at 1.5%.

Pasteurised milk and cream samples tested include those products produced and sold in Queensland as well as those from interstate. The range examined includes whole, fat-reduced, skim and flavoured milks, creams including those thickened with gelatine, and frozen novelties. The Brisbane laboratory also regularly analyses samples airfreighted from Tanubada, New Guinea.

In general, total plate counts comply with advisory standards in most instances, but coliform contamination, indicative of inadequate post-pasteurisation factory hygiene, occurs too frequently, particularly in flavoured milks and creams. The Major U.H.T. Cream Treatment Plant at the Malanda factory consistently produces commercially sterile cream. Until recently, post-pasteurisation contamination of this cream frequently occurred when it was being filled into cans for transporting. This has now been eliminated by packaging cream with adequate hygiene control prior to transport.

Microbiological quality of cultured milks is checked at Toowoomba and Brisbane. Quality of all products, particularly yoghurt, is only fair, as only one factory (a Queensland one) consistently produces a product which conforms to our bacteriological advisory standards. Other Queensland and all interstate brands frequently do not comply with advisory standards.

During 1972-73, 102 milk powders were analysed for export to Asia, and N.A.T.A. certificates issued. Only 8 samples (7.8%) failed to meet bacteriological standards.





**Four-row planter and fertilizer-cultivator combination used for planting navy beans and other row crops, and also for inter-row cultivation.**

From time to time, samples of casein have been examined for advisory purposes only. N.A.T.A. certificates have not been requested.

Butters imported from New South Wales were of a slightly better bacteriological quality than those made in Queensland. (Average B.Q.I. for New South Wales was 460 as compared with 406 for Queensland.) Bacteriological quality of pat butters was the same as for 1971-72. A number of bacteriological surveys have been carried out at the request of the general manager of the Queensland Butter Board to detect sources of plant contamination.

During the year, 75 N.A.T.A. certificates were issued certifying the bacteriological quality of "Junex" and "Meletone" and the materials used in their manufacture.

Three hundred and twenty-three export cheese samples were analysed from the two Queensland factories which have continued to export cheese to Japan. One factory produced cheese which frequently contained *E. coli* Type I, and the source of contamination was traced.

Because the cheese hygiene improvement service was no longer accepted as an effective method of upgrading cheese factory hygiene, we now regularly sample and analyse cheddar cheese manufactured at Queensland cheese factories for the local market. The level of coliform contamination in the cheese is taken as an indicator of factory hygiene, and the results obtained for each factory over a number of sampling occasions is taken as an indication of the relative needs for trouble-shooting surveys. Cheese is now being sampled in Brisbane at the point of grading, and officers of the Toowoomba laboratory are sampling cheese at the factory of origin.

In view of the relatively small volume of non-cheddar cheese, an attempt is being made to sample each variety manufactured at each Queensland cheese factory once every six months. In view of the elevated salt content of these types of cheese, the absence of coliforms was not unexpected.

Cheese starters, either freeze dried or in liquid medium, are distributed to the industry as required.

A total of 784 samples of milk, cream and butter were analysed for DDT and metabolites of which some were analysed in detail for dieldrin, HCB and lindane. These samples were from Booval, Boonah, Cooroy, Chinchilla, Gympie, Kenilworth, Millaa Millaa, Quinalow, and Brisbane (pasteurised milk).

### SEEDS

During the year, 13 387 seed samples were tested. The number of samples handled at the new laboratory in Toowoomba was 721.

In the production of certified seed, hybrid maize production was higher than it has been for several seasons. In south-east Queensland, following a request from the New South Wales Department of Agriculture (on the occurrence of *Helminthosporium maydis* in maize hybrids bred on the male sterile Texas cytoplasm), it was agreed to brand bags

according to the type of parent seed used in their breeding. Fortunately stocks of normal cytoplasm seed were sufficient to produce most of the popular hybrids and so maintain supplies for industry.

Production of certified sorghum seed also increased, although there were complaints relative to the genetic purity of the seed. Production of forage varieties was not attempted by growers this season, as large amounts of carry-over seed are still held on merchants' premises. Growing-on trials of all certified sorghums are planned for future seasons in the hope that the quality of certified sorghum seed can be upgraded to meet the competition of increasing quantities of uncertified seed.

Production of tomato seed also rose, and an additional variety named Strobelee was added to the varieties being grown for the production of certified seed.

The figures for pasture varieties improved, mainly due to the increased production of both Lawson Townsville stylo and Narok Setaria. An amount of 105 kg of Oxley fine stem stylo was produced during the 1971-72 season, this being the first seed of the variety to be certified. The pasture variety Cook stylo is expected to produce seed in the coming season, some 36 ha having been planted on the Atherton Tableland.

Although there was a small drop in seed production of green bean seed, it is quite apparent that this is an expanding part of the seed industry. Stringless beans for processing form the largest portion of the production, and new varieties are being added each season.

The admission of the navy beans to the Seed Certification Scheme, and the establishment of a pilot scheme for navy beans to ascertain the desirability of planting disease-free pure seed, at the same time advancing toward the eventual certification of navy beans, has been approved by the Seed Certification Committee.

Oat seed once again has met with no success in the certification scheme, and discussions are current regarding the formation of an Approved Oat Seed Scheme with the aim of producing seed which, although not certified, would be of high quality.

A new grain terminal commenced operations in Brisbane, and will provide an additional outlet for export grains.

The quality of seed intended for sowing and offered for sale was again criticised by inspectors, with insect infestation the major problem, and poor store hygiene suspected as the main causal factor. With the trend to minimal stockholding by small merchants, larger wholesalers are now becoming the subject of more intensive inspections.

Twenty-one seed research projects were current, and, as usual, the more commonly referred problems involved irregular or recalcitrant behaviour in the germination of seeds of some useful additions to the ever-widening list of commercial plant varieties. Phytotoxicity and stability of some newer commercial seed protectants, discoloration of white navy bean seeds by red soil, and varietal identification in seedling oats were some of the unusual studies.

