

Queensland Department of Primary Industries
ANNUAL REPORT 1971-72



Technicians at work in the Queensland Herbarium, mounting specimens and producing information for transfer to computer memory.

Presented to Parliament by Command



From brigalow scrub to pasture. The programme at the Brigalow Research Station, where Hereford cows are shown here on green panic pastures, is aimed at methods of developing and maintaining pasture and crop production on cleared brigalow country.



Consultative Committees of district primary industries representatives are of much assistance in planning programmes on Research Stations. This is the committee for the Biloela Research Station in session.

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ORGANIZATION OF THE DEPARTMENT

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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.
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Director, Fauna Conservation Branch	..	G. W. Saunders, D.Agr.Sc.
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Deputy Directors	..	L. G. Newton, M.V.Sc., J. W. Ryley, B.V.Sc.
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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)
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Deputy Director	..	G. I. Alexander, B.V.Sc., M.S., Ph.D.
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Field Services Branch	..	W. D. Mitchell, B.Agr.Sc., Dip.Agric.Ext. (Director)
Research Branch	..	V. R. Smythe, M.Agr.Sc. (Director)
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Assistant Director	..	A. Hegarty, B.Sc.
Development Planning Branch	..	A. Hegarty, B.Sc. (Director)
Soil Conservation Branch	..	J. Rosser, B.Agr.Sc. (Director)
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Assistant Director of Marketing	..	E. O. Burns, B.Com., A.A.C.A., F.A.S.A.
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Marketing Services Branch	..	D. R. Lewis, B.Sc. (Econ.) (Director)
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Horticulture Branch	..	R. C. Cannon, B.Agr.Sc. (Director)
Agricultural Chemical Laboratory Branch	..	F. Chippendale, M.Agr.Sc. (Director) (Apptd. Oct. 1971)
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 1971-72

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, 1972.

The Deputy Director-General (Mr. A. A. Ross) acted in my stead with distinction for several months during my absence.

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 the gross value of primary production in 1971-72 is estimated to be a record \$844 million, which is \$31 million better than the previous highest in 1968-69.

Agricultural production reached its highest point in terms of gross value, but the categories pastoral, dairying and pig raising, and poultry and beekeeping had all experienced higher returns.

The production situation in terms of output showed a response to the rainfall, which was average or above average in many parts of the State.

Widespread rains in August 1971 produced a better than average spring in most regions and pastoral conditions were promising. The beef cattle market for both store and fat cattle was buoyant. With the exception of the Charleville area and parts of the Central West, sheep were in good condition and lambings fairly good. Follow-up rain until the end of December was scattered and variable in quantity, resulting in a wide range of pastoral conditions over the State at that time.

While some heavy structural damage was recorded in the Townsville region from cyclonic disturbances, the losses recorded by the primary sector during the cyclone season have been far outweighed by the improvement in both surface and underground water supplies, and the promotion of substantial pasture growth throughout the principal coastal beef cattle regions.

The first cyclone of the season swept across Townsville late in December, and extended in a band inland, to be followed by other strong rain influences which resulted in more than adequate falls in the benefited areas. A feature of the cyclonic rain was the sharp dropping off in falls along the edges of the rainfall path and seldom was there a wide spread from the centre of the influence. This resulted in a sharp contrast in pastoral conditions between contiguous areas.

Following a generally dry February, good rains fell over a wide area in March and assured good early winter pastoral conditions. The areas currently declared drought-stricken represent those unfortunate enough to miss substantial falls.

The improved seasonal conditions, together with buoyant cattle prices and some recovery in wool prices, have provided better prospects for graziers after a number of years of considerable economic hardship. In addition, the provision

of assistance through the Rural Reconstruction Scheme and the Wool Growers Assistance Scheme has allowed many graziers in the western sheep lands to consolidate their viability in the longer term.

Favourable production conditions were experienced for most of the principal agricultural industries during 1971-72. Suitable growing and harvesting conditions for the wheat and barley crops were experienced during the period August to December, resulting in an estimated total production for the season of 29 and 11 million bushels of wheat and barley respectively.

The late summer-early autumn rains promoted the growth of a wide range of summer grain and seed crops. The areas devoted to summer crop production during the recent summer included grain sorghum 890,000 acres, maize 115,000, sunflower 160,000, navy beans 22,000, peanuts 81,000, soybeans 35,000, panicum 28,000, and white French millet 46,000. The production estimate for the 1972 State cotton crop stands at 26,000 bales of raw cotton.

Estimates for the 1972 sugar crop, which is now being harvested, are for the production of 2,626,000 tons of sugar from an available harvest area of 574,000 acres. This production forecast compares most favourably with the State record 1971 production performance of 2,626,631 tons of sugar. In this connection it is most significant that 155,691 acres of sugar cane are now irrigated, this representing some 24.3% of the total area under cane.

The seasonal conditions in the less favoured areas will be evident from the following record of drought area declarations.

The year commenced with 14 whole and 2 part shires declared drought-stricken. These were located in a block covering the south-west and central-western pastoral lands, and extended as far north as the Townsville-Mt. Isa railway line. In September the border shires of Paroo, Bulloo and Diamantina plus a part of Barcoo were removed from the drought-declared list. With improvement in the pastoral situation, a further 9 whole shires and 2 part shires were removed in April 1972, leaving only Quilpie and a portion of Barcoo declared at that time. This situation was short-lived as conditions deteriorated fairly rapidly, resulting in the re-declaration of Paroo and Murweh together with portions of Balonne, Bulloo and Tambo shires. At the end of the financial year there were 3 whole and 4 part shires declared drought-stricken, with ominous signs of drought in other shires in the same region.

AGRICULTURAL BANK

Advances approved during the financial year 1971-72 under various Acts administered by the Bank are as follows:—

Agricultural Bank Acts		\$13,421,814	
Farm Water Supplies Assistance Acts ..		\$453,016	
War Service Land Settlement Acts		\$63,186	
Soil Conservation Act		\$4,643	
Drought Relief to Primary Producers Acts—			
Relief to Graziers (1969 Scheme) ..	\$74,869		
Restocking Loans (1969 Scheme) ..	\$345,393	\$420,363	
TOTAL			\$14,363,022

Approvals under the Agricultural Bank Acts show an increase in excess of \$700,000 over the previous year's figure and this, coupled with the fact that borrowers' repayments exceeded estimates by over \$3,440,000, is indicative of a heartening recovery in those segments of primary industry depressed by the past years of drought. Prospects in the dairying, cane and tobacco growing industries and most grazing areas appear to be steadily favourable, and while grain-growers, particularly those affected by the recent mice plague, will require further time to recover it is expected that, given normal seasons, their prospects also will be good.

Advance approvals under the Farm Water Supplies Assistance Acts represent only little more than half of the 1970-71 figure and it must be assumed that farmers and graziers are deferring their water conservation needs in favour of stabilization of their affairs. The previous growth rate of the scheme suggests a temporary decline only.

Drought relief finance on concessional terms to eligible graziers for "carry-on" purposes was continued until December 31, 1971, when assistance was concluded. Restocking loans were available until June 30, 1972.

On May 16, 1972, Cabinet approved assistance by way of loans, to a maximum of \$2,000, on concessional terms to eligible grain-growers who suffered loss of grain crops as a result of mice damage. Bank finance for this purpose has been approved under The Agricultural Bank Acts and advance approvals to June 30, 1972, totalled \$77,000.

The rate of interest on all existing overdraft loans and new loans approved under the Agricultural Bank (Loans) Act, the Farm Water Supplies Assistance Acts and the Soil Conservation Act was reduced from 7½% to 6½% per annum as from February 1, 1972.

DROUGHT SECRETARIAT

The Commonwealth-State Consultative Committee on Drought proposed the establishment of a Drought Study Group, which was subsequently confirmed by Standing Committee on Agriculture with the following terms of reference:

- (1) To undertake a study of drought.
- (2) To collate and assess existing relevant climatic, biological and economic information relating to drought and its management.
- (3) To develop an integrated model suitable for the testing of various combinations of drought strategies in a pilot study area and subsequent development for other regions.
- (4) To highlight specific gaps in the available information and advise on action to provide the needed information.
- (5) To present the results from testing and using the model and assessing the long-term biological and economic implications of various drought management strategies.

The Drought Secretariat represents the Department on the Study Group, as Queensland has been selected as the location for the pilot study. At its inaugural meeting in Brisbane in December 1971 the Study Group considered some related projects begun or about to begin in Queensland and decided to lend some technical support. This will take the form of a workshop on modelling to be held in Brisbane in July 1972, where staff engaged in these projects will have the benefit of advice from authorities in the field of modelling for this type of situation.

The manuscript for the report of the Drought Practices survey conducted jointly by C.S.I.R.O. and this Department has now been completed and publication is planned. The report contains a comprehensive analysis of the effects of practices employed during the 1964-1966 drought based on survey data obtained from 180 pastoral properties in the State.

One of the recommendations of the Drought Mitigation Committee (1966) was that there be a co-ordinated approach through commodity marketing boards to off-property storage of drought fodder. Since some additional storage facilities would be required, the State sought the Commonwealth attitude towards possible support for such a proposal. The Commonwealth referred the proposal to the Consultative Committee on Drought, where other States considered it had little application to their situation. Consequently, the Commonwealth has not seen fit to participate in a scheme of this nature.

An allied proposal considered by Australian Agricultural Council was the establishment of a National Fodder Reserve. The Australian Wool Board sponsored a study into the economic feasibility of a scheme based on grain storage. The results of the study were inconclusive and did not stimulate Commonwealth enthusiasm.

It is reasonable to expect that a scheme for limited off-property grain storage would be less costly in Queensland than elsewhere because of the better potential balance of summer and winter grain crops in this State.

EXTENSION REORGANIZATION

The proposals for reorganization of the Department's extension services mentioned in last year's report received the approval of the Public Service Board and steps are in train to set up an Extension Services Board and an Extension Services Section with a cadre of Regional Extension Leaders.

It is intended to establish 13 agricultural extension regions, viz., Far Northern, Burdekin, Central Coast, Burnett, South Burnett, Near North Coast, East Moreton, West Moreton, Darling Downs, Near South Western, Far South Western, Central West and North Western. Within these regions will be 34 districts for which extension programmes will be drawn up by district committees consisting mainly of local extension officers but with some representation of research workers.

The following summary of selected guide-lines will indicate how the extension services are planned to operate.

- (1) Teamwork is the keynote, with all extension officers functioning in a district programme.
- (2) Use is to be made of all methods of extension to assist farmers to achieve their goals through definition of problems, adjustment to technological change, improvement of technical and managerial efficiency, and conservation of production resources.
- (3) Contact with farmers is to follow a whole-farm approach, recognizing land capability.
- (4) Advice is to be given in a farm management context.
- (5) Adoption of programme planning is desirable for effective overall operation of the extension service.
- (6) Direct contact between extension and research services is to be maintained.
- (7) Extension services are expected to be dynamic, show sound leadership and promote the well-being of rural industries.

The development of the extension services from this point will depend on the calibre of the regional leaders obtained and the facility with which extension officers in the field can adapt themselves to the change. As officers at numerous centres have on their own initiative developed informal co-ordinated groups over the past few years, little difficulty is expected in making the transition to formal regionalization.

AGRICULTURAL ECONOMICS

To meet a growing demand from primary producers for farm management advice, 16 agricultural economists are now stationed in country centres, representing an increase of three in the past year.

In this period of agricultural adjustment, economists have been considerably involved in rural reconstruction through advising farmers seeking financial assistance, particularly in southern and central districts. Initial requests were concerned mainly with debt reconstruction, with the emphasis now on assessing the feasibility of farm build-up proposals.

Economic research is being undertaken to develop more flexible approaches to management problems in the wool and beef industries. Factors affecting the supply of primary products in the dairy, pig and horticultural industries are being investigated. Regional studies are under way in Cape York Peninsula and the Condamine-Maranoa basin and it is planned to extend these studies on economic potential to other areas of the State.



Returns from members of the Farm Management Accounting Service being processed through the computer.



A tagged brolga in a study of the behaviour of native birds in North Queensland.

Standing Committee on Agriculture has appointed a special committee, including the Director of Economic Services, to prepare guide-lines for future development of farm management services throughout the Commonwealth. This committee is concerned mainly with farm recording systems and analysis, farm management techniques generally and farmer education on the business side of farming.

FAUNA CONSERVATION

In its first full year as a separate branch, the Fauna Conservation Branch consolidated planning for future activities.

To provide technical data as an aid to administration of the Fauna Conservation Act, the Branch has a zoological research section. At the present time the field work is centred at Warwick, Townsville and Brisbane under the guidance and direction of experienced zoologists.

At the Hermitage Research Station, near Warwick, a small team of zoologists and technician assistants is involved in field ecological studies on marsupials, particularly macropods. Detailed research work, much of which has been published, has been undertaken on the grey kangaroo. Studies are continuing on reproduction aspects and field population dynamics. As kangaroos are subject to harvesting pressure, the Fauna Conservation Branch is continually monitoring field populations. The age composition technique being used was developed by the Hermitage research team and is an invaluable tool in applied fauna conservation.

At the Animal Health Station, Oonoonba, Townsville, there is a similar research group. The work in north Queensland has involved field studies largely on waterfowl and

brolgas. However, a considerable amount of work is under way on avi-fauna generally, including seabirds. Seasonal patterns of movement, breeding and feeding have been studied for the 15 species of waterfowl occurring in north Queensland. This work has enabled the Department to formulate a conservation policy and programme based on sound ecological information.

At Brisbane, zoologists are attempting to sort out the species of native rats by means of breeding, morphological and chromosome studies.

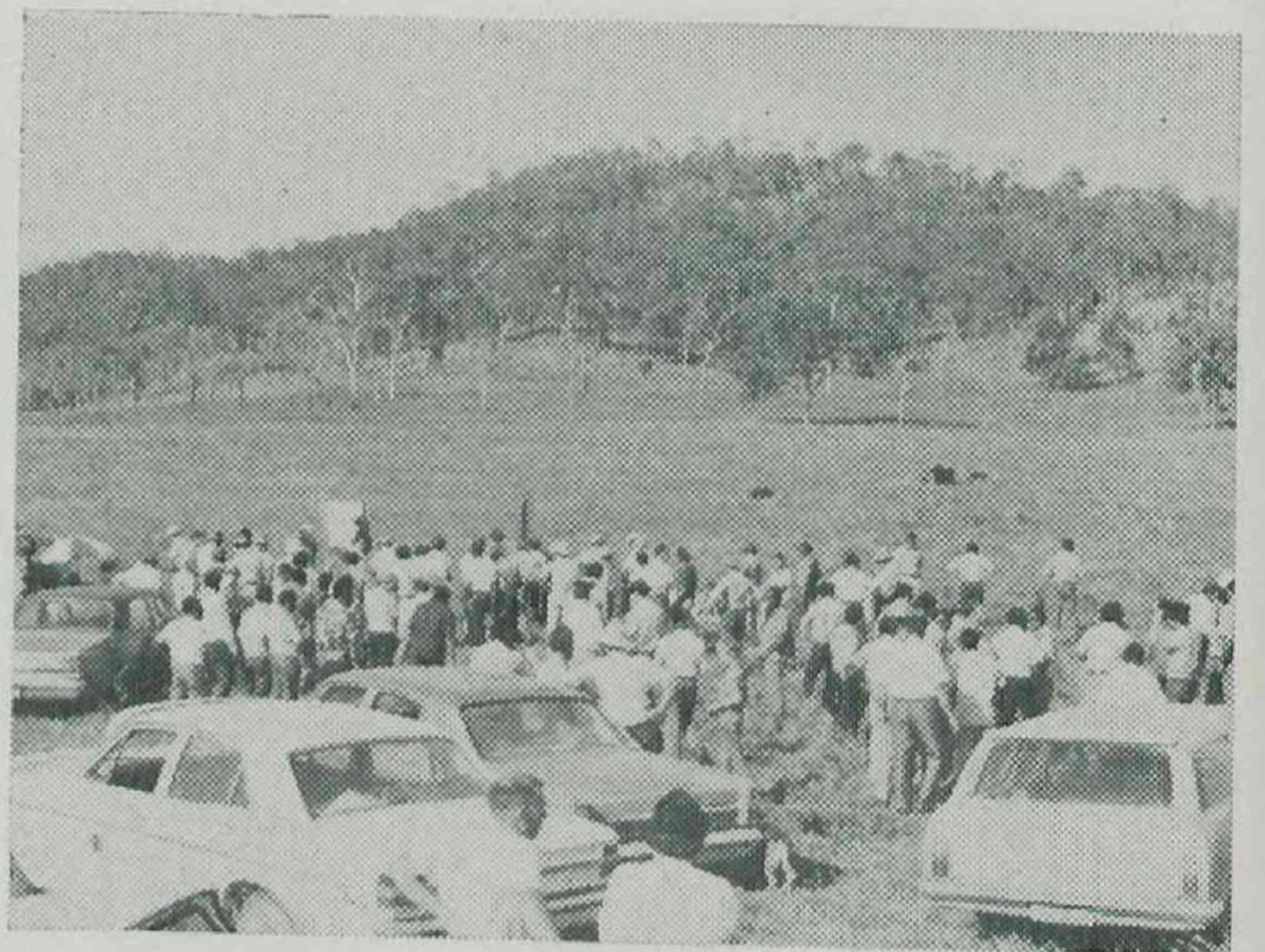
A study of the biology of crocodiles in relation to their significance to the ecosystem of the Gulf and Peninsula was begun. The commercial crocodile industry is also being monitored.

The other main section of the Fauna Conservation Branch is a regulatory section. Fauna rangers are responsible for the day-to-day administration of the Act. In this they rely upon the services of approximately 3,500 *ex officio* fauna officers (police, stock inspectors, forest rangers, etc.) and 1,200 honorary protectors. Although not enjoying the glamour often associated with research work, the regulatory section handles the great volume of field, inspectorial and paper work involved with permits, licenses, prosecutions, etc. Its services are readily available to those seeking advice on fauna conservation matters.

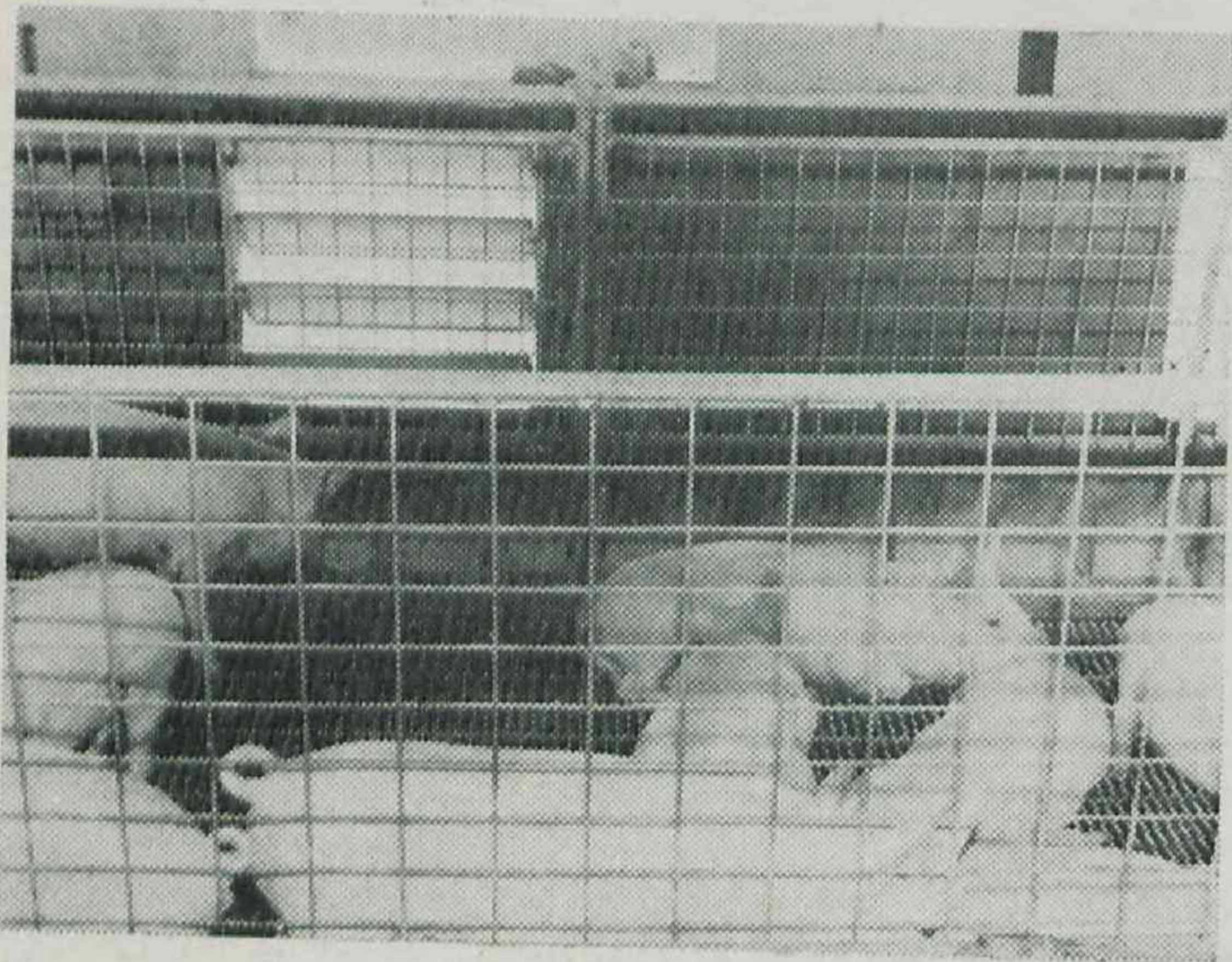
Controls on kangaroo harvesting, coupled with good seasonal conditions, resulted in a much reduced harvest of kangaroos in 1971, the harvest being only 65% of the 1970 harvest in numbers of kangaroos and related macropods taken commercially for skins and carcasses. Kangaroo populations remain sound throughout the State.



Breed development: F1 Sahiwal x Shorthorn heifer and her $\frac{3}{4}$ grade Sahiwal calf at "Swan's Lagoon" Cattle Field Research Station on the Burdekin.



The results of an experiment and their implications are discussed with a group of farmers.



Early weaner cages have become a feature on a number of modern piggeries.



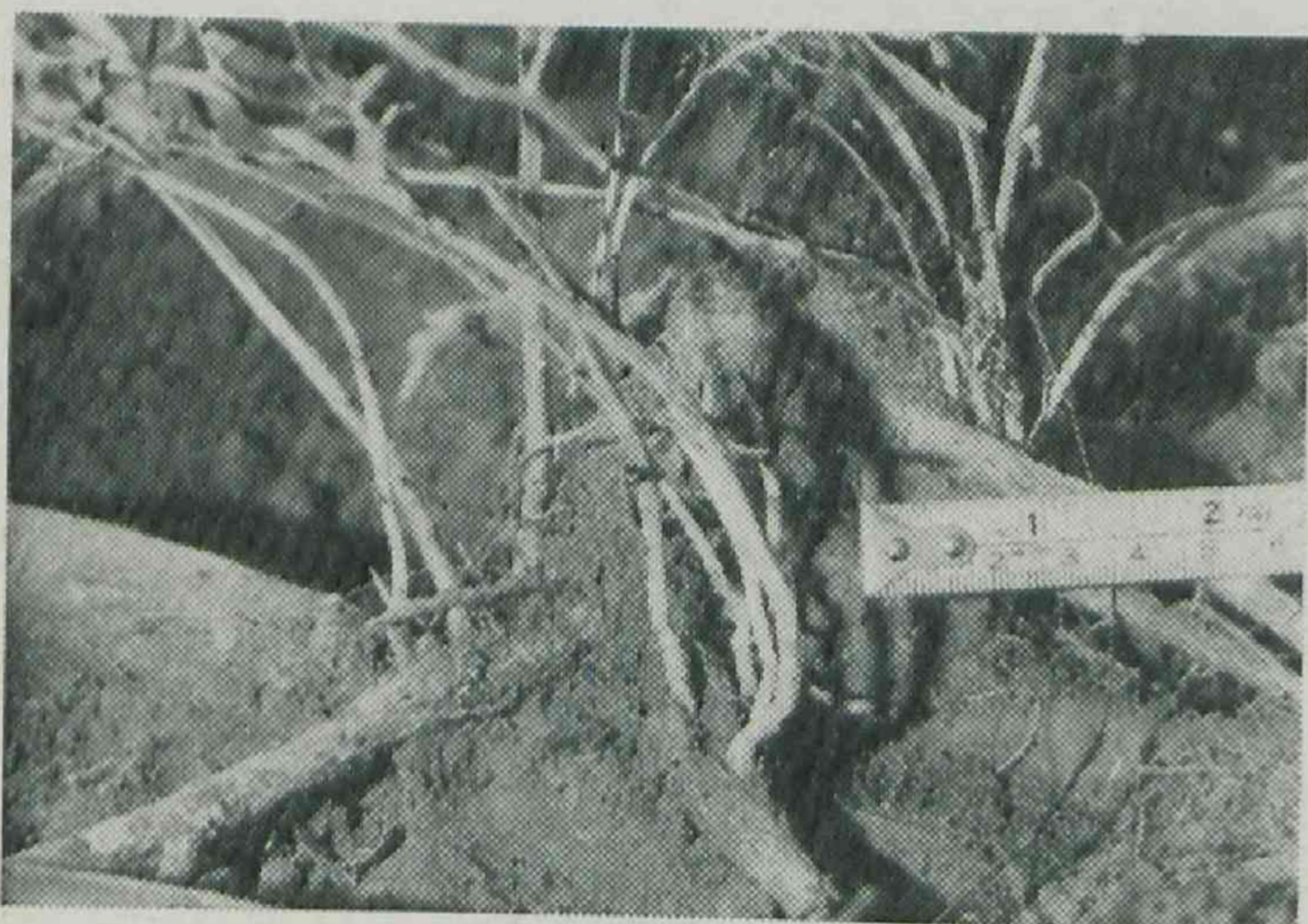
Steers fattening on irrigated pangola grass pasture at Millaroo Research Station.



Flowering of these out-of-season chrysanthemums was induced by artificial lighting.



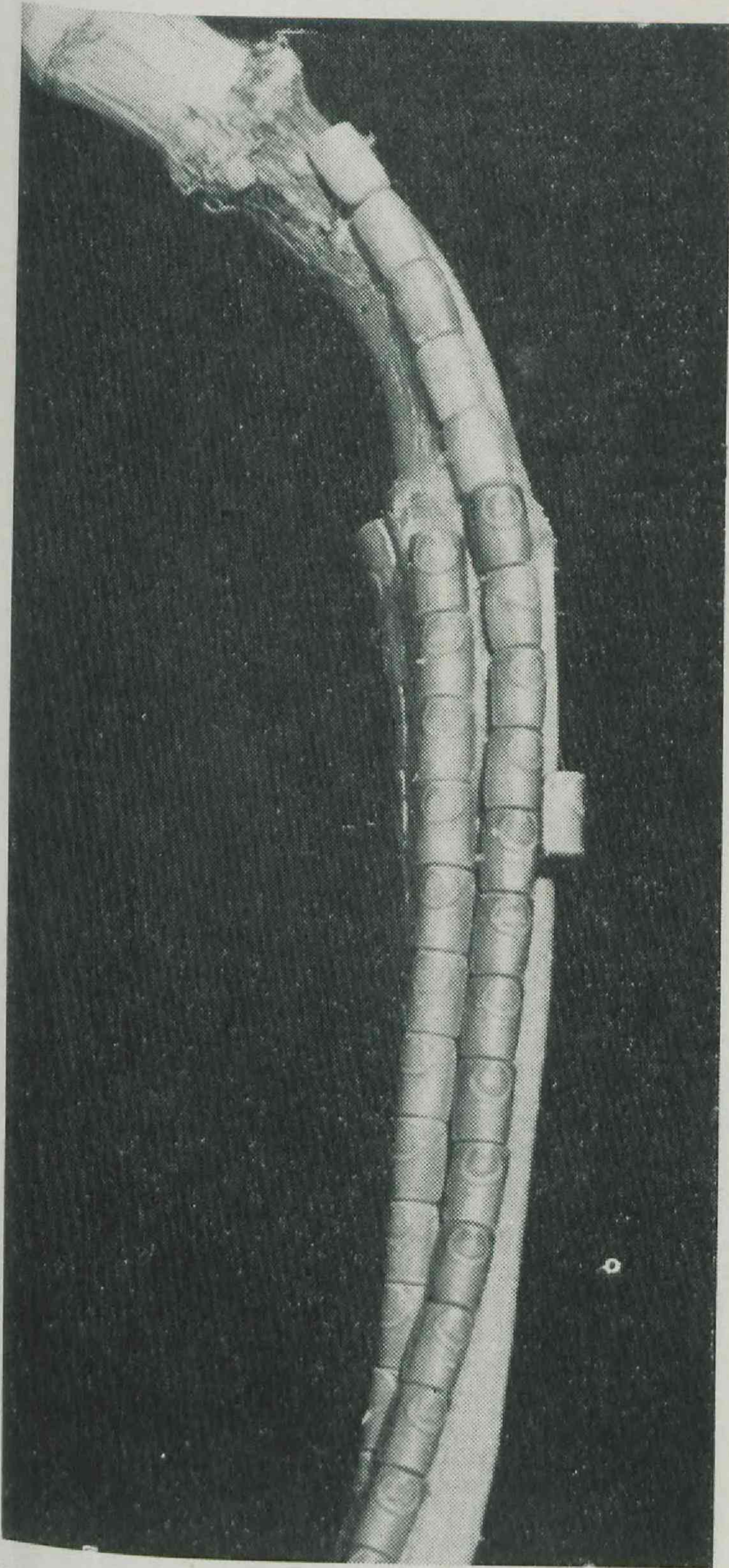
Evaluation of new sunflower varieties at Biloela Research Station.



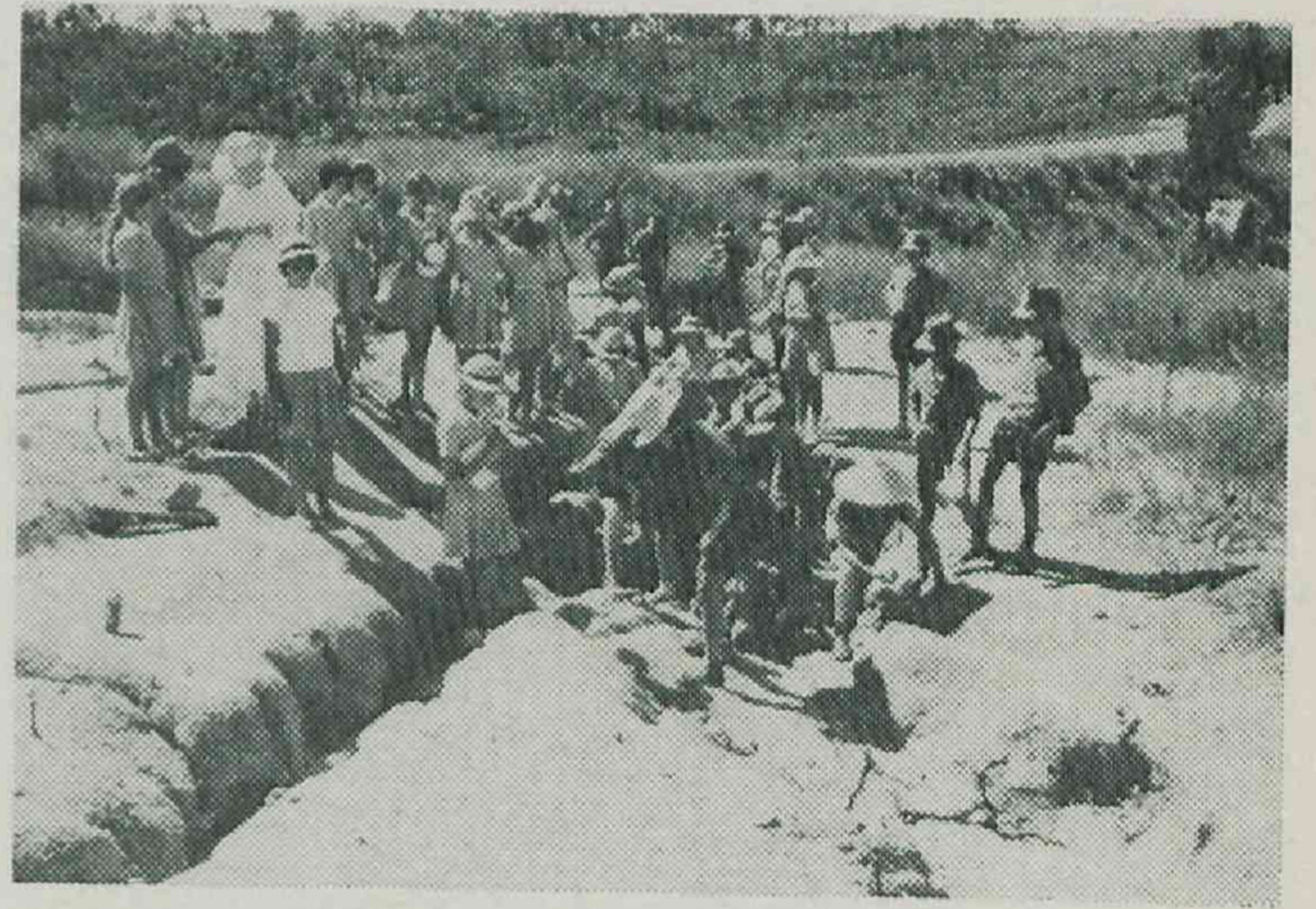
Root suckers on bastard sandalwood in a permanent quadrat north of Clermont.



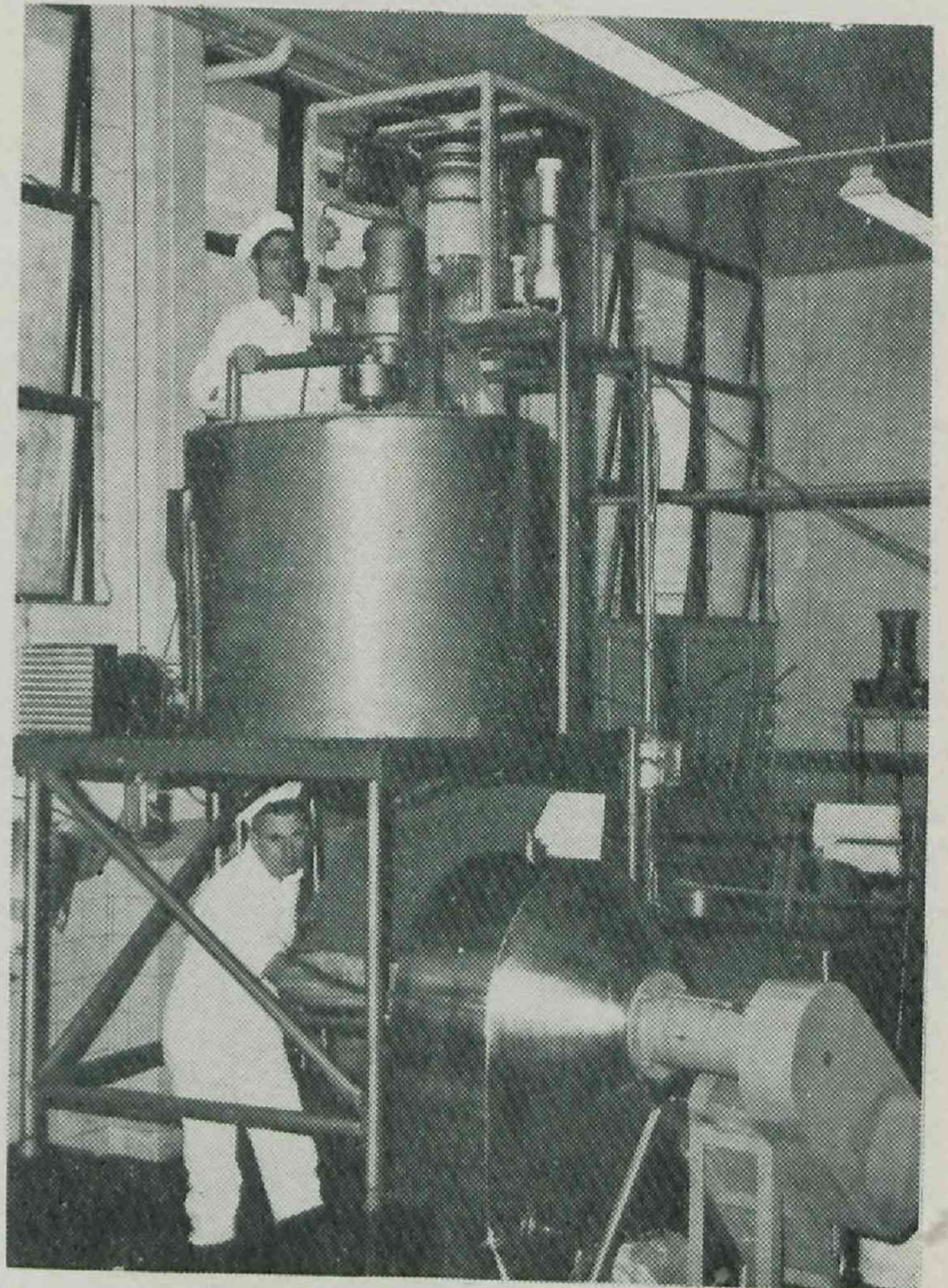
A microtome being used to cut thin sections of a nodule from the roots of a tropical legume for nematode studies.



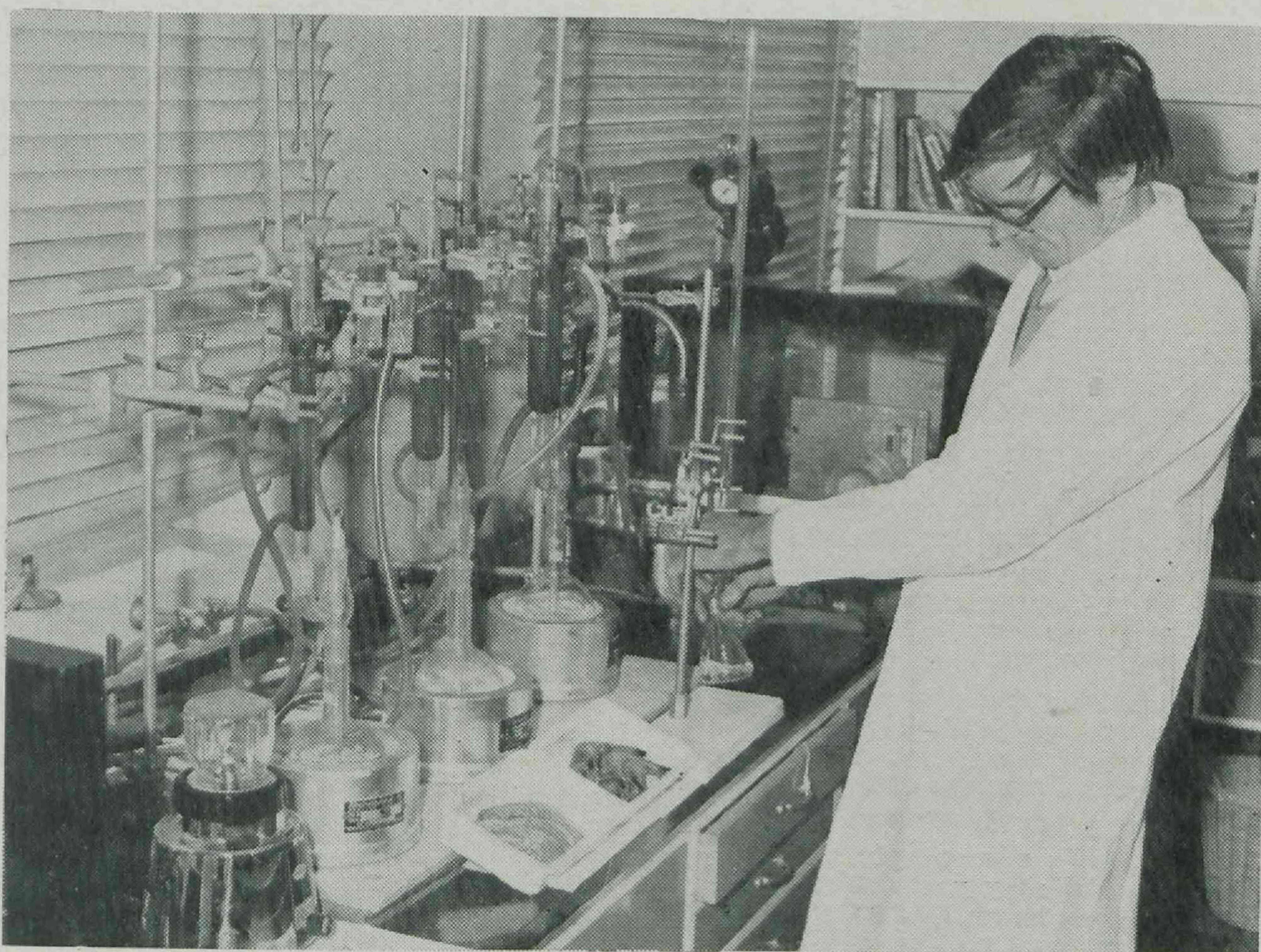
This is not a stack of cans but eggs of the black passion bug laid on a passion-fruit vine.