On behalf of the International Seed Testing Association three types of referee tests were conducted, as well as a series of tests to be used in the Copenhagen workshop. From this latter study there comes the suggestion that insufficient attention is paid in Queensland to the recognition of abnormal seedlings in general. The results obtained with samples of *Phaseolus vulgaris*, a major local crop, were disquietening in this particular series of tests.

### EXPORT INSPECTIONS

In the past year, 348 049 packages of fruit and vegetables were inspected prior to export, compared with 525 162 packages in the previous year.

Consignments of plant material exported from Queensland (for which Standards Branch assumed responsibility from January 1, 1973) numbered 47.

There was a decrease from 58 002 to 41 673 in the number of packages of citrus fumigated with EDB prior to interstate consignment.

### FARM PRODUCE AGENTS

There are 60 farm produce agents licensed in Queensland, made up of 47 in the Brisbane metropolitan area, and 13 situated in six different country localities throughout Queensland. Inspections carried out under "The Farm Produce Agents Act of 1964" showed that agents generally met their obligations in the operation of trust accounts, including preparation and audit of books of accounts, as well as possession of adequate fidelity bonds.

The affairs of one agent who defaulted in December, 1970, are still in the hands of the Receiver.



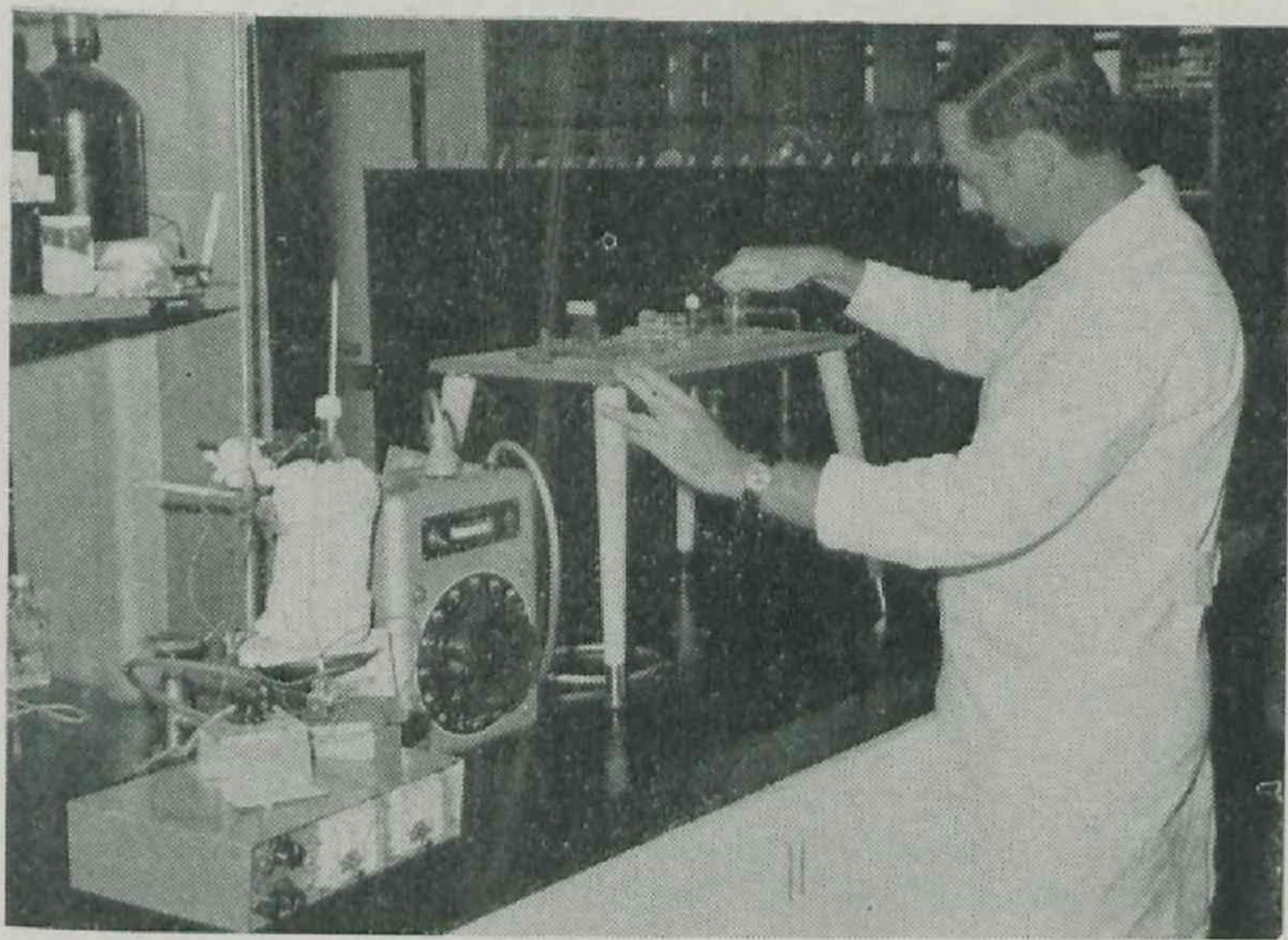
## X. Fisheries

Research, extension and regulatory matters concerning fisheries and marine life are handled by the Fisheries Branch, which has the support of various Departmental laboratories. The Branch conducts fisheries research jointly with C.S.I.R.O. at the Fisheries Research Laboratory at Deception Bay. The major projects at that centre are a study of the king prawn fishery of south-eastern Queensland in association with C.S.I.R.O. and a wetlands survey as part of the investigations connected with the extension of the Brisbane Airport. The Branch operates a small laboratory at Mourilyan Harbour.

### FISHERIES RESEARCH

In addition to a continuation of the Branch's research into parasitic and disease outbreaks in southern Queensland oysters, an investigation was commenced on the epizootic affecting a wide variety of estuarine fishes in south-eastern Queensland.