Field inspections are an important way of introducing school children to the problems of soil erosion and means for their control.



Freeze concentration of milk in the pilot plant at the Otto Madsen Dairy Research Laboratory.



A technician at the Sandy Trout Food Preservation Laboratory carrying out chemical estimations associated with studies of prawn melanosis.

WATCHING THE ENVIRONMENT

Two aspects of the Department's concern for the environment are worth recording here.

One is the involvement of the Botany Branch in vegetational studies. This has helped in the development of a rational approach to the assessment of conservation potential of relatively unspoiled vegetation over a wide range of habitats from the coastal wetlands and tropical rain-forest to semi-desert in the arid interior.

The particular responsibility of botanists and ecologists has been to describe the structure and study the inter-relationships of vegetation types in the areas concerned, map their patterns of distribution, prepare comprehensive inventories of plant species, and indicate particular species or areas that should be conserved or protected.

One off-shoot from these studies has been a greater understanding of the vegetation of intact beach-dune systems and the development of improved techniques for revegetation of coastal dunes that have been mined or otherwise damaged.

A second aspect of environmental control is pollution following the use of residual herbicides.

Bio-assay studies recently concluded on the alluvial black clays of the Darling Downs have demonstrated a relatively rapid loss of activity of residues of the herbicide picloram. The vertical leaching of the herbicide in this soil type was confined to the surface foot of soil, with very little picloram being detected below 6 in. Dangers of accumulation of phytotoxic residues from annual applications at recommended rates do not therefore exist in this environment and the possibilities of pollution of ground-water through leaching of residues through the soil profile on this soil type must be considered infinitesimal. Leaching on soil types low in organic matter and clay content could be expected to be greater and this situation remains to be investigated.

EROSION DANGERS

Weather conditions during the year were such that erosion was generally less severe than usual. During the cyclone period, ground cover of native pasture, improved pasture, crops and crop residues was sufficient to minimize erosion in many areas. There were the usual exceptions associated with isolated intense storms or more generally in cases where land remained in bare replanting condition into the wet season.

Another notable exception was in the Mareeba-Dimbulah area, where some growers attempted to grow peanuts in tobacco paddocks. This predictably proved a disaster. The sloping sandy tobacco soils have survived under irrigated tobacco only by virtue of the erosion-susceptible stages of the cropping cycle being in the dry spring. Any attempt to grow peanuts or any other row crop under rainfall during the wet season on this tobacco land must result in erosion.

The extent of erosion in pastoral areas is not well documented and a knowledge of the actual situation is a necessary prerequisite to taking effective action to control the erosion. With this in view a series of erosion surveys has been planned and in the year under review a report on "An Erosion Survey of the Upper Nogoia River Catchment" was completed and published. The authors reported that they were unaware of any other catchment area of comparable size in Queensland with an equally menacing erosion hazard. The authors estimated an average annual soil loss of 9,187 area-feet, or 14 million tons, from the 6,440 square mile area. Possible erosion mitigation measures are at present under consideration.

LAND UTILISATION

The Division of Land Utilisation through its component Development Planning and Soil Conservation Branches has oversight of land use issues related to rural industries.

However, with the wider appreciation of the competitive demands for the use of Queensland's land resources, Divisional staff are becoming increasingly involved in assessing these resources and determining the limitations and suitability for various uses. While a primary aim is to examine land use in the context of rural production, the use of land for other purposes such as recreation, wildlife refuges, scientific study and national parks is receiving attention.

In accord with this broader approach Divisional staff have assisted in the Moreton Regional Study being conducted by the Co-ordinator General's Department and represent the Department on the Land Use Committee of the Environmental Control Council.

Divisional staff are also participating in the joint Commonwealth-State Burdekin Basin Study, the objective of which is to examine the overall potential for land and water resource development of the Burdekin River Basin with particular reference to water availability and possible future needs or uses for urban, irrigation, power generation, industrial (including minerals) and flood mitigation requirements.

ANIMAL DISEASE CONTROL

There has been considerable activity in animal disease control, and particularly in the field of eradication of serious diseases.

As reported last year, a national scheme for the eradication of tuberculosis and brucellosis in cattle was commenced in 1970.

The original plans for the tuberculosis eradication section in Queensland provided for concentration on the more closely settled country in which a long-standing scheme of tuberculosis eradication in dairy herds was operating. It was found possible to extend testing under the new eradication scheme into contiguous areas.

Restrictive action taken during the year on the importation into the United States of beef from animals which had shown particular signs of tuberculosis infection had its repercussions in Australia. One of these was a ban on the movement of untested cattle into New South Wales. In order to assist beef producers in areas outside the declared testing areas, special testing facilities were provided by the Department in certain districts.

The acceptance of the whole of the State as a pleuro-pneumonia-free area during the year was the culminating point of an eradication campaign which had been prosecuted over a number of years. It is not to be expected that tuberculosis eradication will require a lesser effect and in fact it may well be a much more protracted campaign.

ACTIVITY AT A.I. CENTRE

The Wacol Artificial Insemination Centre has been a focus of activity throughout the year. A major development has been the inclusion of privately-owned sires in the team supplying semen for general use. Privately-owned bulls were introduced to the centre for the first time in August 1971. There are now eight bulls from five properties in this category from Murray Grey, Droughtmaster, Hereford, Poll Hereford and Santa Gertrudis studs. Arrangements are proceeding for entry of a Braford sire. There are 14 dairy and beef breeds represented at Wacol and, in addition, semen is available from the newer breeds, such as Charolais and Simmental. The range of imported breeds will be greatly extended in the near future and semen will be imported direct from Canada as well as from Great Britain and New Zealand.

Approximately 1,800 persons visited the centre during the year. Apart from individuals and small groups, parties were sponsored by Artificial Breeding Co-operatives, Rural Youth Clubs, Discussion Groups, University Faculties, Agricultural Colleges, State and private secondary schools, A.I. technicians and organizations conducting courses in animal husbandry. In almost every month a party of overseas visitors inspected the Centre and made visits to herds from which bulls at the Centre had been purchased. Visitors to the centre were from Canada, U.S.A., Britain, Eire, South Africa, Taiwan, India, Ceylon, Indonesia, Papua and New Guinea and New Zealand.

Construction of a new export centre is contemplated to meet the requirements of special markets. During the year semen was exported to New Zealand, Fiji, Territory of Papua and New Guinea, Taiwan and the Philippines. The largest single export was 2,000 doses of Poll Hereford semen to New Zealand in June 1972. Enquiries have been received from several south-east Asian countries and Mexico for semen from the Australian Milking Zebu breed developed by C.S.I.R.O.

THE MILKING ZEBU

The Department is co-operating with C.S.I.R.O. in comparative studies of the performance of the Australian Milking Zebu, developed in a breeding programme based on Sahiwals and Jerseys at Wollongbar, in New South Wales. These cattle are tested for heat tolerance, tick resistance, fertility and production. A number of females have been released to commercial dairy farms in Queensland and Departmental officers are observing their performance. In addition, where farmers are maintaining animals of this breed independently, similar comparisons are being made. Semen from this breed is available from Wacol.

NEW DAIRY FOODS

Work has continued in the development of new dairy foods of four distinct types—beverages, desserts, toppings and confections. Beverages which have been formulated and manufactured have included alcoholic and non-alcoholic drinks from milk and whey. Non-alcoholic drinks showing most potential are milk/fruit combinations containing nutritional properties of both milk and the particular fruit used for flavouring. Banana milk, orange milk and mango milk have been successful, and some have been powdered. Sweet and dry whey wines flavoured with cherry, plum or passion fruit have been well received and expert opinion is now being sought on these products.

Three desserts were produced using milk concentrates, yoghurt and continental cheese respectively. All three preparations may be made with fruit as well as a wide range of other flavours. They may be used as economical nutritious family desserts or adapted for party fare as high calorie, luscious foods. All three mixtures withstand freezing and thawing. A fruit-flavoured topping made from cultured cream has been well received by taste panel evaluation. A wide range of puddings from hot winter dishes to ice cream could be combined with this sauce.

Toffees, fudges and marshmallow have been successfully produced from concentrated whey, and these confections are being brought to the notice of confectionery manufacturers. In addition, preliminary studies showed that an apricot cream confection was rated highly by taste panel evaluation.

LOT-FED BEEF EXPORTS

The developing Japanese market for lot-fed beef took a further step during the year with the letting of contracts to specialist feed-lot fatteners in central and southern Queensland. The demand is for well-finished carcasses of about 650 lb. weight from slightly older cattle than are normally fattened under feed-lot conditions. However, as has been the case with most feed-lot ventures which have been attempted to date, the price relationship between store cattle, fat cattle and grain has been the main determinant of economics of the enterprise, and if the narrow margin which has existed so far continues this is likely to restrict further major developments in the supply of lot-fed beef to this market.

PLANT BREEDING

The Johnson grass strain of the sugar cane mosaic virus has caused severe damage to many sorghum crops in recent seasons. While the commercial hybrids have different reactions to the disease, none is resistant. Virologists and plant breeders are incorporating the disease resistance available in a little used forage sorghum, *Krish*, into several of the more important grain and forage hybrids. Results have been most encouraging. It is likely that seed of mosaic-resistant versions of several commercial hybrids will be available in the next few years. Already, major seed companies have requested seed of the resistant breeding material for use in their programmes.

A new maize hybrid QK217, bred at the Kairi Research Station in North Queensland, is on schedule for release in 1972-73. It has yellow grain which gives it a decided commercial advantage over its predecessor, QK37. Also it is resistant to the recently recorded *Helminthosporium maydis* leaf blight which caused severe damage in susceptible varieties on the Atherton Tableland.

PACKAGING CHANGES

Departmental officers have been working for some time to improve fruit and vegetable packages and packing methods, and to minimize transport injury to commodities.



New packaging methods: a vibrator being used to produce a tight fill in a tomato packing line.

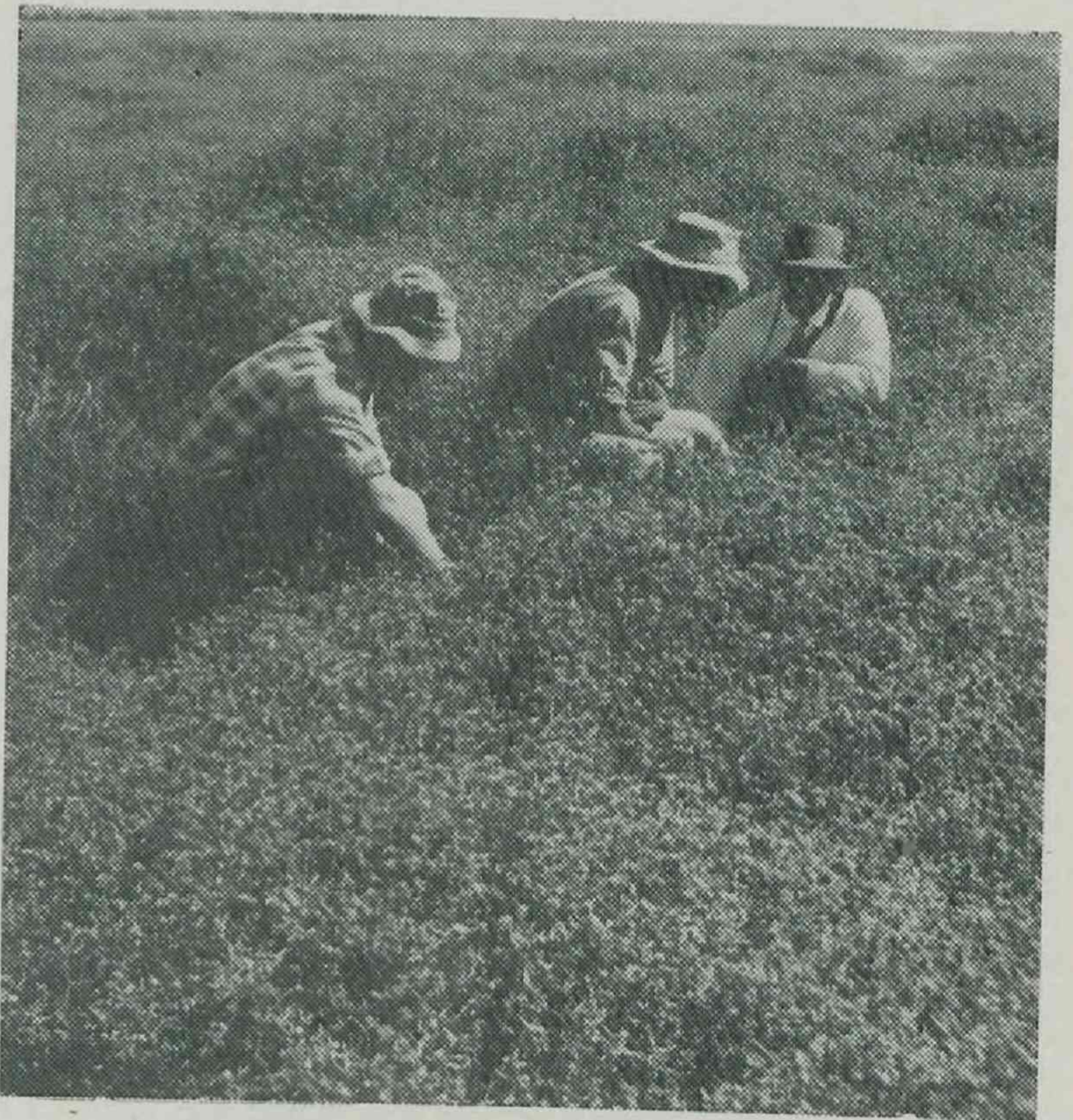
One useful development from this work had been the substitution of a loose fill method for the previous laborious pattern pack for tomatoes. The loose fill not only saves considerable time in packing but it also results in less damage to the fruit, as considerable damage results from the pressure used in forcing fruit into position for the pattern pack. However, the loose fill had the disadvantage that the container would hold less fruit with this method. This has now been remedied by a modification called the tight fill, in which the fruit is settled by suitable vibration to a carton content as high as that of the pattern pack, but in much less time and with less damage. This method has aroused the interest of large growers and has been adopted by the Committee of Direction of Fruit Marketing in its packing operation at Rocklea.

PASTURE SEED PRODUCTION

If the improved pasture plants which have been developed for various parts of Queensland are to be put to maximum use, it will be necessary to ensure that adequate supplies of seed are available at a reasonable price.

The Department has a Pasture Reproduction Physiology Unit on the Atherton Tableland giving close attention to the factors involved in the production of seed of tropical pasture plants.

Seed harvest balance sheets have been prepared for Schofield stylo, Siratro, Gatton panic and *Stylosanthes subsericea* to pinpoint the fate of all seed set. This has revealed considerable wastage of potential seed.



Inspection of stylo seed study areas on Walkamin Research Station on the Atherton Tableland.

For example, only 25% of the total seed set on *Stylosanthes subsericea*, a promising species for North Queensland, was recovered by header harvesting. This represented only 34% of that potentially available to the header. Of a total seed set of 2,200 lb./ac., 500 lb. were harvested, 600 lb. remained in the standing stubble after harvest, 800 lb. were on the ground and 300 lb. were in the header windrows.

With Siratro, up to 600 lb./ac. of seed can accumulate on the ground and cannot be recovered by conventional harvesting. Suction harvesting, previously unused for this species, has recovered up to 260 lb. of this seed. This has more than doubled the annual seed recovery.

Under North Queensland conditions, the best means of exploiting the suction harvester appears to be to treat the crop as an annual or biennial, employ the usual header-harvesters and then suction harvest at the final operation before re-establishment.

BOTANICAL IDENTIFICATION

The flora of Queensland contains a large number of introduced species which have found conditions so suitable that they have spread beyond the points of original establishment to become permanent elements in the vegetation.

Some of these plants, such as Townsville stylo, are encouraged to spread because they are useful grazing plants. Others, such as Noogoora burr, become weeds of considerable economic importance.

An alert botanical service is essential to ensure that introduced plants that are potentially noxious are located at an early stage so that steps can be taken to eradicate them before they get out of hand.

In the past year, the Botany Branch identified 10 named species of plants not previously recorded as growing wild in Queensland, which were noted in the field or received for identification. Seven of these are growing in native plant communities, six are recorded from other States and one is new to Australia. Three are introduced species, one a legume commonly grown for pasture and now naturalized as a weed, and two are plants that are serious weeds overseas. Neither of the last two has been recorded from elsewhere in Australia and steps are being taken to organize eradication.

Botanical exploration in southern, central and far north Queensland and subsequent taxonomic studies of the material collected revealed the presence in this State of several undescribed species in different families. As a result of this work and examination of specimens received for identification three rare native plants were rediscovered. All three were imperfectly known and have not been seen since they were originally described more than 60 years ago. One of them was of extraordinary botanical interest and importance. Examination of fruits, now available for the first time, showed that the structure of the seed is unique and that the plant should be placed in an entirely new family. This family was formally described and named.

Following renewed representations by ANZAAS to the Australian Academy of Science for the preparation of a new Flora of Australia, a Special Committee met in Canberra and made firm recommendations for lines upon which the work can proceed. These were accepted by the Academy and the Director of the Botany Branch was chosen as one of the four Australian botanists who will constitute the Executive for this project.

LOCUSTS AND MICE

In the past two years, plagues of locusts and mice have caused considerable damage to crops in restricted areas of the State.

Outbreaks of these pests in plague proportions are usually short-lived and separated by a number of years of low populations which cause no concern to farmers. There is good reason to believe, therefore, that the end of the serious situations created by locusts and mice is in sight and that once populations decline they will not rise substantially again for several years.

Queensland is no better placed than other States and countries to combat plagues of these pests. In fact, since sorghum was the main target of the locusts and this is a particularly difficult crop to protect, Queensland growers probably have fewer defences against this pest than farmers in other areas.

Though various control measures were attempted on a commercial scale, one can only say that experience here paralleled that elsewhere—there is no practical method of saving crops from massive attacks by locusts and mice.

This does not mean that all avenues are closed. It does mean that a careful appraisal of all available information will have to be made and local research directed along lines which appear to be the most promising for our conditions.

The chemical approach will need to be pursued with caution so that direct and residual hazards to the health of humans, livestock and fauna will be minimized.

Perhaps the biological approach, or an approach through crop management practices, will prove more profitable.

METRICATION

The Department has been getting ready in various ways for the transition to the metric system of weights and measures.

All the Acts and Regulations administered by the Department have been examined to ascertain where amendments will be necessary.

The Department is represented on an Inter-departmental Metrication Committee which is examining the implications of the change on Government administration. It is represented also on the Agricultural Information Sector Committee which has been formed with Australia-wide representation to assist primary producers in changing to metric. An intra-Departmental Committee is concerned with collecting and transmitting appropriate information to Departmental officers throughout the State.

STAFF TRAINING

There was considerable activity in staff training during the year, particularly in refresher courses for technical and scientific staff. Continuing advances in technology demand not only a high level of basic training but the regular up-dating of the knowledge of officers.

Several branches conducted short refresher courses or workshops for their officers. In addition, opportunities were provided for officers to attend technical conferences and workshops in other States and numerous specialist officers made visits to research institutes in other States. On several occasions, Departmental officers were invited to participate in interstate conferences as resource persons.

Overseas visits are mentioned later.

Several extension and farm management training schools and workshops were conducted by the Information and Extension Training Branch and the Economic Services Branch.

Induction courses were held for new appointees to the Department.

Divisional and Branch heads are rostered to participate in courses in administration development being conducted by the Department of the Public Services Board.

Several officers won fellowships for overseas study and were assisted by the Department in various ways.

OVERSEAS TOURS

Mr. F. Chippendale, Director of the Agricultural Chemical Laboratory Branch, visited laboratories and agricultural research institutes in New Zealand, Canada, United States of America, Great Britain and Malaysia and attended the International Congress of Irrigation and Drainage in Bulgaria.

Dr. M. Bengston, Senior Entomologist, completed a study tour of North America, United Kingdom, Europe, Israel and India, in which particular attention was directed to recent advances in stored products entomology.

Mr. J. L. Alcorn, Plant Pathologist, attended the International Mycological Congress in the United Kingdom and visited institutions in the United Kingdom, Canada and United States of America. His particular interests were plant disease, herbarium management, fungal taxonomy and retrieval of plant disease records.

Dr. G. M. Behnken, Plant Pathologist, after completing his Ph.D. studies at the University of California undertook a short study tour through U.S.A., Canada and Europe, with emphasis on insect-borne plant viruses.

Mr. S. L. Everist, Director of the Botany Branch, attended the International Symposium on Useful Wildland Shrubs in Utah, and subsequently visited several research institutions in the western United States of America to observe methods of dealing with the utilization of native browse plants and unwanted woody plants.

Mr. L. Pedley, Senior Botanist, completed his term of office as Australian Botanical Liaison Officer at the Royal Botanic Gardens, Kew. He was able to solve many outstanding problems on classification and nomenclature of Queensland plants.

Mr. A. L. Clay, Director of the Division of Animal Industry, led the Australian delegation to the World Veterinary Association Congress and made a study tour of the United Kingdom, Eire, Canada, U.S.A. and Mexico.

Mr. N. H. Hall, Senior Administration Officer, was included in a team to make a study of fruit and vegetable marketing in U.S.A., Canada and the United Kingdom.

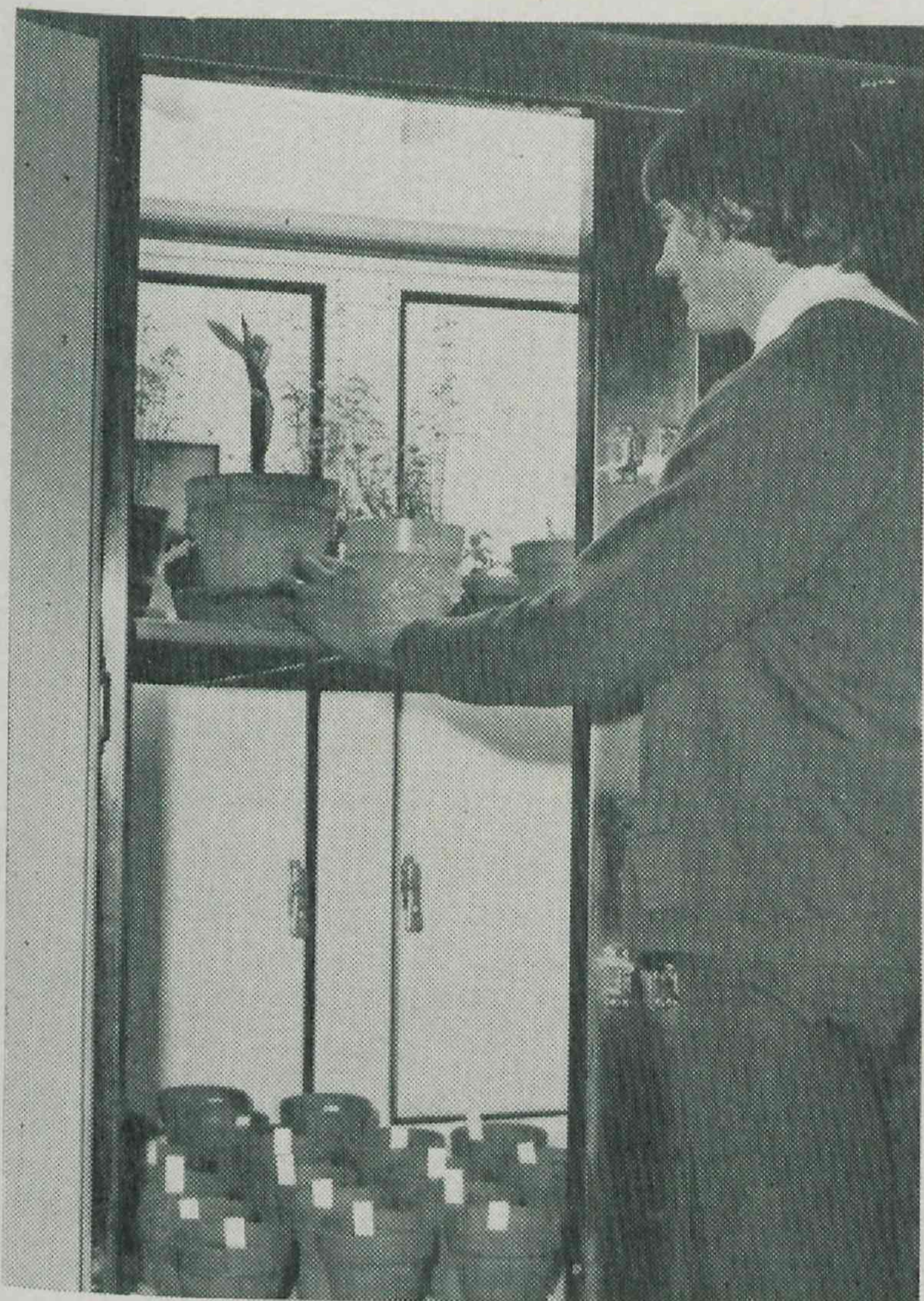
Mr. G. Short was a member of a team which examined the prospects for banana exports to Japan.

BUILDINGS AND EQUIPMENT

The new Plant Pathology Building at Indooroopilly was officially opened in September. The design of the new building has proved to be highly satisfactory and has allowed for considerable expansion of activity. There is now complete integration of all the sub-disciplines such as plant virology, plant bacteriology, mycology and plant nematology. An experienced senior laboratory technician was appointed during the year to supervise the electron microscopy unit. The microscope is being widely used by officers in other Branches of the Department in addition to Plant Pathology. Its use has helped considerably in the rapid diagnosis of plant diseases caused by viruses.

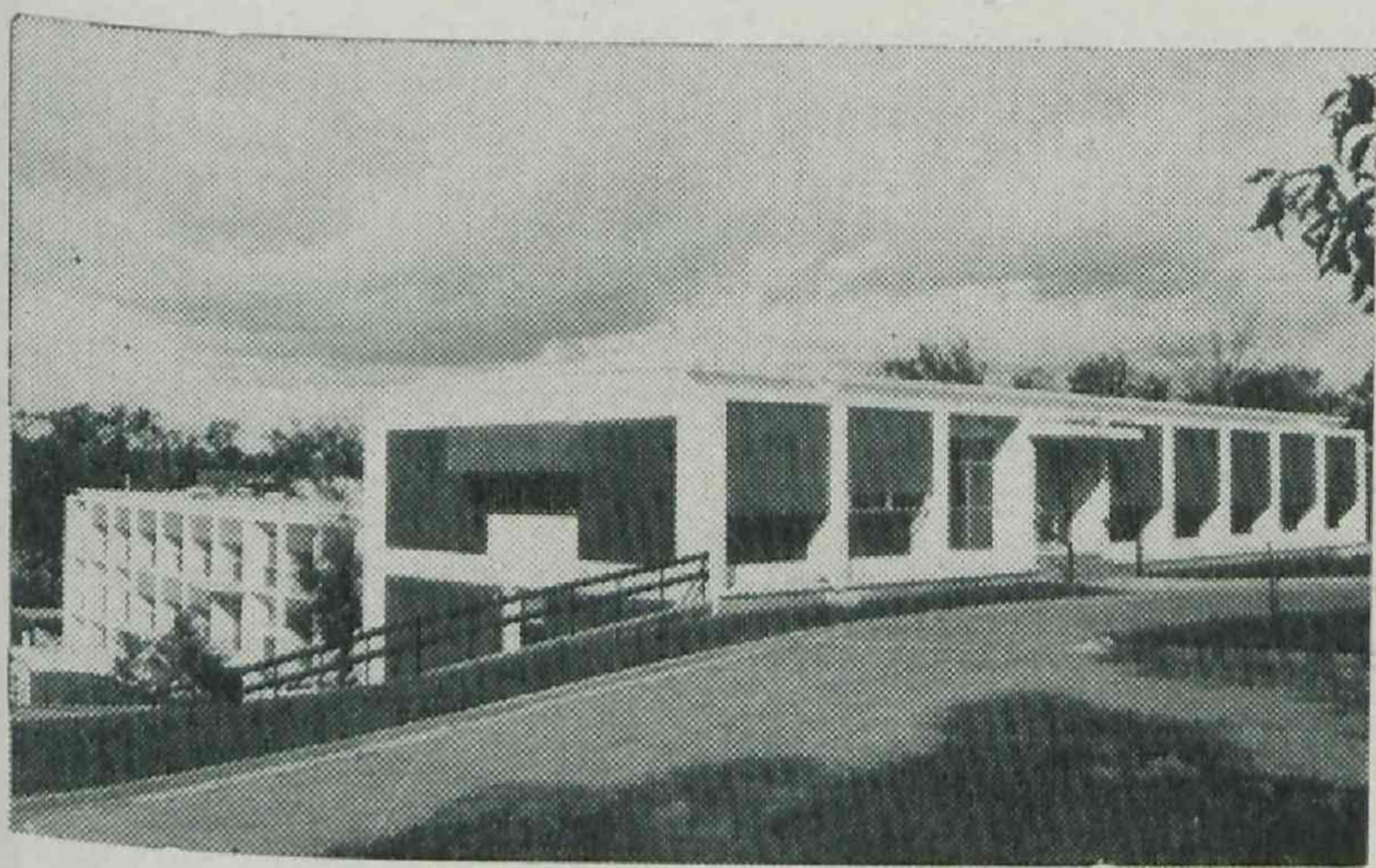
The new Agricultural Chemical Laboratory Building at Indooroopilly is nearing completion. It is expected that it will be occupied early in the new financial year. Major equipment, which will make it one of the best equipped laboratories of its type in the world, has been purchased and is awaiting installation.

Stage II of the Standards Branch building at Indooroopilly was completed early in 1972 and opened on April 19. Apart from the administrative advantages to be derived in



Plant disease experiments in a controlled environment cabinet in the Plant Pathology Branch.

having Branch staff accommodated in one building, it has already become evident that the additional space and modern equipment provided are important aids in promoting operational efficiency. These improved facilities have enabled Branch planning to be extended to include research work into seeds.



The new Standards Branch building at Indooroopilly.

An intensive system pig farrowing house is to be constructed at Biloela Research Station. An office and plant laboratory building has been designed for Coolum Research Station. Provision has been made for the construction of a potato research and cold storage building at Gatton Research Station.

Plans and specifications have been prepared for a new administration and laboratory building at Hermitage Research Station, and construction of pens for marsupial research has been undertaken.

A new laboratory/seed store is in the final stages of construction at Walkamin Research Station.

A new Fisheries Research Laboratory was opened at Deception Bay.

Completion of the Husbandry-Biochemistry Stage II Building at the Animal Research Institute provided new office and laboratory accommodation for Husbandry Research Branch and Biochemical Branch staff.

A building to acclimatize boars following completion of performance testing and before they return home was completed at the Pig Testing Station at Rocklea.

Office, shed, feeding yard and stock yard facilities were erected on the cattle section of Hermitage Research Station and the first zero-grazing experiment commenced.

STAFF LOSSES

The sudden death of Mr. J. C. Johnson, Senior Plant Pathologist, meant the loss of a relatively young officer who had made a marked contribution to the fruit and vegetable industries. Mr. R. J. O'Sullivan (District Inspector of Stock) died on the eve of retirement after 38 years' service.

There were an unusually high number of retirements during the year. Those who had served for a considerable time included Messrs. W. J. Cartmill (Director, Agricultural Chemical Laboratory Branch), M. R. Muller (Chief Adviser in Dairying), S. Burchill (Senior Administration Officer), M. P. Logan (Senior Clerk, Division of Dairying), T. G. Graham (Agrostologist), E. L. Melville (District Adviser, Pig Section), K. King (District Adviser in Horticulture), K. M. Ward (Chief Horticulturist), and W. P. Dower (Senior Clerk, Horticulture Branch).

OVERSEAS AID

Apart from providing individual training ranging from a few days to several months for a large number of technical personnel from overseas countries, the Department played a major part in organizing and conducting three group courses for specialists from overseas.

These courses, each of which catered for about 25 students, were concerned with Seed Improvement and Certification, Subtropical and Tropical Horticulture, and Ranch Development and Management.

Most of the participants were sponsored by the Commonwealth Government under its foreign aid schemes—Colombo Plan, Australian South Pacific Technical Assistance Plan, and Special Commonwealth African Assistance Plan. Other students were sponsored by F.A.O., the World Bank and other authorities.

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 significant development in breeding investigations was the commencement of a series of field experiments aimed at assessing the role of the Africander and its crosses, e.g. Belmont Red (F4 Africander X British), as an alternative third breed in crossbreeding programmes using Brahmans and Herefords. This is the first assessment of a Belmont breed under commercial conditions. The Africanders will be compared with Droughtmasters and Brafordes in terms of fertility and growth of progeny.

At "Swan's Lagoon," breeding herds of half and three-quarter grade Brahmans are being developed and the Shorthorns phased out. The Sahiwal grading-up programme is continuing satisfactorily and a number of F1 bulls were sold to the industry. Surplus Africander females were sold and the breeding programme is being concentrated at "Toorak" Sheep Field Research Station, Julia Creek.

A major breeder study was commenced at Parada in which the reproductive performance of Brahman cross cows and the liveweight production of progeny are being studied.

At Kairi Research Station, in a breed comparison study with Shorthorn, Friesian and Brahman cross steers, the Friesians gained more liveweight than the Brahman cross, which were superior to the Shorthorns. Carcass data revealed that at light slaughter weights the Friesians were underfinished and had a lower yield of saleable meat than the other two breeds.

A Sahiwal herd has been established at "Brian Pastures" Pasture Research Station and will be graded up by artificial insemination.

Major breeder trials are now in progress at "Brian Pastures" with the basic aim of maintaining an early calving regimen through from heifers to mature cows, in which good reproductive rates can be achieved economically.

Performance Recording

During the year the beef cattle performance recording scheme, initiated in early 1970, continued using the New South Wales Department of Agriculture processing facilities. Four herds have withdrawn from the scheme for various reasons, leaving 30 herds continuing to performance record. Generally, acceptance of the scheme has been good and co-operators remaining in the scheme appear convinced of the advantages of performance recording in spite of the cumbersome procedures involved in the present scheme.

With the introduction of the National Scheme due in early August, a workshop was conducted at the University of New England during May. The aim of this workshop was to train intermediaries in all aspects of the National Scheme. Intermediaries will promote the scheme and provide assistance to producers during the introductory stage of the new scheme. Some 23,000 leaflets promoting the National Scheme are being distributed throughout the State through the activities of extension staff and the co-operation of stock and station agents.

In the National Scheme two separate recording systems (2-stage and 4-stage) are available and a producer can elect to use either one. While both systems record the same essential data and provide identical reports, the recording procedures are quite different. The 4-stage system uses four forms and is similar to the system presently being used. The 2-stage system only uses two forms, is easier to operate and is more appropriate to Queensland conditions.

Nutrition

Experiments continued at the Animal Research Institute on intensive finishing of steers on high-grain rations, intensive finishing of calves, growth and carcass type of animals finished on grain compared with pasture, nutritive value of reconstituted grain, survival feeding, urea toxicity and mineral deficiencies.

Generally, producers consider that sorghum is a "safer" grain than wheat in intensive finishing rations for cattle. During the year, Shorthorn cattle were intensively finished on a simple diet of 90% wheat grain and 10% Rhodes grass chaff as roughage and grew at approximately 2.6 lb/head/day from 500 to 850 lb. liveweight. Production in the groups where sodium bicarbonate was included at levels of 1.0, 2.5 or 5.0% of the grain component was no better than that of the groups without sodium bicarbonate. Feed efficiency was much better in the groups fed cracked wheat compared with those fed whole wheat.

In intensive finishing diets the roughage is the minor component of the nutritive value but is necessary to prevent digestive upsets. In rations based on 90% cracked sorghum grain, cotton seed hulls as a cheap roughage source were compared with lucerne chaff as a more expensive roughage source. Over a liveweight range of 500–850 lb. the cattle receiving cotton seed hulls had an average daily gain of 2.8 lb. compared with that of those on lucerne of 2.5 lb. Addition of 3% tallow to rations increased liveweight gain and resulted in better feed conversion ratios. Free-choice supplements of soil, salt and phosphate did not improve production.

Cattle were successfully finished over a liveweight range of 500–850 lb. liveweight on a diet of 90% cracked millet grain and 10% lucerne chaff.

The carcass composition of calves with restricted nutrition early in post-natal life when on a high quality diet to 850 lb. liveweight was no different from that of calves grown unrestricted from birth. However, at the same liveweight cattle finished on a high-grain ration had about 25% more fat than those finished on pasture.

Pregnant then lactating cows and steers after 7 days grazing virtually pure stands of *Coloniao* guinea grass had changed salivary sodium:potassium ratios indicative of deficient dietary sodium intake. The changes in the cows persisted for the 72 days of the trial but this ratio returned to normal in the steers in 40 days. The calves born during the period had normal saliva composition.

Calves early-weaned at 3 days from their dams and fed milk replacer to 130 lb. liveweight were then fed simple diets of sorghum grain and meatmeal or sorghum grain and urea in pelleted form. There were no differences in performance between calves fed milk replacer once daily and those fed twice daily. Meatmeal-supplemented calves are out-performing urea supplemented calves up to 220 lb. liveweight but not at heavier liveweights.

The research programme at "Swan's Lagoon" Cattle Field Research Station continued satisfactorily with only one new experiment in which the response to additional energy (molasses *ad lib.*) to a urea-molasses supplement to growing cattle grazing spear grass pastures is being assessed.

It has now been demonstrated that in all years liveweight responses of up to 0.5 lb. gain per day may be obtained in growing cattle grazing native pastures with urea-molasses supplementation from May to the break in the season. In most years this response is highly economic, the greater proportion of the liveweight advantage being retained at the end of the following wet season. Biuret was also shown to be a satisfactory alternative to urea when fed with molasses to young growing stock. Black phosphoric acid was confirmed as being deleterious to young growing stock when used as a source of supplementary phosphorus.

A significant finding at "Swan's Lagoon" was a substantial response in terms of increased calving rates and weaning weights of calves of cows supplemented with urea-molasses during the dry season. A phosphorus-molasses supplement during the wet season also increased pregnancy rates.