The Biochemical Laboratory investigated a number of methods for detection of kerosene-tainted mullet, based on the changed fat content of the affected fish. The Torry Freshness Meter, loaned by C.S.I.R.O., showed initial promise but its readings were affected too much by other factors in the fish. Useful information was obtained, however, relating to the effects of handling on the retention of the quality of mullet when stored.



An experimental taint-detector being developed at the Animal Research Institute. This work is financially supported by the Fish Board.

The evaluation of a buoyancy test continued in conjunction with work on the Carle Thermal Analyser unit. An ultrasonic method of detecting the changed fat content of the fish proved unsuccessful.

Staff of the Biochemical Laboratory and the Fisheries Branch collaborated in a concentrated fish tagging programme during April and May. Three thousand eight hundred mullet were caught, tagged and individually sampled near Luggage

Point during the six-week period preceding the annual northward spawning migration of the mullet. Fish and tags returned should provide information on the possible source of tainted mullet caught north of Brisbane and on the general migratory behaviour of the sea mullet.

Initially, 80 untainted mullet were transferred from the Southport area to the Brisbane River at the Luggage Point Sewerage outfall. The individual fish were tagged and before release a sample of muscle taken and stored for later analysis. It was hoped that some of the fish when recaptured would show whether taint could be acquired in the Luggage Point region. None of these fish were recaptured during the extensive tagging undertaken during April and May.

Work continued during the year on the fish spoilage project. This research was supported by a grant of \$8 900 from the Australian Fishing Industry Research Trust account.

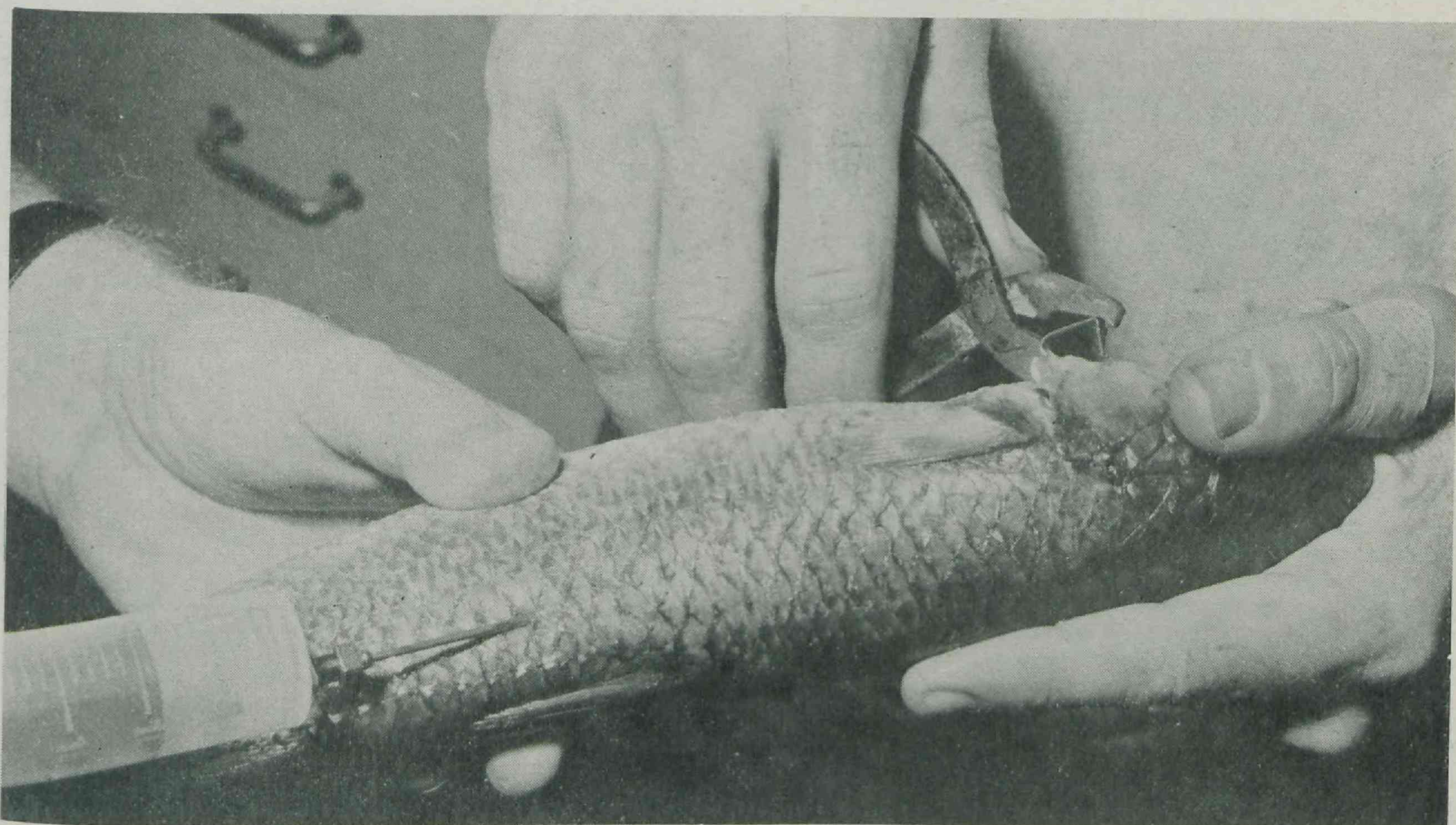
Bacteria capable of producing "off" odours on fish stored at low temperatures have been isolated and identified. Current work involves identification of the chemical compounds associated with these "off" odours. Because of the differences in spoilage patterns between species, an investigation of the free amino acid content of fish muscle was commenced.

Assessment of bacteriological counts commenced using fish samples regularly collected at the Fish Market. It is intended to extend these assessments to other sectors of the fish industry as a service to industry.

### CROWN-OF-THORNS STARFISH

The crown-of-thorns starfish research team based at Mourilyan Harbour continued its work on monitoring the occurrence of starfish aggregations in the region between Townsville and the Whitsunday Islands, and its studies of coral recolonisation and regrowth on previously attacked reefs between Cairns and Townsville. Results from these programmes were presented at seminars in Brisbane and Guam and at the Second International Symposium on Coral Reefs held recently at sea in Great Barrier Reef waters. Recolonisation of coral on reefs affected by starfish is encouraging.

Field trials on the feasibility of using perforated plastic tubing containing a copper-sulphate-unigel mixture as a barrier to starfish movements were carried out on selected reefs off Bowen late in 1972. Although the tubing used acted as a deterrent to the passage of starfish, it proved unsatisfactory for large-scale application under the conditions encountered on the offshore reefs.



More than 3 500 captured mullet have been gill tagged and muscle biopsied before release during an investigation of kerosene taint.



# XI. Review of the Primary Industries in 1972-73

## BEEF AND VEAL

Seasonal conditions in the beef producing districts during the year varied from area to area, but, in general, were satisfactory. Areas such as the south-west, north-west and Bowen-Mackay area experienced dry conditions during the first half of the year with stock in backward condition and some losses reported. However, during January and February, widespread rains occurred and at the beginning of March nearly all stock were in fair to excellent condition. Towards the end of the year, dry conditions began to reappear but abundant feed supplies were available and stock generally were in good condition.

Store cattle prices were maintained at high levels throughout the year with keen demand and limited supplies of stock. The fat cattle market was similarly strong with stock reaching record price levels during the latter half of the year following keen local and export competition.

Queensland's beef cattle population stood at 9.180 m at March, 1973, compared with 8.375 m in March, 1972. Slaughterings during 1972-73 showed a large increase of 16.9% compared with 1971-72, while production during 1972-73 demonstrated a similar large increase of 11.14% compared with 1971-72.

Domestic consumption of beef in Australia remained relatively static in 1972-73. However, it became apparent during the year that there was a general world-wide shortage of red meat, and Queensland's beef and veal were keenly sought by overseas buyers. This resulted in Queensland's exports in 1972-73 being 24.3% greater than in 1971-72.

The United States continued as the major market for Queensland and Australian beef with large increases in imports following the suspension of meat import quotas in June, 1972. The quotas were suspended by the U.S. administration in an attempt to contain spiralling domestic meat prices. Exports in 1972-73 from Australia to the United States increased by 17.5% compared with 1971-72.

Further large increases in exports to the Japanese market were recorded with significant increases in exports of chilled beef. Exports to the United Kingdom and the E.E.C. in general also showed large increases following the easing of import restrictions by these countries as it became apparent that there was a general meat shortage in Europe.

The trend towards road transportation of stock continued to the extent that it virtually replaced hoof movements.

## WOOL

At the end of the financial year, the overall pastoral situation in the sheep country in Queensland was good; plentiful general rainfall was experienced in February. Few, if any, store sheep were available for sale, and a good lambing is essential for restocking purposes. Winter feed supplies in most districts were assured but rain was required to relieve drought conditions south-east of Cunnamulla, and to maintain winter pastures in south-east Queensland.

The 1972-73 wool-selling season resulted in a level of prices not seen since the high level of 1950-51. The reasons for the turnaround stem from the complex interaction of a general fashion swing towards natural fibres, favourable reaction to the general reversal of the world textile industry slowdown, a rundown of world wool stocks, and lower world production.

Japanese domination of the buying market and strong European support maintained prices at a high level. Japanese buying did slacken off temporarily in early April resulting in the Australian Wool Corporation stepping in to prop up the falling market.

The gross value of wool production in Queensland is estimated at \$122 470 000 in 1972-73 compared with \$55 426 400 in 1971-72 which included a deficiency payment of \$3 524 000. Subsidy assistance was unnecessary in 1972-73.

The Australian Wool Corporation, an amalgamation of the former Australian Wool Board and the Australian Wool Commission, commenced operations on January 1, 1973. It is charged with the responsibility of formulating a wool marketing plan designed to alleviate the large price fluctuations which the wool industry has experienced in recent years.

It is unfortunate that there is a shortage of experienced labour in the industry and that no new, long-acting blowfly insecticide has become available. Under these circumstances

the need to obtain long-term protection from the long advocated mules operation for protection of Merinos against blowfly strike becomes imperative. For this reason it is fitting that an increasing number of lambs are being "mulesed" at marking. Under existing conditions increasing use of this operation at marking must be made.

The industry's reaping of the harvest, shearing, is under close study. As few young men are learning shearing, difficulties in obtaining sufficient shearers to harvest the wool may well face the industry within the next decade. No immediate solution to the problem is available.

Under the combined influence of droughts and low wool prices, the State's sheep numbers have shown a general decline during the last decade. The preliminary estimate for sheep at March this year shows that numbers have fallen to about 13.5 million, the lowest for 67 years. Under the influence of rising prices for wool, sheep numbers will undoubtedly increase.

After the dramatic improvement in the price of raw wool during the past year it would appear that the industry can be guardedly confident that, unless costs rise drastically, it can regain its economic stability and look forward with some confidence for at least a limited period of time.

## PIGS

The Queensland pig industry experienced mixed fortunes during 1972-73. A situation of over-supply applied for a large part of the year with prices being depressed during the first six months around 26c per lb for prime grade pigs "on consignment". Combined with the low prices for pigs, a difficult situation also developed with respect to feedstuffs during this period. A shortage of high quality protein feedstuffs occurred and inputs such as fishmeal, meat and bone meal, soybean and feed grains were either unprocurable or were available only at very high prices. The situation eased during the latter half of the year with prices steadily rising to around 32c per lb for prime grade pigs by June. Although availability and costs of most feeds still remained the major problem in the industry, the position had eased slightly during the second six months.

The depressed prices for pigmeat and rising input costs during the year placed further economic pressure on smaller or less efficient piggeries and side-line units, continuing the trend of recent years for producers to become more intensive or be forced from the industry.

The large supply of pigs caused slaughterings to reach a record level of 951 000 pigs during the year, an increase of 19.8% over 1971-72. Production of pigmeat increased similarly with a rise of 19.6% over 1971-72.