An interesting differential breed response to various levels of urea feeding has been obtained in an experiment in which responses to 1, 2 and 3 oz. urea per day were measured in Shorthorns and Brahman crosses. The Brahmans did not respond beyond the lowest level while the Shorthorns responded up to the highest level. In subsequent studies both Brahman and Sahiwal F1 crosses failed to show any response beyond 1 oz. urea per day. This result is in line with findings elsewhere that urea recycling is more efficient in Brahman crosses. If this work is confirmed it may be possible to recommend that only 1 oz. urea be fed as a daily supplement to *Bos indicus* crosses.

Two years of the breeder supplementation trial at "Swan's Lagoon" have been completed, information being available on 3 years' conception and 2 years' weaning data. Both Shorthorns and Brahman cross heifers have achieved very satisfactory and similar pregnancy rates, the Shorthorns having a marginally shorter calving to conception interval. There was little difference in pregnancy rates on native and Townsville stylo pasture, except that the stocking rate on the latter was twice that on native pasture. A dry-season supplement of urea-molasses (93%) and a wet-season supplement of molasses-phosphoric acid (88%) both increased pregnancy rates over controls (79%). Crossbred calves gained 2.11 lb. per day in comparison with 1.87 lb. per day for Shorthorns. Townsville stylo pastures increased calf gain per day from 1.9 to 2.1 lb. per day. Urea-molasses supplement significantly increased weaning weight in comparison with controls and groups fed molasses alone.

In a pen experiment at Ayr Research Station designed to investigate the role of molasses in urea-molasses supplements, it was shown that urea and molasses in combination increased intake significantly more than the additive effects of urea and molasses alone. There was no effect on dry-matter digestibility. The result tends to confirm that liveweight responses to urea-molasses are due to increased intake and that some nutrient factor in molasses enhances intake responses to urea nitrogen.

In a further pen study at Ayr Research Station, intake and liveweight responses to biuret were enhanced by the feeding of a mineral mix containing sodium, sulphur and phosphorus. The adaptation period to biuret was shortened by the mineral mix.

In a series of biuret supplementation trials in the north-eastern dry tropics, liveweight responses were obtained in all locations except on basalt country north of Charters Towers. These results support the responses obtained at "Swan's Lagoon". There can now be little doubt that productive and economic responses to NPN supplements are obtainable in growing cattle grazing native pastures in the dry tropics in most years. However, extrapolation to southern Queensland environments and to improved species such as brigalow pastures would be highly speculative. Studies have commenced to define the productive role of these supplements in these areas.

A survey of suspected phosphorus-deficient areas in south-western Queensland was commenced in order to define the pattern of deficiency throughout the year and to ascertain the extent of the problem.

Phosphorus supplementation trials aimed at assessing the response in terms of enhanced reproductive performance in breeders are in progress in several deficient areas of the State. Large numbers of cows are involved and it is anticipated that information on the economics of this form of supplementation will emerge.

A limited number of feedlot studies were completed. The use of an inert synthetic roughage enabled a 100% grain ration to be fed safely. In two such trials feed conversion was superior to that of a standard 85% grain, 15% stubble ration, but weight gains were slightly inferior. In another study at Bundaberg, up to 40% dundar (a wet molasses fermentive soluble waste material) was fed with grain and bagasse with satisfactory daily liveweight gains.

Reduced productivity in breeding cattle on basaltic soils on the eastern Darling Downs has been shown to be due to a sodium deficiency. Low sodium levels in water and pasture and wide distortions of the normal sodium-potassium ratio in saliva have characterized this unusual field disorder. Significant production responses to sodium chloride supplementation have been observed in suckling calves. The weight response in their dams is less significant despite a clinical response as evidenced by examination of the sodium:potassium ratio of their fluids.

Pests and Diseases

Cattle tick.—During the period June 1, 1971, to May 31, 1972, inclusive, a total of 688 tick samples was tested with the following results:—

Mt. Alford strain resistance	20
Biarra strain resistance	295
Mackay strain resistance	14
Gracemere strain resistance	4
Ridglands strain resistance	172
No resistance	183

Further cases of Mt. Alford strain resistance were detected in ticks from holdings at Beenleigh (1), Caboolture (2), Cooroy (1), Gundiah (3), Gympie (2), Howard (1), Nambour (2), Obi Obi (1) and Tiaro (1), and further individual cases of Gracemere strain resistance were found at Mossman, Sarina, Mackay and Nankin. A further seven holdings in the Rockhampton area, five in the Innisfail area and one in the Townsville district developed Biarra strain resistance, with a further additional case of Mackay type resistance at Gladstone.

Following evidence that Biarra strain resistance was becoming fairly widespread in the area immediately north of the Burrum Heads-Kingaroy administrative tick line, a new administrative tick line was declared on November 8, 1971, to include the southern portion of Miriam Vale shire and the area south of the northern boundaries of Kolan, Perry, Gayndah and Wondai shires. Cattle moving north from south-eastern Queensland are required to take two clean treatments and cross the administrative tick line within 24 hours of the final treatment.

While the stabilizing of chlorphenamide still causes some difficulties, its use as an additive in organophosphorus (O.P.) dips has greatly improved tick control on properties with serious control failures when using O.P.'s only. This medicament was recently registered for use alone. Although it has given encouraging results in experimental dips, including one under Departmental control, it is too early to assess its value under owner control. Experimental evaluation is continuing on a number of other promising tickicides, two of which may be commercially available next season.

By and large, the long-term prospects for chemical control of cattle tick are gloomy. In about one-third of the tick-infested area, the new products are making their appearance just in time to prevent complete breakdown on many properties. While measures taken to prevent the spread of resistant strains have been reasonably successful, there has been a steady increase in the distribution of resistance. There is also evidence to suggest the evolution of new strains closely approximating known strains in tickicidal resistance.

The problem of multiresistant tick in Queensland has rendered ineffective acaricides that remain effective elsewhere and produced a demand for new chemicals for a very limited market. To meet this special problem, work on the residue characteristics of new chemicals has been undertaken in collaboration with the chemical industry where potential new chemicals fulfil certain criteria based on need and expectation. The object is to provide the cattle industry with effective acaricides that will not inhibit the market acceptance of Queensland beef.

Tuberculosis.—Since the inception of the National Scheme for Eradication of Tuberculosis and Brucellosis in October 1970, almost 1,000,000 cattle have been tested for tuberculosis on approximately 4,000 properties. Within the protected areas, 500 reactors (0.05%) have been detected. This level is in keeping with a low incidence of tuberculosis found at slaughter of cattle from these areas. The incidence of infected herds tested to date within the protected areas is about 8 per 1,000.

Participation of Inspectors in the organization of tuberculin testing of a shire basis has been adopted to encourage graziers to submit their breeding cattle to a test to enable testing to be undertaken efficiently. Field staff have addressed meetings of stockowners and used mass media to outline the objectives of the tuberculosis and brucellosis programmes.

Approximately 115 veterinary practitioners are participating in the scheme, most testing within 50 miles of their headquarters. Several practitioners from northern New South Wales are testing in the border areas and some in the far south-western areas.

Although testing of beef cattle within the coastal shires may be completed within 2 years, problems associated with the lack of facilities for testing and distances involved in making contacts with properties can be expected to slow down the progress of testing of shires in the western portion of the protected areas.

Outside the protected areas, more especially the far west, several pastoral companies have now employed veterinary surgeons on a part or full-time basis to undertake eradication measures on properties where there has been a long record of infection based on meatworks returns.

Three Government veterinary officers have begun pilot testing of beef cattle on infected properties in the far western areas where incomplete mustering for testing at regular intervals often limits the testing of the entire breeding herd. Two are concentrating on the Bulloo shire, where almost all properties have a history of infection. The reactor rate has ranged from 2% to 5%.

Restrictions on the introduction of cattle to New South Wales introduced in February 1972 created an immediate demand by graziers in the Darling Downs, Roma and Goondiwindi areas for testing of breeding herds to qualify for movement of sale cattle to this State.

A recent decision by the United States not to accept meat from no-lesion reactor cattle and slaughter cattle with visible lesions unless cooked has presented an unanticipated difficulty. A considerable proportion of reactors to the tuberculin test as well as visibly affected animals satisfied meat inspection standards. These are no longer acceptable and other outlets must be found for them.

Brucellosis.—Strain 19 vaccination of beef cattle within the brucellosis protected area is not encouraged unless there is evidence of brucellosis or the property is at risk of becoming infected from neighbouring holdings. A rapid field test for brucellosis is presently under consideration to enable a survey of beef cattle on properties where blood samples cannot be readily collected from breeding cattle at slaughter.

Pleuropneumonia.—The fifth successive year has passed without evidence of bovine contagious pleuropneumonia in Queensland. Another milestone was passed during the year when the whole of the State was accepted by the National Sub-committee as being free.

A monitoring system involving the inspection of lungs at meatworks is being maintained to ensure that no latent infection escapes detection on properties. Lungs with pneumonic lesions are routinely submitted to the diagnostic laboratories at Yeerongpilly and Oonoonba for detailed bacteriological and pathological examinations to ensure that the disease is not present in latent form.

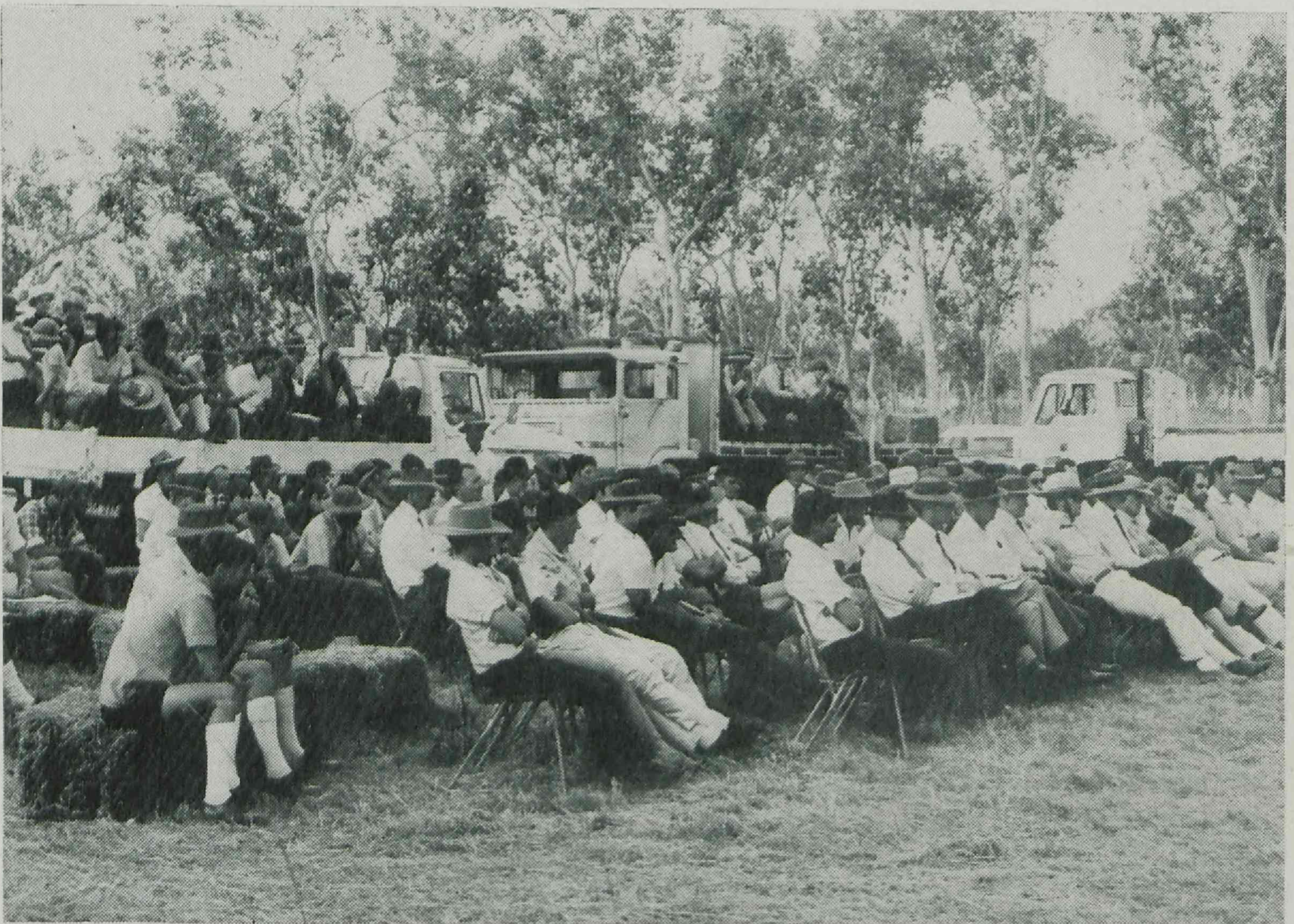
Miscellaneous.—An interesting heifer dystocia trial was concluded at Brigalow Research Station. Pregnant heifers were grazed at low, medium and high planes of nutrition during the third trimester of pregnancy. Nutritional level was correlated with the body-weight of heifers at parturition. The low level reduced birth weight of calves but the highest level of calving difficulty was in this group. Average daily weight gain of calves during the first 3 months was correlated with level of nutrition prior to calving, illustrating the effect on lactation of pre-calving nutrition. The lower level of nutrition produced a significantly lower total liveweight of weaner per heifer calved. The highest level of pre-calving nutrition increased subsequent conception rate. It might be concluded that alternative methods of controlling heifer dystocia to restriction of nutrition in late pregnancy might have to be adopted in this environment.

The study of foetal and neo-natal calf losses has been modified to concentrate on the causation. Emphasis is now being placed on virus and other infectious causes of abortion. The roles of I.B.R. and *Leptospira hardjo* are being examined in some detail.

Further work has been done on St. George disease. The *Pimelea* species that are distributed widely in Queensland are capable of producing scouring and/or the oedematous disease. All of the plant, including very dry aged plant, can have a considerable activity.

Extension

With a return to more favourable seasonal conditions over much of the State, the demand for advice on drought mitigation measures which has existed for several years has diminished. This has allowed staff to widen their extension activities away from routine advisory duties and devote more time to developing and extending new husbandry techniques such as aspects of breeding herd management which can be expected to have important repercussions on reproductive efficiency, particularly in the northern beef cattle areas.



The desire of beef cattle men to keep abreast of technological advancements is demonstrated by their attentive participation at this field day.

Recognizing that poor nutrition is a major cause of low reproductive rates in the State's beef herds, particularly in the dry tropics, increasing effort is being directed towards this field of investigation by research and extension staff and there are already indications that significant improvement is being achieved by the tactical use of phosphorus and nitrogen supplements. This, coupled with already developed management practices aimed at the maintenance of body condition of the breeding female, can be expected to have far-reaching effects on reproductive efficiency in beef herds. At the same time, disease factors in infertility are not being overlooked and investigations in this direction are concurrently being carried out.

The increasing demand from producers for advice on a wide range of husbandry practices and the continued response from producers to formal extension activities is clear evidence of their awareness to keep up with new developments in technology with a view to improving production efficiency to stave off the effects of rising costs and maintain their business as an economically viable unit.

Economics

A survey of beef properties has been undertaken in the Miriam Vale and Kolan shires to assess management systems on different sized properties in the Bundaberg region. It is proposed to expand this research along with work being conducted at Rockhampton to develop a more flexible approach to assessing farm management problems encountered by beef producers in coastal regions.

With good prospects in the beef industry, numerous budgets have been prepared for graziers wishing to expand their existing beef herd, to change over from sheep to beef or to move out of dairying. At current cattle and land prices, a conservative approach is desirable, particularly where the borrowing component is high. To be reasonably assured that the venture will remain viable in the long term, provision may be made for a decline in beef prices over the next few years, bearing in mind the current rate of expansion in the beef industry, particularly in southern States.

Considerable interest is evident in feed-lotting, which is a fairly risky proposition under present conditions. Where considerable capital investment is involved in equipment and yards, competitive buying of livestock and feed combined with a large throughput and a premium for the product is desirable for successful operation. For the small producer, fattening on grazing crops is likely to be more profitable.

SHEEP

Research studies on reproduction, nutrition and range management are being carried out at "Toorak" Sheep Field Research Station, Julia Creek.

Some of the physiological reasons for differences in fertility between plain and wrinkly ewes are being examined. Studies of the water metabolism of the two classes of animals indicate that water intake is some 15-16% higher and water turnover rates 60% higher in plain ewes, suggesting that these animals are better adapted than wrinkly ewes.

The effects of high temperature on some endocrine aspects of reproduction, in particular levels of plasma progesterone, were examined. However, data obtained suggest little differences in plasma progesterone status between plain and wrinkly animals. Results suggested that luteal function is not altered by the ability of the animal to respond to high environmental temperatures.

Studies were made on the response of rams to high ambient temperatures and subsequent fertility. Marked individual variations in ram fertility were noted. It was possible from the results to select rams in which both rectal and scrotal temperatures remained at low levels and in which seminal degeneration was low.

Fertilization failure has been shown to be a major cause of reduced fertility in ewes in the spring and the autumn in tropical Queensland. Seminal degeneration in the ram is associated with a high degree of fertilization failure.

Rams selected on the basis of rectal and scrotal temperature status were mated to ewes which had also been selected on the basis of rectal temperature status. Data obtained indicated that temperature status of the ram and the degree of seminal degeneration which occurs have a marked effect on fertilization rate. However, no significant differences in fertilization rates between "hot" and "cold" ewes were noted.

Studies on the effect of weaner nutrition on lifetime productivity of ewes in a semi-arid environment were continued. Preliminary assessment of the data indicates that a higher proportion of ewes which experienced a good growth rate when 6-12 months (high plane) produced lambs at their first joining at 18 months of age.

In the nucleus trial, records of lambing performance and wool production from plain and wrinkly sheep were maintained. The low skinfold score groups have continued to produce more lambs than the wrinkly groups.

B

The survival rate of young lambs subjected to the Mules operation at lamb-marking in this tropical environment is being investigated further.

The drought feeding trial to evaluate the responses to urea/molasses supplementation by ewes grazing dry Mitchell grass pastures has terminated. Analysis of data from this experiment has been completed and is now being prepared for publication.

Determination of water intake of sheep in relation to pasture conditions and ambient temperatures, management studies on Mitchell grass, wool growth, grazing time and pasture yields and composition are still being examined.

The chemical defleecing trial showed a wide animal-to-animal variation in response to the treatment. An adequate wool break allowed the defleecing of some animals, while in others the fleece could not be removed. Sunburn was a major problem under the conditions of the experiment.

The South Australian Exchange Trial was continued. Results at the Department of Animal Physiology (Waite Agricultural Research Institute) of animals transferred from Toorak to Adelaide indicate that the effects of severe stress early in life (high temperatures and poor nutrition) have not been removed by the change to a more favourable environment. South Australian strain ewes transferred to Toorak appear to have lower fertility than the Toorak sheep.

Three grazing trials, one on the Darling Downs and two in the central west, are in progress. The first mulga grazing trial has been completed. An extension of this trial is in progress to determine whether a practical and economic system of molasses supplementation can be devised for pregnant ewes on a mulga diet. The supplementation trial at "Merino Downs", Surat, has been completed and the results are being analysed.

Work on the effect of short-term protein intake on the spectrum of liver enzymes of sheep on a low plane of nutrition has continued. This work, aimed at protecting ruminants against urea intoxication, has been extended to assist in determining the status of protein nutrition on a flock basis. Other biochemical indices of protein status of sheep are being examined.

During the year outbreaks of blowfly strike indicated difficulties of control under field conditions and laboratory studies confirm the wide geographical distribution of flies resistant to available insecticides. Two jetting formulation trials are in progress in the central west to evaluate the length of protection given by a new formulation of an insecticide which has been used for a number of years.

Preliminary trials to evaluate the economic use of sheep rugs supplied by C.S.I.R.O. Division of Textile Research have been started in the Barcardine area.

With the establishment of two new centres at Charleville and Goondiwindi, farm management advisory services are being expanded in the sheep industry. The Australian Wool Board is financing a 3-year project to study farm management problems in the uncertain environment of the semi-arid pastoral sheep zone centred on Charleville.

In the forthcoming year, it is proposed to examine the feasibility of transporting wethers from southern breeding areas to northern sheep properties in preference to maintaining breeding properties with low lambing percentages. Particular attention will be given to relative costs of maintaining flocks in both localities and to problems of selling aged wethers from northern properties.

Sheep-beef economics were examined in meetings with graziers on the box-sandalwood country in the west of the Waggamba shire. A report was subsequently issued to assist graziers in calculating the profitability of changing over from sheep to cattle on their properties.

Small groups of graziers have continued recording in the farm management accounting service in the Muttaborra, Dirranbandi and Karara districts, with a new group being established at Charleville.

PIGS

Experiments continued on the comparison of wheat, barley and sorghum in grower/finisher diets, the partial replacement of protein supplements in cereal-based diets with synthetic amino acids and the biological evaluation of protein concentrates.

Further trials confirmed that in diets of approximately 80% grain for grower/finisher pigs, wheat resulted in superior growth rates and feed conversion ratios compared with barley or sorghum, barley being a little better than sorghum. Wheat-fed pigs had greater backfat thickness than pigs fed either barley or sorghum. Supplementation with synthetic lysine and/or methionine did not eliminate the differences in growth rate between the three grains.

A basal diet of 80% sorghum and 12% meat-and-bone meal was supplemented with four levels of lysine (0, 0.2, 0.4 and 0.6%) and 2 levels of nicotinic acid (10 and 20

mg./kg. diet). There was no significant production response to either level of nicotinic acid supplementation. Supplemental lysine improved both growth rate and carcass lean yield content. The maximum response was at the 0.4% supplemental level.

Problems relating to infertility in sows continued to be studied, although the incidence appeared less than during the previous summer, possibly due to cooler weather. A number of sows in the Townsville area were reported to have aborted in early to mid pregnancy, while others in late pregnancy farrowed dead pigs, following cyclone "Althea". A project to investigate the influence of "Neguvon" on kidney worm infestation at the Cherbourg Aboriginal Settlement did not suggest that this drug was an effective treatment.

From the 1970 and 1971 varietal trials at Kingaroy, Biloela, Wowan and Hermitage a total of 124 sorghum samples were received by the Biochemical Branch of which 64 have been analysed. The crude protein content of these grains ranged from 7.2-18.1%. Also, 95 maize samples from Kingaroy, Kairi and Biloela were received, of which 89 have been analysed. Crude protein content of these grains ranged from 8.6-14.0%. It is hoped that by the end of 1972 all samples will have been analysed for amino acids (including tryptophan and cystine), energy and minerals, when the results will be compiled for statistical analysis. The project aims to provide a valid and comprehensive review of the amino acid composition of Queensland grown sorghum and maize over a wide range of crude protein contents and growing conditions.

Particular features of routine activity by pig advisory staff were associated with ration formulation, often involving the assistance provided by the computer programme for designing least cost rations, and assistance with building plans and designs.

Assistance continued to be provided on various aspects of performance recording. Results from litter recording were again published, 5,533 litters in 66 herds averaging 9.7 pigs born alive in each litter, with 8.4 being weaned. With a farrowing interval of 174 days, this indicates the production of 19.4 pigs born alive and compares with the State average of 15.7 recorded by the Bureau of Agricultural Economics in their recent survey. The large difference indicates the very wide range in productivity which exists.

Interest in herd improvement continues to increase and assistance continues to be provided with on-farm performance testing and selection of breeding stock. At the boar testing station, Rocklea, 188 boars were tested (105 Large White and 83 Landrace) and 95 were approved (49 Large White and 46 Landrace).

Financial assistance has been provided by the Australian Pig Research Committee for an investigation into structural changes which have occurred in the pig industry in Queensland over recent years. Particular attention is being given to the relative importance of grain-pig enterprises compared with dairy-pig enterprises and adjustments which might occur in the future. The market requirements of pigmeat processors will also be studied as a basis for determining necessary changes in present management practices to meet future market needs.

A pig management recording scheme on the Atherton Tableland is being maintained to provide an assessment of piggery efficiency in terms of profit margin over feed costs per sow. In addition, a number of pig producers in southern and central Queensland have continued membership in the Farm Management Accounting Service and a further report is being published.

Planning was also commenced on a consumer marketing survey on pigmeats, finance for which has been provided by the Pig Industry Research Committee.

POULTRY

Experiments conducted during the year examined the influence of nutrition (particularly mineral nutrition) of both grower and layer diets and genetic selection on the quality of the egg, the influence of type of cage housing on egg production, the evaluation of Queensland feed ingredients and the effect of various methods of restriction of nutrient intake on egg production.

Further experiments confirmed that phosphorus level in the diet influences the layer's calcium requirement and consequently the strength of the egg shell. The high phosphorus levels in Queensland diets based on meat-and-bone meal necessitate a higher calcium allowance than that previously recommended.

Shell strength and albumen (thick white) quality have been shown to be heritable traits. The response in the flock to a practical selection programme is being investigated.

Further experiments confirmed that in caged layers subsequent egg production was not affected by debeaking pullets at either 5 days, 12 weeks or 20 weeks of age as a control measure for cannibalism.

Contrary to the results of previous experiments, further experiments showed that no improvement in production was demonstrated when cage populations of uniform liveweights were compared with populations of mixed liveweights and that the lighter hens in the populations tolerated the multiple bird cage system (2 or 3 birds per cage) as well as the heavier hens.

A further comprehensive range of maize and sorghum samples of defined agronomic detail were bioassayed for metabolizable energy content.

The acquisition of additional environment recording equipment has permitted the expansion of investigations of brooding area design and management. Investigations of noxious gas levels will be undertaken, as exhaust gases from heating units may be expelled into the brooder room at dangerous levels.

As a preliminary to considering the establishment of a least cost feed formulation service, a State-wide survey was conducted to find out how many producers mix their own poultry feed and how many birds are involved. Results showed that in south-eastern Queensland about 40% of layer feed used is mixed on the farm. There is a higher proportion of farm mixing on central and northern farms. It was decided that it was not practicable to develop a least cost feed formulation service.

A survey of manure handling methods on cage farms indicated that there is a lack of suitable handling and removal equipment on the market.

A survey of water sources showed that 35% of Queensland layers have access to town water, 54% to underground water, 28% to dam water and 9% to stream water.

A Poultry Management Recording Scheme has been in operation on the Darling Downs for the past 3 years. Interest has centred on obtaining rearing costs of replacement pullets for comparison with buying point of lay pullets from commercial hatcheries. The performance of laying flocks is also being studied with a small group of producers in south-eastern Queensland to record margin over feed costs, egg production and layer mortality. Both schemes are now computerized.

Improved technology and the increasing efficiency of primary producers have resulted in many industries producing more than the market will absorb, except at unpayable prices on the export market. This has resulted in the pressing need for supply-demand management schemes in these industries, and such a scheme is being developed in the egg industry.

The Egg Marking and Grading Regulations were amended to provide for additional grades of saleable eggs.

Popular extension events held during the year included the Seventh Poultry Industry Festival, a Poultry Science Seminar and a Poultry Information Exchange.

The relative efficiencies of chemical and heat treatments for the reduction of bacterial contamination of egg shell were investigated by Dairy Research Branch officers at the South Queensland Egg Marketing Board. Average number of bacteria on the shells of untreated farm-fresh eggs ranged from 69,000 to 520,000 per shell. Eggs from birds housed in cages contained fewer shell-borne bacteria than those from birds held on deep litter. Stained and soiled eggs carried an average of 16,000,000 bacteria per shell. Although the microflora of clean untreated eggs was predominantly gram-positive, gram-negative bacteria constituted up to 99% of the total bacterial population on heavily contaminated shells; this is considered important, as egg spoilage is caused almost entirely by gram-negative bacteria.

Washing eggs in a sanitizing solution of 49°C eliminated between 91 and 99.9% of the shell-borne bacteria. Quaternary ammonium compound was more effective than hypochlorite. When eggs were washed in water at temperatures between 57.5 and 67.5°C for fractions of the limit times for coagulation there was a greater margin of safety at the lower temperatures. Washing in a solution of quaternary ammonium compound was superior to heat treatment in eliminating shell-borne micro-organisms.

Washing eggs at the limit period for coagulation became more effective when the quaternary ammonium compound was added at the recommended concentration. This compound was less effective when the time of immersion was reduced to half the limit period. Greater attention should be paid to the time temperature relationships necessary to produce the maximum bacterial reduction when hot water is used to commercially wash eggs. The bacteria remaining on the shells after washing were predominantly gram-positive. In all experiments the number of shell-borne bacteria was reduced to a level which would not contribute to the bacterial population of the egg product.

BEEKEEPING

A direct result of the honey flora surveys conducted in the Paroo district in the south-west was the first major use of this area by Queensland and New South Wales migratory beekeepers. Over 10,000 hives of honeybees were situated along the Paroo River between Hungerford, Eulo and Yerrol. Estimated production was about 1 million lb. of honey, principally from yapunyah (*Eucalyptus ochrophloia*).

Revision of the handbook entitled "The Honey Flora of South-Eastern Queensland" was completed and a new volume was published under the title "The Honey Flora of Queensland".

The major research project on longevity of worker honeybees is continuing at Warwick. This long-term study aims at elucidating the casual factors of honeybee dwindling. Techniques for a project to study the relationship between plant sap pressure and nectar production have received preliminary attention.

A severe outbreak of the laval honeybee disease, American foulbrood (*Bacillus larvae* White), occurred at Goondiwindi and necessitated infected material and 17 live diseased hives being destroyed by burning. This is the first recorded occurrence of this disease in Queensland since 1957.

MEAT INSPECTION

Departmental slaughtering and meat inspectors provided full-time inspection services at abattoirs and part-time inspection at slaughterhouses. They also undertook regular structural and sanitary inspections at all premises licensed under the Meat Industry Act and Regulations.

The number of licensed poultry slaughterhouses fell to 102, as smaller operators ceased. The demand of fresh killed poultry is increasing. Attention has been given to weight gain tests at processing establishments to ensure that weight gains are kept within the statutory limit of 8%.

Grading of beef was undertaken at the Cannon Hill, Toowoomba, Ipswich and Townsville abattoirs and at privately operated meatworks in Brisbane and Ipswich. Lamb and hoggett classifications marking was also carried out at major abattoirs slaughtering for the local trade.

Five manual counting boards, four for bovine head diseases and one for bovine liver diseases, are now being operated at meatworks and other disease recording devices are under trial.

A standard procedure for the collection of information on tuberculosis in slaughter cattle has been widely accepted. Tuberculosis-like lesions are sent to laboratories for examination and endeavours made to trace the origin of positive cattle.

A trichomoniasis survey in slaughter cows was commenced at four Brisbane meatworks.

A large-scale bruising trial with cattle in transport was conducted jointly with owners and a meatworks operator. The trial showed that many factors are involved in the incidence of bruising between a far western property and a coastal meatworks.

Back-tagging investigations have been continued on cattle. The system is in commercial use to identify store cattle from tuberculosis-approved properties submitted for sale at sale-yards.

III. Dairy Research and Extension

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

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

FIELD SERVICES

The normal level of service to primary producers by the Field Services Branch continued during the year. The specialized service to processing plants expanded during 1970-1971 was consolidated in this period. A total of 24,943 farm visits was undertaken, 9,896 being of a routine inspection nature, 5,438 concerned with quality improvement, 5,119 for purposes associated with the Dairy Pasture Subsidy Scheme and 4,490 for advice on dairy cattle nutrition.

Special assistance was provided in those areas where bulk milk conversion was initiated and where milking machine efficiency checks were requested. A total of 313 bulk milk vats was installed and 712 milking machines were examined. It is disappointing that more producers do not avail themselves of this free service.

Supervision of milk distribution agencies throughout the State with the exception of the Brisbane Milk District is a regulatory function co-ordinated by Branch staff. Approximately 2,500 licences are supervised annually.

The number of surveys of dairy product manufacturing plants which were undertaken approximated 300. These embraced market milk, butter, cheese and casein production. Improved bacteriological and chemical quality of produce has resulted in several plants, although generally there is a significant problem of coliform contamination in milk and cheese products.

The programme of whole-farm development demonstrations commenced during the previous year was consolidated and additional demonstrations initiated. Seventeen property owners are co-operating with the Department in their presentation of this extension programme designed to highlight the significance of short-term and long-term planning in association with budget programming. Satisfactory involvement of neighbourhood producers has eventuated and excellent teamwork has been generated amongst local Departmental technical staff.

Teaching schools in nutrition of dairy cattle have been undertaken in several districts in the major dairying regions. These have been well attended and a significant change in knowledge and attitude effected. In addition, factory advisory staff have provided specialist instruction to the employees of several dairy product processing plants with the concurrence of factory managements.

A general summary of activities on a State-wide basis indicates a variety of extension activities and a satisfactory level of contact with producers:

	Number Held	Total Attendance
Farm walks	35	459
Field days	30	1,789
Method demonstrations ..	22	126
Film/illustrated talks/lecture evenings	99	2,862
Project Clubs	19	695
Farmer schools	33	902
D.E.A.C./Discussion Group/Q.D.O meetings	168	3,428
Producer contacts—Office	20,500
—farm visits	24,943
TOTALS ..	406	55,704

At the request of the Committee administering the Marginal Dairy Farm Reconstruction Scheme, a survey of property owners who have participated either as vendors or

as purchasers in the scheme has commenced. The objectives of the programme are to obtain information with respect to initial progress, ultimate development plans, immediate problems of amalgamation and other problems encountered. Eighty surveys have been conducted to date.

To combat an increasingly severe problem of milk composition below legal requirements, a programme of detection and control was initiated in the south-eastern milk districts of the State during the year. Assistance is being given to factories in testing for solids-non-fat and associations are being encouraged to establish their own testing programmes. Field officers are undertaking farm visits and conducting group meetings on the subject.

BREEDING

The Wacol Artificial Insemination Centre under the control of the Dairy Husbandry Research Branch holds a large number of beef bulls as well as dairy bulls, the total for all breeds in June 1972 being 108. Semen collected at the Centre in 1971-72 was over 133,000 doses, and some 40,000 doses from 56 bulls were processed for use only in the herd of the owner of the bull.

Sales of semen reached almost 95,000 doses, while 37,800 doses of semen imported from Britain and New Zealand were received in bulk and distributed in small consignments.

Distribution of semen from dairy bulls supplied to Artificial Breeding Co-operatives was: Friesian 52.1%, A.I.S. 29.1%, Jersey 14.2%, Guernsey 3.6%, and Ayrshire 1.0%.

New distribution centres were formed during the year and much attention has been given to promoting artificial insemination.

The training course for inseminators was completed by 68 trainees during the year.

All bull-proving inseminations in 1971-72 were carried out by commercial co-operatives and the system of incentive payments for effective daughters was extended to the A.I.S. and Jersey breeds in addition to the Friesian breed, which had been proving in this manner since 1965.

During the year, a unique team of four young Friesian sires entered the Wacol centre. These bulls are sons of A.I. proven sires from such diverse countries as Britain, New Zealand and Canada, and will be used in 1973. This follows the 1972 team, which will consist of four sons of a British A.I. proven sire.

All young sires entering Wacol are obtained by mating proven sires to selected merit register cows in leading stud herds. In future, it is intended to make proving teams as attractive as possible by including at least one son of an overseas sire in Friesian and Jersey teams and one New South Wales sire in the A.I.S. team. If possible, sires nominated by breed societies will also be included. These modifications will call for increased co-operation from the dairying industry in making herds available for proving.

HERD RECORDING

Membership of the various herd recording schemes continued to vary with seasonal conditions. In addition, the decline in dairying, particularly in areas that are operating on a butterfat economy, has meant a reduction in the number of dairymen in these areas who desire to record individual production in their herds. As a result, the number of Herd Recorders was reduced by six to 48.

However, there has been a renewed interest in herd recording in the south-eastern coastal area, where the wet summer provided better conditions than in 1970-71 and where

a large percentage of farmers are market milk suppliers. This has resulted in the trend for farmers milking large herds of 150 cows or more to commence production recording.

The average production yields for cows recorded under the Pure Bred, Group and Bi-monthly Production Recording Schemes during 1970-71 are given below for comparison.

Scheme	No. of Herds	No. of Cows	Average Milk Yield (kg)	Average Milk Yield (lb.)	Average Butterfat Test (%)	Average Butterfat Yield (kg)	Average Butterfat Yield (lb.)	Average Days
Pure Bred	162	4,627	3,194	7,035	4.3	136	300	260
Group	821	38,667	2,400	5,287	4.2	101	222	253
Bi-monthly	64	3,488	2,151	4,737	4.1	89	196	

"Limerick Wanda Gem", owned by K. A. and M. R. Hickey, became the first Friesian cow in Queensland to produce 454 kg (1,000 lb.) butterfat when she produced 9,187 kg (20,235 lb.) milk and 488 kg (1,075 lb.) butterfat in a standard 300-day lactation.

The field work in connection with a project to determine whether lactation production can be estimated with sufficient accuracy from monthly measurements of yield and composition at one milking only, or composition at one milking only together with yield at both milkings on the same day, has been completed. The results are being processed.

The introduction of centralized testing using an automatic tester to process samples at a central laboratory is contemplated as an economy measure and construction of facilities is expected to commence early in 1973. The transport of samples under Queensland conditions presents some problems and these are being closely investigated in current field trials.

As the data bank of lactation performance is being accumulated following the introduction of computer processing of records in 1966, it is becoming more feasible to produce relevant statistical analyses of interest and use to the industry.

Work has commenced on projects involving the calculation of genetic parameters for milk production traits to aid in formulating breeding programmes for Queensland dairymen. Programmes have also been initiated to extract data on production records of daughters of A.I. Proven Sires. Comparisons are planned with a view to estimating the rate of genetic improvement which may be attributed to the use of A.I. A project designed to handle Pure Bred cow information that was previously recorded manually has been continuing.

NUTRITION

A trial involving limited milk feeding of dairy calves was completed at Biloela Research Station during the year. Weaning at 7 weeks was compared with weaning at 5 weeks, and with once-a-day feeding of either wholemilk or separated milk. A concentrate supplement was available to all treatments, and calves were grazed on lucerne. Although separated milk for 5 weeks was associated with reduced weight gain, the average daily gain from this group of 0.61 kg (1.35 lb.) / day is more than adequate for dairy replacements at a very economical rearing cost.

A trial involving comparisons of forage sorghum and sorghum silage as a source of roughage, two sources of energy (molasses and grain sorghum) and two sources of protein, non-protein nitrogen and cottonseed meal, was undertaken.

In the continuing trial on irrigated, fertilized pangola grass pasture at Ayr Research Station, liveweight in the Friesians decreased in the second year, calvings were somewhat later in the Friesians and production showed a tendency to decrease in this breed. Considerable improvements in these aspects were shown in the groups supplemented with molasses/biuret (30 molasses: 1 biuret by weight), indicating that the pasture is deficient at certain periods in either energy, protein, or both.

Detailed work on rumen pH has been carried out on the Ayr station in order to devise a sampling method which does not depend on variations in pH associated with the sampling site.

In vealer production trials at Millaroo with Sahiwal-Jersey and Sahiwal-Friesian calves suckling dams of the Friesian and Jersey breeds, a depression of birth and weaning weights in calves of Friesians in the higher stocking rate treatments was observed. Production per acre favoured the higher stocking rate, but weaning weights were not improved by supplementation.