The oversupply situation on the local market was relieved to some extent by the rapid escalation of the export market. Exports of pigmeat, mostly to Japan, increased from 1 368 tons in 1971-72 to 4 321 tons in 1972-73.

Pig population continued to increase slowly and reached a total of 550 000 at March 31. However, there has been a steady flow of culled breeding stock to slaughterhouses since then at levels above the average numbers. The true production position is somewhat obscured by the continued importation of pigs from north-western New South Wales for slaughter at Queensland factories; it is anticipated that for the full year the net import of pigs will approximate 90 000.

The small wheat and barley crops from the 1972 harvests and subsequent steep rises in world prices of feed grains resulted in substantial increases in local grain prices. Similarly world supply conditions resulted in an almost complete cessation of imports of fish and soybean meals.

Synthetic lysine, which has been in increasing demand, also increased in price and the supply position deteriorated; it appears doubtful if this position will alter.

Local sources of protein were at a considerable premium toward the end of the year. Meatworks by-products almost doubled in price despite some restrictions on exports. The record soybean crop, estimated at 38 000 tonnes, must have been a favourable influence but supplies of the meal have been difficult to obtain, and large quantities appear to have



moved to southern markets at higher prices. Other oil seed products have been obtainable in limited quantities but quality does not compare with that of soybean meal.

Many producers were forced to cease mixing their own feeds under these conditions; consequently, demand for ready mixed feeds and protein concentrates rose, in spite of an appreciable increase in their costs over the year, and some adverse comments from producers regarding quality.

The unfavourable ratio of feed prices:pig prices gave rise to a cautious approach to any plans for increasing production by extending unit size. The general trend was to maintain net income by improving management practices, general efficiency, and quality of pigs marketed. Some units increased sow numbers, which tended to balance losses of breeding stock through closure of small or uneconomic units.

The Queensland Pig Industry Producers' Association continued to increase in strength and a total of 18 branches now operate. Through the Federal body, and by representations on the Australian Pig Industry Research Committee, the organisation has reached an influential position, but increased liaison and co-operation between producers, processors, butchers and consumers is seen as being very necessary.

### EGGS AND POULTRY

For the first time in 10 years, egg production in Australia in 1972-73 fell below the previous year. Total commercial production in 1972-73 was recorded at 198.3 m. doz and was 5.1% below the level of 1971-72.

Commercial egg production in Queensland has shown a tendency over the past six years to fluctuate, and diverge from the national trend. Queensland was the only State in which production increased in 1972-73. In south Queensland, the major production area of the State, an increase of 5% in commercial production for the first 44 weeks of 1972-73 was recorded in comparison with the corresponding period of 1971-72.

Although the export price for eggs and egg products remains uneconomic for producers, the position was improved by large clearances of accumulated cold store stock with consequential savings in refrigeration storage costs. A minimum import price policy effectively discourages exports of pulp to the U.K. Japan is expected to become increasingly self-sufficient and current exports to that country also face strong competition from other sources, particularly from China. In the absence of alternative prospective markets, exports of eggs and egg products are unlikely to improve.

The decrease in Australian commercial egg production and in stocks contributed to a general improvement in returns to growers.

Significant progress was made during the year towards the introduction of a Demand/Supply Management Scheme on a national basis. The primary objective of the legislation is to stabilise the industry by containing egg production within payable limits, and to provide efficient growers with a greater degree of economic security. The proclamation of the legislation is subject to its acceptance by a majority of growers at a poll on the question. By agreement the number of hens held in Queensland will not exceed 1.9 m. in the first year.

Availability and price of certain stockfeeds posed problems for both the egg and chicken meat industries. The year was one of high and increasing feed costs, with little relief, except towards the end of the year, from price increases in eggs on the local market.

The trend to fewer but larger farms continued, but it is felt that the introduction of quotas and improved egg prices may slow down the rate of decline in farm numbers.

Broiler production continued to increase at a steady rate during the year under review and is estimated to be up by about 9% on the previous year's figure.

A most important development was the sharp deterioration in relations between contract growers and processors. Formation of State and Federal Broiler Growers' Associations and approaches to State and Federal Governments by growers seeking legislative control of contract growing conditions were the result of the general dissatisfaction existing.

Day-old chicken production showed a trend to reduced hatchings of layer type chickens. It is estimated that these are down by about 16% on the previous year, and indicate that a decline in egg production can be expected in the coming year.

### DAIRY PRODUCTS

The Queensland dairying industry continued its gradual decline with an increasing number of dairy farmers switching to a wholemilk economy, veal production and other farm enterprises coupled with an amalgamation of holdings.

Butter production in 1972-73 declined to an all-time low of 15 500 tons, a decrease of 2 416 tons on the previous record low in 1971-72.

For the fourth successive year, Queensland imported butter supplies from southern States to satisfy local requirements and sundry market commitments; boxes were shipped from Victoria and/or northern New South Wales in 1972-73.

Cheese production in 1972-73 was 8 423 tons. This exceeds the 1971-72 level of 7 931 tons, but does not match the 1966-67-68 record production levels.

Average net returns to producers of butter in 1972-73 will be lower than in 1971-72. Payments for 1972-73 for butter and cheese will approximate \$46.85 per cwt and \$34.25 per cwt. respectively, including bounty in comparison with \$51.55 per cwt. and \$35.27 per cwt. in 1971-72. Export earnings have fallen below the levels of the previous year following a weakening in the international prices of butter and skim-milk powder. On the local market, butter prices remained unchanged but there were improvements in cheese prices.

Japan replaced the United Kingdom as our major cheese market, while South-east Asian countries assumed greater importance for butter in the form of butteroil since the U.K. joined the European Common Market. Because of Queensland production shortages and a seasonal fall in productions in Victoria early in 1973, difficulty was experienced in maintaining supplies of butteroil to south-east Asian markets.

A committee set up by the Australian Agricultural Council to examine the basis of payment for milk for manufacture recommended that the method of payment be changed from the present butterfat only basis to one where payment is made up of two components, one for the weight of fat and one for the weight of protein.