Evaluation of glycine-green panic pastures continued at Kairi Research Station. A modified trial was introduced in 1970-71 and the first complete lactation figures show production of butterfat ranging from 139.5 kg/ha (124.6 lb. per acre) in low stocking rate groups of 1.3 cows per hectare (1 cow per 1 acre). Individual yields decreased markedly

"Sunny View Little Princess 30th", owned by J. Phillips and Sons, completed her eleventh lactation with a production of 8,410 kg (18,525 lb.) milk and 356 kg (785 lb. fat), to bring her lifetime production to 116,645 kg (256,927 lb.) milk and 4,849 kg (10,680 lb.) butterfat—the highest recorded lifetime production of any cow in Australia.

at high stocking rates. Supplementation with 3.6 kg (8 lb.) of grain in early lactation produced a variable return ranging from .52 kg (1.15 lb.) of milk/kg (lb.) grain to 3.60 kg (7.9 lb.) of milk/kg (lb.) grain.

In non-protein nitrogen trials at various centres only limited responses have been obtained and it is obvious that while non-protein nitrogens may substitute for a proportion of protein in the diet they cannot be relied upon to compensate for deficiencies in quality of the available ration, particularly low-quality pasture. The role of minerals in improving the response to non-protein nitrogen supplementation will be further examined.

Concentrate supplementation has resulted in monetary returns approximately equal to the inputs at manufacturing milk prices and it is evident that the economics of concentrate feeding depend largely on market price of the product and side-effects from special-purpose uses such as maintaining market milk quotas.

In a multiple suckling trial at four calves per Friesian cow, weight gains of 0.77 kg (1.7 lb.) / day were achieved for calves up to 150 days of age. However, with the decline in milk supply of the cows and deterioration in pasture quality over winter these weight gains were not maintained, so calves turned off at 300 days lacked size and condition for immediate slaughter. The trial has been modified to test the effect of grain supplementation on weight at slaughter.

DISEASES

Since the inception of the Brucellosis Eradication Programme late in 1970 there has been very little change in the pattern of Strain 19 vaccination of dairy heifer replacements. The number of dairy herds undertaking vaccination has remained at about 30% for at least 10 years. Despite the adoption of Strain 19 vaccination over a 20-year period, there remains a disturbingly high incidence of herds showing evidence of brucellosis based on the milk ring screening test recently applied to bulk milk samples. The incidence of infected herds varies from 14% to 80%. Despite this high herd incidence, brucellosis does not appear to be recognized as a problem by dairy farmers except for relatively few herds where the disease is causing abortions.

About 40,000 doses of Strain 45/20 brucellosis vaccine have been used in dairy and beef herds where the disease is active, i.e. where there have been abortions due to brucellosis. This vaccine has the advantage that it can be used to protect adult cattle exposed to infection.

It is now proposed to adopt compulsory vaccination of all dairy herd replacements as a preliminary step to eradication by test-and-slaughter methods.

As a consequence of the Mastitis Detection and Control Survey of 1969-1971, a platform testing programme to determine the incidence of high cell count milk consigned to processing plants was initiated in February. Testing is being undertaken on a monthly basis and results categorized into three ranges corresponding to cell counts of "less than 500,000/ml", "500,000-1,000,000/ml" and "greater than 1,000,000/ml". Recordings are being made in 20 locations embracing approximately 3,200 suppliers. Advisory programmes will not be undertaken until an adequate record has been obtained on each supply to establish a problem pattern.

MISCELLANEOUS

An initial response of 8% in conception rates to a modified technique of insemination incorporating uterine massage has been attained in a trial on the Darling Downs.

Freeze-branding trials have shown a success rate of 85% legible brands using dry ice and careful control of technique. Results with liquid nitrogen have been variable. Escutcheon tags have been used in further identification trials. Losses of up to 10% of the tags have been experienced over a period of approximately six months. The rate of loss has been disappointing.

ECONOMICS

Further assistance has been given to dairy farmers by Economic Services Branch in assessing the economics of changing over to bulk milk from cream production, the critical factors being the values to be placed on skim-milk fed to pigs and labour saved.

Further studies in the Burnett region have indicated that dairy beef generally does not generate sufficient income to be a viable alternative to dairying. Also the practice of growing grain crops on small dairy farms is discouraged, as higher returns are more likely from growing improved pasture or grazing fodder crops.

The change in the dairy industry around the larger coastal cities in central Queensland from a cream to a liquid milk supply has caused a number of producers to break with the traditional twice-a-day feeding milk or milk replacer to calves until weaning. The reasons for this change have been the increasing value of milk and the relatively high cost of milk replacer. Studies of three common calf rearing systems from birth to weaning have indicated that a saving in cost can be achieved through a combination of once-a-day feeding, early weaning and subsequent feeding on a concentrate supplement with hay.

Investigation of long-run supply response to price changes indicates that dairy farmers on the Darling Downs plan production in the current period according to the expected net returns from dairying, the expected prices for alternative sources of income, and production in the preceding period. Research is continuing into the supply/response patterns in other districts in south-eastern Queensland.

Time series and cross-sectional data from the Farm Management Accounting Service are being combined in a study of major factors affecting dairy production on Queensland farms. Present analysis suggests that farmers could increase their income by greater expenditure on livestock, machinery and equipment, feed, seed and fertilizer, and land in order of priority.

DAIRY PASTURE SUBSIDY SCHEME

Applications were received at a steady rate throughout the year, reaching a total of 3,125 by June 30. This is an increase of 305 on last financial year and reflects the improved climatic conditions experienced this year in most dairying districts. The figures from the Darling Downs show a marked response to these conditions, with an increase of over 50% compared with last year in the Eastern Downs districts and over 100% increase in the Western Downs. Central Queensland and South Burnett have also increased their numbers over the last year. Wide Bay, comprising the districts of Gympie East and Gympie West, Cooroy, Nambour and Maleny, is slightly down on last year's figures. The number of initial applications is about the same as last year—10% of the total.

About two-thirds of Queensland's dairymen are in the Scheme, with the Atherton Tablelands leading the State on a percentage participation basis. The farmers not yet taking part are mostly in areas of the State where annual rainfall averages are less than 30 inches.

Table 1 shows the number of applications approved in the nine regions for each year since the Scheme began in 1966.

TABLE 1
APPLICATIONS FOR SUBSIDY RECEIVED SINCE INCEPTION OF THE SCHEME

Region	1966-67	1967-68	1968-69	1969-70	1970-71	1971-72	No. of Registered Dairies at 30-4-72
North Queensland	283	288	311	255	233	229	428
Central Queensland	80	131	101	128	98	117	386
North Burnett	191	261	247	354	311	317	663
South Burnett	187	382	440	374	305	355	698
Wide Bay	754	1,022	829	980	642	613	1,276
East Moreton	350	489	404	477	346	378	925
West Moreton	250	673	713	556	570	583	1,242
Eastern Downs	228	391	335	417	290	470	1,499
Western Downs	31	63	52	45	25	63	236
Totals	2,354	3,700	3,432	3,586	2,820	3,125	7,353

Applications and claims approved during the year were as follows:—

No. of applications approved ..	3,125
No. of claims approved ..	1,811
Subsidy approved for payment ..	\$339,344.52
Area approved for payment ..	29,899½ acres

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

Total number of applications approved ..	19,017
Total number of claims approved ..	15,115
Total subsidy paid ..	\$2,928,011.90
Current subsidy deferred ..	\$80,291.46
Total subsidy approved for payment ..	\$3,008,303.36
Total area approved for payment ..	208,035½ acres
Average subsidy paid per acre ..	\$11.96

At the end of the year 22 dairymen had reached their maximum entitlement of \$2,000 and this number will be increased when deferred payments, due on July 1, are made. Other farmers with smaller herds have also exhausted their entitlement based on cow numbers in the herd. The number of these farms cannot be estimated as they may vary from season to season with the purchase of additional cows.

During the year two major policy changes in the Scheme were approved. The first was proposed to assist dairymen who had lost lucerne areas planted under the Scheme. A grant was announced by the Minister to subsidize replanting lucerne areas destroyed by the protracted rains early in 1971. Assistance was based on 25% of the cost of replanting to a maximum of \$5 per acre with a maximum of \$100 per farm. This amount was additional to the maximum entitlement due under the Scheme. To date only 14 claims have been received. Total expenditure amounted to \$1,054.90 paid

on 229 acres. Most farmers preferred to replant under standard Dairy Pasture Subsidy Scheme terms to obtain a higher rate of subsidy. Only those dairymen who had reached, or were approaching, their entitlement limit took advantage of the grant.

The second major addition was the admission of milking goat herds to the Scheme. For the purpose of assessing acreage entitlement, one cow was considered equivalent to three goats. Only one goat herd is participating in the Scheme.

Administration of the Scheme is proceeding smoothly. Field officers involved in District Committees appear to be integrating Dairy Pasture Subsidy Scheme activities with other extension duties very satisfactorily. The continuing active co-operation of the district industry representatives on the District Committees has been a major factor in the success of the Scheme and has provided a further important area of contact between the industry and the Government.

PRODUCTS RESEARCH

Analysis for pesticide residues in dairy products has been continued by the Dairy Research Branch, with particular reference to chlorinated hydrocarbons. No more than 2% of the 1,402 samples analysed exceeded the accepted level for total content of DDT and its metabolites.

Until 1970 little information was available on detailed chemical analysis of milk from the major dairying areas of the State. Dairy Research laboratories at Brisbane, Malanda, Murgon and Toowoomba are now regularly examining bulk samples of milk from selected factories within their respective districts to provide information to fill this gap. By this means milk composition, relationship of various constituents and the value of milk for specific purposes can be determined at any point of time.

Experimental work on the concentration of dairy products by freezing has been continued. The development of new freezing equipment has been satisfactory and a large

flake ice storage vat together with a system of agitators and augers was designed and constructed in the workshop of the laboratory prior to the installation of an instant ice flaking machine. In addition, refrigeration was installed to the storage vat to permit continuous operation without thawing. After numerous trials, the ice flaking machine was modified to give satisfactory results. However, serious difficulties remain in regard to separation of the concentrate from ice.

Experiments with new-type biodegradable base products have yielded interesting results and some success has resulted from the use of a gel type detergent. In other respects some new formulations of detergents based on chlorodiphenol compounds are causing concern because they may be responsible for the production of tainting compounds.

The study of cheese ripening with special reference to enzymology has continued. Cheese batches have been examined for proteases, phosphates and lipases throughout their ripening period. Protease and phosphatase activities remain stable throughout maturation and appear to depend mainly on the cheese starter used in manufacture. Lipase activity, on the other hand, decreases markedly over the first 3 months of ripening and then remains stable. The initial specificity of lipase is similar to the acid lipase of milk, whereas the specificity of lipase in older cheese more closely resembles that of the cheese starter.

Accelerated ripening techniques using cheddar cheese slurries were investigated during the year. Addition of potassium sorbate to slurries produced by homogenizing cheese curd with salt solution was necessary for normal flavour development.

Similarities and differences between phospho-peptides and bitter peptides in cheese have also been investigated. It has been shown that these two groups of peptides, while having some properties in common, are completely distinct and that phospho-peptides play no part in the development of bitter flavours in cheese.

Mould growth in packaged cheese has continued to cause trouble with resultant loss of quality and value of produce. These problems were investigated at one factory which had

installed a new type of packaging equipment. Using new laboratory techniques, the residual oxygen content of the packages was able to be determined which pinpointed defects in sealing operations and faults in the sealing membrane. When these defects were corrected a satisfactory seal with an impervious membrane was possible whereupon moulding ceased.

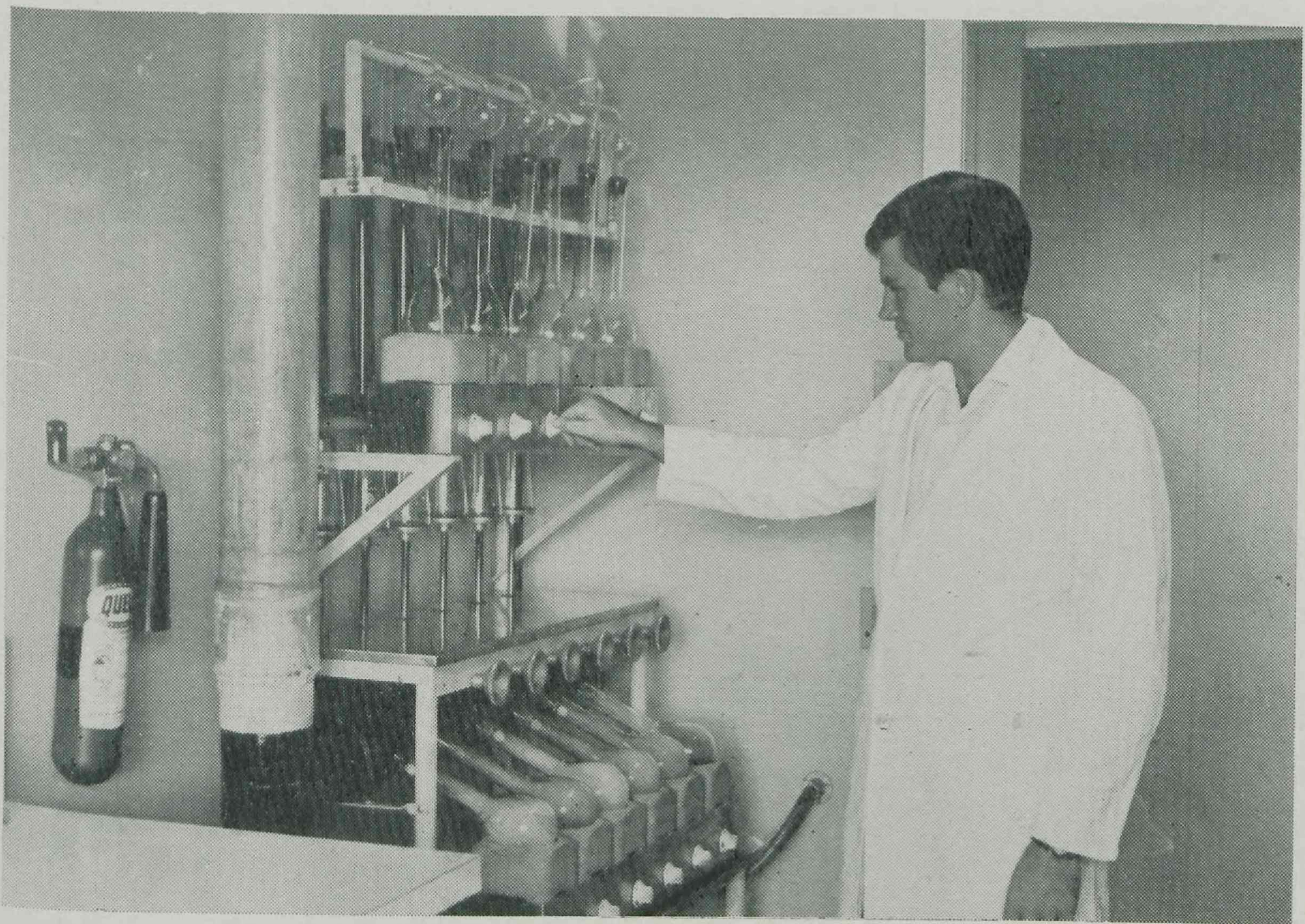
Three batches of stirred curd cheese were manufactured and vacuum pressed for comparison with cheddar cheese. No difficulties were experienced. However, due to an absence of commercial interest no additional investigations were undertaken.

The influence of temperature and time of curing of Gouda cheese was examined in a series of trials to determine the optimum conditions for eye formation. Results for eye formation show the optimum curing temperature was 60°F. Cheese cured at 48°F and 54°F exhibited few eyes and these tended to be of small diameter, while cheese cured at 66°F developed too many eyes of rather large dimensions. It appears that eye formation is established within the first 2 weeks of curing, as little increase in eye numbers was observed after this time.

A feasibility study with disposable polypropylene cheese cloths for hoop dressing was undertaken successfully.

A prototype cheese press pressure tester designed by C.S.I.R.O. Dairy Research and fabricated by Downs Co-op. Dairy Assn. Ltd. was tested and found to be useful as a commercial standardizing instrument.

Conditions governing the promotion of milk lipase activation and subsequent development of lipolysis have been investigated. Activation by agitation with foaming was found to be dependent on duration and temperature of previous milk storage as well as on degree and temperature of agitation. Although previous work has indicated a maximum susceptibility to agitation activation at 37°C, it was found that a second important maximum occurs at 15°C, which is approximately the maximum permitted temperature of the contents of farm bulk milk tanks during addition of a second or subsequent milking.



Milk protein estimation at the Malanda regional dairy research laboratory.

A monthly survey of tanker milk received in the Brisbane area has been conducted to pinpoint dairying areas where lipolytic milk is produced. Factors governing the production of such milk have been examined. Individual cow surveys have indicated that a large percentage of lipase activity occurring is "spontaneous", initiated simply by cooling the fresh milk. It appears that genetic background of the milk is important in determining tendency to produce spontaneously lipolytic milk. Other important factors found to be involved are stage of lactation and availability of green pasture.

As nearly all raw milk throughout the State is refrigerated prior to pasteurization, methods for determining quality of such milks have been extensively investigated. A high percentage of 'sample agreement' has been obtained with a modified nitrate reduction test using alpha-naphthol and penicillin, indicating that this method, using an incubation temperature combination of 15/30°C and with a nitrate reduction standard of 5½ hours, could be used routinely to differentiate raw refrigerated milks with high psychrotrophic and total bacterial counts.

A study of the enzyme systems of *Pseudomonas* organisms has been continued. Proteases elaborated by *P. fluorescens* and *P. aeruginosa* are very stable to pasteurization in the presence of casein. Synthetic substrates for assaying proteinases produced by *P. fluorescens* and *P. aeruginosa*, both common phytochromic contaminants of raw milk, were examined. No substrate tested is sufficiently sensitive for quality assessment of commercial raw milk supplies.

Overwhelming evidence has accumulated pointing to the insufficiencies of the methylene blue test for milk grading in this State, and in consequence experimental work has been completed in a number of districts to study the total bacterial count of milk as a criterion to replace the methylene blue test. Under the circumstances of the investigation, the total bacterial counts show up clearly as being much superior, and steps are now in hand to recommend its adoption.

Because an appreciable number of samples of milk, cream and butter have been found to contain *E. coli* Type I, cultures of these organisms isolated from samples have been examined for heat resistance. None of the cultures was resistant to H.T.S.T. pasteurization (72°C for 15 seconds).

Increasing attention is being paid to enterococci as a group of bacteria which are also useful as indicators of faecal contamination of food. Results so far obtained show that enterococci almost always outnumber *E. coli* in pasteurized dairy products and may be more sensitive indicators of the possibility of faecal contamination.

For a number of years penicillin agar has been used in the laboratories of the Dairy Research Branch to demonstrate the presence of post-pasteurization contamination in milk. Because thermophilic penicillin resistant organisms were isolated regularly from this medium the significance of these organisms on the penicillin agar method was investigated. It has been shown that unhygienic cleaning practices are associated with a high incidence of these organisms and it has been concluded that the original medium when used for the detection of post-pasteurization contamination would remain a useful tool in quality control if the sample of milk for testing were examined before and after laboratory pasteurization.

New work has been commenced aimed at providing information on thermophilic organisms which grow in milk supplies and which cause pasteurized milk to fail the legal standard set down. Large numbers of these organisms, particularly the

thermoduric micrococci, have been isolated from milk supplies and have been subjected to intensive study using a wide range of morphological, biochemical and physiological tests.

Investigations have been carried out to demonstrate any possible improvement to butter quality which might accrue from storage at low temperature (-10°F as against +10°F).

The Otto Madsen Dairy Research Laboratory has co-operated with other research establishments throughout the country in an investigation involving the breakdown of butterfat into a hard and a soft portion. Various methods of separation of the crystallized portion of fat have been examined and some uses of the various fractions have been explored. In particular, cheese has been made by substituting 20% of the original fat in the milk with hard fat fraction of high melting point. By homogenizing the hard fat fraction in skim-milk it was possible to incorporate this fat without loss. In several trials no loss in grade points resulted from such fat substitution when the cheese was graded after one month's storage. This work is continuing.

In the pilot plant of the Otto Madsen Dairy Research Laboratory experiments have been carried out in the production of high-fat creams for special markets. Creams with fat contents varying from 60% to 78% have been prepared with and without additives and with and without starter ripening.

Considerable effort has been given to promoting to commercial processors new forms of dairy products emerging from the research programmes of the Dairy Research Branch. Encouraging responses have been obtained for the extended manufacture of fruit yoghurt, the processing of fruit flavoured milk drinks and the use of tart fillings. This activity is mainly one of promotion and must necessarily proceed in an orderly manner.

Trials have been carried out at the Kairi Research Station to examine the effect of variation in stocking rates on total production and composition of milk of cows grazing glycine/green panic pastures. In all four herds the butterfat percentage of milks increased as the lactation progressed. At the same time herd butterfat levels also improved as the stocking rate decreased. Solids-not-fat levels followed the reverse trends, i.e. values decreased as the lactation progressed. However, percentages of solids-not-fat were maintained at higher levels at lowest grazing pressures until the close of lactation. Total protein and casein values tended to increase as lactation progressed, with protein levels remaining marginally better as stocking rate decreased.

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

Within the dry tropics the immediate need is for summer-growing plants, the grazing of which can be deferred into at least part of the dry season as a maintenance quality diet. Such plants could be grown either intensively on small areas, or at relatively low density and cost on large areas.

Townsville stylo has not fulfilled the expectations engendered by the Northern Territory work as it fails to hold its feed value through the dry season in coastal and sub-coastal Queensland. *Macrotyloma uniflorum* (= *Dolichos uniflorus*) is possibly more resistant to weathering by dew, frost and moulds and unacceptable to insects, but in its present form has manifest failings such as inadequate dormancy to ensure annual regeneration under erratic opening rains. Selection in such characters as pod shattering, seed size and plant habit and studies of their effect on its annual regeneration and utilization are among the objectives of the present breeding programme, which includes ancestral material from around the Indian Ocean. Another species under test (*M. axillare* (= *D. axillaris*)) has shown some adaptation and ability to perennate on the basaltic soils of Mt. Garnet-Mt. Surprise area and has low palatability in the growing season which may cause grazing to be deferred until the early dry season.

Fortunately there is a wide range of other *Stylosanthes* species, some perennial, some biennial and some annual, which are currently showing promise in various sections of the northern region. As testing of these progresses, it is possible that legumes may be located which are adapted to a wider range of environments than Townsville stylo and more effective in improving pasture production. An 11-month grazing season using Schofield stylo has already been demonstrated with 60 in. of rainfall at Meluna, south of Weipa. The other end of the rainfall scale is illustrated by 20 in. at "Yarrowmere" in the yellow earth, desert country south of Charters Towers. Here *S. mucronata* (A 41219) has continued to persist and spread by seedlings.



Trials for the valuation of tropical legumes at the South Johnstone Research Station.

The coastal area between Ingham and Cooktown is now well served with proven pasture cultivars and establishment fertilizer requirements have been defined. The current research programmes seek to fill troughs in the yearlong feed supply. To this end several new cultivars were released this year. These have better winter and spring growth patterns than the standard types. This particularly applies to Cook stylo (*Stylosanthes guyanensis*) and Belalto centro (*Centrosema pubescens*). As well, prolific cultivars of stylo (Endeavour) and *Desmodium heterophyllum* (hetero) were also released. Hetero should be particularly useful in providing a compatible legume for association with such stoloniferous grasses as pangola and *Brachiaria decumbens*.

In east-central Queensland, Townsville stylo has been able to fulfil a more useful role, combining well with the native grasses, especially black spear grass. At "Lowville", near Marlborough, Townsville stylo/spear grass pastures receiving 1 cwt./ac. superphosphate per year are able to maintain liveweight gains in cattle at 1 beast to 4 ac. until August each year. This is an advance of at least 3 months compared with the native pastures. Attempts are now being made to introduce Siratro, fine-stem stylo and American buffel grass into the "Lowville" pastures to see if the remaining nutritional gap in winter can be further narrowed.



Oxley fine-stem stylo is a promising legume for the granite soils of the Burnett region. Here a seed crop is being harvested.

Means of providing adequate protein in the diet of grazing animals remains an important problem under study at "Brian Pastures" Pasture Research Station. Following exhaustive legume introduction work, attention has been focused on *Leucaena leucocephala* and fine-stem stylo. Over the 1971 winter (March to August) steers gained 9 lb./head on unsupplemented native pasture, 60 lb. with cottonseed meal supplementation and 68 lb. with access to $\frac{1}{2}$ ac. of leucaena per animal as well as $1\frac{1}{2}$ ac. of native pasture. Animals gained 105 lb./head when the leucaena was also supplemented with cottonseed meal.

Within the brigalow areas, where regrowth is not a problem on ploughed areas, strong grass pastures can be readily restored by minimal cultivation and seeding techniques with buffel grasses and/or green panic. Where longer term cultivation is intended, there is an urgent need for a legume for use in ley pastures. Siro Peruvian has proved the outstanding cultivar for short-rotation use. It outyields Hunter River lucerne over the first 2 years and combines well with the available grasses. Hunter River remains the outstanding cultivar where a productive life of longer than 2 years is required.

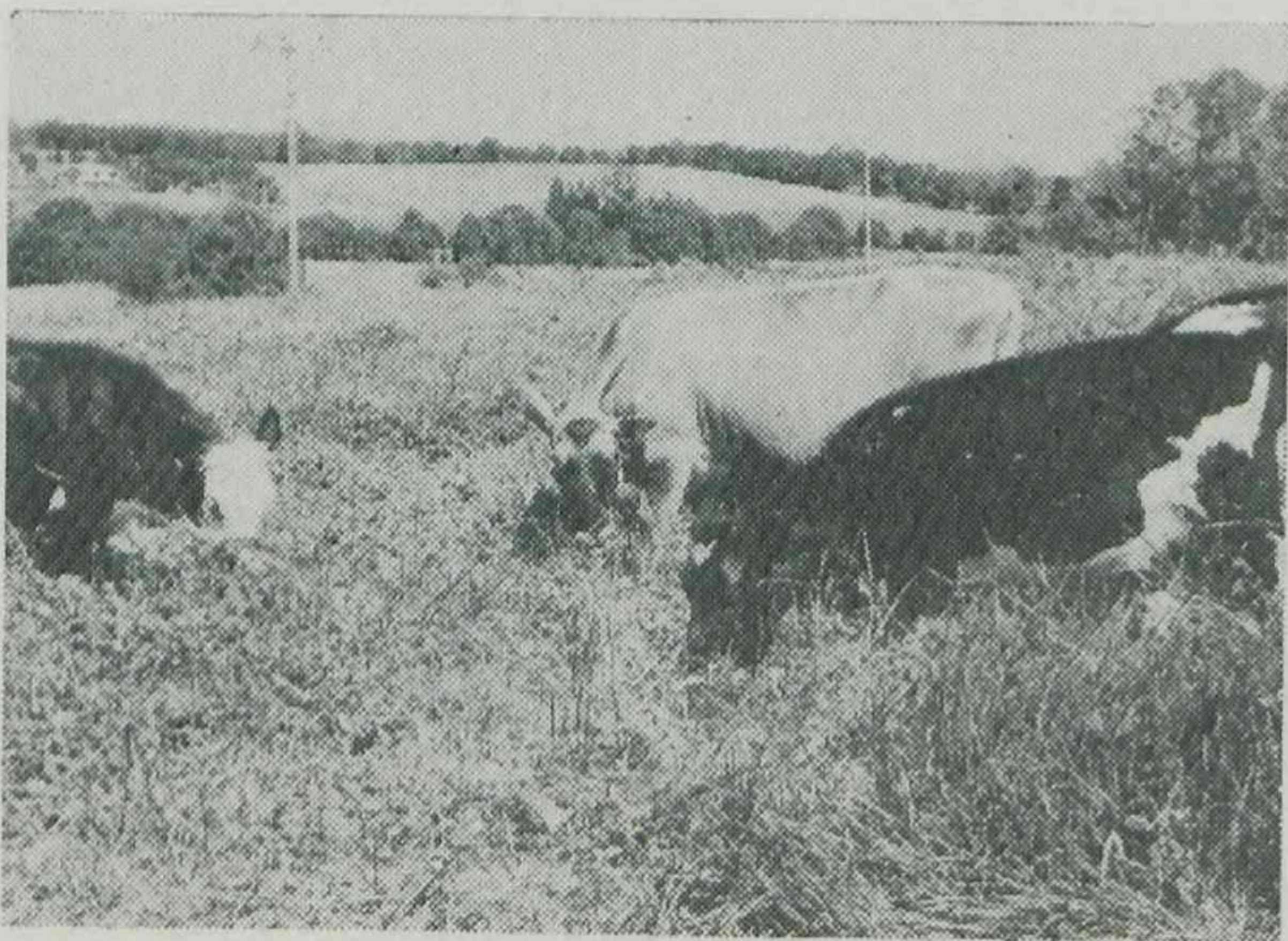


Biloela buffel grass does well on poplar box flats in the Roma district

At Biloela under irrigation Hunter River continued to stimulate associated grass yields in the 3rd year after establishment despite two extremely dry early years. In March 1972 this stimulation approach that achieved from the annual application of 100 lb./ac. of nitrogen. On some brigalow soils, however, lucerne is not well adapted and alternative legumes are being sought. *Leucaena* has grown well at Theodore and provided useful winter/spring grazing.

On the flooded brigalow country the major research has been the location of grasses which will give stable pastures on the large expanses of country subject to erratic inundation by the Connors, Mackenzie and Isaac Rivers systems. To date only the Makarikari panic group have shown flood and drought tolerance. In 1971, stands in one location withstood up to a week of 10-12 ft. inundation on two separate occasions. *Bambatsi* panic, otherwise flood and drought tolerant, is slow and unreliable to establish and seed is expensive. On the other hand, *Urochloa mosambicensis*, which shows no flood tolerance, has re-established rapidly from seed following several floods. Buffel grasses have also shown some ability to re-establish in the manner.

Within the dairying areas of the State tropical pasture species evaluation is oriented towards selection of grasses and legumes either with specific attributes like cold tolerance, or for specific situations such as wet soil, low rainfall areas or sandy soils.



Tropical pasture mixtures provide good summer feed in south-eastern Queensland

At Cooroy the *Setaria sphacelata* strain, C.P.I. 32930, exhibited good frost tolerance but was less productive than C.P.I. 33452. The former also has tolerated frost in other experiments at Eumundi, Gatton and Mt. Mee. Results from Gatton have shown that it provides a better standover winter fodder than other tropical grasses and also is a useful irrigated pasture species either with nitrogen fertilizer or in association with white clover.

Species evaluation in the marginal rainfall areas of West and East Moreton has continued at several sites. Results to date suggest that the panicums hold most promise. Among the strains that warrant further attention are Gatton, Sabi and Petrie panic and two strains of *Panicum coloratum*. Less success has been achieved with legumes. *Siratro* and *Miles lotononis* appear the best but some *Stylosanthes* species warrant further investigation.

On the Atherton Tableland, Tinaroo glycine grows profusely on the better basalt soils but has shown only limited promise on the poorer basalt, granite and metamorphic soils. Greenleaf desmodium has proved capable of outstanding production on these soils but it can be lost from mature pastures because it is highly susceptible to damage by webworm and rough brown weevil. Insecticidal control has proved effective in achieving legume persistence.



Annual winter grazing medics can be grown in parts of south Queensland. Harbinger medic, shown in the foreground, is one of them.

Better tropical species have considerably reduced the period of inadequate quality feed. However, there is still a vital need for species which grow and/or provide standover feed of reasonable quality in the winter-early spring period. To fill this cool and often dry season gap there has been further evaluation of a wide range of grasses and legumes.

An intensive evaluation of temperate grasses and legumes is proceeding. At Cooroy 13 varieties of ryegrass are being tested. Seeding Ronpha grass and Australian phalaris have shown promise at Mt. Mee. At Cooroy, out of 29 *Trifolium* varieties no introduction proved superior to the present commercial varieties. On the elevated, frosty Evelyn Tableland, two African clovers (*Trifolium semipilosum* C.P.I. 27218 and C.P.I. 25347) have been found to combine extremely well with kikuyu.

Low herbage production from existing native species in mulga lands has turned attention to alternative forms of fodder. The programme of species evaluation, although based on the Pastoral Laboratory at Charleville, has expanded to include testing sites at Barcaldine and Richmond. At present 130 introduced and native species are being grown for initial screening and seed build-up. The most promising material, as far as establishment, persistence, production and (in the case of annuals) regeneration are concerned, are in the genera *Dactyloctenium*, *Antheplora*, *Schmidtia*, *Cenchrus* and *Eragrostis*. There is interest in the role that some of the lower fertility demanding annuals—such as *Dactyloctenium*—can play in creating a plant community sequence, ultimately allowing establishment of more desirable perennial species.

Dactyloctenium giganteum, an introduced annual grass from Central Africa, has been oversown in 56 ac. of native pasture near Barcaldine on a sandy arid red earth soil.

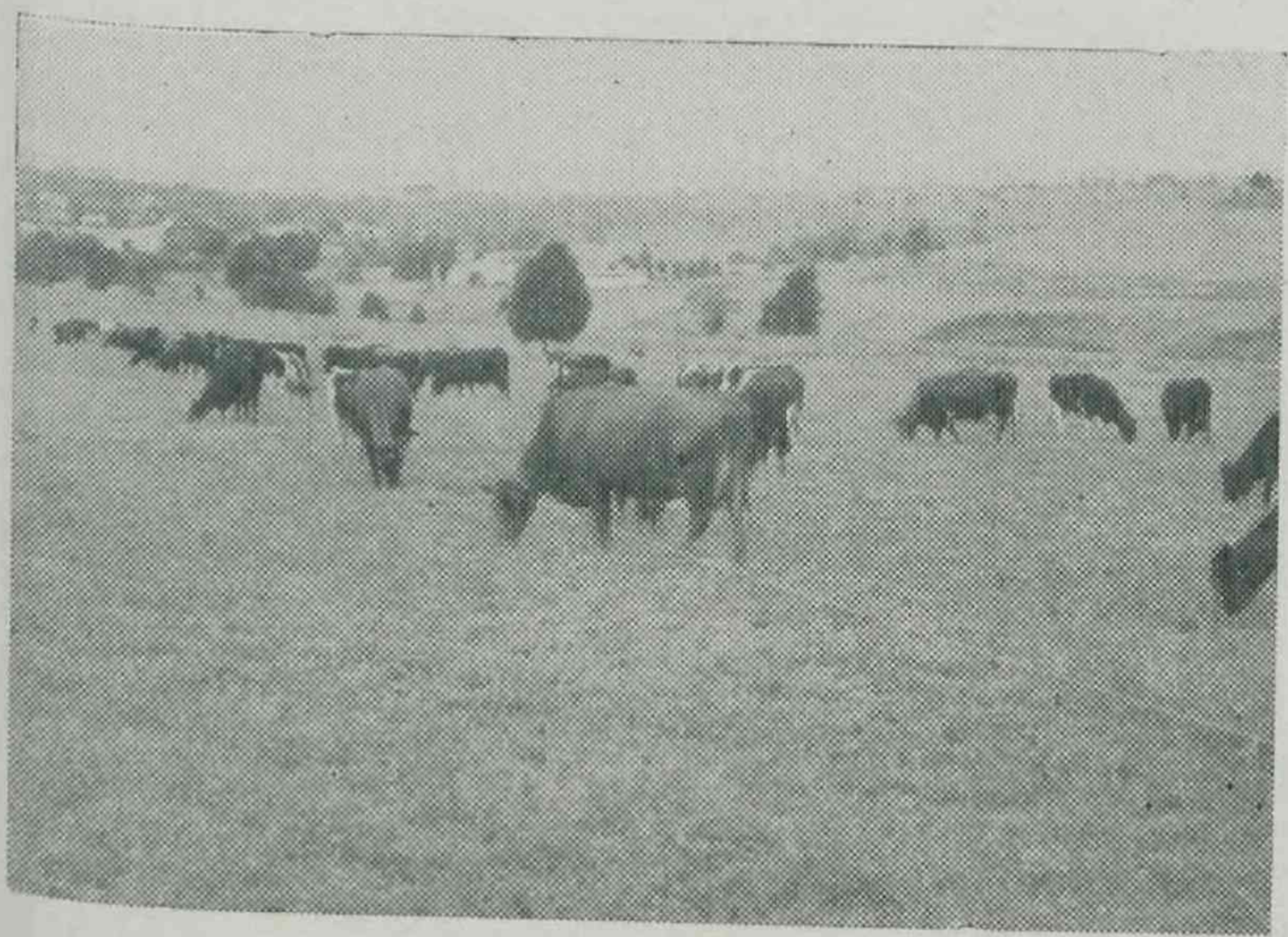
Average presentation forage yields in March 1971 were 1,000 lb dry matter/ac. in the *Dactyloctenium* paddocks compared with 670 lb D.M./ac. in the native pasture paddocks. Sheep were maintained without body-weight loss and with similar fleece weights at stocking rates of 3½ ac./sheep in *Dactyloctenium* paddocks and 7 ac./sheep in native pasture paddocks from March to November.



White clover fills the winter-spring gap in some parts of south-eastern Queensland.

At Gatton, in a comparison of temperate and tropical species for use under irrigation, Priebe's prairie grass and Grasslands Manawa were shown to persist poorly on the heavy black clay soil. Two tropical grasses (Gatton panic and *Setaria sphacelata* C.P.I. 32930) persisted well despite the heavy frosts experienced. White clover performed extremely well. The tropical legumes greenleaf desmodium and Tinaroo glycine performed well in summer but their productive period was too restricted for irrigated pastures and they did not withstand the intensive defoliation necessary for an irrigated pasture.

In general, protein and soluble carbohydrate content was twice as high in the temperate grasses and legumes as in the tropical species. Water use efficiency was considerably higher for the tropical species in summer and autumn, but over the whole year there was very little difference between the two groups.



A mixed tropical/temperate pasture near Malanda, on the Atherton Tableland. This is an irrigated pasture of ryegrass, white clover and setaria.

These results demonstrated the value of the frost-tolerant setaria and white clover for use in irrigation pastures. The temperate grasses, although not very persistent on the heavy soil, are likely to be more persistent on lighter soils. They would still contribute a considerable amount to any irrigated pasture. The use of nitrogen was shown to give excellent production from pure stands of tropical grasses but not pure stands of temperate grasses.

PASTURE ESTABLISHMENT

Detailed observations on the regeneration of native species from seed have now been carried out for 2 years near Charleville. This work has shown that there is ample seed in the soil for regeneration but large falls of rain (in excess of 2.5 in. in summer and 1.5 in. in winter) are required to produce any significant seedling numbers. Greatest regeneration occurs from autumn and spring rains, but irrespective of the time of emergence, survival is extremely low. The post-emergence period is the critical stage in the establishment of a healthy mature plant in mulga soils. Proposed extensions to this work over the ensuing 2 years will include studies on the influence of soil nutrients, radiation and seedling defoliation.

A major problem with the open downs country of the Central Highlands is the difficulty of establishing small-seeded grass species. This problem is common to many areas of heavier textured soils in the sub-humid sections of the State where rainfall is irregular and unreliable in quantity and duration. In the past a number of attempts have been made to modify the soil environment to achieve better establishment. Successes with such methods, however, have been marginal. At Emerald a different approach is being tested. This is to seek grasses which may be naturally more adept at establishing under these difficult conditions. In particular, *Bothriochloa insculpta*, *Dichanthium aristatum* and *Urochloa mosambicensis* have shown considerable ability to establish and spread. They could provide useful species for incorporation in ley pastures on the heavy black clay soils following fodder or cash cropping.

On the south coast two projects associated with pasture establishment have been completed. One experiment involved differential sowing rates of Nandi setaria, Siratro and greenleaf desmodium. The sowing rate of the legume component was the main factor affecting pasture yield, chemical and botanical composition. Thus as the Siratro sowing rate was increased its yield and that of total pasture increased, the nitrogen content of the setaria was raised and the proportion of legume to grass increased.