Under this new basis, it is hoped that cream producers, who at present supply cream to factories which accept both wholemilk and cream, will be encouraged to convert to supplying wholemilk only.

The industry in general is undergoing structural adjustment under the Commonwealth/States Marginal Dairy Farms Reconstruction Scheme. In addition, \$5.5 million in loans have been provided by the Queensland Government to assist in the establishment of economically viable units.

During the winter months of 1973 difficulty was experienced in several provincial cities with continuity of local supply and it was necessary to bring in additional quantities to maintain minimum volumes. This situation is a cause for concern.

It is predicted that there will be continuing expansion in the supply of "milk only" to processing plants in the future thus allowing greater flexibility in manufacturing operations.

The processing plants of Esk, Gayndah and Goombungee ceased manufacture with local supplies being diverted to neighbouring factories. Amalgamation decisions were entered into by a number of dairy associations. It is anticipated further closure of butter producing plants will occur in the next year as a consequence of reducing returns and closure of marginal dairy farms. Preparations for the manufacture of acid casein in Monto were completed and an expansion in calf starter production undertaken at Toowoomba and Warwick centres.

The expenditure on buildings and equipment by the industry to maintain standards in line with modern practice and market a variety of dairy products amounted to \$2 050 000 with 91% being allocated to market milk and milk products enterprises.

The number of dairy farmers supervised by field officers during the year fell from 7 560 to 6 600 which represents a decline of 12%. There was a corresponding decrease in the numbers consigning only cream, these now being reduced to 2 800.

With the reducing population of dairy farmers serious problems are occurring in orderly and regular collection from farms thus burdening producers with increasing transport expenditure.

### HONEY

The economic position of the honey industry in Queensland is excellent. Honey prices, both domestic and overseas are outstanding, having reached an all time high. Consumer demand is well above normal and exceeds supply. Production of honey has been slightly below average owing to irregular flowering of major nectar-secreting floras. The blooming prospects of these species for the next year have been affected adversely by the dry winter.

### SUGAR

Queensland produced 2.67 m. tons of 94 n.t. sugar in 1972, exceeding last year's record by 1.7%. Cane harvested for milling totalled 17.8 m. tons which was slightly lower than in the previous season but the c.c.s. content was higher.

Australia exported 2.17 m. tons of sugar in 1972, an increase of 340 000 tons over 1971. Japan continued as our largest market, taking some 615 000 tons, although higher



returns were received from sales to the United Kingdom, which accounted for 441 000 tons. Sales to the U.S.A. totalled 196 000 tons. Long-term contracts for the sale of sugar to Malaysia and Singapore were signed in 1972 and significant sales were made to Russia and China.

High world free-market prices prevailed throughout 1972, with the average International Sugar Agreement daily price for the year being 7.27 U.S. cents per lb. some 62% higher than the 1971 average of 4.50 cents per lb. The average London daily price for 1972 of £stg.72.53 per ton c.i.t. established a new record; the previous record of £stg.71.70 per ton was in 1962. Consequently, the supply commitment provisions of the International Sugar Agreement, which were operative throughout 1972, remained in force for the beginning of 1973, and initial export quotas have not been allocated for 1973.

In the next year several important agreements are due for re-negotiation, and the orderly marketing of Australian sugar will depend on the successful conclusion of these talks. The British Commonwealth Sugar Agreement will expire in December, 1974, and Australia is seeking a satisfactory phasing-out period for our current exports to the U.K.; the United States Sugar Act will be reviewed before the end of 1974, and the International Sugar Agreement is currently being re-negotiated. Responsible participation of the European Economic Community will be an important factor in the success of these re-negotiations.

### WHEAT

The 1972-73 wheat season was severely affected by a dry planting period, and a wet and hail-damaged harvest. Estimated plantings in 1972-73 of 1m. acres resulted in an estimated production of only 13.6m. bus. In 1971-72, 1.4m. acres yielded 26.5m. bus.

The 1972-73 crop was the fifth to be marketed under the current Wheat Stabilisation Plan. The guaranteed price for exports up to 200m. bus. was increased by 5 cents to \$1.568 per bus. bulk basis f.o.b ports for f.a.q. wheat. This was also the minimum price for f.a.q. wheat sold within Australia other than for flour milling. The home consumption price of wheat milled into flour on an f.a.q. basis was increased by 6.06 cents to \$1.8406 per bus., bulk basis, f.o.r. ports. The increase comprised 5 cents in the guaranteed price and 1.06 cents in the cost of freighting wheat to Tasmania.

Adverse seasonal conditions in all wheat producing States restricted the overall Australian production in 1972-73 to 206m. bus., the lowest recorded since the 1959-60 season. Production in 1971-72 was 306m. bus.

As a result of the low production and relatively low carryover stocks and the expected buoyant export market, the total Australian Wheat Delivery Quota for the 1973-74 season was increased by 107m. bus. to 514m. bus. Queensland's quota was set at 43.2m. bus. compared with 38m. bus. in 1971-72.

Australian export sales of wheat and flour during 1971-72 reached 275m. bus. compared with the record 332m. bus. in 1970-71. However, due to the low level of production, carry-over stocks were only 53.2m. bus.—the lowest in four years.

### BARLEY

In 1972-73 it was estimated that the area planted to barley was only 180 000 acres, from which production was 70 000 tons. In 1971-72, 392 000 acres produced 246 000 tons.

Receipts by The Barley Marketing Board reached only 18 000 tons or 26% of the total Queensland crop. About 50% of Board receipts were classified as malting quality compared with 40% in 1971-72, and Queensland maltsters were forced to import barley from interstate. This was in marked contrast to 1971-72 when Queensland supplied interstate maltsters with some 36 000 tons.

While wheat has tended to be more profitable than barley in the past, recent price increases have favoured barley which should now result in comparable returns being obtained from both crops.