There has been a steadily increasing demand for the registration of areas for the production of seed of Narok *Setaria sphacelata*. There was a lack of demand for certified seed of Townsville stylo cultivars Lawson and Gordon. Only 1,000 lb. of stylo seed was certified in the 1970-71 season, compared with 10,801 lb. in the previous season.

PASTURE NUTRITION

Research into mineral nutrition requirements of pastures and fodder crops is continuing in all districts, emphasis being placed less on establishment than on maintenance fertilizing.

Five field projects have just been established to determine the residual effect of molybdenum on a range of soil types in south-eastern Queensland. The effect on up to five different tropical legumes is being assessed in these joint experiments with C.S.I.R.O. Division of Tropical Pastures.

In a project at Cooroy and Gympie it has been found that neither soil nor plant analyses are completely reliable for predicting fertilizer requirements. However, where both soil and plant nutrient levels have been either low or high, predictions have been reasonably accurate.

On the Atherton Tableland supplementary nitrogenous fertilizer applied to an irrigated green panic-Tinaroo glycine pasture drastically reduced the percentage of legume. Following cessation of nitrogen application the legume content again increased.

On the wet tropical coast there is evidence that after fertilizer applications and careful management there is accretion of soil organic matter and structural improvement in soils once considered extremely infertile. This suggests the creation of a steadily improving environment.

On the wet Mackay coast in pot trials, phosphorus has been shown to be widely deficient, and molybdenum to be deficient on the solodic and brown earths, but not on the podzolic soils. Large responses to sulphur and less responses to potash have been obtained from pot experiments by the second harvest. In the field these responses, except for that to potash, have been confirmed in the first 2 years of experimental pastures.

PASTURE PRODUCTIVITY

In south-eastern Queensland adequate dry matter for animal production is obtained from a variety of sources and protein shortage is the most important factor limiting satisfactory animal reproduction, growth and finishing. The extent of this shortage and the periods when it occurs have been sufficiently elucidated to indicate measures necessary to overcome the problem.

The levels of production that can be obtained on the wet tropical coast are illustrated by the fact that at South Johnstone at a stocking rate of 1.66 head/ac. under rotational grazing,

a pangola/hetero pasture has given a liveweight gain of 709 lb./ac. for the year. A younger *Brachiaria decumbens*/hetero pasture under similar conditions produced 548 lb. liveweight per ac. By comparison, in another experiment stocked at 2 beasts per ac. without the associated legumes, but receiving 220 lb. N per acre., pangola produced 791 lb./ac. and *Brachiaria decumbens* 767 lb./ac. liveweight gain for the year.

At Blackall, for the fourth consecutive year, female weaner ewes have been used in a buffel grass grazing experiment at rates of 2 ac., 1 ac. and 0.5 ac./sheep. Adequate forage supplies have been available in the two lightly stocked treatments but hand-feeding of the other sheep has been necessary for survival on two occasions in 1970-71. Buffel grass basal cover has remained virtually unchanged at 2 ac. and 1 ac. per sheep but has been greatly reduced at 0.5 ac./sheep.

Weight gains per head from October 1970 to August 1971 were 49 lb. for 2 ac./sheep (including 9.1 lb. greasy fleece), 43.7 lb. (8.6 lb. greasy fleece) at 1 ac./sheep and 18.4 lb. (6.5 lb. greasy fleece) at 0.5 ac./sheep. Suppression of oestrus was observed in ewes at the heaviest stocking rate.

The pasture productivity trial at Brigalow Research Station was terminated. In the final year, liveweight gain per head was diminished at the highest stocking rate of 1 beast per 2½ ac. by approximately 17%. There was only a marginal difference between the medium (1-5 acres) and the lowest (1-7½ acres) stocking rates. The order of animal production was green panic, buffel, Rhodes grass. Liveweight gain per acre was highest at the highest stocking rate but the depression in animal performance, particularly if this prevented finishing to an acceptable slaughter standard, could nullify this advantage.

The time and age of introduction study at Utchee Creek is being wound up. It has been determined that all ages of male cattle may be successfully introduced onto good wet tropical pastures at any time of the year. Growth rates are quite satisfactory in all classes but it appears that steers yield the best return in comparison with weaners and heavier bullocks. Provided parasite control is adequate, cattle suffer no setback on introduction to these pastures.

At Coolum Research Station, the beef production on nitrogen-fertilized pangola grass trial was concluded in the autumn after another unsatisfactory year due to prolonged inundation of pastures.

The pilot study of the performance of breeding cows on fertilized pangola on wallum sands was continued after modification. It had been found that heifers which calved during the summer had a high incidence of lactation anoestrus and as a consequence pregnancy rates at second mating were most unsatisfactory. Calf performance was also low under the extremely wet conditions.

At Parada, the pilot vealer production study on irrigated fertilized pangola grass was completed. Liveweight production in the two treatments (300 lb. N at 3 cows per acre and 100 lb. N at 1.6 cows per acre) were very satisfactory at 1,316 lb. and 839 lb. per acre respectively.

At Millaroo, the beef productivity trial on irrigated pangola continued with liveweight production per acre below that of the 1,000 lb. achieved in the previous year. The irrigation problems have not been resolved and waterlogging and excess water usage continue to plague this work.

Rust (*Puccinia oahuensis*) defoliated pangola grass stands in the Bundaberg area and in many places in North Queensland. Pangola striate virus symptoms were detected in specimens from North Queensland.

LEGUME BACTERIOLOGY

In a field trial with *Leucaena* the rhizobium strain NGR8 failed to give good infectivity even in the absence of competition. CB81 on the other hand performed well despite the fact that the reactions of these two strains were indistinguishable in glasshouse tests. Tests with *Lotononis* have indicated that "hard seed" is a significant factor in producing a low percentage nodulated plants following inoculation.

NATIVE VEGETATION

It appears that energy, as supplied in herbage (grass and forbs), is the main factor limiting animal productivity in the mulga lands of south-western Queensland. Studies in plant ecology have highlighted the paucity of herbage on mulga ranges and the large number of palatable as well as unpalatable woody plants that can occur. The objective of management techniques is therefore to shift the woody plant/herbage balance in favour of herbage while maintaining essential drought reserves in the form of fodder trees.

Since 1964 two trials have been maintained at Boatman Station (mean average rainfall 18.5 in.) and Monamby

(M.A.R. 15 in.) in which the effects of different mulga tree densities have been measured. Mulga tree density is the main determinant of herbage yield. Yearly herbage production is very low, being generally less than 800 lb./ac. and has not exceeded 1,300 lb./ac. This rather emphasises the delicate balance existing between the grazing animal and the vegetation, particularly when the role of other consumers (e.g. termites, which can account for 300 lb. herbage/ac.) is considered. This together with droughts means that animals are frequently maintained on the leaves of mulga trees. Recently work was commenced on the effect of tree density on soil moisture availability, rate of depletion of soil moisture reserves, run-off and herbage growth.

The ability of mulga ecosystems to continue to support stock in times of drought has contributed to two basic problems in the semi-arid regions, namely, a decrease in the quantity of palatable herbage and an increase in the density of unpalatable shrubs. These conclusions have been reached from long-term vegetation studies using transects and grazed and ungrazed exclosures.

The inedible woody shrub turkey bush (*Eremophila gilesii*) has been the subject of a detailed study. It occurs on 4-5 million acres west of the Warrego River in populations as high as 25,000 plants/acre. In such cases establishment of useful species is impossible. Although methods of eradication, such as with herbicides or mechanical treatment, are quite successful removal is unwise until means of economic revegetation with a useful species are determined.

FODDER CROPS

A shift in emphasis from forage crop variety testing to testing of techniques aimed at increasing establishment reliability has been made over the last 12 months in the dryland forage cropping programme based on Charleville.

Previous work revealed that forage sorghums are the most successful rain-grown summer crops on the black soil Mitchell grass country, while for winter both oats and barley have produced satisfactory fodder yields. In 1971, forage sorghum plantings on a water-spreading mulga site near Cheepie, although made under apparently ideal conditions, were largely unsuccessful. This again highlighted the difficulties associated with establishment on the mulga soils. Failures can be attributed to surface crusting, death of plants through inundation and possible seed deterioration also from flooding.

At Richmond, the dam on the Shallow Storage Project filled in March-April 1971 and planting of both summer and winter crops was possible. Late planting of grain sorghum resulted in heavily depressed grain yields through cold weather and frosts at flowering time. However, grain yields of wheat and barley were of the order of 2,000 lb. and 1,200 lb. per ac. Crops of safflower, grain and forage sorghums were successfully established in the ponded area. These were used to fatten steers in the spring and early summer.

Within the brigalow areas cattle fattening on both winter and summer crops is extensively employed. At Brigalow Research Station little difference in animal performance has been recorded between various forage sorghums although *Sorghum alnum* tends to be lower than Zulu or Sugardrip. Even without rain during the grazing seasons animals continued to gain weight at a beast to 0.6 ac. for up to 4 months. Gains of up to 200 lb. per head have been recorded over this period.

At Biloela over the 1971 winter/spring period the total soil moisture used and total forage produced were quite similar for two barley cultivars, two oat varieties, a rape and a winter wheat variety. This was around 500 lb./ac. O.D.M. per inch of water used. Rate of water use varied with crop growth rate, but all reached a similar final yield of 5-6,000 lb./ac. dry matter. Safflower was the only exception: it recorded a total yield of only 3,000 lb. D.M.

ECONOMICS

An economic assessment of beef cattle raising on irrigated pangola grass is being undertaken based upon trial results at Parada Research Station up to 1970. As in the case of improved pastures on the wet tropical coast, intensive stocking (up to three beasts per acre) under good pasture management, entailing adequate fertilizer usage, is essential for store fattening to be a profitable enterprise. Profitability may be improved where irrigated pastures are integrated with a beef breeding enterprise to top off stores from a western block.

A study is being undertaken on the economics of land clearing in the dry tropics to indicate the increased stocking rate necessary at varying development costs per acre to break even and provide a satisfactory return on the extra capital investment involved. This break even approach is desirable as graziers with a sound knowledge of the carrying capacity of their properties can assess whether the extra stocking required is feasible.

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

The wheat varietal testing programme was re-organized and expanded in 1971, when 21 trials embracing the major wheat production areas were completed successfully.

Most trials comprised 12 varieties and in 14 of the trials six varieties recommended as prime hard for 1971 were included. While the average yield for the 14 trials was 2,080 lb. (34.7 bus.) per acre, the yields of the six prime hard varieties were as follows: Timgalen 2,060, Mendos 1,971, Gatcher 1,905, Gamut 1,873, Spica 1,798 and Tarsa 1,748 lb. In four Central Queensland trials which averaged 1,749 lb. (29.1 bus.) per acre, Gamenya replaced Gatcher. Yields of the five recommended prime hard varieties and of Gamenya were as follows: Timgalen 1,830, Gamenya 1,755, Mendos 1,717, Gamut 1,645, Spica 1,594 and Tarsa 1,434 lb. The relatively poor performance of the newly released New South Wales Government variety Tarsa probably stems from the fact that it is slower maturing than the other varieties. It may have performed better if planted earlier. In 1972 Tarsa will be tested with other slower maturing varieties in a separate series of trials. Quality of all the prime hard varieties in the trial series was good.

Drought hardening of wheat seed increased yield by an average of 12.4% in formal trials conducted over three seasons. In 1971 a semi-commercial testing programme was instituted with the co-operation of the State Wheat Board and the Barley Marketing Board. Fifty trials spread through the wheat-growing regions were established. Each trial consisted of two adjacent 10 acre blocks one of which was planted to drought hardened seed and the other to control seed. In environments where there was more severe stress and the control yield was less than 25 bus./ac., the plants from drought hardened seed had a mean increase in yield of 17% over the control. The increased yield stability of crops from drought hardened seed appears to be sufficient to warrant usage of this technique in regions where wheat yields below 25 bus. are fairly frequent.

The Nutrient Screening of Queensland Cereal Soils project continued. During the year 13 soils were given their preliminary screening in glasshouse pot trials. Eleven field tests were made in which emphasis was given to inclusion of elements shown to be deficient in pot trials. In the glasshouse experiments, significant responses to phosphorus, zinc and calcium occurred on six, three and two occasions respectively. The field trials gave generally disappointing results due mainly to adverse seasonal conditions.

Stem rust of wheat (*Puccinia graminis tritici*) was of little significance in 1971. Moderate levels of leaf rust (*Puccinia recondita*) were reported on Timgalen, Gatcher, Mendos and Spica in the Central Highlands. These records represent the first widespread development of leaf rust races able to attack Timgalen and Gatcher in the central wheat area. Crown rot (*Fusarium graminearum*) was widespread on the Darling Downs. Further selection for resistance to this disease is proceeding. Tests indicate that the major source of resistance to common root rot (*Cochliobolus sativus*) in the cultivar Festival was obtained from the line Pusa III.

In a survey of wheat growers it was found that 97.5% used seed treated with a fungicide prior to sowing. In follow-up visits to farmers using untreated seed no bunt (*Tilletia* spp.) was detected.

BARLEY

Bussell, a Western Australian variety, performed well in the 1969, 1970 and 1971 Regional Barley Varietal Testing Programmes, and produced 2,127 lb. (43.2 bus./ac.) in 1971, the highest average yield of the 10 varieties common to each

of nine trials. This yield was 14% above the average yield of 1,862 lb. for all 10 varieties in the nine trials. Unfortunately, Bussell's grain quality is below that required for malting grade. Clipper, the variety accepted for malting grade in Queensland, yielded 1,957 lb., or 5% above the trial mean. Clipper outyielded Prior, the previous malting variety, by an average of 12% as compared with figures of 0, 7 and 27 for the years 1970, 1969 and 1968 respectively.

Marked response to addition of nitrogenous fertilizer has been obtained over three seasons with irrigated barley on the Darling Downs. In 1970, when nine varieties were tested at five rates of nitrogenous fertilizer ranging from 0 to 150 lb./ac., increases in yield occurred at all levels of application above nil. The yield obtained from the 150 lb. treatments (3,975 lb.) was 112% greater than that of unfertilized plots. Grain nitrogen content was reduced by increasing applications of nitrogenous fertilizer. This is an encouraging feature of the trials, as malting quality tends to be inversely related to grain nitrogen content.

GRAIN SORGHUM

Ten successful trials were conducted in the 1970-71 Regional Grain Sorghum Varietal Testing Programme, seven in southern Queensland and one each at Kingaroy, Biloela Research Station and Walkamin Research Station on the Atherton Tableland. Apart from extensive strain testing, commercial hybrids of early, medium and late maturity were included in six of the trials, only one of which was irrigated. Of these, Texas 626 (4,685 lb. or 73.1 bus./ac.) yielded best. It was followed by Texas 610 (4,391), Pioneer 846 (4,389), DeKalb E57 (4,338), DeKalb C42 (4,315), Yates NK212 (4,311), XQ5161 (4,200), DeKalb X255 (4,014) and NK207 (3,858).

The hybrid XQ5161 developed by Departmental plant breeders has shown good resistance to lodging over several seasons. It has been released and is among the hybrids recommended for growing in 1972-73, particularly where lodging is likely to be a problem. Of the early hybrids, Yates NK133 yielded best while Pacific 303 topped the list in the late-maturing group.



Inspection of grain sorghum varieties under test on Brigalow Research Station.

Studies on the Central Highlands (Emerald Shire) have shown a high degree of correlation between rainfall and grain sorghum yields. Using probability analysis there is a 60% chance of receiving sufficient rain to yield over 10 bus./ac. but only 40% for yields above 20 bus.

Sugarcane mosaic virus was again widespread and caused serious losses throughout the sorghum areas in southern and central Queensland. Work on the incorporation of the resistance possessed by Q7539 into fixed breeding lines is continuing.

Seedling blight (*Fusarium moniliforme*) caused serious losses in plantings in south-eastern Queensland, particularly where cool weather followed planting. Benomyl seed dressings have given promising results against this disorder.

MAIZE

Good progress has been made in North Queensland in maize breeding and agronomy as a result of research conducted by the Kairi Research Station team on the Atherton Tableland.

Excellent sources of resistance to head smut, a serious disease on sections of the Atherton Tableland, have been found. Prospective commercial hybrids incorporating these resistances are faring well in field performance trials. Commercial release of a head smut resistant hybrid is feasible for the 1973-74 season.

As data are accumulated on rotation studies at Kairi, a striking feature is the quite substantial yield increase which occurs in the first two crops of maize after pasture. The mean increase of these treatments over the control (continuous maize) for three consecutive seasons is 75%. The accumulating trial data will provide a guide for calculating the benefits that could be derived from rotating with maize the considerable area of the Tablelands' arable land currently under pasture.

Two very practical results have emerged from a joint agronomy-pathology study on the effect of cultural practices on disease incidence in maize on the Tableland. The most outstanding is the combined beneficial effect of nitrogen application in reducing *Diplodia* cob rot and increasing yield. The other is the fact that early ploughing reduces disease incidence in most years while tending also to increase yield.

In a rain-grown maize time and rate of application fertilizer study conducted in the Warwick district in 1970-71, the amount of nitrogen applied affected yield to a greater extent than did the timing of application. While unfertilized plots produced 2,290 lb. (38.1 bus.) per acre, those fertilized with 50, 100 and 150 lb. of urea/ac. yielded 35, 61 and 83% higher than those from the unfertilized plots. In the 1971-72 season trial, plots receiving 150 lb. urea yielded 4,750 lb., 185% better than the unfertilized treatment (1,670 lb.).

Investigations in maize nutrition on the Darling Downs indicate a strong residual effect of soil applications of zinc sulphate monohydrate. Research has shown that to correct a zinc deficiency a grower may need only to apply a blanket dressing of monohydrate (30-40 lb./ac. is recommended) every few years instead of applying a small increment each year.

A leaf disease, known as southern leaf blight in the U.S.A., was recorded for the first time in Queensland and Australia early in 1972. This disease caused devastating losses in the U.S.A. in 1970 when a race of the causal fungus, *Helminthosporium maydis*, capable of attacking hybrids carrying the Texas male sterility factor (T) in the cytoplasm spread rapidly. The Queensland outbreak was reported first in the north but the disease was later seen in all the main maize-producing areas. It was only in the north and in the wet coastal areas in the south that serious losses were recorded. As in the U.S.A., hybrids carrying the T factor were the most seriously affected. The hybrid GH128 was severely attacked by the disease on the Atherton Tablelands and in the Cooktown area. The occurrence of this disease, which could have spread naturally from countries to the north of Australia or been introduced from overseas inadvertently in seed lines, is of considerable significance. A reorientation of breeding programmes eliminating the use of T cytoplasm will now be required.

This disease outbreak coincided with a much higher incidence of leaf blight (*Helminthosporium turcicum*) than usual. The prolonged wet conditions undoubtedly favoured both diseases. Sugarcane mosaic virus again caused losses in susceptible hybrids throughout southern Queensland.

The economic viability of maize farms on the Atherton Tablelands is showing improvement, with the use of fertilizer being more widespread. Areas previously under pasture and brought back into production this year are expected to yield up to 2 tons/ac. Whereas maize had a gross margin (gross return less cash production costs) of less than \$20 per acre 5 years ago, increased yields will now give growers returns of \$35-40 per acre.

TOBACCO

Evaluation of tobacco varieties for resistance to diseases and adaptation to local environments continues to be an important part of the tobacco research programme in Queensland. The need for introducing overseas tobacco varieties for commercial release has been reduced as the result of a breeding programme conducted by C.S.I.R.O. whereby local varieties are being developed incorporating disease tolerance. A blue mould resistant, black shank tolerant variety (40T67) bred by C.S.I.R.O. has undergone extensive field evaluation in north Queensland and is expected to be available for commercial release in 1972-73. In southern Queensland a co-operative breeding programme is in progress to develop a tobacco variety resistant to blue mould, strain APT 2. As a temporary measure tobacco hybrids incorporating some degree of APT 2 tolerance are being evaluated and have given encouraging results.

Nutritional studies on tobacco have included a continuation of trials on potash-nitrogen inter-relationships at South-edge Tobacco Research Station and trials involving foliar urea applications at Bundaberg, where leaching can be a serious problem. At Southedge Tobacco Research Station results have indicated that leaf quality can be impaired by either late side-dressings of potassium or by high potassium levels generally. In attempting to minimize leaching at Bundaberg, foliar applications of urea have given positive yield responses when applied as a supplement to preplanting fertilizer mixture. Further studies involving foliar nutrition will be directed towards comparing soil and foliar applied nitrogen and potassium in various forms.

In the Mareeba-Dimbulah area, unlike most major tobacco producing countries of the world, tobacco is dependent largely on irrigation for its water requirements. At South-edge Tobacco Research Station the effect of water stress on tobacco is being studied and it has been shown that yield and type of tobacco produced are influenced appreciably by variations in watering practices. Water stress prior to flowering can depress yields by 10-15% and raise the nicotine content of the leaf, while water stress after flowering results in a high proportion of off-type and immature leaf. These studies are being continued to determine the effect of water stress applied at different stages of plant growth on tobacco growth, yield and leaf type.

Interest in mechanization within the tobacco-growing industry is becoming widespread as labour costs rise and labour becomes scarce. A range of equipment is now available which can appreciably reduce labour required in the growing, harvesting and curing stages of tobacco production. The Department's role in mechanization within the tobacco industry is predominantly of an advisory nature by giving publicity to new developments, accompanying growers on inspection tours, and mounting field days such as the mechanization field days held at Southedge Tobacco Research Station in 1971, when over 500 people attended.

Detailed biological studies of tobacco pests have enabled entomologists to develop a pest prediction service whereby tobacco growers in the Mareeba-Dimbulah area are advised of the correct time to apply insecticides. By following the recommendations of the prediction service growers are able to implement control measures with maximum effect and a saving in production costs through a reduction in the number of spray applications needed.

The consequent use of strategically timed insecticide applications has been of advantage to beneficial insects and this year parasites have been able to contribute to overall control of tobacco pests. With the planting of a "winter" crop, tobacco was cultivated in the area for eight consecutive months, thereby extending periods of pest activity. All pests species were present but not in prolific numbers and as a result of Departmental advice little insecticide was applied. Consequently when major field plantings began in August parasites were present in large numbers and able to suppress the rapid build-up of pest populations well into the growing season.

To enable the exploitation of natural control agencies with minimal interference from insecticides, improvements in chemical control are constantly being sought. In a seedbed trial at Mareeba, granular methomyl incorporated into the soil prior to planting showed promise in controlling tobacco stem borer (*Scrobipalpa heliopa* (Low.)) and tobacco leaf miner (*Phthorimaea terella* (Walker)). This formulation of methomyl, which is absorbed by the roots of the tobacco plant and translocated to leaf and stem tissue, would be less hazardous to beneficial insects than conventional foliar sprays.

Blue mould (*Peronospora tabacina*) although present early in the season in North Queensland was brought under control by spray programmes and caused insignificant loss. Detailed studies on blue mould indicate that spore release according to diurnal rhythm occurs at a time of atmospheric turbulence and is probably responsible for farm-to-farm dispersal and "spot mould" within a field. Spores released during rainfall bring about a high intensity of disease close to the source.

Black shank (*Phytophthora nicotianae* var. *nicotianae*) was recorded on more than 40 farms but the severity was generally of a low order. Four of the 12 experimental plantings of the new blue mould resistant cultivar 40T were unfortunately affected by this disease. Resistance screening work to this disease is continuing.

It is thought the generally late preparation of land for the 1971 crop was the cause of the higher than usual incidence of stem rot (*Rhizoctonia solani*).

Benomyl gave good control of frog-eye leaf spot (*Cercospora nicotianae*) provided spraying was carried out at fortnightly intervals. Daconil and captafol gave good control of leaf spot (*Ascochyta arida*) in the Inglewood area.

In trials at Mareeba, Du Pont 1410 was the only chemical treatment other than EDB to show real promise against root-knot nematode under conditions of severe infestation. In a detailed survey of tobacco properties in the Mareeba/Dimbulah area it was found that EDB treatment always gave good nematode control where care was taken to obtain a good surface seal.

In a nematode and weedicide experiment in tobacco crops, chemical treatments did not appear to affect nitrogen mineralization. Chemical desuckering treatments were shown to be associated with an increase in sugars and falls in nitrogen and total alkaloids in the leaf. These findings are extremely interesting and experiments are continuing.

At the request of the Australian Tobacco Board, a Departmental Agricultural Economist carried out an Australia-wide survey into the effect of loose leaf selling and bulk sorting on the production and marketing costs of tobacco. It was estimated that, after a period of adjustment, the industry could expect an average saving of 6.9 cents per lb. of cured tobacco leaf by adopting the new system. Subsequently, the Australian Tobacco Board decided to implement the conversion during the 1972-73 selling season and to accept a figure of 6 cents per lb. as the expected savings to growers. A report on cost movements in the farming sector of the Australian tobacco industry between 1968-69 and 1970-71 was also prepared.

A survey is being undertaken 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. A small group of farmers in the Mareeba-Dimbulah area continued to record in the farm management accounting service.

COTTON

Maintenance, testing and some crossing work are continuing in the cotton-breeding programme. The emphasis remains on upgrading fibre quality, particularly strength. Two strains of cotton which are reported to be resistant to *Heliothis* infestation have been introduced from U.S.A. and these will be used in the breeding programme. Some attention is also being given to obtaining a variety more suited to the short-season environment of the Darling Downs than the current commercial variety Deltapine Smoothleaf. So far, however, there are no varieties which appear to be sufficiently earlier in maturity to avoid the late-season cold conditions which result in reduction of quality.

Trials to evaluate nitrogen nutrition in terms of fibre quality and yield are continuing at Theodore and Brookstead.

Testing of growth suppressants has continued in the Lockyer Valley. In the 1970-71 summer trial excessive wet weather resulted in very rank growth and the crop lost most of its early fruit. Under these conditions CCC increased yields, even at very low rates, while significantly reducing plant height without any apparent effect on maturity.

Thorough control of aphids in cotton demonstration trials resulted in an average yield increase of 200 lb. seed cotton per acre on the first pick. However, there was a trend towards equalisation of total yields at the second pick, confirming that control of early-season seedling pests is not warranted. Besides effecting a saving in production costs, elimination of early-season insecticide applications would enhance survival of beneficial insects.

A variety of cotton reputedly resistant to species of *Heliothis* in U.S.A. has undergone preliminary testing to determine if resistance extends to *Heliothis* species occurring in Queensland. The basis of resistance in this variety lies in its reduced attractiveness to *Heliothis* moths for egg-laying. When tested at Toowoomba eggs deposited by moths of the native budworm (*Heliothis punctigera* Wall.) on the resistant variety totalled only 25% of the number on standard varieties. Although variability in egg production by individual moths is an important factor, the results are sufficiently encouraging to warrant further investigation of this approach.

These experiments indicate that a reduction in the number of insecticide applications on cotton may be possible without unduly sacrificing yield or fibre quality.

Wilt (*Verticillium dahliae*) was severe throughout most cotton-growing areas. It is apparently favoured by the cool, wet conditions experienced last season.

PEANUTS

Peanuts in the Kingaroy district nodulate profusely under natural conditions. Native strains of the *Rhizobium* nodule bacteria, however, may not always form an entirely effective relationship with introduced plant species. To determine the effectiveness of the native strains a joint pathology-agronomy project was carried out at Kingaroy in 1970-71. Peanut seed of a standard commercial variety was inoculated in four different ways with a bacterial strain known to be effective for peanuts. It was found generally difficult to superimpose the applied inoculum strain over the existing soil *Rhizobium* by any method. Results of this, and yield data, suggest that no advantage will be gained by inoculating peanuts in the South Burnett area with introduced *Rhizobia*.

A detailed survey was made in 1970-71 in an effort to determine the cause of erratic peanut stands on the Atherton Tableland. The survey showed that the seed used was generally of good quality but that mechanical faults in many planters used reduced the germination considerably. A 12% loss in germination due to this cause was common. It is considered that the mechanical defects in the planters can be readily overcome in most cases.

The peanut mottle virus which recurred again last season was much more widespread this year. Symptoms were much more severe than previously encountered. Seed transmission tests showed that it was carried over in approximately 2% of the seed from diseased plants.

Leaf spot (*Cercospora* spp.) was widespread and serious even in southern Queensland. Benomyl sprays, now widely used, gave good control.

Economic analysis shows that peanuts remain the most profitable dryland crop in the South Burnett, with navy beans a close second. Sorghum is the best grain crop, with soybeans gaining in popularity.

SUNFLOWER

Results from plant population-time of planting studies on the Darling Downs indicate that optimum populations are 40,000 and 20,000 plants/ac. under irrigated and rain-grown conditions respectively. The rain-grown optimum population is also supported by a Roma study. Narrow row spacings (14 in.) tended to give higher yields in both rain-grown and irrigated trials on the Darling Downs and this spacing is recommended where wider row spacings are not required for cultural practices such as inter-row cultivation and fertilizer banding.

Fifty-two sunflower lines selected mainly for their high oil value were crossed in the glasshouse at Hermitage Research Station in the winter of 1971 and the crosses grown out in the summer of 1971-72. The objective of the trial is to determine which lines on combination produce superior varietal hybrids.

A mass selection programme is under way with the popular Peredovik variety at Hermitage Research Station under irrigated and rain-grown conditions. The objective of the project is to determine over a 2-year period the effectiveness of mass selection for increasing seed yields, oil percentage and oil yield. If a superior population is developed it should be possible to produce better inbreds and consequently superior hybrids.

Sunfola 69 (1,826 lb. or 52.1 bus./ac.) provided the best average yield in three regional sunflower varietal trials conducted at Hermitage and Biloela Research Stations and at Goondiwindi in 1970-71.

Rust (*Puccinia helianthi*) was severe in 1971-72 crops of sunflower. Experimental evidence was obtained to indicate that this disease has a marked effect on yield.

The economics of sunflower and safflower growing on the Central Highlands were examined in relation to the main crops grown, sorghum and wheat. Taking the average sorghum yield of 18 bus./ac. (at \$30/ton), a yield of sunflowers of 12 bus./ac. (at \$80/ton on rail) is required to provide an equivalent return to sorghum. As sunflowers normally yield fairly close to sorghum, this crop is very competitive with sorghum at these prices. However, the value of sorghum stubble for grazing should also be taken into account. With wheat averaging 12 bus./ac. (\$110/bus.), safflower (at prices ranging from \$80 to \$100/ton on rail) does not need to yield as high as wheat, as is generally the case, to produce equivalent returns. Allowing for a reduction (25%) in yield, safflower becomes competitive with wheat in the Central Highlands at prices over \$80/ton (on rail).

SOYBEAN

The Regional Soybean Varietal Testing Programme was expanded considerably in 1971-72 when 11 trials were conducted in the State's major cropping regions from Walkamin in the north to Dalveen in the south. Results to hand from 10 of the trials conducted in southern Queensland give an indication of the phenomenally good seasonal conditions experienced. The average yield of the 12 varieties included in all 10 trials was 1,938 lb. (32.3 bus./ac.), with the variety Hood (2,202 lb.) yielding best. Hood was followed by Bragg (2,101), Davis

(2,068), Semstar (1,971), Hill (1,951), Leslie (1,921), Hampton (1,911), Pickett (1,884), Wills (1,872), Semmes (1,858), Dare (1,814) and Hinn (1,704) lb.

An adaptation study to assess the variation in yield, maturity, oil and protein percentages and their inter-relationships among present varieties is under way. Groups of 90 varieties representing a wide range of maturity and origin are being grown at five locations in southern Queensland for three seasons. Results from the 1970-71 season indicate that flowering times of 45-60 days are most suitable for rain-grown culture and 55-80 days for irrigation. Early maturity contributes towards yield stability. From the programme it is hoped that suitable genotypes for future breeding will be selected.

Initial trials in a field nodulation study with soybeans on the Darling Downs demonstrated that the highest grain yields were obtained when inoculated plants were fertilized with nitrogenous fertilizers. The most effective and economic applications which will cause no depression in inoculations have been determined. In conjunction with this, investigations are now proceeding to determine the best time to apply nitrogen.

Evaluation of chemicals for weed control of soybeans has been commenced.

Wildfire (*Pseudomonas tabaci*) occurred again in commercial soybean plantings throughout south-eastern Queensland. Some cultivars such as Wills and Hampton possess worthwhile resistance. Although tobacco plants have proven susceptible in the glasshouse, this host has not yet been found affected in the field. It is a serious disease of tobacco overseas. Bacterial blight (*Pseudomonas glycinea*) and bacterial pustule (*Xanthomonas phaseoli* var. *sojense*) were also widespread and important. Rust (*Phakopsora pachyrhizi*) continued to be a problem in wet areas but was not important in the main producing areas of southern Queensland.

TEA

An economic assessment of tea-growing in North Queensland was published in the *Queensland Agricultural Journal* based upon results obtained at South Johnstone Research Station and production estimates under commercial conditions in the Innisfail district. The profitability of seed and clonal tea was compared over a range of yields and prices. It is estimated that a seedling tea yield of 2,000 lb./ac. and a price of 40 cents/lb. are required to provide a satisfactory return on the large amount of risk capital involved.



Section of the tea plantation at South Johnstone Research Station.

MISCELLANEOUS CROPS

The wheat-wild oat competition trial was not harvested because of mice damage but dry-matter determinations indicated that under the good seasonal conditions experienced wild oat populations as low as 10 plants per square yard had measurable effects on wheat growth. The summer management trial, growing summer crops and employing a winter fallow, showed that this practice reduced wild oat populations to very low levels after 2 years. The trial is continuing and some treatments provide for 4 years of winter fallow. Because of gully erosion the winter management trial has had to be re-located.

Although 12,768 bus. of Minhafer oats seed were grown on registered areas, only 1,538 bus. were certified. Several growers withdrew their seed before certification procedures were applied. Growers find it uneconomical to have their seed certified because of lack of demand and cost of treatment.

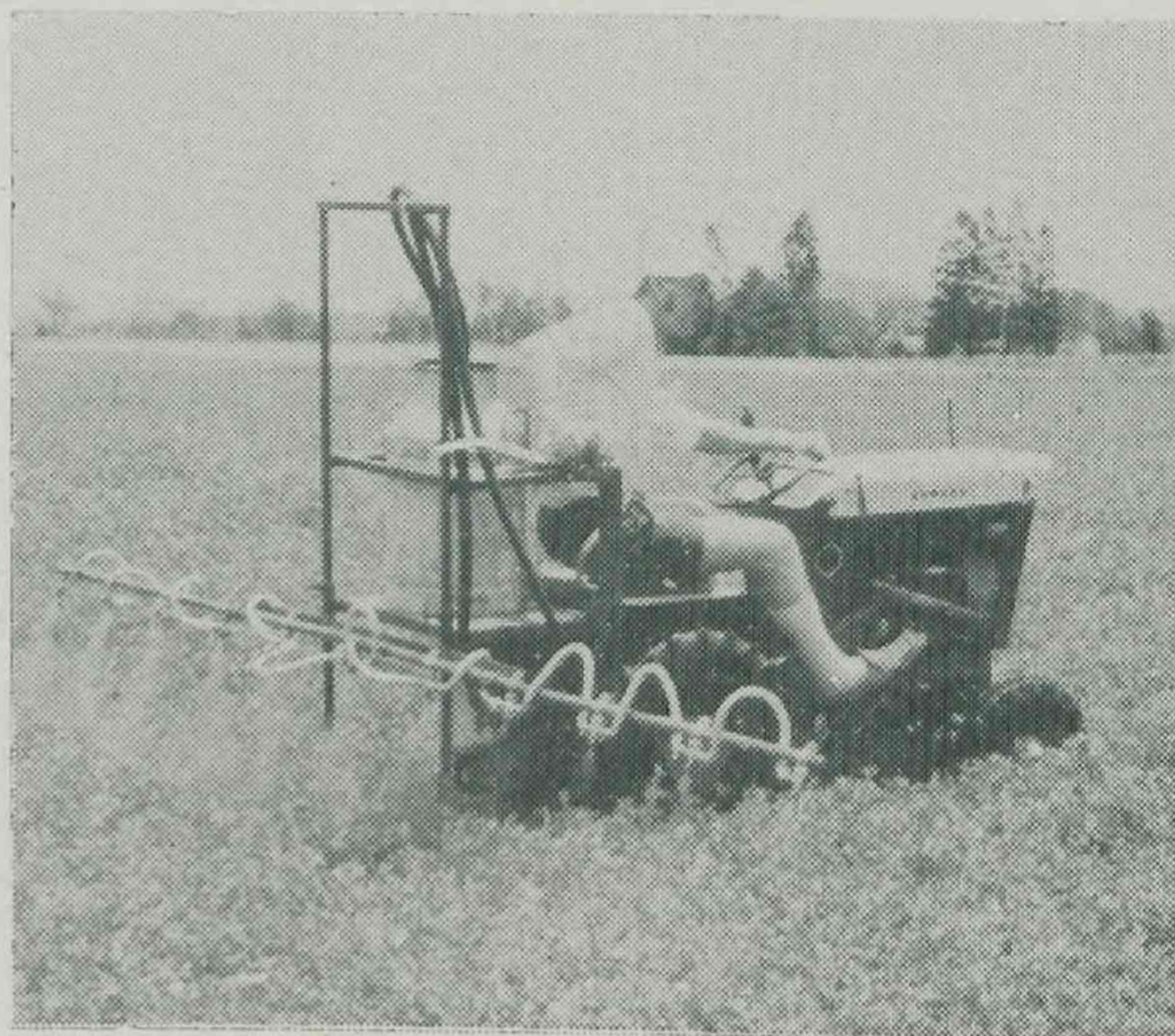
The commercial navy bean varieties Kerman and Gallaroy are now susceptible to a new race of rust, and breeding and selection for resistance to this have commenced. Some breeding work aimed at increasing stalk strength is also in progress.

At Kingaroy, fertilizer trials on phosphate-deficient soils have shown that lack of phosphorus limits yields severely and that strong responses to nitrogen only occur in its presence. Some problems with potash and trace elements are also becoming apparent.

Three years of nitrogen fertilizer trials on irrigated navy beans at Inglewood have shown that soil dressings of between 75 and 90 lb. nitrogen/ac. are optimum on the recent alluvial silty clay loam soils along McIntyre Brook. Rates higher than about 90 lb. of nitrogen give further slight yield responses but the increased monetary return barely equals the cost of the extra fertilizer.

A serious new disease of navy beans was reported in the Kingaroy district late in the season. The cause appears to be a virus identical to that causing the peanut mottle disease. Symptoms vary from a mild mottle of the leaves to death of the plants. In some crops up to 50% of the plants have been affected. There is a suggestion that varieties may differ in their susceptibility to the disorder.

A virulent virus epidemic of budworm caused a decline of budworm populations in lucerne fields in the Lockyer and Beaudesert districts over a period of 4 weeks. Studies of this nuclear polyhedrosis virus have demonstrated the potential value of insect pathogens as control measures.



Mini multi-purpose tractor adapted for boom spraying of lucerne plots in insect control trials.

In laboratory experiments the disease was transmitted by some female *Heliothis* moths to their progeny via the eggs, thus ensuring a relatively high rate of infectivity. Ninety per cent. of budworm deaths resulting from virus infection occurred during early larval life, when damage inflicted on crop plants would be comparatively slight. Given favourable conditions the epizootic could therefore eliminate the insects before a significant financial loss was sustained.



Preliminary testing of a velvet bean variety on the Burdekin.

Studies of the seasonal population fluctuations of the jassids *Austroasca alfalae* (Evans) and *Austroasca viridigrisea* (Paoli) on lucerne indicated that for much of the year populations are small and resultant damage unimportant. Numbers build up in summer to peaks during the period from December to April. Crop-mowing operations drastically reduce population numbers through either indirect mortality of juvenile stages susceptible to desiccation or enforced migration of adults. In conjunction with the seasonal history studies, economic injury level investigations have demonstrated that chemical control of jassids may be warranted only at times of peak population development and not always then. Where control is justified, insecticides such as dimethoate and carbaryl, lacking the residue problems of the chlorinated hydrocarbons, have been proved satisfactory.

Investigations on diseases of lucerne were increased considerably. Organisms found associated with serious disease symptoms in the crowns and roots included *Phytophthora megasperma* var. *sojae*, *Rhizoctonia solani* and *Colletotrichum trifolii*.

Marketing research studies were undertaken in lucerne, navy beans, broom millet and citrus.

IRRIGATION PROJECTS

Research work has continued at Emerald to obtain information for the use of new irrigators who will occupy farms in the 1972-73 summer. General agronomic data on cotton, grain sorghum and wheat are already available, and now information on soybean, sunflower and barley is being sought.

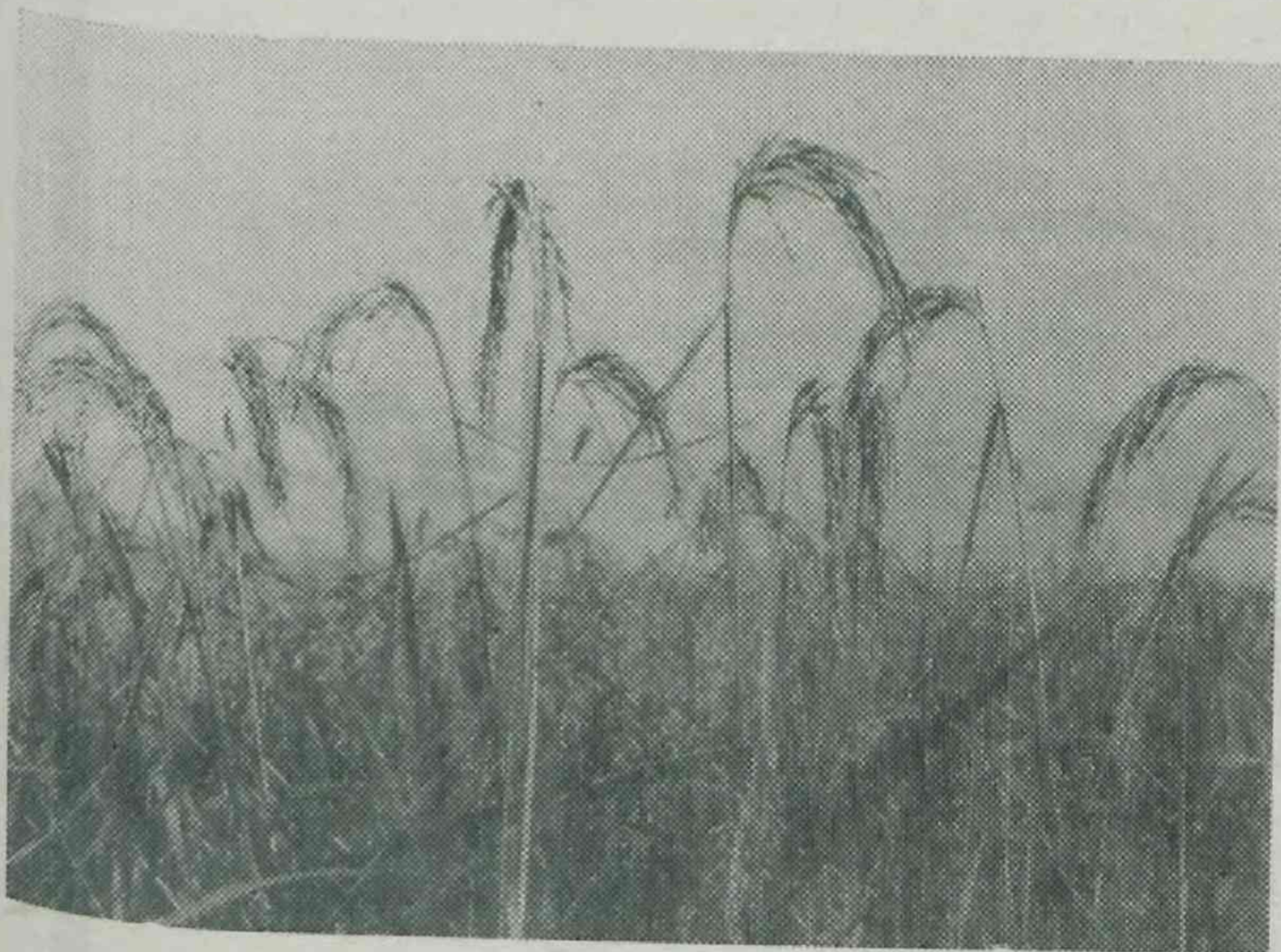
The time of planting trial for sunflowers showed that highest grain yields and oil yields per acre are obtained from a December planting. A similar trial for soybeans confirmed that sowing in the first week in December will give highest yields. Time of planting studies on grain sorghum have shown that planting in the period August to October, as soon as the soil reached 65°F., produces maximum yields under irrigation and in most years avoids heatwaves and rain at harvest.

A sorghum irrigation x population trial gave a top yield of 6,240 lb./ac. (104 bus.) when irrigated at 10-day intervals from the boot stage, but plots irrigated at 7-day intervals were not significantly lower in yield at either the high (100,000 plants/ac.) or the low (50,000 plants) populations. In addition, at the low population, irrigations at 14-day intervals did not give significantly different yields, and hence if a grower is bound by a 15-day water delivery roster, he should aim for the low plant population.

Work commenced on open downs soils to evaluate the effects of different furrow gradients and furrow flow rates on soil movement during irrigation. These studies are being carried out in co-operation with the Irrigation and Water Supply Commission and the Soil Conservation Branch, in order to fix guidelines for irrigation layout design for left bank farms.

An intensified programme is also under way in the Burdekin irrigation area to obtain information relevant to the proposed future expansion of irrigation facilities in the Burdekin basin. Rice has received a great deal of attention in recent years and the current programme to define optimum fertilizer practice and amounts, weed control recommendations, sowing rates and water management is nearing completion. Varietal testing will continue at Millaroo Research Station, although at present Bluebonnet still appears to be the best variety available for this district.

A start has been made to study the performance of sorghum, maize, soybeans, sunflower and safflower under irrigation on a range of soils including initially the Delta, Levee and Barratta areas.



The rice industry is now firmly established on the Burdekin, with annual production approaching 20,000 tons.

Work on Barratta soils under intensive management and frequent irrigation has given encouraging results. In a maize varietal trial planted in June 1971, the variety DeKalb XL361 gave the top yield of 7,992 lb./ac. (133.2 bus.) and several other varieties yielded above 7,500 lb. A bulk area of DeKalb 805A maize on mainly Oakey sandy loam gave a commercial yield of 6,272 lb./ac. (112 bus.). A Pioneer 846 sorghum crop under similar intensive management gave only 2,240 lb. grain per acre due to poor tillering and poor seed set resulting from low air temperatures.

Top yield from a soybean variety trial on Barratta soil was 1,716 lb./ac. (28.6 bus.), which is also fairly encouraging, but a similar trial on levee soil gave yields up to 2,820 lb.

These experimental yields indicate that these rather difficult soils can be irrigated successfully, and larger areas of these crops will be grown on these soils in order to define satisfactory irrigation and agronomy practices for commercial application.

At the Inglewood Field Station, irrigation studies have been carried out with wheat and navy beans. In the case of wheat the attempt to maximize the yields of the current commercial premium hard varieties by increasing plant density and nutrient levels has been thwarted by severe lodging. It would appear that genotypes specially bred for high-fertility conditions are required and unfortunately those currently available are not of premium hard quality.

The navy bean response has been more satisfactory and this crop could find a place on irrigated farms in this area.

A simple crop rotation trial has been in progress at the Inglewood Field Station on the fine-grained alluvial crusting soil. Various combinations of perennial and annual crops and pasture are being used in a treatment phase of 3 years, which will be followed by an evaluation phase in which the treatment effects will be assessed on annual crops. Already increased infiltration rates have been observed on plots laid down to perennial plantings and annual winter pasture. A Rhodes grass pasture-winter oats demonstration is also being conducted to assess soil improvement potential on a larger scale.

EXTENSION

The extension service has demonstrated an ability in programme flexibility. It has superimposed on its economic and management strategy programmes new programmes designed to take advantage of more bountiful seasons.

Crops with market prospects have been encouraged. Oilseed crops have reached record acreages. Growers have been assisted with information that has enabled them to select varieties most suited to their situation and to apply high standards of crop husbandry. Soybean acreages have increased enormously and yields have improved. Throughout the State new areas of sown pasture have been planted and old areas resown to more drought tolerant species.

In south-eastern Queensland a soybean extension programme in 1970-71 contributed to a record acreage for the 1971-72 season. An intensive "follow up" service helped to produce highly acceptable yields. Ten newspaper articles were published and 4 radio releases, supplemented by numerous farm visits, were made between planting and harvesting. 'The Soybean Digest' was printed and distributed to all growers in contact with the Department. A successful industry is now established in Queensland.

On the Darling Downs an exciting and relatively new approach to land use is in operation in the Jondaryan Shire. Farmers, a fertilizer company and Departmental officers are working together to map soils on individual farms and record responses to fertilizer, cropping systems and cultural methods. 140 farms and 178,000 ac. are presently involved. Farmer group meetings and farm visits are supplemented by a useful publication, "The Jondaryan Plains Report".

In the Burnett districts, extension programmes have been mainly concerned with sown pastures. Two good seasons have helped with establishment. The farmer's discussion groups at Miriam Vale and Rosedale have accumulated a wealth of knowledge and the confidence to proceed with sown pasture programmes. A new group has been formed at South Kolan.

In Central Queensland, extension emphasis has also been on sown pasture. On the wet coast about 18,000 ac. have been established and in the sub-coastal areas an estimated 43,000 ac. have been seeded. Three discussion groups have been formed in the brigalow areas north of Rockhampton and a new group in the Mackay district. These groups are bringing farmers and graziers into closer touch with new technology.

On the Atherton Tableland the efficiency of maize production continues to improve. In 1970-71, out of 93 growers only 30 did not use fertilizer. In the 1971-72 season, 14 of the previous 30 adopted fertilizer usage. Again about 5,000 ac. have been planted to sown pasture, bringing the total to over 30,000 on dairy farms. The effect has been that total milk production has risen by about 1,000,000 gallons a year over the last few years.

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.

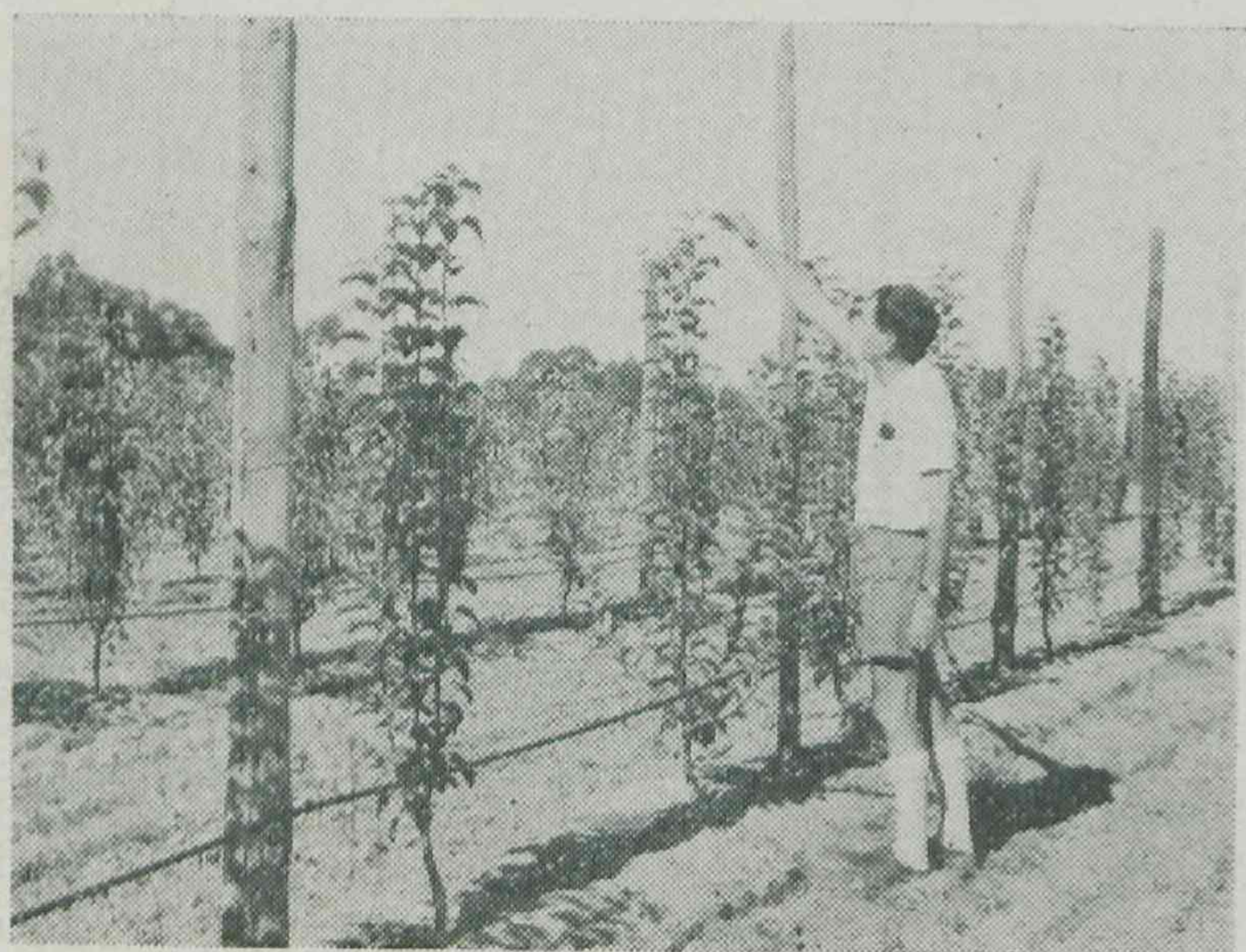
Liaison with industry is maintained through a number of Horticultural Advisory Committees. Within the Branch informal research/extension committees are responsible for the definition of problems in production and handling and assist in the co-ordination of research and extension activities. Horticultural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

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

In general, apple yields in Queensland are low because of poor and shallow soils, erratic rainfall and tree growth. Research efforts are directed towards intensive production methods. Trials are under way with closer planted trees to promote early bearing, increase yields and at the same time reduce costs of harvesting, spraying and pruning. Considerable work is in progress both in the glasshouse and in the field to determine the most efficient ways of using the limited supplies of irrigation water. Efforts are also being made to increase the depth of soil which the tree roots can effectively exploit, firstly by means of subsoil drainage to minimize harmful ponding of water on the impervious subsoil, and secondly by the use of herbicides to replace the traditional deep cultivation.



Establishing a trial in close planting of apples at the Granite Belt Horticultural Research Station.

A tree nutrition survey is being conducted to determine the relationship between tree yields and tree and soil nutrient levels.

It is also likely that the breeding work in progress in the Granite Belt will produce trees more adapted to this distinctive environment, and consequently more productive than the current varieties. This breeding programme, designed primarily to produce an early red-skinned apple of better quality than present early varieties, is still in its early stages, but over 600 seedlings came into bearing last summer. Attractive colour has been easy to obtain, but quality is more difficult. However, eight early-maturing, attractive, good quality selections appear to warrant further testing.

In the programme designed to produce a yellow-fleshed, early-maturing peach of high quality, 164 seedlings matured fruit before the end of December. The earliest maturing date was December 14, ten days earlier than Starking Delicious, the first commercial yellow-fleshed variety. As

many of the crosses derive their earliness from white-fleshed parents, and white flesh is dominant, it will take further breeding generations to produce yellow fleshed, early types from these crosses. Some of the American early yellow-fleshed varieties introduced from southern States are being grown commercially and show considerable promise.

The introduction and testing of wine grape varieties is continuing, as part of a programme to look into the possibility of producing high quality table wines in several districts in Queensland. Small variety trials have already been planted at Applethorpe and Inglewood, and material is available for planting a large-scale trial of 16 varieties at Ballandean. In preparation for the time when it will be necessary to test the quality of wines from the different varieties, the Sandy Trout Food Preservation Research Laboratory is studying pilot wine-making techniques, and an officer from this Laboratory recently visited appropriate southern laboratories to discuss advanced methods.

Although diphenylamine (DPA) at the recommended concentration is an effective control for scald in apples, outbreaks of severe scald still occur, probably due to failure to maintain effective concentrations of DPA. Stripping of DPA from the dips, and chemical breakdown, would account largely for the low concentrations. A simple test procedure devised for checking the concentrations of DPA in the dips confirmed the considerable loss of DPA as dipping proceeded in Granite Belt tanks.

A trial carried out to test the effectiveness of ripening of green apricots with ethylene at various temperatures showed that apricots could be ripened with ethylene in rooms held at 85°F. This temperature appeared also to give good control of brown rot, which can be a serious post-harvest disease of apricots.

PINEAPPLE

Leaf analysis has been used in Hawaii for some years as a basis for fertilizer recommendations for pineapples. Work has been in progress in Queensland for some time to establish leaf nutrient level standards for our conditions. Indications to date are that desirable levels for potassium are 3,000 p.p.m. 3 months prior to plant crop initiation, dropping to 2,500 upon initiation. However, it has become apparent that potassium has an adverse effect on the uptake of magnesium, and further attention must be paid to magnesium nutrition.

Flower induction treatment in autumn and spring for early summer and autumn crops respectively has been more effective with BOH than with ANA. As BOH is going out of production, further work with ANA was conducted and confirmed that a second application of ANA 2-3 weeks after the first greatly improves flowering.

Another chemical, ethrel, is quite effective, but as it reduces subsequent suckering, it is suitable only for ratoon plants which are to be turned in after the ratoon crop is harvested. The addition of urea to the ethrel spray greatly improves its effectiveness, permitting it to be used at about half the concentration that would otherwise be required.

Used as a spray on the fruit just before anticipated harvest time, ethrel has been found to bring about uniform external colouring of the whole crop. For a given treatment, using

current maturity standards, it would enable almost the whole of the treated fruit to be picked on the same day. Fruit matured somewhat sooner and weight appeared to be slightly reduced. This use of ethrel is being investigated further.

In the Rockhampton district ethylene has been found to be a more effective flower inductant than ANA and recent work indicates that its effectiveness is not reduced by its incorporation in nitrogenous sprays.

BANANAS

It has been found with many crops in recent years that higher yields can be obtained with spacings closer than those which are traditionally used. Trials were laid down with bananas on the Upper Murray last year to compare plant densities ranging from 750 to 1,250 per acre, planted with alternate standard and narrow inter-row spacings, the standard spacing to permit of ready movement of implements. The trial is not yet completed, but plant and sucker growth at the higher densities appear very satisfactory.

Where bananas are consigned to distant markets, a problem exists in that some of the fruit may be ripe on arrival, and ripe fruit may be indiscriminately mixed with the green fruit. What is required is that all the fruit should arrive in a green condition, ready for rapid, uniform ripening under controlled conditions in ripening rooms. It has been thought that precooling the fruit prior to consignment might retard the more forward fruit, enabling it to reach its destination in a green condition. It was also thought that comparatively low fruit temperatures persisting after the precooling would improve the general condition of the fruit. Experiments with North Queensland fruit have not been promising, as precooling to temperatures of 55°F, even with the provision of insulation to retard subsequent heating, has delayed ripening by little more than a day.

Two banana clonal selections made in south Queensland and called the Dwarf Mons Mari and the Queensland Cavendish are being multiplied in north Queensland, and it is possible that these may be less susceptible to wind injury than the Mons Mari.

A block of Lady Finger bananas exhibiting calcium deficiency symptoms in 1969 responded to applications of lime and dolomite with a yield increase of over 15%. Deficiency symptoms have not subsequently been obvious even in the untreated plots, but it is recommended that the soil pH for Lady Fingers be maintained at about 6.

Difficulty in controlling banana weevil borer (*Cosmopolites sordidus* German) with recommended sprays of 0.05% dieldrin by a grower in South Queensland was attributed to the possible development of dieldrin resistance. A survey of approximately 10% of the plantations in the South Moreton district indicated only one in which an extensive weevil infestation was associated with regular dieldrin usage. Laboratory tests of the weevils from this plantation demonstrated their susceptibility to dieldrin. A subsequent field trial on the affected plantation confirmed that correctly timed dieldrin sprays did protect banana plants from established borer populations. The existence of the original infestation on this plantation was due not to dieldrin resistance but to other factors.

In anticipation of a possible future need for an insecticide to replace dieldrin, the compound pirimphos-ethyl was tested in the field trial at Narangba. This insecticide showed promise in controlling banana weevil borer and may be available as a useful alternative should dieldrin resistance ever develop in Queensland.

Every year a red blemish of mature fruit known as "maturity bronzing" results in a large financial loss for banana growers in North Queensland. A survey showed banana flower thrips (*Thrips florum* Schmutz) to be the only insect species present on all blemish bunches and trials were undertaken to determine the significance of the insect as a possible causal agent.

Thrip numbers on certain bunches were maintained at a low level throughout the season by heavy applications of insecticide while on others populations were allowed to develop unchecked. Despite an apparent difference in thrip numbers there was little difference in the degree of bronzing at harvest, the percentage blemished fruit being 52.0% and 57.6% for treated and untreated bunches respectively. The upper hands consistently exhibited a greater degree of bronzing ranging from 92.6% of fruit blemished on the uppermost hand to 29.5% on the lowest. Although biological studies have shown that the lower hands are more favoured for development of thrip populations and consequently subjected to heavier attack, these findings indicate that maturity bronzing does not result directly from flower thrips infestations. Possible less obvious causes are now being investigated.

Two new fungicides with systemic properties, NF44 and BAS 3460, both gave control of post-harvest diseases of bananas equivalent to that obtained with benomyl when

applied as a dip after harvest. Good control of leaf spot (*Cercospora musae*) and speckle (*Mycosphaerella musae*) in North Queensland was obtained with the standard spray schedule despite the wet conditions experienced.

The Banana Export Feasibility Study Group, established to assess prospects for a major expansion of the banana industry in North Queensland for the Japanese market, completed an interim report covering production, packing and transport. Subsequently, three members of the study group visited Japan to study the organization, handling methods, prices and demand operating in the very competitive Japanese market. A final report is being prepared.

PAPAWS

The Richter's Gold, a papaw variety selected for its good fruit quality and relative freedom from ripe fruit rots, has been released to a commercial grower for seed production, and seed should be available to the industry in 1973. Breeding work is continuing and some of the progenies from Richter lines crossed with S7 show considerable promise. S7, a Sunnybank selection, is a reliable cropper with well-shaped fruit on long stems which facilitate picking and minimize distortion which often results when fruit are jammed together on short stems.

A condition of papaws known as "bumpy fruit" is much more prevalent than usual, and is of considerable commercial significance. Its cause is not yet known, but it is most common on light sandy soils.

Work has been going on for some time on the propagation of papaws by cuttings, and a fair measure of success has been obtained. In addition to being useful for breeding and research, cuttings if they can be produced easily enough offer considerable advantages for commercial production. Amongst these are uniform plant and fruit type, early, low cropping, out-of-season crops and control of the number of males and females in the plantation.

The most serious outbreak of yellow crinkle for many years occurred in most crops from Yarwun south, with up to 40% of the plants affected. The favourable conditions early in the season allowed a build-up of weeds and the insect vector of the disease.

WATERMELON

A number of watermelon varieties have been compared in the search for a satisfactory wilt-resistant kind. The best of the varieties tested was Calhoun Grey. In addition to having a high level of resistance to fusarium wilt, it outyielded the other varieties and its fruit was of very acceptable market quality.

CITRUS

A number of citrus trials comparing a range of varieties on several different rootstocks have been in progress for 11 years.

In a Late Valencia trial in the Maroochy Shire, Cleopatra has so far given the highest yields. The Benyenda strain of Late Valencia continues to outyield the other two strains under test by a small margin. In a navel orange trial in the Central Burnett, rough lemon is the best rootstock, followed by sweet orange, Emperor and Cleopatra, with *Trifoliata* yielding very poorly. The local Benyenda strain of navel has clearly outyielded the Victorian strain in this environment. With the Joppa orange in the Central Burnett, rough lemon continues to give the highest yield, followed by Cleopatra, sweet orange and Emperor, at about the same yield, and *Trifoliata* performing very poorly.

With lemons, the rough lemon rootstock leads by a considerable margin, followed by sweet orange and Cleopatra, with Emperor and Sampson tangelo yielding appreciably less. Sour orange is so far the poorest stock.

In an Ellendale mandarin trial in the Central Burnett, rough lemon and sweet orange stocks are both giving high yields, followed closely by Emperor and Cleopatra. *Trifoliata* has performed much better as a stock for Ellendales than it has for other citrus scion varieties in this series of trials.

The new trickle degreening of citrus is becoming an established commercial practice, as it speeds up the rate of degreening considerably. From a number of studies of factors which might affect the speed of the process and the quality of the product, it has been found that the maximum rate of degreening occurs at about 27.5°C, and at this comparatively high temperature the colour and flavour of the fruit are not impaired. At high temperatures the fruit developed higher acidity and a higher sugar content than at low temperatures. The influence of levels of carbon dioxide and ethylene on the rate of degreening was ascertained. It was also determined that high levels of ethylene favoured the development of the fruit disorder known as anthracnose.

In a citrus leaf analysis survey in the Lockyer to assess fertilizing practices, deficiencies of phosphorus, magnesium and manganese have been found in many orchards, while nitrogen, potassium and chlorides have been found in several instances to be present in excessive amounts.

For many years oil sprays have provided good control of red scale (*Aonidiella aurantii* (Maskell)) on citrus. However, their use on Glen Retreat mandarins causes plant injury, resulting in extensive blemish and shedding of fruit. Two alternative chemicals, methidathion and omethoate, have been proved to provide effective control of red scale without detriment to the tree or crop. These materials are now recommended for use on sensitive varieties. Where there is little risk of injury, however, oil sprays are still preferred owing to their less harmful effects on parasites and predators.

AVOCADOES

A leaf analysis survey has been conducted on 18 avocado orchards in the Redlands district, to compare existing nutrient levels with those which in overseas and local work have appeared to be desirable. In general, the trees were found to have adequate nitrogen, magnesium, iron and manganese. Although the levels for phosphorus, potassium and calcium were slightly below the desired levels in some instances, it is not considered that corrective measures are required. However, some attention to zinc nutrition will be needed in almost all situations.

Root rot (*Phytophthora cinnamomi*) caused heavy losses again this year following the excessively wet conditions experienced during the summer. Stem-end rot and anthracnose (*Colletotrichum gloeosporioides*) caused heavy losses this year. Post-harvest dips with benomyl have shown promise against these disorders.

An analysis of costs and returns from avocados in south-eastern Queensland was undertaken in response to numerous enquiries on the potential for this crop. Prospects for high returns, particularly on the southern markets, encouraged large plantings in recent years, increasing from 10,000 trees in 1960 to 43,000 in 1970. As recent plantings reach bearing age, a substantial increase in production may be anticipated.

STRAWBERRIES

The variety Tioga proved to be very susceptible to wilt (*Verticillium dahliae*). Redlands Crimson and Torrey appear resistant. In a glasshouse trial, root lesion nematode (*Pratylenchus vulnus*) was controlled in Redlands Crimson by dipping planting material with three new nematocides.



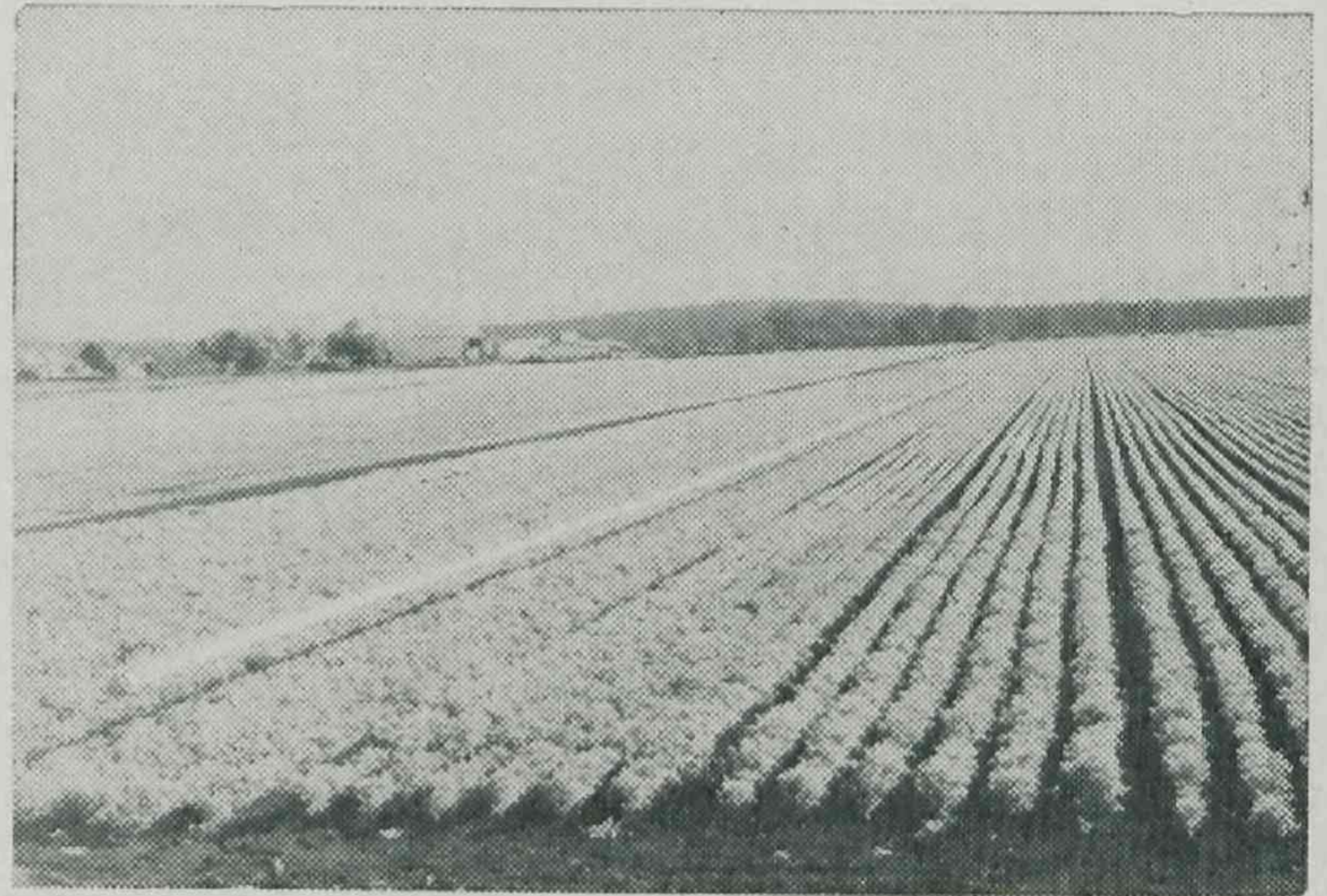
Mechanical harvesting of beetroot in the Lockyer Valley.

VEGETABLES

Vegetable production is increasing rapidly in the Lockyer Valley, where the extensive alluvial soils and the general availability of water for irrigation permit of considerable expansion. There has been a large increase in bean acreages recently, and an appreciable increase in the already large acreages of peas and beetroot. Another quite recent development is the planting of 200 acres of "baby" carrots, and also a substantial area of cauliflowers, for processing. The greater part of vegetable production in the Lockyer is for processing, but production for the fresh market is also considerable. There is also increasing production of vegetables in the nearby Fassifern area, though the total acreage is much smaller than in the Lockyer.

The soils and climatic conditions in the Lockyer and Fassifern districts, where vegetable production is increasing rapidly, are rather different from those in the traditional

horticultural districts where cultural methods have developed and been assisted by research over many years. Consequently new problems have appeared in these districts, and have required investigation.



Extensive plantings of baby carrots for processing are being made in the Lockyer Valley.

Poor growth and production of a number of bean plantings has caused concern. On investigation it has been found that, in general, beans in the Lockyer require much more nitrogen than has been recommended in the older bean-growing districts and that sulphate of ammonia is the most effective source of nitrogen. In certain parts of the Lockyer the irrigation water is rather too saline for beans; it has also been found that deficiencies of zinc and manganese may frequently be depressing yields.

The tomato industry is benefiting by plant improvement work at the Bowen and Redlands Horticultural Research Stations. Most recent developments have been the good performances of two varieties recently introduced from Florida. In Bowen the variety Walter, obtained from Dr. Walter of Bradenton (Florida), is resistant to a serious new strain of fusarium wilt and has given good yields of good quality fruit. It promises to be the leading variety in the Bowen district. At Redlands a breeding line introduced from Dr. Stobel of Homestead (Florida) has performed so well that it warrants release for commercial production, and permission has been obtained from the appropriate authorities in Florida. At the same time, breeding work is in progress in this State and some of the breeding lines at present being screened in the Lockyer contain promising processing types.

Further trials were conducted at the Redlands Station to evaluate a range of insecticides for control of the major pests of cabbages during the winter growing period. Diazinon, "Gardona" and leptophos applied at both 7 and 14-day intervals were compared with untreated plots and the common commercial practice of endrin/azinphos ethyl combination sprays applied at 7-day intervals. All weekly treatments provided adequate pest control, resulting in the production of first grade cabbages. Fortnightly treatments produced second grade cabbages owing to higher levels of insect damage. In view of this difference in marketability, it would appear that under the condition of heavy pest pressure experienced in the trial, weekly insecticide applications resulted in a financial advantage.

Trials to select a reliable, preplanting seed-dressing for beans indicated that monocrotophos at 1:500 parts by weight of seed provides 2-3 weeks protection from bean fly (*Melanagromyza phaseoli* (Tryon)) depending on the population level of the pest. Treated seed required an extra 12-14 hours to germinate but percentage germination was not affected. At an estimated cost of 59 cents per acre, seed treatment represents a definite financial advantage. Nevertheless, foliar sprays remain an important method of combating bean fly and a number of insecticides have been tested against the pest. Promecarb, diazinon and dimethoate each at 0.025% active constituent provided adequate control and have largely superseded DDT in the Nambour-Gympie area.

"Summer death" was prevalent in the cultivar Gallatin 50 grown for processing during November. Siratro seed crops on the Atherton Tablelands are reported to be infected with halo blight (*Pseudomonas phaseolicola*). The widespread occurrence of this disease in these crops presents a hazard to bean production in certain areas, particularly where seed crops are being grown.

An increase in production of certified bean seed from 1,707 bushels in 1970 to 3,908 bushels in 1971 is indicative of merchants' expectations of an expanding market both at home and overseas for this seed.

A report has been prepared on how dairy farmers in the Gympie region have been combining dairying with bean growing. In a suitable environment, bean growing, during winter, supplements income from dairying. However, bean profitability varies considerably as market prices fluctuate markedly according to supply.

Watermelon mosaic virus caused unusually severe symptoms in the spring and summer, with deformed fruit being common in pumpkins, watermelons, marrows, squash and zucchinis. The good weather conditions experienced resulted in rapid crop growth and this may have accentuated the effect of the virus.

Research in potato agronomy is following three main lines at present, viz. determination of a simple and precise method of scheduling irrigation based on actual water needs of the crop, evaluation of potato breeding lines in co-operation with plant breeders in southern States, and evaluation of different sources of certified seed potatoes.

Trials aimed at developing a simple irrigation scheduling method have given useful information but the project has not yet reached the stage where firm recommendations are possible. In the spring crop, irrigation prior to tuber setting does not influence yield providing that soil moisture is adequate for emergence. In autumn, however, this stage corresponds with high temperature conditions and maintenance of the soil moisture above the 70% available moisture level is necessary to ensure an adequate number of tubers are set. After the tubers have set, however, irrigation when soil moisture drops to 70% of available moisture gives the best overall results.

Termination of irrigation early, that is, after 85-90 days from emergence, has been found to decrease yields but it seems to hasten tuber maturity, expressed as skin strength, and also improves the "chipping" quality of tubers.

Work has shown that there is a good possibility of growing quality seed potatoes in Queensland. Seed potatoes harvested near Killarney at a time suitable for sowing the main Queensland winter crop gave similar yields to those obtained from certified southern seed. Tasmanian pathogen tested seed also yielded well, but contamination with powdery scab precludes its use in Queensland.

The inter-State co-operative potato evaluation project commenced in 1970. Some 67 lines introduced initially have now been reduced by preliminary screening for agronomy characters to some 16 lines for further testing. A further 63 lines were received for testing in 1971-72. This programme is not expected to result in new commercial variety recommendations for several years.

Powdery scab (*Spongospora subterranea*) continued to be a serious problem in the winter-grown potato crop. The detection of this disease in certified seed from interstate was a matter of concern this year. In field tests the cultivar Sequoia proved far more susceptible than Bungama, Exton, Sebago and Kurrel. Soil temperatures of 60°F or below at 4 in. were ideal for disease expression. In glasshouse tests benomyl used as a pre-planting dressing and post-planting applications reduced stem-end rot (*Fusarium solani*) from 65% to 6%.

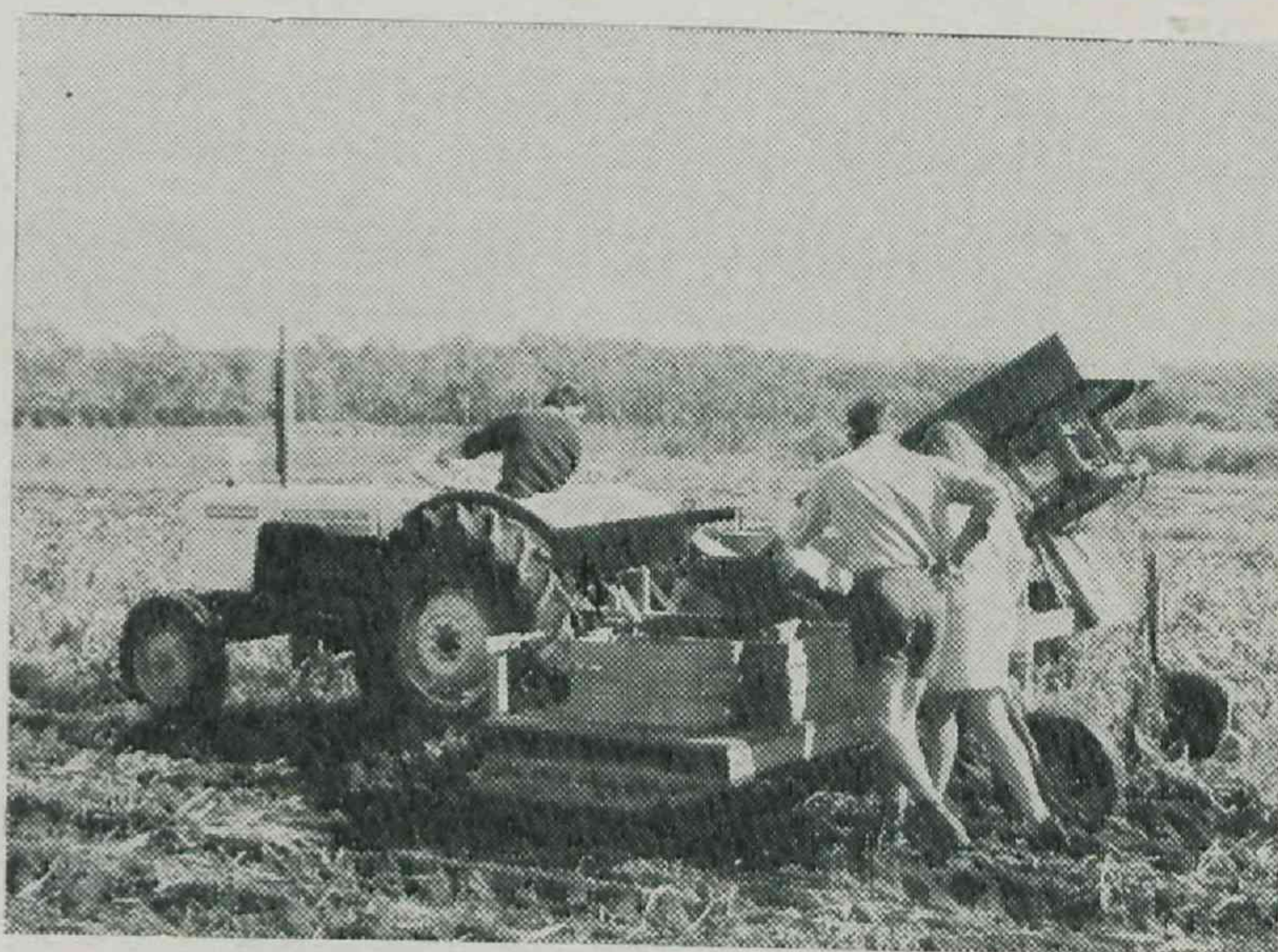
Concern was expressed by officers of the Department of Agriculture, New South Wales that some Queensland produced potatoes infested with powdery scab had entered New South Wales. Investigations and extension work involving the services of officers of Standards Branch, Agriculture Branch and Plant Pathology Branch have been undertaken to minimize the spread of this fungus disease.