### GRAIN SORGHUM

Plantings of the 1973 crop were estimated at 900 000 acres compared with last season's record planting of 1 045 984 acres. Heatwave conditions during the growing season reduced yields to an average of some 25 bus. per acre, compared with over 29 bus. per acre in 1972. Correspondingly, production fell from 820 000 tons to an estimated 670 000 tons.

South Queensland accounted for about 60% of the total Queensland crop. With a limited local market, the Queensland Graingrowers' Association expects to export some 220 000

tons on behalf of growers compared with 350 000 tons in 1972. However, this situation could change according to seasonal conditions and a rapidly rising demand for feed grain.

In central Queensland, because of dry conditions in some areas, production is not likely to exceed 200 000 tons; exports by the Central Queensland Grain Sorghum Marketing Board are expected to be about 150 000 tons.

Price increases have made sorghum and maize more profitable and seasonal conditions have tended to favour summer rather than winter crops.

### MAIZE

It was estimated that 101 000 acres of maize were planted in 1973, of which 94 000 acres were available for harvest. Production is estimated at 85 000 tons compared with 95 920 tons in 1972.

The Atherton Tableland crop is expected to reach last year's level of 17 000 tons all of which will be sold on the local market.

### PEANUTS

Production from the 1972 season was a record 45 051 tons. Quality was above average.

Australian annual requirements are estimated at about 38 000 tons, nut-in-shell basis, and The Peanut Marketing Board will be forced to export about 6 000 tons from the 1972 season. Export prospects are good, particularly in view of the substantial crop reductions in South Africa and India.

A prolonged wet period hampered plantings for the 1973 season, and a subsequent hot, dry period reduced the expected yield to about 38 000 tons.

### NAVY BEANS

The 1972 season was a record one for the navy bean industry. The planting of 22 000 acres yielded 6 146 tons, cleaned weight. As a result, Australian navy bean imports were at a very low level. There are encouraging export prospects in the Pacific and the United Kingdom.

Adverse seasonal conditions, particularly a prolonged hot, dry period coinciding with a severe insect infestation, reduced the 1973 harvest to approximately 3 500 tons gross weight.

### COTTON

Production of 29 326 bales from the 1972 season was in excess of that of the previous season. Although prices grade for grade were comparable with those of last year, the Commonwealth Government's decision to revalue the Australian currency in December, 1972, and the de facto revaluation in February, 1973, made it most unlikely that growers' net average returns will reach the level of the 1972 season. However, cotton prices are increasing on world markets and this could offset the losses through currency realignments.

Severe heliothis infestation in central Queensland was largely responsible for reducing the 1973 harvest to less than 26 000 bales.

### TOBACCO

Tobacco leaf sold in Queensland in 1972 totalled 18 449 870 lb. and realized \$21 377 794. The average price of 115.9 cents per lb. compared favourably with the average price of 117.3 cents per lb. recorded in the previous year. Once again the average sale price reflected the lack of competition at auction, especially on the high-priced lines.

The 1972-73 growing season was satisfactory in all growing areas. No major set-backs were suffered. In the six months ended June, 1973, 12 811 790 lb. of leaf were sold at an average price of 117.1 cents per lb. compared with 15 780 275 lb. at an average of 117.8 cents per lb. at a similar stage of the 1972 sales.

### OILSEEDS

Total production of oilseeds continued to increase during 1972-73, but adverse seasonal conditions reduced production to below earlier expectations.

Safflower plantings of 7 500 acres were well below the 30 873 acres of the previous season. Production reached only 1 384 tons compared with 3 424 tons in 1971-72. The linseed



## FRUIT AND VEGETABLES

Cannery intake of pineapples during the 1972 crop year amounted to 88 586 tons, 9% less than in the previous year. By the end of the year, 830 subscribers to the cannery had delivered pineapples, 45 fewer than in the previous year.

Final prices paid for 1972 by the Cannery Board under the Rationalization Plan were: No. 1 Pool \$91.13 per ton; No. 2 Pool \$51.04 per ton. There was also a \$2 per ton profit distribution in each pool.

Sales of solid packs of pineapple, juice and blended drinks all showed satisfactory increases over the previous year's level.

The rate of increase in production of bananas seems to have levelled off, particularly in north Queensland. However, the industry is still concerned at the very real possibility of over-production and the periodic gluts which may develop. As a consequence, a National Banana Marketing Development Scheme will operate in all major markets in the Eastern States and in Adelaide. The scheme came into operation in Queensland on June 1, 1973; an integral feature is an agreed minimum selling price. The main aim is to try to ensure that poor quality fruit does not reach the market. In this way, the industry hopes to improve and stabilise returns to growers.

Apple production in the Granite Belt in the 1973 season was estimated at 2.5m. bus., slightly better than average. The pear crop was estimated at 180 000 bus., also slightly better than average. Quality of both fruits was variable, with significant quantities affected by hail and other climatic factors.

Returns to apple growers were not as good as in the previous season, but record qualities of apples were placed in cold storage in expectation of better prices later in the year. Declining prospects on export markets have reduced grower support for this section of the industry. Excessive hail damage further reduced the industry's ability to meet its export commitment and exporters were unable to fulfill orders towards the end of the export season.

There was a medium crop of stonefruit.

Because of marketing and other economic problems in the deciduous fruits industry, the Commonwealth Government offered assistance to growers by way of compensation for removing surplus fruit trees. However, by the end of the year, the last date on which applications could be received, only about 40 Queensland growers had applied for assistance.

Citrus production is expected to be close to last season's record crop of 1.7m. bus. Grapefruit production increased by 40% to 70 000 bus. A co-operative packing shed was established in Gayndah and is now in operation. This shed will handle a large proportion of the fruit from the Gayndah district, including export fruits. Export prospects for Queensland citrus continue to improve.

Potato production from the 1971-72 crops was recorded at 130 000 tons, compared with 108 000 tons in the previous year. Prospects for the 1973 autumn crop look far less promising. Early estimates indicated a harvest of 26 000 tons compared with 44 600 tons from the 1972 autumn crop. Prolonged hot, dry growing conditions in late summer and early autumn were the main reasons for the setback to crops. The onion crop is well down on last year's 27 000 tons. Adverse weather will probably reduce production to about 18 400 tons.