Weed control and weed competition trials in onions are continuing. Combinations of chemical herbicides are available which give virtually complete weed control for the life of crop and the use of these herbicides is permitting higher density plantings of onions, with yields per acre in the 20-25 tons range. The elimination of tillage is also being evaluated and results to date suggest that soil type has significant effect. Where the soil tends to cake and crust, some tillage is an advantage, but in the case of self-mulching soils, tillage appears to be a disadvantage, possibly due to damage to the root system of the onions. The weed competition trial again indicates that onions are most susceptible to weed competition in the early stages of growth. For example, allowing weeds to grow uncontrolled till the onions had reached the 2-3 leaf stage reduced the yield by 45%.

ORNAMENTALS

In recent years the production of ornamentals has expanded rapidly to become a substantial industry, with a growing trade in cut flowers and a demand for nursery stock increasing with rapid developments in landscaping. As a

step towards investigating some of the problems of this very diverse industry, the Horticulture Branch has recently appointed a Horticulturist to the Redlands Horticultural Research Station. Some time must initially be spent in surveying the industry to assess its most urgent problems and its most promising avenues of improvement, but already some interesting and useful work is under way on a problem which the Main Roads Department has encountered in the establishment of seedlings of certain attractive native species on road embankments.



The ornamental industry is growing. Mechanized lifting of gladiolus corms has been introduced.

Wilt (*Fusarium oxysporum*) was serious in carnations. Another disease of considerable importance elsewhere was recorded in carnations for the first time in Queensland. This is stem rot caused by *Fusarium graminearum*.

The following leaf diseases due to nematodes were recorded for the first time in Queensland:—*Aphelenchoides fragariae* on begonias, ferns, *Ficus elastica* "Decora" and *Crossandra undulifolia* in southern Queensland; and *Aphelenchoides besseyi* on ferns at Cairns.

PACKAGING

In the development of better packages and packing methods it has been necessary to determine what were the main sources of damage to the container and the contents, so that packages could be submitted to appropriate tests. It has been found with apples that a major source of fruit bruising is dropping of the container, and the relationship between drop height and drop number has been determined. With this knowledge it is possible to design suitable tests to predict the effects of modification of packing and handling systems on fruit injury.

Initial investigations into the effect of precooling tomato fruit grown at Bowen and intended for distant markets indicated that there was a distinct improvement in appearance and firmness of fruit that ripened in transit, but no marked effect with fruit which arrived in a green condition.

A closely related aspect of the problem is the heat which the fruit may develop in the field and packing shed, and how this is affected by conditions at the time of picking, and by methods of handling in the field and in the packing shed. Investigations have already shown that the temperature of fruit in the field is closely related to that of the air temperature at the time, though somewhat higher. It is now proposed to study how fruit temperature is affected by various methods of handling.

ECONOMICS

A detailed study of production methods, costs and returns for over twenty fruit and vegetable crops is being undertaken in the Gympie region with the co-operation of specialist growers. In addition, market prospects and price variations are being examined.

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.—Land unit mapping of the brigalow lands of Area III of the Fitzroy Basin Brigalow Land Development Scheme was continued by the Development Planning Branch. Most of this mapping has been undertaken at the photo-interpretation level, and as a result the area mapped during the year increased by some 2,872,880 acres to give an aggregate total of 5,636,824 acres. Eighteen land-use plans based on soils and vegetation were prepared by the Central Drafting Section to be used when property development plans are being drawn up.

Departmental extension and technical services are gradually being provided in Area III, which has initially been divided into three broad geographical regions. Most new settlers have been contacted by an Advisory Officer. Discussion groups are being constituted in each region.

An economics research project to evaluate future agricultural development in the Fitzroy River Basin is nearing completion. Similar studies are planned for other major agricultural regions of the State.

Beef Industry Study.—This study was continued during the year but at a much reduced tempo because of other commitments by both Commonwealth and State officers engaged in the study. However, the delay is not without advantage since it provides time for the partly complementary beef and wool industries to reach equilibrium in a situation where the latter industry is now achieving a more satisfactory economic base.

Sheep Industry.—A climatological study of the Northern Sheep Zone commenced during the year. The study area includes some 1,200 properties and embraces the shires of McKinlay, Richmond, Flinders, Winton, Longreach, Aramac and Ilfracombe. In this project simulation techniques are being used to document the effects of climate on pastoral productivity and economic viability and in due course should provide guidelines for re-structuring of pastoral industries in the study area.

Western Arid Zone.—Considerable progress with the rate of mapping the resources of far-western Queensland has followed the setting up of a multi-discipline team. A Land System Map for Part A of the Study Area at a scale of 1:500,000, together with vegetation and soil maps at a scale of 1:1,000,000 relating to 36 million acres of land in the south-west corner, has been prepared by the Central Drafting Section. Descriptions relating to the various land systems, vegetation patterns and soils are being finalized for publication.

Photo-interpretation, reconnaissance field traversing and site sampling activities relating to the Part B mapping area of 24 million acres have been completed. The definition and description of the component land systems, vegetation and soil units will be a major activity for the team during the second half of 1972.

Comber Project.—The Comber project to assess the availability and utilization of resources in the Condamine-Maranoa region is being continued. The primary objective is to ascertain the adequacy of existing research and extension activities in the region and to determine an order of priority for future needs.

Cape York Peninsula Study.—Analysis of land capability, soils, vegetation and stocking rate data for the area indicates that intensity of activity in the beef industry is dependent mainly on proximity to the southern transport link between Normanton and Mareeba. Land capability and length of growing season seem to have negligible influence. Economic Services Branch officers are collecting land-use data on holdings in the area and this should lead to more specific findings.

Wallum.—Prospects for developing the wallum region for beef production were examined by a Technical Sub-Committee with representation from the various branches involved. Doubts were expressed concerning whether beef breeding properties could be made economically viable in the long term. Research is continuing into the feasibility of combining an existing spear grass property with a wallum block for fattening steers.

LAND USE

Isis Land-use Study.—The land-use study report prepared by the Isis Land Use Committee, which was completed in May 1971, contained recommendations that were approved by the Government on November 1, 1971.

The approved recommendations included a suggestion that special attention should be paid to land in close proximity to the proposed irrigation channel between Gregory and Elliott Rivers. A reconnaissance survey of some 11,000 acres of State Forest and vacant Crown land revealed the existence of between 4,000 and 5,000 acres of land which was subsequently verified by the Bureau of Sugar Experiment Stations as being suitable for irrigated cane production.

A check of the soil survey of that section of State Forest 779 approved for excision for sugar-cane production was carried out. This survey confirmed the accuracy and suitability for farm design of a detailed soil survey carried out some years ago by the Forestry Department.

A report, together with a map summarizing the soils information available for the Forestry and vacant Crown land which may be used for cane production, was prepared and forwarded to the Irrigation and Water Supply Commission.

The Commission will be assisted by a local land-use committee in the implementation of the approved plans for re-adjustment of the sugar-cane farms.

Gin Gin Land-use Study.—During the year an inter-departmental committee completed a study of the 90,000 acre Gin Gin-Maroonan area. A reconnaissance soils map was prepared and a detailed statement of the physical and chemical properties of the 13 soil associations was prepared.

It was concluded by the Committee that there is adequate suitable land available in the area to enable transfer of assignments from the 2,200 acres of steep land. Highlights of the report relate to the severity of erosion on the steep lands of the Gin Gin district and the recommendation that the Soil Conservation Authority take appropriate steps under the Soil Conservation Act of 1965 to have the area declared an "Area of Erosion Hazard".

Eastern Downs land-use study.—A joint project by Soil Conservation and Development Planning officers to investigate land capability/land use on approximately 1.6 million acres in the basaltic uplands of the Eastern Darling Downs was initiated during the year. The main purposes of the project are to provide a physical and economic assessment of soils and present land use, to determine desirable land-use changes based on land capability, and to investigate the effects of desirable land-use changes on productivity and economic viability of individual properties.

An initial survey of a 12,000 acre sample area in the Wyreema-Cambooya district included an intensive investigation of soils and an attempt to establish productivity ratings for the various soil types based on an interview survey of 26 farmers in the sample area and discussion with Departmental officers.

Soil loss data for the various soil types and cropping and conservation practices have been determined. Erosion hazard potential for 14 mapping units involving 8 cropping sequences have been calculated.

Documentation of soils and land-use data has been extended over an area of approximately 100,000 acres. As a result of the experience gained in the detailed investigation of the sample area, together with the more extensive use of aerial photographs, the additional area has been covered in a relatively short period. The mapping of the soils of the 1.6 million acres could be completed in about 3 years if the present rate of mapping could be maintained.

Granite and traprock survey.—This survey has been undertaken at the request of the Eastern Graziers' Regional Development Committee. A survey is considered necessary in view of changing markets for the area's main primary products—wool and fruit. This should allow a regional appraisal and enable a valid solution to be reached for development of the area as a whole. In particular, the trend from wool to beef requires assessment of its potential impact on the land resource. The aim of the survey is to produce a more detailed inventory of soils, vegetation, landforms and climate than has been available in the past.

The area is approximately 2,000,000 acres, and includes the shires of Rosenthal, Stanthorpe and part of Inglewood. Air photo-interpretation has been based mainly on landform characteristics, since the natural vegetation cover is widely disturbed. Most of the field work for the Granite Belt has been completed and photo-interpretation is under way for the traprock.

IRRIGATION

Barambah-Barker Creek.—A joint study of proposals for the construction of various dam sizes at alternative sites on Barambah and Barker Creeks was carried out during the year by Economic Services and Development Planning officers. Land capability/land-use aspects and economic aspects of 10 alternative proposals were examined. The lack of a readily marketable, highly profitable crop that can be incorporated in the production pattern militates against the attainment of an acceptable economic result.

Three Moon Creek.—A similar study to that for Barambah Creek was undertaken by Economic Services Branch officers for a proposal to erect a dam at Cania Gorge on Three Moon Creek. The stored water would be used to re-charge the aquifer in order to stabilize irrigation of about 9,000 acres of alluvial soils in the Monto-Mulgildie districts. This project is still under examination but it suffers from the same problem referred to in the Barambah Creek notes.

Lower Mary River-Tinana Creek.—As a result of a meeting sponsored by the Maryborough and District Promotion Bureau, and at the request of the Irrigation and Water Supply Commission, 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 has been undertaken by the Department of Primary Industries.

The investigation will be in parallel with an Irrigation and Water Supply Commission study of the feasibility of constructing a tidal barrage in the Mary River and distributing irrigation water (to be supplied from Borumba Dam) to stabilize cane production and possibly enable the development of other crops in the area.

Following inspection and recording of some 50 soil profiles, an overall impression is that the imposition of a complex drainage system of four major geological units has resulted in a reasonably complex soil-landform distribution. An initial impression has also been gained that limitations other than soil type will probably make much of the undeveloped land unsuitable for irrigated cane production.

It seems likely, therefore, that economic justification for the scheme will depend mainly on stabilization of cane production through irrigation. Inherent in such an irrigation scheme will be a capacity to increase production to meet any expansion in sugar peaks, or to accommodate a transfer of some assignments from outside areas.

Stage II, Leslie Dam.—Serious over-committal of available underground water resources in the Condamine Basin, and of surface supplies along the Condamine River, has led to investigations into the feasibility of completing Stage II of the Leslie Dam, the construction of a diversion weir to the North Branch and the establishment of a series of weirs to improve the efficiency of distribution of irrigation water.

Preliminary economic assessments of the proposal have been made by Economic Services and Development Planning Branches. These show that benefit/cost ratios greater than 1.0 are likely for each of the alternatives considered, provided that between 6,000 and 7,500 acre feet of replacement water is actually available on farms from the proposed irrigation works, to compensate for the serious short-fall in the supply of water from underground sources.

WOODY PLANT CONTROL

Brigalow.—During the year several of the experimental projects on the control of brigalow suckers at the Brigalow Research Station were completed. Some points of interest to emerge were as follows:—

- (a) A trial on brigalow suckers which involved ploughing in summer or winter for up to 3 years using Chamberlain, Little Giant and Majestic ploughs showed that the Majestic plough gave the best results at all depths and at all times. Kills of 100% were achieved after 3 years of ploughing with the Majestic plough irrespective of depth or season.
- (b) A trial designed to determine the pattern of regrowth following non-directed knapsack misting of 4 to 5-year-old brigalow suckers with 2,4,5-T in diesel distillate, and to relate this to the effectiveness of a second misting, indicated that the most consistent results were obtained when the second misting was applied 10 months after the initial misting. In this trial the initial misting was applied at 2-monthly intervals over a period of 12 months and the second misting was applied 6, 8, 10 and 12 months after the initial treatment. Poorest results were obtained when the initial treatment was applied in dry spring and dry early summer. Results achieved by applying the second misting 8 months after the initial treatment were also good at all times of the year except when the initial treatment was applied in dry spring. Results in this trial complement results obtained in an earlier trial in southern brigalow areas.
- (c) An assessment of an area of ultra low volume (ULV) spraying at a property near Dingo was made during August 1971. Results 18 months after treatment showed a 24% kill of suckers about 3 ft. 6 in. high. Results in the Baralaba district showed the ULV technique to compare rather unfavourably with commercial spraying at the normal volume of 2–2½ gal./ac. at about the same time. On the latter areas results 18 months after treatment indicated 77% kill of all brigalow in burnt-out brigalow scrub and 98% kill of 5–7 ft. high suckers in an area of cleared brigalow. Final results cannot be assessed until 1973.

Dawson gum or blackbutt.—Experimental work on the control of brigalow-Dawson gum was continued at the Brigalow Research Station, using mechanical, chemical, cultural and fire treatments in an attempt to control regrowth. One result already evident is that one complete cultivation regimen in either summer or winter is sufficient to eliminate most of the Dawson gum regrowth. The brigalow regrowth is proving more difficult to control with fire and mechanical techniques.



Trial on mechanical control of burnt-out brigalow-Dawson gum scrub at Brigalow Research Station. The area in the foreground was pushed, stick-raked, burnt, ploughed once and sown to pasture.

Sandalwood (Eremophila mitchellii).—In co-operation with C.S.I.R.O., a woody weed survey form has been developed. Field work was completed on a pilot survey to test the usefulness of this form in obtaining and processing information on sandalwood for assessing the efficiency of particular treatments (e.g., pulling, burning, etc.), relating the results of treatments to environmental factors (including climate, seasonal conditions and habitat factors) and management techniques, and providing data for extension and possible lines for further research.

The pilot study has been carried out in the three areas of the Fitzroy Basin Land Development Scheme and data on vegetation, topography, soils, climate and land clearing techniques have been collected from 120 sites. Analysis of the data has begun using both existing C.S.I.R.O. numerical programmes and a special data retrieval programme based on INFOL systems. Early results from these analyses indicate that relationships do exist between the input variables and new guide-lines for work on the control of the species should be available in the near future.

Permanent quadrats have been established in Area III of the Fitzroy Basin Land Development Scheme to record the fate of sandalwood and Dawson gum on pulled areas after they are burnt. Eleven new quadrats were established in October to monitor the effect of the summer burns.

A recently completed chemical control trial on sandalwood regrowth at the Brigalow Research Station gave poor results. Non-directed misting was used and the best kill was 65% using 6 lb. 2,4,5-T ester in oil per acre. A new trial using directed misting and several previously untried chemicals has been commenced.

FARM MANAGEMENT ACCOUNTING SERVICE

Membership has been maintained at approximately 250 producers, which is the limit of the processing facilities. A new group is being established in the Charleville district.

A new annual printout service has been introduced to cater for producers who already have a good set of records and are interested in the quarterly cash flow statements financial performance. The monthly mail-in recording scheme

is being maintained for members who have no other records and are interested in the quarterly cash flow statements for financial control. Annual statements from both services will be combined to provide more meaningful group averages through greater membership.

More use is being made of this accounting service for its essential function in farm planning as members avail themselves of a budgeting service where the economist assists them to prepare next year's budget.

Enterprise coding was introduced successfully on a pilot study basis in 1971-72. While more detailed coding is entailed in allocating costs and returns to specific enterprises, the results are more informative than a whole-farm analysis.

This service has played an important role in the development of the A.C.C.R.A. code since its introduction in 1970-71. The Australian Agricultural Council has recognized the suitability of this code for use throughout the Commonwealth in uniform coding of farm financial and physical records.

This service is fulfilling three important functions:—

- (a) In providing an informative farm management service to a limited number of producers particularly when combined with other technical advisory services.
- (b) As a factual basis for farm management advisory work and applied agricultural economics research on a regional basis.
- (c) In developing farm management accounting services appropriate for major industries throughout the State.

VIII. Special Field and Laboratory Services

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

SOIL CONSERVATION

During the year 3,008 requests for assistance were received and 5,826 property visits made to assist with the development of soil conservation programmes. The number of requests continues to decline, probably due to continued difficult financial conditions in many sectors of the agricultural community. A revival of interest occurred in West Central Queensland. This was associated with land-use planning and an increase in the application of contour cultivation between grass strips.

A further 353 landholders, the lowest total in the past 6 years, commenced contour farming programmes for the first time, bringing the cumulative total of co-operators to 7,738, or 18% of landholders in the State. The total number of holdings in the State is listed as 43,162 and the 7,738 co-operators is 18% of these. Allowing for an unknown but substantial number of holdings that do not require contour farming, the actual percentage of co-operators is actually higher than this.

The Soil Conservation Branch is placing increasing emphasis on the assessment of land capability of properties and the preparation of land capability plans and land-use plans. Technical guides to conservation land use are helping to give more objectivity and uniformity to this part of the Branch's work. Land-use plans were issued to 71 more landholders this year and the area covered in these plans was some 230,472 acres. In most cases the decision to prepare a land use plan depends largely on the willingness and ability of the landholder concerned to make use of such a plan, but in three areas of the State a more systematic mapping of land use at the individual farm level on a district wide basis has been adopted.

In West-Central Queensland combined land capability and land-use plans were prepared and issued to 13 landholders involving a total area of nearly 168,000 acres. An indication of the upsurge in interest is that a further 70,000 acres involving six landholders has been spoken for.

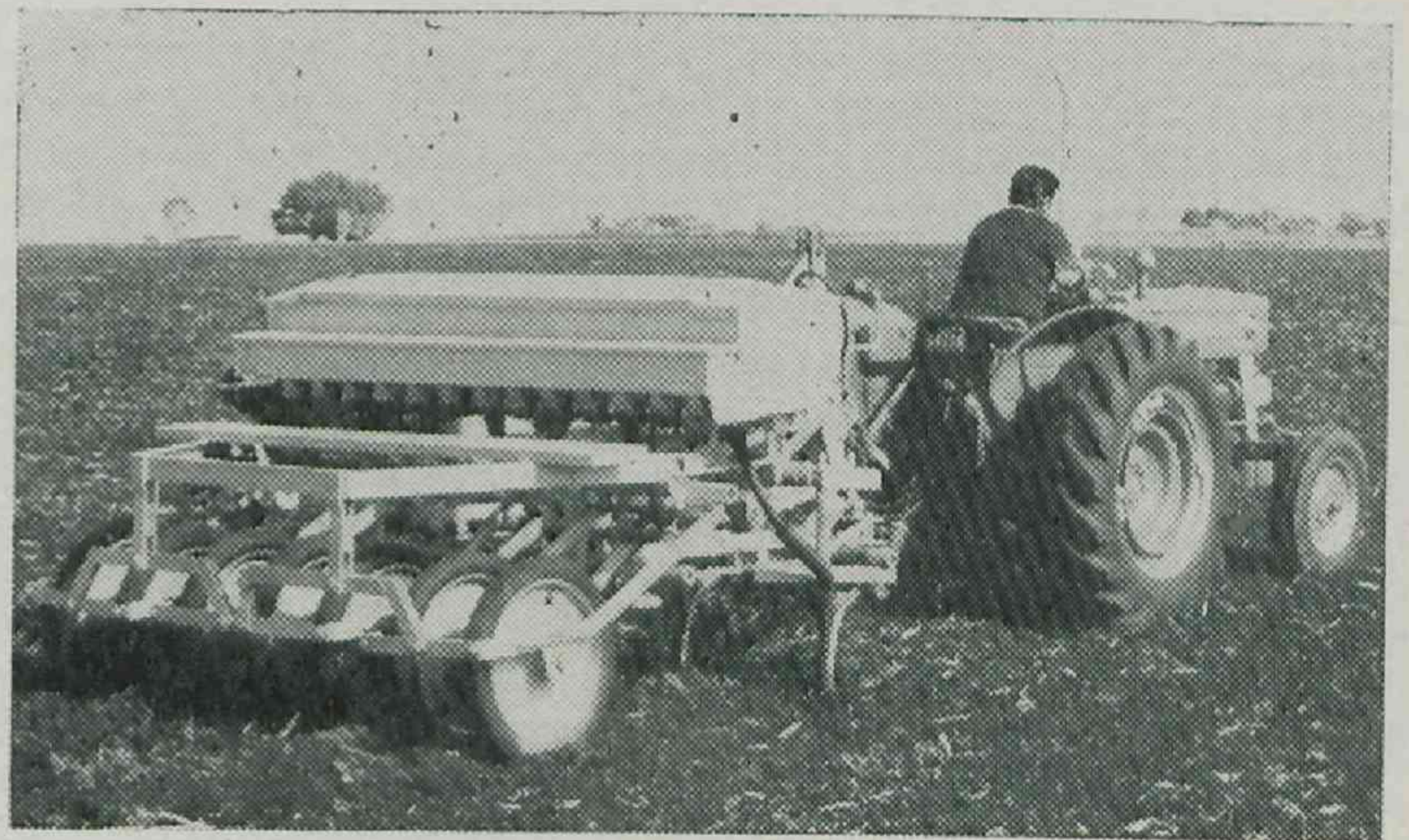
On the Western Darling Downs an attempt to arouse interest in two selected small catchments by the preparation of Land Capability and Land Use Plans was attempted but the acceptance by landholders was disappointing, no doubt because conservation land use in the area chosen involves in some cases an unpopular switch from cultivation to pasture.

On the Eastern Darling Downs systematic mapping of the land resources is being carried out in the basaltic uplands. This is an extensive area of steeply undulating black soils where only partial erosion control has been achieved. To date a sample area of 12,000 acres involving 26 farms has been mapped and a report is in preparation. Preliminary mapping directly onto aerial photographs has been carried out on a further 90,000 acres.

Some 120,900 acres of erosion-prone cultivation land was marked out for contour farming, bringing the total area of land worked on the contour in Queensland to 1,290,000 acres. The area treated was 7% less than the area treated last year.

The area treated by contour banking shows a continued decline in all regions. The area treated by other contour measures rose on the Eastern Downs and in West Central Queensland, raising the overall totals back to the 1968-69 level or better in these two regions. Provided that contour cultivation unsupported by banks is backed up by adequate supporting measures, this trend away from banks in some areas is compatible with sound conservation.

The application of stubble mulching as a conservation practice has been pursued actively, particularly in the Eastern and Western Darling Downs Regions, where the availability of improved stubble handling machinery for testing on farmers' properties has given impetus to the extension programme. Farmers' interest and the results achieved to date in the development of machinery that will cultivate and plant in stubble have been very satisfactory. In the Dalby area two press wheel drills have been built locally by farmers and many standard machines have been modified.



Stubble mulching machinery in use on the Darling Downs.

Local machinery agents are beginning to realize the demand for stubble handling machinery and at least two local manufacturers have entered the scene. One has produced a new seed drill that will clear more stubble than any other drill in the market. Another is producing 36 in. sweeps and has also recently manufactured a plough to incorporate the sweeps and other tine implements with improved trash clearance.

On the debit side, the John Deere Co., have decided not to import a very successful press wheel drill and this has been a blow to the programme. Fortunately, finance has been made available by the Commonwealth Department of Primary Industry to enable the Department to purchase the John Deere equipment, including the 100 series chisel plough and the press wheel drill, and these will be available for further trials and demonstration.

A machinery project incorporating a modified press wheel planting unit sponsored by the Toowoomba Farmers' Festival Committee and carried out by officers of the Soil Conservation Branch at Toowoomba is proving very successful in planting trials begun late in the year. On a property at Wyreema an area of Clipper barley was planted 86 days after the last significant fall of rain. The crop emerged 10-12 days after planting and the strike compared with a medium to good stand from a planting made under ideal conditions.

Evaluation work is continuing with imported stubble mulch machinery. To date 40 farmers have participated in evaluation of the implements over a wide range of soil, climatic and management conditions.



Maintaining waterways is an important soil conservation measure. This scene is on a tobacco farm in the Mareeba district.

In brief, the imported implements have successfully achieved better utilization of soil moisture through planting in the optimum planting period, improved soil surface conditions beneficial to erosion control, improved crop establishment, particularly under adverse conditions, elimination of the problem of crop residues, reduction in number of tillage operations and costs, reduction of farm equipment needed, and probably improved soil moisture availability, at least in the short term. Emanating from the programme is an investigation of the types, shapes and pressures of press-wheels necessary to improve crop establishment under field conditions.

In soil erodibility studies, soil from 10 selected sites covering a range of Queensland grain soils has been subjected to detailed examination. In addition, aggregate stability, aggregate distribution and infiltration measurements have been carried out using simulated rainfall. Further work will now be delayed until the Departmental rainfall simulator is completed.

The base infiltration rate of clay soils is dependent on clay mineralogy and clay content for soils within similar mineralogical groups, is controlled by organic carbon per unit clay within the clay groups examined, and is highly correlated with organic carbon per unit surface area of clay irrespective of clay type. Coarse-textured soils have high infiltration rates but are frequently structurally unstable under rainfall. Final infiltration rate of clay soils is determined largely by the release of dispersed clay in the surface layer brought about by soil saturation and the mechanical action of raindrop impact.

Field moisture data collected during the period are available as gravimetric moisture percentages. Most of the soils were cracking clays exhibiting a changing bulk density with changing water content. Various methods of bulk density measurement were investigated during the year and standard regressions relating bulk density to water content were derived in the unidimensional swell-shrink range by using thin-walled tubing and direct volumetric sampling, and in the three dimensional range by applying theoretical relationships to the observed field bulk density and moisture range.

Wilting point determinations using the sunflower method have been carried out on samples from all sites. This has produced wilting point data significantly lower than those measured under observed wilting conditions in the field. The differential increased with depth which suggests that such factors as root depth and distribution, soil diffusivity and weight of overburden contribute to restricting water availability. Observed field moisture limits have therefore been used in assessing net available water content.

The bulk density changes characteristic of these soils produce marked changes in surface soil height which is not normally considered in moisture measurement. To enable correction for this factor, layer thickness changes within the profile over the available water range have been calculated. This suggested a maximum surface height change of 8.7 in. in comparison with a maximum measured change of 6 in.

Volumetric moisture content has now been calculated for almost half of the available data. The following general conclusions have been drawn from the data so far: (a) Rainfall storage appeared to be confined to two periods of the year, one in summer (December-February) and one in winter (May-July). Relatively the storage efficiency was greater in the winter period. (b) The efficiency of storage at any time decreased as the level of antecedent water storage increased.

A water balance accounting programme (WATBAL 3), based on the 'Waterbal' model of Fitzpatrick and Nix was written by Systems Branch of I.W.S. and is now available to the Branch. This single layer model provides for weekly simulation with variable planting dates and multiple cropping facilities. To date its use has been restricted to shallow phase black earths and efforts have been concentrated on validation of basic model functions. The simulation of 16 crops over 9 years on a site at Cambooya showed a high level of agreement between estimated and actual soil water storage. The predicted cropping potential appeared to compare favourably with that achieved in the field where nine crops were grown in 5 years. Further development of the model is planned with the inclusion of a stress index related to grain yield for the various crops.

A study to assess the economic benefits of soil conservation measures being applied in the South Burnett region is under way.

The Haly Creek No. 1 Project Area in the Kingaroy area, which was completed in 1970-71, needed frequent follow-up attention. Lack of rainfall early in the season prevented adequate stabilization of the works of general benefit in the scheme and August rains consequently caused damage to the waterways. Following renewed damage in October/November, repair work was suspended until mid March, when a section of the waterway was dressed with topsoil containing kikuyu and regraded. The plan for the Boonyouin No. 1 Project Area, also in the Kingaroy area, was approved in

November 1971. Timetables for the implementation of the scheme were determined in consultation with two of the landholders and works of general benefit, a sod chute and waterway, were constructed in early June 1972.

During the year three new applications for advances under the Soil Conservation Act were received, together with one application for an additional advance. The total of effective approvals now stands at 43. The Agricultural Bank granted approvals totalling \$2,803 during the year and cancelled undrawn balances amounting to \$3,780. The total of effective approvals now stands at \$65,444.22. Payments made during the year amounted to \$800 and the total payments made by the Agricultural Bank in the 7 years since the scheme commenced is \$55,780.82.

DIAGNOSTIC AND IDENTIFICATION SERVICES

The number of samples handled by the Agricultural Chemical Laboratory Branch continue to increase. There was a greater emphasis in the last 12 months on oilseed analysis and analyses for soil surveys and land-use surveys.

The proclamation of all parts of the Agricultural Chemicals Distribution Control Act has led to an enormous increase in the number of samples analysed for pesticide residues. Damage by spray drift has come mainly from chlorinated phenoxyacetic acid herbicides.

Comment regarding suitability of waters for irrigation and stock was provided to the Irrigation Commission on 3,500 samples analysed by the Government Analyst.

The Tobacco Laboratory, Northgate has continued its analytical service to growers. An important feature of this service is that district tobacco extension officers collect the samples.

Studies in transformation of fertilizer nitrogen using stable isotopes have shown that, provided black earth soils are not waterlogged, denitrification is not a significant contributor to fertilizer loss. In a field experiment there was little leaching of nitrate below 40 cm (16 in.) under the influence of 19 cm (8 in.) of rain.

At Millaroo studies on nitrogen transformation and redox potentials in rice soils continue. Beneficial effects of previous gypsum and deep ripping treatments are evident after periods in excess of 5 years in a long term soil amelioration experiment.

At Biloela a fertility assessment of a large area of cracking clay soils, involving glasshouse and laboratory work, was completed.

With the development of commercial soil testing services there is a greater farmer awareness of nutritional aspects of soils. It is likely therefore that there will be increased emphasis on soil analyses for resources and land-use surveys (including irrigation) and for projects such as regional fertility assessment and improvement of soil test interpretations.

There is a tendency, in assessing stock feeds, to look beyond the classical measurements for minerals, fibre and carbohydrate and the Agricultural Chemical Laboratory Branch is studying methods for measuring additives, vitamins and amino acids. This work will increase rapidly when the new facilities become available at Indooroopilly.

More than 13,000 specimens were handled by the Botany Branch identification staff. This represents an increase of about 50% on last year's demands from the public and outside organizations.

Samples of stomach contents received were not quite so numerous as last year but many samples of drug plants were identified for the Police Department.

Of the 10 new plant records noted, three were based on specimens received for identification. The remainder were discovered in the course of botanical or land resource surveys. The most interesting of the new records were:

Gmelina asiatica, a rambling, thorny shrub, native to India not previously recorded as naturalized in Australia, which is spreading rapidly in a limited area between Rockhampton and Yeppoon and gives cause for concern.

Solanum carolinense (Carolina horsenettle), first received from Bundaberg in 1963 but not then identified specifically, and now showing persistence despite regular spraying with 2,4-D.

Senecio magnificus, a tall annual composite native to central Australia, which was noted in Queensland for the first time about 150 miles south of Winton.

Hexaspernum paniculatum, previously known only from a single specimen collected here in 1911 and now rediscovered in the Harvey Creek area.

A plant provisionally identified as *Calycanthus australiensis*, but now believed to belong to a different family.

A revision of *Neurachne* and allies was published and another paper dealing with a review of *Leptochloa* and the generic limits of *Danthonia* was also completed. The text of a

revision of *Schizachyrium* was completed. Receipt of some historic grass specimens on loan from the British Museum (Natural History), London, allowed taxonomic work on *Paspalidium* to be virtually completed. The native and introduced species of *Setaria* were studied and revised.

During his tenure of office as Australian Botanical Liaison Officer at Kew, Mr. L. Pedley was able to finish most of his work on the species of *Acacia* in northern Australia, to prepare accounts of several other genera and to clarify some difficult taxonomic and nomenclatural problems relating to native, naturalized and cultivated legumes.

A second expedition to the Blacktown Tableland collected about 1,500 specimens. Determination of specimens from the first expedition was completed, the information transferred to computer memory and the specimens incorporated in the herbarium. These two expeditions discovered many plants not previously known to occur in central Queensland.

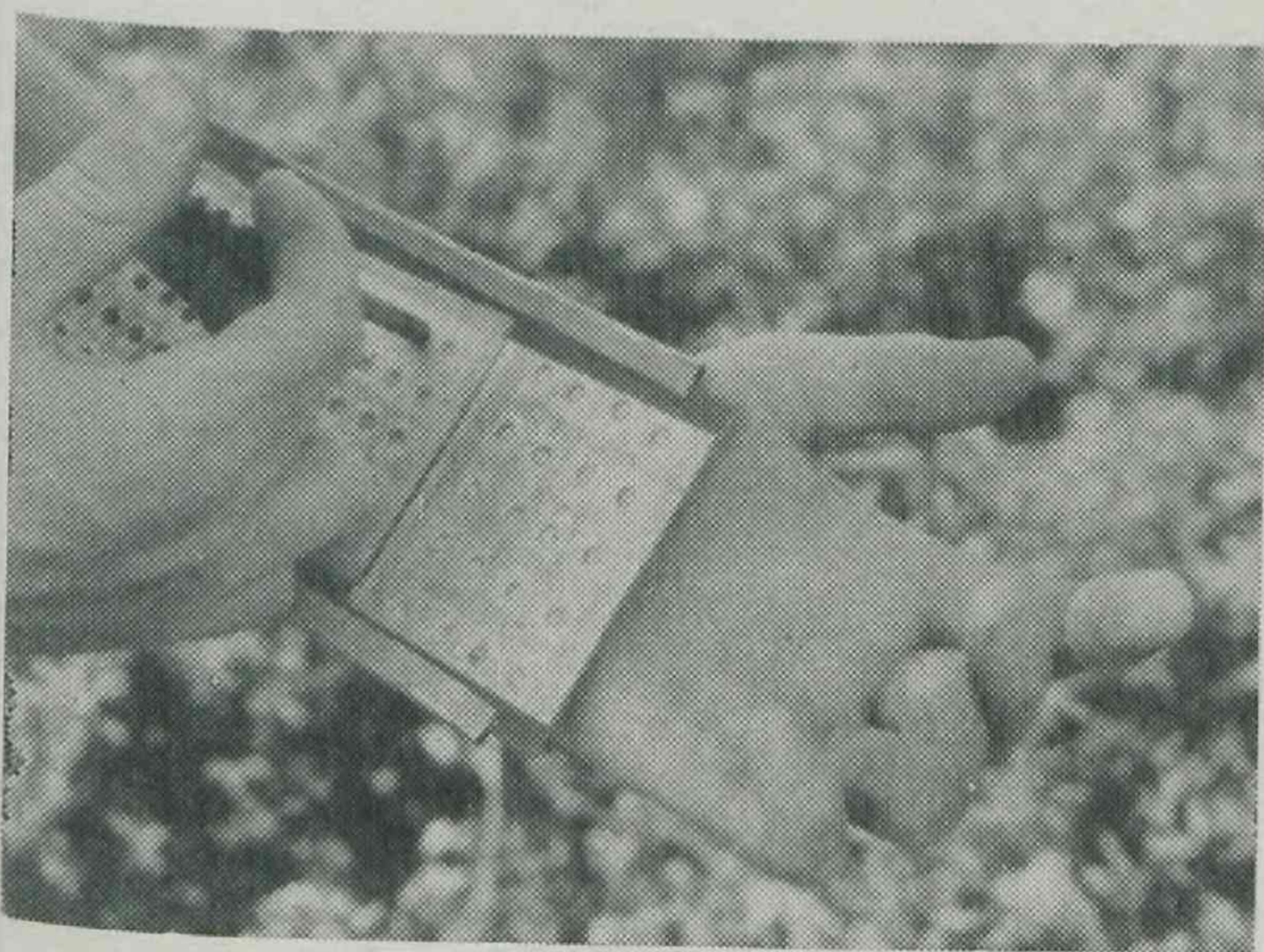
Work on the cytotaxonomy of *Solanum nigrum* and the work of editing and revising a large unpublished manuscript on *Eremophila* by the late Mr. L. S. Smith were considerably advanced by discussion with other specialists in Adelaide. A paper on the cytology and distribution of *Crassocephalum* in Australia was completed.

The nematode and nematode-trapping fungi surveys were continued by the Plant Pathology Branch. Nineteen genera and 56 species of such fungi have now been identified from Queensland soils. The nematode advisory service handled more than 500 samples from farmers, and advice was given on the need for fumigation.

During the year the insect identification service of the Entomology Branch provided approximately 1,300 insect identifications to field staff, other branches, quarantine authorities, farmers and members of the public. One interesting identification of medical importance concerned a species of jumper ant, *Myremecia nigrocincta* F. Smith, the bite of which by allergic action caused near-fatality of hyper-sensitive persons on two occasions.

Taxonomic research on fruit flies of the subfamily Dacinae has resulted in a major revision of the group. This has enabled the ready identification of many species of fruit flies from the South Pacific region and is of considerable importance to quarantine authorities.

While all insect groups are continually under review, special studies were undertaken on the hymenopterous parasites of sorghum midge, *Contarinia sorghicola* (Coq.). This investigation is expected to yield a number of new records when taxonomic determinations have been finalized.



Field collection of *Heliopsis* eggs for parasite study. Each egg as it is punched from a leaf is pressed into a hole in a cardboard frame and the frame when full is covered with cellulose tape.

At present certain control operations in the specialized field of stored product entomology depend on the use of fumigants or volatile insecticides. When using phosphine gas against infestations of the tobacco beetle, *Lasioderma serricorne* (F.), the permeability of the walls, floors, and ceiling of tobacco stores has an important influence on retention of the gas for effective and economic treatment. Investigations have proved that diffusion of phosphine through hardboard and other building materials readily occurs but can be inhibited by polyethylene or polyvinyl chloride sheeting, aluminium foil or treatment of the hardboard surface with sealer/undercoat/enamel paint systems, shellac or polyurethane varnish.