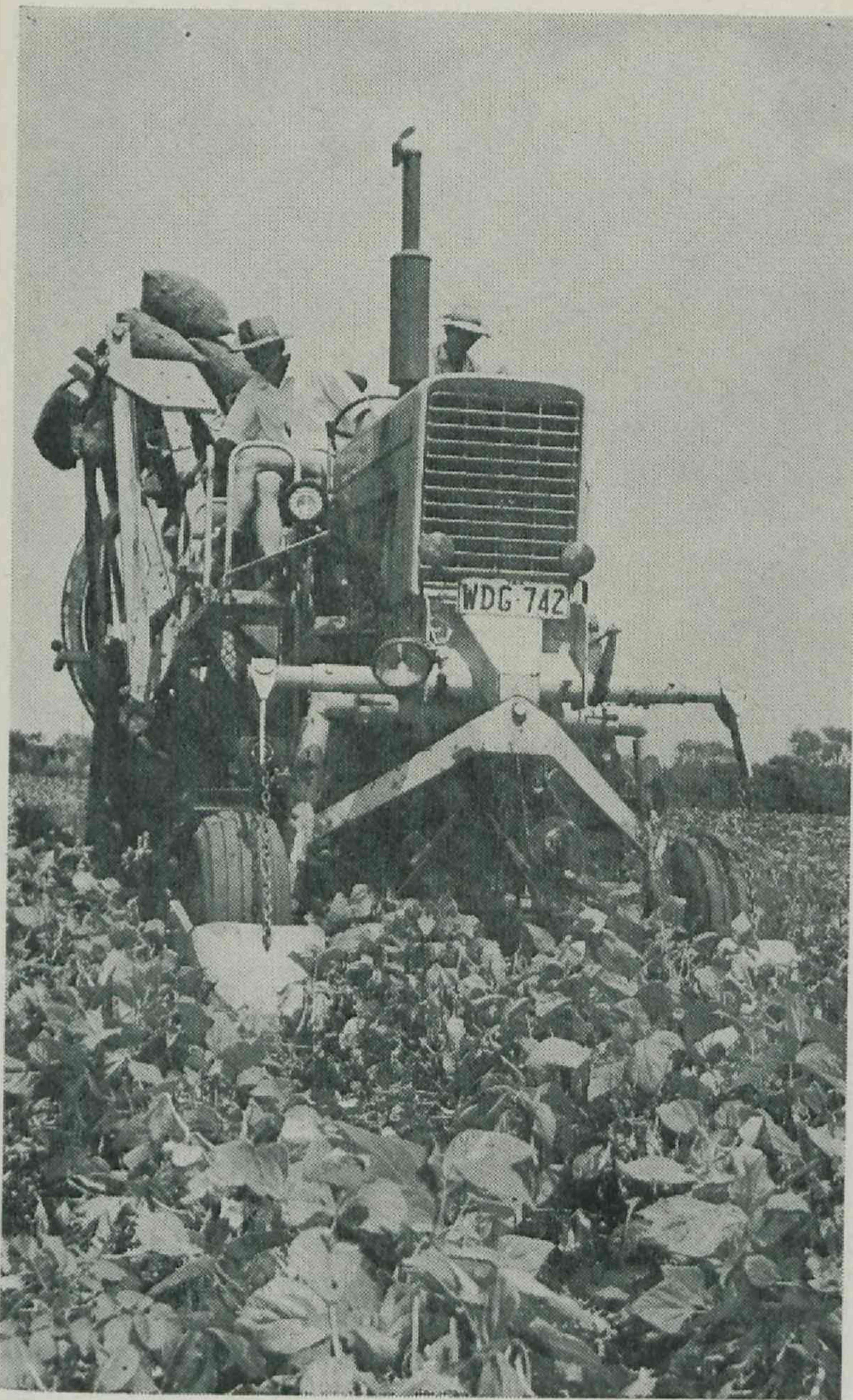
Production of vegetables for processing continued the upward trend of previous years with notable increases in beetroot, "baby" carrots and potatoes.

In general, Brisbane market prices for many fruit crops showed improvement while vegetable prices tended to remain stable.

## FISHERIES

The 1973 Gulf prawn season opened in mid-March on a very depressed note but picked up somewhat in following months. Some good catches were made on the east coast during the year, but the total prawn harvest is expected to be well down on last year's record landings.

The mullet fishery remains somewhat depressed because of the "kerosene" taint problem, but landings of reef fish and scallops have been maintained at satisfactory levels.



Machine harvesting of processing beans in the Lockyer Valley.

acreage, which has been declining in recent years, marginally increased to 5 500 acres in 1972-73. Production was 1 500 tons compared with 1 280 tons in 1971-72. Sunflower production continued to expand with an estimated crop of 50 000 tons compared with 22 239 tons in 1971-72. A similar expansion occurred in soybeans, with about 40 000 tons being produced compared with 21 659 tons in 1971-72.

Market prospects for the Queensland vegetable oilseed industry remain buoyant. The present favourable market situation could lead to further expansion during 1973-74.

## RICE

Due mainly to water limitations and the introduction of an industry stabilisation scheme, rice plantings in 1972-73 were restricted to 10 868 acres compared with 8 777 acres in 1971-72. However, as a result of more favourable growing and harvesting conditions, the estimated production of 17 000 tons for 1972-73 was substantially higher than the 10 635 tons produced in 1971-72.

## GINGER

In view of the level of carryover stocks of manufactured products, growers' acreage quotas for the 1973 crop were reduced to 330 acres, compared with an actual planting of 440 acres in 1972. Preliminary estimates indicate a total crop of 5 454 tons for the 1973 season, of which 1 820 tons were expected to come from the early harvest.

There appear to be promising markets in Japan and the U.S.A. for green ginger, and some experimental shipments were made during the year. The industry established warehouse and cold storage facilities at its Buderim factory specifically to cater for this market, which is expected to expand rapidly.