A method currently in use for control of tropical warehouse moth (*Ephesia cautella* (Walker)) in bulk storage involves the release of dichlorvos from "pest strips". This volatile insecticide is short lived and its continuous release necessitates frequent replacement of the "pest strips". A



An agricultural adviser and a plant pathologist discuss lucerne disease problems with a farmer.

system using time switching equipment has now been developed to provide automatic discharge of high atmospheric levels of dichlorvos at specified intervals only. The system can be pre-set for the insecticide discharge to coincide with peak moth activity at twilight. This control technique would not have been feasible without the detailed behavioural studies that enabled the plotting of the peak periods of moth activity.

Services undertaken on behalf of the Division of Animal Industry and other Departmental units by the Biochemical Branch comprised 3,379 diagnostic analyses, 2,363 dipping vat samples and 7,437 samples from trials. The use of active additives in dipping vats has increased the analytical burden in this service.

AGRICULTURAL ENGINEERING

The appointment of two new staff members during the past year has enabled a consolidation of the activities of the engineering section. The problem of lack of workshop facilities will be substantially solved with completion of the new workshop and installation of new equipment.

The first stages of two projects commenced last year have now been completed. These dealt with the removal of poultry manure from cage sheds and the efficiency of different types of peanut threshers.

The poultry manure survey revealed that in the survey area there is an estimated annual production of 90,000 tons of manure on a wet basis. This is equivalent in terms of chemical fertilizer components to an approximate value of \$600,000. With the scale of the removal problem in the survey area, its non-seasonal nature and the need for mechanization, there appears to exist the potential for a contract business embracing removal, treatment and marketing.

The project dealing with an investigation into the performance of peanut threshers revealed several aspects that required further study. It is proposed to use the same machine for all studies in order to examine the relationships between machine speed and the incidence of loose shelled kernels and extraneous matter.

Several items of machinery have been specially developed for the use of research workers, viz. a precision fertilizer applicator for use in vegetable crops, and a water injection planting unit to increase germination percentage in grain crops, a 3-point linkage soil sampler for routine soil sampling, and a mobile gas-fired drying oven. In addition, the field evaluation programme on the imported John Deere stubble mulching equipment was continued.

ANIMAL QUARANTINE

With the lifting of restrictions on the importation of cattle bred in New Zealand and semen from their imported stock, there has been a considerable volume of imports, amounting to 1,200 cattle (predominantly Charollais and their crosses).

The growing movement of animals and semen from Australia to other countries is indicated by the following list of exports during the year from Queensland:—

Cattle to Papua/New guinea	486
Cattle to Taiwan	820
Dogs	232
Cats	70
Horses	94
Pigs	393
Day-old chickens	204,241
Semen (doses)	1,614

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

During the year, 150 written examinations were held, 20 for applicants for the pilot chemical rating licence and 130 for applicants for the commercial operator's licence. From these examinations, 36 agricultural pilots and 463 weed control operators qualified for licences, which have been issued. A further 412 licences restricted to the use of specified ground equipment for the distribution of specified weedkillers have also been issued. Each applicant for these licences needed to be examined individually and the task was only accomplished by the co-operation of other Government Departments and authorities.

Notifications of damage were received during the year totalling 26. Damage was alleged in 18 centres between Cairns and Brisbane to cotton, safflower, wheat, sorghum, lucerne, improved pasture, tomatoes, marrows, pineapples, lettuce, papaws, avocados, pecan nuts, nursery plants, ornamental trees and gladioli.

During the year, 4,409 applications for registration or re-registration of agricultural requirements were received. Included in these applications were claims by manufacturers regarding the efficacy of 1,354 preparations. The decrease in the number of applications for the registration or re-registration of fertilizers from 1,029 last year to 488 this year reflects consolidation within the fertilizer industry. There were also a smaller number of special fertilizers supplied, 212 as compared with 1,028 last year.

SEEDS

The Agricultural Standards (Seeds) Regulations of 1969 were amended in February 1972. These amendments included the alteration to standards for seeds of a number of pasture and cover crop species which had been discussed and accepted at the last meeting of Chief Seed Testing and Regulatory Officers. During the year, 12,532 seed samples were received for testing.

Certification activities including the certification of seeds of hybrid maize, grain sorghum, hybrid forage sorghum, sweet sorghum, french bean, cowpea, oats, pasture species and tomato have been maintained.

The third meeting of the Co-ordinating Committee for Seed Certification was held in Canberra during the year. Arising from the meeting it was decided that a draft scheme for annual self-pollinating legumes be submitted to Standing Committee on Agriculture for ratification before being forwarded for consideration to the O.E.C.D. Advisory Group. Queensland could be expected to take a prominent part in discussions with O.E.C.D. on annual self-pollinating legumes.

There has been an increase in the number of purity analyses of seeds undertaken at Toowoomba.

EXPORT INSPECTIONS

In the past year, 525,162 packages of fruit and vegetables were inspected prior to export, compared with 400,182 packages in the previous year. There was an increase from 30,770 to 58,001 in the number of packages of citrus fumigated with ethylene dibromide prior to the fruit being consigned interstate. In addition, 400 packages of citrus were treated for export overseas.

FARM PRODUCE AGENTS

There are 60 farm produce agents licensed in Queensland comprising 47 in the Brisbane area and 13 situated in country districts. Inspections carried out under The Farm Produce

Agents Act of 1964 show that these agents had observed legal provisions relating to books of account, trust accounts and trust account audit requirements.

DAIRY PRODUCTS

The five laboratories of the Dairy Research Branch have continued to conduct quality control services for dairy products. The service has been extended to special milk products such as low-fat milk, flavoured milk, table cream, and fancy dairy foods such as yoghurt. In addition, samples from Port Moresby have been regularly received and analysed in the Brisbane Laboratory to assist industry in the Territory of Papua and New Guinea.

Pasteurization efficiency of all milks examined was excellent, as determined by phosphatase test, but some variability of heat treatment of pasteurized cream was detected. The compositional and hygienic quality of all products was maintained at a satisfactory level.

Similar quality control schemes have been conducted for butter, cheese, casein and milk powder, both for home consumption and export. Two of the laboratories have continued to carry out analysis of cheese destined for the Japanese trade, while the Otto Madsen Dairy Research Laboratory at Hamilton has also analysed samples of margarine in the course of requirements under the Margarine Act.

A number of milk samples exhibited sub-standard freezing points, including 258 which contained added water in quantities ranging from a trace to 10%. In some instances there was evidence of adulteration during tanker filling operations and handling at factories.

Results of tests for penicillin in milk also revealed an increase in the incidence of this type of contamination, as 26 tanker milks, 12 bottled milks and 58 farm milks were found to contain residues of penicillin. The incidence of extraneous matter in dairy produce has persisted during the year despite emphasis on prompt and effective follow-up work. The percentage of samples with unsatisfactory extraneous matter was 3.6% for butter and 44% for cheese.

A total of 18 pasteurized creams and 36 milks failed to meet the respective standards for butterfat, while 200 milk samples were substandard for solids-not-fat and 49 milk samples gave low results for total solids. Over-moisture butter comprised 4.2% of Queensland butter, 7% of imported New South Wales butter and 10.1% of imported Victorian butter. Results for cheese samples reveal that 40 samples were over-moisture and 38 were sub-standard for fat on a dry weight basis.

Laboratories of the Branch have assisted in careful sampling of milk in specified districts for the monitoring of radio-active fallout resulting from French nuclear tests carried out in the Pacific area.

EGGS

Participation by the Dairy Research Branch in all phases of egg quality work including bacteriological examination of egg pulp for export purposes ceased in December, 1971. Up to this stage, many thousands of samples of egg were analysed for plant control and export purposes, and a considerable amount of investigational work being carried out by officers of the Branch was completed. With the appointment by the Egg Marketing Board of its own resident bacteriologist, a stage has been reached where industry is accepting responsibility for a larger measure of the technical work associated with its own activity.

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

Research into sporadic parasitic and disease outbreaks in southern Queensland oysters is being continued, with research being concentrated on a sporozoan Haplosporidian parasite thought to have been responsible for several of the mortality outbreaks.

The pesticide content of oysters in eight streams debouching into Moreton Bay have been examined quarterly for 2 years by the Biochemical Branch. The levels of chlorinated hydrocarbon pesticides related to population rather than agriculture and responded to variations in stream volume rather than to seasonal changes agricultural enterprise.

A comprehensive inter-departmental Mortality Situation Report on live pearl oysters collected from fishing grounds in the Torres Strait area for cultured pearl operations has been prepared and research into the cause of the mortality is continuing.

Although the rate of mortality in live shell collected during the 1971-72 year has almost returned to normal (i.e. 5%), the surviving shell has remained "sick" and "weak", rendering it unsuitable for cultivation purposes.

As the causative agent responsible for this mortality has not yet been identified, and because the live shell remains unsuitable for cultivation purposes, the Department has supported a proposal for a limited number of permits to be issued, on application, for live pearl oysters to be imported from Western Australia, in order to prevent a total collapse of the cultured pearl industry in the Torres Strait area. This support will remain in force only until the Torres Strait live pearl oysters recover sufficiently to be used for cultivation purposes.

Work continued during the year on the fish spoilage project. Bacteriological studies dominated the activities this year. The composition of the bacterial flora of fish, immediately after harvest, at receipt at the Fish Board depots, on the auction floor at the Fish Market, after processing, and purchased from retail stores was established by identification of many hundreds of isolates obtained at these points. The results show that there are significant changes in bacterial population during handling, both numerically and in composition. Other experiments comparing market process and laboratory process showed that contamination plays a part in increasing the bacterial population of fish products.

Gas chromatography was also used in examining the volatile fish spoilage odours. The actual bacteria involved in spoilage have been detected using this method. These bacteria are being characterized in order to identify contamination problems. It has been found also that the intestinal contents of uncleaned fish are instrumental in a percentage of such fish being condemned, and a programme has commenced to study the anaerobic bacteria which can produce repugnant odours characteristic of the gut of poor quality fish.



Bacteriological sampling of fish at a depot in the course of spoilage studies.

This work will be aided in the forthcoming year due to the fact that the Australian Fishing Industry Research Committee has allocated an amount of \$8,900 from its Trust Account to the Department to facilitate the work.

CROWN-OF-THORNS STARFISH

The Fisheries Branch Crown-of-Thorns starfish research team based at Mourilyan Harbour has been engaged in a series of studies funded from the trust fund set up by the Commonwealth and Queensland Governments for research into various aspects of the *Acanthaster* problem.

In the course of these programmes, several hundred square metre quadrats have been mapped in detail and photographed for the assessment of coral recolonization and regrowth on reefs which have been subject to attack by the starfish, and a series of experiments have been set up to measure the growth rates of individual species of corals. Four cruises were made in the general reef area off the section of the mainland coast between Townsville and Upstart Bay, and over 100 diving stations were occupied in the course of surveying the present location of starfish concentrations and the extent of coral damage.

Reef waters off the Mourilyan Harbour Laboratory have been regularly monitored for levels of a number of pesticides and fertilizers as part of a programme to determine whether such factors may have been contributory to a starfish population expansion.

XI. Review of the Primary Industries in 1971-72

BEEF AND VEAL

In general, conditions over the beef-producing areas of the State were the best for many years although there were still some isolated pockets of drought, particularly in the north-west, the far south-west and the Warrego and Blackall districts.

Store cattle prices increased following good rains. Competition has been particularly keen for breeders and this demand has been reinforced by some movement by graziers from the wool industry into cattle. The fat cattle market has been similarly firm with upward trends in values being maintained.

Queensland's beef cattle population stood at 8.44 m. at March 1972, compared with 7.28 m. in 1971. In the 11 months up to the end of May the number of cattle slaughtered for export was 13% higher than for the corresponding period in 1970-71 and total carcass weight of all cattle slaughtered was also up 13%.

The United States continued as the major export market, but the Australian quota determined by the United States for 1971 was not filled. Industrial unrest on the U.S. waterfront, uncertainties in the international currency situation, and diversion to the United Kingdom were factors in this shortfall. The 1972 U.S. quota has been increased by 7.2% on the 1971 level.

Increases in exports to Japan, U.S.S.R. and the United Kingdom occurred. There was a heavy demand for fat cattle from exporters with commitments in the Russian beef contract. Demand was also influenced by the acute shortage of beef exports from South America which caused a major shortage in the United Kingdom and European trade.

Lice infestation was prevalent during the winter, particularly in "clean" country. There was greater than normal tick activity in northern areas during the winter-spring period and heavy tick populations were apparent in southern coastal areas. The above-average spring season and wet summer conditions favoured buffalo fly propagation. Heavy worm infestation of young cattle was apparent in coastal areas, particularly where intensive grazing of improved pastures was practised.

WOOL

The wool industry had another trying year. Although the sheep country generally enjoyed better feed conditions than during the previous year, some part of the sheep country was suffering from drought conditions at any time during the year. At the end of the financial year a large part of the south-western sheep country was in the early stages of drought.

For the first time for a number of seasons, the downward spiral in prices has been reversed. The longer term picture is far from clear, but it seems unlikely in the immediate future that prices will return to the very depressed levels of last year. The year's sales totalled 456,464 bales at an average price of \$105.44 per bale, which was \$17.19 per bale above the 1970-71 average.

By December 1971, the stockpile held by the Australian Wool Commission had reached a peak of 931,000 bales. However, from February 1972, with improved demand from overseas buyers, the Commission was able to start reducing its stockpile by feeding it back to the trade.

To assist wool-growers, the Commonwealth Government introduced direct subsidy payments during the 1971-72 season. The scheme provides that growers receive a minimum price of 79.2 cents per kg, and consideration is being given by the Commonwealth Government to extending it for another year, from July. However, prices at recent sales have been such that few producers have had to seek this assistance.

Following upon representations from the industry, the Commonwealth Government agreed to the amalgamation of the Australian Wool Board and the Australian Wool Commission into a single authority, to be known as the Australian Wool Marketing Corporation. One of the Commission's first tasks will be to investigate methods of implementing a wool acquisition scheme.

PIGS

In the first half of 1971-72 pig production was encouraged by increased availability of feed grains at relatively lower prices. With good summer grain crops, virtually all pig-producing districts experienced the best season for 2 years.

A good demand for breeding stock both for replacement and to increase herds persisted throughout the year. Since March, the industry has been consolidating its position and recent investment has been mainly in improvements to existing facilities. The trend toward more intensive production is continuing, with some marginal producers moving out of the industry. The number of producers with 100 to 1,000 sows rose to about 80.

Slaughterings at meatworks and bacon factories in Queensland totalled 787,400 bodies, an increase of 6.17 per cent. on 1970-71. The comparable increase in carcass weight was 9.1 per cent., indicating a substantial increase in the average carcass weight.

Prices of prime grade porkers and baconers "on consignment" fluctuated to a peak of 32 cents per lb. but towards the end of the year stabilized around 26 cents per lb. Comparable fluctuations in prices occurred in North and Central Queensland with prices of baconers settling at 30 cents per lb.

Export of pigments increased, particularly to Japan, but still represented only 2% of production. Exports of stud stock to Asian markets continued at a satisfactory level.

Preliminary reports on the economic survey of the Australian pig industry conducted by the Bureau of Agricultural Economics have been made available. These indicate a low level of productivity of profitability but it is of interest that productivity in Queensland was better than the average for all States (15.7 pigs born alive and 11.7 pigs sold per sow each year compared with 14.8 and 10.3 respectively, for all States). As anticipated, the larger herds (1,000 pigs and over) and the specialist units had the best return to capital and management (7.7% and 5.4% respectively).

Following support from the industry organizations at State and Federal levels an Australian Pig Industry Research Committee was formed under the Pig Industry Research Act, 1971. The allocation of funds for research, collected by a levy under the associated Pig Slaughter Levy Act, 1971, has commenced and will make a valuable contribution to the future of the industry.

The near-record cotton crop and the record production of soybeans during the year will provide the industry with a valuable additional source of protein meals. The need to import soybean oil meal from the U.S.A. is declining with the expansion in soybean production and it is anticipated that the industry will shortly cease to be dependent on such supplies.

Prospects in the future will depend on the industry's ability to control production within home market requirements, as no substantial export potential is yet evident. In the longer term, research is necessary into all aspects of production and marketing if pigmeat production is to be tailored to consumption requirements.

EGGS AND POULTRY

Australian commercial egg production in the first 36 weeks of 1971-72 was 4.3% higher than production in the corresponding period of the previous year. In the case of South Queensland, the main producing area of the State, commercial production fell slightly to 1.4% below that recorded for the first 44 weeks of 1970-71. In Central Queensland commercial production fell by 3.1%.

Controlled egg production in Queensland in 1971-72 was 23.6 m. doz. In addition, it is estimated that about 5 m. doz. are sold yearly interstate, and 2.4 m. doz. are produced in North Queensland and in other areas outside the control of a marketing board. It is estimated that overall Queensland production was slightly lower than last year.

Export outlets for surplus production have declined and the result has been a very large build-up in unsold Australian stocks of frozen egg pulp. C.E.M.A.A. reimbursements to Queensland producers have fallen, and have had the net effect of reducing egg prices paid to producers. Many small and

medium sized egg farms have ceased production. Egg production in Central Queensland continues to be at a level below that required to supply the local market.

Until such time as production controls are introduced and become effective, the position can only worsen. There is a tendency for farms to increase size of flock in anticipation of 'controls' and this is reflected in increased hatchings of pullet chickens. The average size of flock has continued to grow. Although nearly 100 registered growers left the industry between May 1971 and April 1972, the total number of laying hens has not altered significantly.

Proposals for the constitution of an egg marketing board for North Queensland and as an alternative an extension of the South Queensland Board to cover the area were defeated.

Broiler production at 16½ million birds was about 6% up on the previous year. A build-up in frozen stocks towards the end of 1971 caused processors to cut back broiler placements temporarily. As a result of the increased availability of locally grown vegetable protein meals, the broiler industry is no longer dependent largely on imported meals. Some of the credit for this development must go to feed firms associated with the broiler industry for encouraging production of oilseeds under contract arrangements.

Day-old pullet chicken production is expected to be 20% up on the previous year. This increase can probably be accounted for by increases in interstate sales and started pullet stocks.

DAIRY PRODUCTS

The world market situation for dairy products improved dramatically during the year, as a result of lower dairy production in the major exporting countries and adverse weather conditions in the E.E.C., coupled with large reductions in E.E.C. stocks through an intensive surplus disposal programme.

Prices for Australian butter in the United Kingdom improved by about 24% to £550 stg. per ton. Similarly, cheddar prices advanced to £440 stg. per ton. The relatively high prices for butter and cheese are considered to be of short-term duration only, as cold-store stocks of butter in the E.E.C. will increase as production improves.

The application of the Common Agricultural Policy when Britain enters the E.E.C. in January 1973 is expected to result in a drastic reduction in outlets for Australian butter and cheese to the United Kingdom when domestic supplies, plus those from other E.E.C. countries and New Zealand, are available in quantities sufficient to keep the market price below the Common Market's threshold price.

The significance to Australia of the United Kingdom market is reflected in annual exports to that area of about 70,000 tons of butter in normal production years. This represents about 30% of the total Australian production and 66% of Australian exports. About 11,000 tons of Australian cheese are exported to Britain annually, out of a total annual production of 70,000 tons.

In order to supply Britain, it is possible that E.E.C. countries may vacate some of their export markets in Asia and South America. These markets could provide an outlet for some of our excess butter. New Zealand, however, will also be looking for markets in these areas to replace her losses in the British market.

Japan may, in time, absorb a substantial quantity of cheese displaced from the U.K. market.

The milk recombining plants established in Singapore, Indonesia, the Philippines, Thailand and Cambodia offer some prospects for increased exports. In the Middle East and in the Mediterranean area, long-term contracts at acceptable prices have been signed.

Proposals for a two-price quota plan have been submitted by the industry and alternative suggestions have been submitted by Victoria. No finality has yet been reached in regard to these proposals.

Under a new 5-year Stabilization Plan, commencing July 1, 1972, the Commonwealth Government will pay a basic annual subsidy of \$27m. The industry also will receive \$800,000 p.a. for processed milk products plus any further subsidy assistance as may be determined each year.

The Commonwealth Government hopes to widen the scope of the Commonwealth-Industry Dairy Research Scheme, which is financed by dairy industry levies and by matching Commonwealth grants. The wider scheme will enable research to be undertaken on marketing as well as production problems associated with all milk and dairy products.

The levels of production achieved in Queensland during the year were similar to the 1970-71 period. Total of 16,200 tons of butter and 7,500 tons of cheese were processed. The production of cheese was a slight increase on the previous season. Again it was necessary to import butter supplies from southern States to satisfy the winter demands. Quantities

required were 191,366 boxes from Victoria and 129,590 boxes from New South Wales. Total quantity of milk used in the market milk trade increased slightly to 49 m. gallons.

There was an increase in the quantity of milk powders manufactured as a consequence of the high priced overseas market demand. It is anticipated this expansion will continue into the following season.

Expansion of product manufacture occurred at Beaudesert and Malanda with casein manufacture, the latter operating a sulphuric acid technique. Milk pasteurization commenced in a new plant at Gympie operated jointly by the Wide Bay and South Burnett Associations, sachet packaging commenced in Mt. Isa, and the Millaa Millaa Association initiated liquid milk deliveries to Darwin, a distance of 1,800 miles.

Consolidation of dairy product processing continued during the period. Approximately \$1,400,000 was expended in manufacturing plants for new equipment and renovation. Of this, 40% was incurred in market milk plants and 40% in factories manufacturing milk products.

The cheese manufacturing plant at Maclagan ceased production and a small milk pasteurization plant at Mt. Mee also stopped bottling. It is anticipated that declining production will result in the closure of a small number of other plants in the future.

The number of dairy producers in the State continued to decline. The number supervised by field officers at April 30 was 7,349, compared with 8,125 in 1971, a decline of 9.5%. Again it is evident that average individual property production levels increased.

Handling of milk in bulk on farms has continued to develop. Kingaroy and Nanango factories initiated receipt in bulk and several factories are considering time schedules for complete conversion to this form of transport. There have been strong industry representations for financial assistance from the Government to facilitate the conversion from cream supply to milk supply in all dairying areas. It is claimed this will stabilize factory operations because of economies of scale and permit more flexibility in manufacturing procedures. It is anticipated problems of cartage must continue to arise as these changes occur, and there is a continuing requirement for consolidation of uneconomic collection routes.

HONEY

Generally the honey-producing industry in Queensland is sound economically, with honey prices at an all-time high. Expansion is taking place in the industry and this will continue, as honey is in short supply for both local and overseas markets. Unfortunately, it appears that during the forthcoming year blossoming of major nectar-secreting floras will be below average.

SUGAR

Queensland produced 2.63 m. tons of 94 n.t. sugar in 1971 from a harvest of 18.1 m. tons of cane. This was a record season for both sugar production and cane harvested. The previous record for cane production was 17.4 m. tons for Queensland and 18.4 m. tons for Australia in 1968. The previous record of 2.6 m. tons 94 n.t. sugar for Queensland, also in 1968, was exceeded, although only marginally because of a lower c.c.s. content of the cane.

The gross revenue from the 1971 sugar crop is provisionally estimated at \$264 m., a rise of \$25 m. over the previous season's final figure of \$239 m. Similarly, a preliminary estimate of the No. 1 Pool price is \$105 per ton and of the No. 2 Pool, or Excess Sugar, \$80 per ton 94 n.t. In the previous season, the prices finally realized were \$104.39 and \$77.10 per ton 94 n.t. respectively.

Of the 1971 season's sugar production, approximately 700,000 tons will be sold on the domestic market, at a fixed price of \$201.60 per ton of refined sugar, or approximately \$190 per ton of 94 n.t. sugar.

On the international scene, at the triennial review of the British Commonwealth Sugar Agreement in November 1971 it was decided that Australia's negotiated price quota under the Agreement will remain at 335,000 tons actual sugar for the years 1972, 1973 and 1974. The negotiated price for 1974 was raised from £43.50 stg. to £50 stg. per ton. At the end of 1974, as part of the British negotiations to enter the E.E.C., Australia is to be phased out of the Agreement over the agreed transitional period for British agriculture, which covers the period January 1, 1973, to January 1, 1978. However, it is still not certain how quickly Australia's quota of 335,000 tons will be phased out during this period.

In addition to this quantity, Australia exported 191,000 tons actual sugar to the U.K. as free market sales.

At the end of 1974, the B.C.S.A. as it currently exists will terminate and all countries involved, with the exception of Australia, will be invited to undertake negotiations with the enlarged E.E.C. to formulate new arrangements for the sale of their sugar.

During 1971, the United States Congress enacted legislation renewing the U.S. Sugar Act for the years 1972, 1973 and 1974. Australia's position under the new Act is more favourable despite the fact that the overall quota remains unchanged for 1972 at 203,000 short tons raw value, based on a U.S. consumption figure of 11.2 m. short tons. The main reason for this is the reduction in the quota reserved for Cuba, and a corresponding increase in permanent quotas allocated to foreign suppliers, including Australia. Also, as the U.S. consumption determination fluctuates between 11 m. and 12 m. short tons, quota allocations to all suppliers are adjusted accordingly.

Other significant markets during 1971 were Japan, which received 492,000 tons actual sugar, and Canada, which received 312,000 tons actual sugar.

The world sugar price, as reflected by the London Terminal Market's daily price, again showed the benefit of an effective International Sugar Agreement. The 1971 average was £46 stg. per ton, compared with £40.4 stg. for 1970. However, in the last few weeks of 1971 and early in 1972, the world price moved up strongly to over £85 stg. per ton, in response to a growing feeling that sugar supplies would fall short of demand for much of 1972. Consequently, all I.S.A. quotas and other limitations on exports for 1972 were suspended in January, and I.S.A. minimum stocks held by exporting members were released.

In addition, there came into effect in January the supply commitment provisions under which importers have the option to purchase quantities from their regular suppliers at a specified price. All of these measures were aimed at increasing the supply of sugar on the world market, thereby bringing down the inflated world price to more normal levels. The measures were still in effect at the end of the year, and had shown some degree of success in halting the price rise.

WHEAT

For the first time since the 1968-69 harvest, Queensland's wheat production in 1971-72 was not seriously affected by drought conditions. Production in 1971-72 was estimated at 29 m. bus. compared with the drought affected crop of 4.4 m. bus. in 1970-71. The area sown to wheat in 1971-72, 1.4 m. acres, resulted in an average yield of 21.4 bus. per acre. In 1970-71, the area was 825,000 acres and the average yield 5.3 bus. per acre.

The 1971-72 crop was the fourth to be marketed under the current Commonwealth Wheat Stabilization Plan. The guaranteed price for exports up to 200 m. bus. was increased by 4.3 cents to \$1.518 per bus., bulk basis, f.o.b. ports for f.a.q. wheat. This price also applied to wheat sold within Australia other than for flour milling. The home consumption price for wheat milled into flour on an f.a.q. basis was increased by 4 cents to \$1.78 per bus., bulk basis, f.o.r. ports. This increase was made up of the 4.3 cents per bus. increase in the guaranteed export price, and a decrease in the cost of freighting wheat to Tasmania from 1.5 to 1.2 cents per bus.

Although Queensland, Victoria and South Australia experienced increased production in 1971-72, adverse seasonal conditions in New South Wales and Western Australia resulted in an overall Australian production of some 306 m. bus., which was only marginally in excess of the 1970-71 level.

The total Australian Wheat Delivery Quota for the 1972-73 season is 407 m. bus., compared with 339 m. bus. in 1971-72. Quotas were increased in all States except Queensland, where the quota remains unchanged at 38 m. bus.

Total Australian export sales of wheat and flour for the 1970-71 marketing year reached the record level of 393 m. bus. compared with 280 m. bus. in 1969-70, and the previous record of 376 m. bus. in 1966-67. As a result of the large increase in exports, carryover stocks at the end of 1970-71 were only 126 m. bus., the lowest level for 3 years.

BARLEY

In 1971-72, it is estimated, 398,000 acres were sown to barley, producing 11 m. bus. with an average yield of 28.4 bus. per acre. This was a vast improvement on the drought-affected 1970-71 crop, which produced only 2.7 m. bus. from an area of 226,000 acres, with an average yield of 12.0 bus. per acre.

Receivals by the Barley Marketing Board totalled 6.9 m. bus., an estimated 61% of total Queensland production. About 40% of Board receivals were of malting quality, compared with 20% in 1970-71. Considerable quantities were sold to interstate maltsters, mainly in New South Wales.

A discount scheme which applies to local feed sales was introduced by the Board in 1969-70. This scheme proved very successful in 1971-72, and a record 70,000 tons of feed barley were sold. As a result, only 15,000 tons of barley were exported to Japan, at a relatively low price.

GRAIN SORGHUM

The area planted to grain sorghum in 1972 is estimated at 882,000 acres, compared with the record 911,118 acres in 1971. Production, however, estimated at 780,000 tons, is only marginally below the previous year's level. The average yield per acre of about 33.6 bus. is slightly above the 1971 yield of 31.9 bus.

South Queensland accounted for about 60% of the total Queensland crop. With a limited local market requirement, the Queensland Graingrowers Association expects to export some 350,000 tons on behalf of growers. In Central Queensland, despite dry conditions in some areas, production should exceed 230,000 tons, and exports by the Central Queensland Grain Sorghum Board are expected to approximate 200,000 tons, compared with the record of 240,000 tons in 1971.

Because of the increased quantities of feed grains entering world markets during 1972, returns to growers from grain sorghum export sales, at about \$31 per ton, grower's siding, are currently some \$4 per ton below last year's.

MAIZE

The area planted to maize in 1972 was estimated at 110,000 acres, compared with 127,800 acres in 1971. This reduction was mainly due to crop diseases, which caused 4,000 acres to be abandoned. Production is estimated at 92,500 tons, compared with 101,900 tons in 1971. However, due to favourable seasonal conditions, the average yield per acre of 33.6 bus. was a slight improvement on last year.

The Atherton Tableland crop is expected to produce only 19,750 tons, compared with 25,790 tons in 1971. Southern leaf blight resulted in reduced yields and the abandonment of some crops.

PEANUTS

Continuing dry conditions towards the end of the 1971 season affected both the yield and the quality of the peanut harvest. Total production was 32,000 tons, well down on the original estimate of 42,000 tons.

Weather conditions for the 1972 season were most favourable for both growing and harvesting. An estimated 81,000 acres were planted with an expected production of 45,000 tons. The size of the crop and the phasing out of the Tariff By-law on peanut oil could create marketing problems and make it difficult to clear oil kernels and surplus edible kernels on the oil market. Export prospects, however, are encouraging.

NAVY BEANS

Severe fluctuations in seasonal conditions reduced the 1971 navy bean crop to about 2,000 tons from a planting of 15,000 acres. As a result of the substantially increased prices in 1971, 22,000 acres were planted for the 1972 season. Weather conditions have been good and the early production estimate of 7,000 tons cleaned weight seems likely to be achieved. Although the South Burnett remains the principal growing area, this season there has been a significant increase in navy bean plantings on the Darling Downs and in the Callide Valley.

COTTON

Excessive rain reduced the 1971 season cotton crop from the early estimate of 22,000 bales to only 13,214 bales. In fact, the entire Australian crop was reduced dramatically because of widespread flooding. At the same time, there was a general world shortage of cotton and run-down of stocks. As a result, returns to Queensland growers increased, and averaged 31.3 cents per lb. raw cotton.

It is considered that the 16,526 acres planted to cotton for 1972 will produce in excess of 26,000 bales, and returns to growers should be comparable with the 1971 returns.

TOBACCO

Tobacco leaf sold in Queensland in 1971 amounted to 19,141,851 lb. and realized \$22,450,777. The average price for the 1971 sales of 117.3 cents per lb. compared favourably with the average price of 115.4 cents per lb. recorded in the previous year. This rise in price was due to an increase in the average minimum price, in the Official Grade and Minimum Price Schedule, from 109.4 cents per lb. to 114.5 cents per lb. However, the increase in the average selling price was not as great as this increase in the average minimum price in the Schedule, due mainly to a lack of competition at the auctions.

The 1970-71 growing season was satisfactory in all growing areas except in the Ingham district, which suffered at the hands of cyclone "Althea". At the end of June, 15.78 m. lb. had been sold at an average price of 117.7 cents per lb., compared with 16.23 m. lb. of leaf at an average of 119.7 cents per lb. at a similar stage of the 1971 sales. The decrease in the average price was brought about by the quantity of "old season's" crop which was offered this year and by lack of competition on higher grades of leaf.

OILSEEDS

Until recently, Australia was the only major grain-producing country in the world that did not have an established oilseed industry. Imports were the main source of vegetable oils and meals used in Australia. However, the Australian oilseed industry has expanded rapidly since 1968-69, initially as a result of the introduction of wheat quotas, which caused growers to turn to alternative crops.

The area of soybeans planted in 1972 was estimated at 35,000 acres and production is estimated at a record 14,000 tons. In 1971, some 6,321 tons were produced from 11,771 acres. Although production of soybeans has increased rapidly in recent years, an additional 100,000 acres need to be planted to meet Australia's domestic requirements.

Production of safflower amounted to approximately 10,000 tons, the highest level recorded since the 15,000 tons crop in 1967-68. The area planted was estimated at 51,000 acres, giving an average yield of 11 bus. per acre. This was a vast improvement on the drought-affected 1970-71 crop, which produced only 365 tons from an area of 5,073 acres, with a low average yield of 4 bus. per acre.

Production of linseed has continued to decline in recent years, and in 1971-72 is estimated at 1,500 tons from 3,000 acres with an average yield of 20.0 bus. per acre. In 1970-71, 8,786 acres yielded 1,937 tons, an average of 8.8 bus. per acre. The decline in linseed production has been mainly due to the increasing production of rubber and acrylic based paints and floor coverings, which have significantly increased their market share at the expense of linseed-oil based products.

A record production of sunflower seed, estimated at 32,000 tons from 150,000 acres, was achieved in 1972. This compared with the previous record in 1971 of 13,969 tons from 49,634 acres. Supply greatly exceeded demand and the Queensland Graingrowers Association expects to export some 20,000 tons of sunflower seed on behalf of Queensland growers in 1972. In 1971, exports were of the order of 7,000 tons.

RICE

The rice industry in Queensland has expanded from small experimental plantings in 1967 to 8,777 acres in 1971-72. Production, estimated at 12,000 tons, would have been substantially higher, possibly about 20,000 tons, but for cyclone "Althea", which ruined the late crops from the December 1971/January 1972 harvest and hindered plantings for the May/June 1972 harvest.

A Rice Marketing Board was constituted on November 11, 1971. In December, the Government, on the recommendation of the Board, approved of the introduction of a quota control scheme to prevent the over-expansion of rice-growing in Queensland. The proposed quota scheme involves special legislation, which is expected to be introduced in the next Parliamentary session.

GINGER

Plantings for the 1972 ginger crop set a new record of 440 acres, a small increase on the previous year. Good growing conditions, combined with adequate irrigation water and improved cultural practices, resulted in high yields, and 1,375 tons of green ginger were taken from the early harvest. This was less than last year, but adequate for market requirements. The late harvest, which was not complete, could produce about the same as last year's, 4,937 tons, which was a record. However, some ginger may be allowed to "stand over" until next year if the market situation so requires.

FRUIT AND VEGETABLES

Pineapple production during the year was estimated at 119,000 tons, compared with 123,671 tons in 1970-71. Factory intake amounted to approximately 101,000 tons, about 3% less than in the previous year. Returns to growers from the fresh fruit markets showed a 10% improvement on those of 1969-70.

The Pineapple Industry Rationalisation Plan, now in its fourth year of operation, continued to operate to the benefit of the industry, with returns to growers being comparable to those of the last 2 years. Sales of pineapple products on the domestic market showed some decline, mainly because of the keen competition from other canned fruits. Juice sales suffered from an upsurge in citrus juice consumption, and also from the increasing popularity of the many blended fruit drinks now available.

Banana production, particularly in the North Queensland areas, continued to increase steadily. Some cyclone damage occurred to plantations in the north early in the first half of 1972. However, the overall effect on production will probably be only slight. Plantations in southern areas suffered from both wind damage and excessive moisture.

The feasibility study into the establishment of a large-scale export industry for the Japanese market, which was commenced in 1970, was finalized during the year. A study group visited Japan in April 1972. Investigations revealed that there was no immediate prospect of Queensland being able to supply bananas to Japan on a large scale.

Banana industry leaders continued discussions with representatives of the New South Wales industry on the subject of stabilization.

Apple production in the Granite Belt in the 1972 season was estimated at 2.0 m. bus. Stone fruit and pear crops were well down on last season's record figures. Largely because of the smaller crops, returns to growers improved significantly on those of the previous season. Orchards suffered some hail damage and this had the effect of reducing the quality of fruit, mainly apples on the fresh market. At the end of the year, considerable stocks of apples were held in cold storage in anticipation of a further improvement in prices later in the calendar year.

The market outlook for canned deciduous fruits and for juice apples throughout Australia is not promising and has deteriorated significantly in the last 2 years. Declining returns from export markets have reduced growers' confidence in the export market and apple exports were below expectations.

Citrus production continued to increase. All the major growing areas were in good condition and fruit quality was satisfactory. Returns to growers showed some improvement, following a year during which prices on the Brisbane Market were at their lowest level since 1962.

Improvements in sales of citrus juices by processors resulted in greater quantities being sought by factories. In 1971, over 7,000 tons of Queensland citrus were processed for juice. This also had the effect of keeping poorer quality fruit off the fresh fruit market, and consequently helped to improve market returns.

Potato production from the 1971 crops was estimated at 106,000 tons, compared with the previous year's figure of 115,000 tons. Onion production for the year was estimated at 19,000 tons, compared with 22,000 tons last year.

Vegetable production in many areas was adversely affected by long periods of abnormally wet weather, which also caused a falling off in quality of many items. The tomato crop was probably the worst affected.

Production of beetroot, beans and peas for processing continued to increase, particularly in the Bundaberg and Lockyer areas.

Brisbane Market prices for many vegetable crops, notably chokos, sweet potatoes and onions, showed improvement over the previous year.

During the year, surveys were made conjointly with the Department of Industrial Development into the feasibility of establishing a mango processing plant in North Queensland and a vegetable processing plant at Bundaberg.

FISHERIES

The year was a poor one generally. Weather conditions along the eastern seaboard were unusually rough during the greater portion of the first half of 1972, and the appearance of a fungus epidemic affecting fishes in certain southern Queensland estuaries also reduced landings, especially in the Bundaberg district. The Gulf prawn fishery, although commencing on a promising note, slumped badly after production had reached approximately two-thirds of last year's record catch.

Commercial fishing vessel licenses issued during the year totalled 2,229 an increase of 6% on last year's issues.

Mortality in live pearl oysters collected from fishing grounds in the Torres Strait area for cultured pearl operations was first reported in July-August 1970. At the height of this mortality, up to 80% of the live pearl oysters collected died, either before they reached the pearl culture farms, or a short time after they were settled in. Of the 20% that remained alive, most were in a very weakened state and were unsuitable for cultivation purposes.

As a consequence of this catastrophe, one company suspended pearl culture operations immediately, and a further two companies have indicated their intention to withdraw from the pearl culture industry completely, leaving only two companies and three pearl culture farms remaining in pearl culturing activities.

The severity of this catastrophe and its effects on the pearl culture industry are demonstrated in the following figures for intake of live pearl oysters for cultivation purposes by pearl culture farms:—

1969-70	316,568
1970-71	129,973
1971-72	28,903

The accompanying table shows the number of licenses issued during the year in respect of edible oyster cultivation.

The area under lease and the number of persons engaged in the oyster industry have steadily increased; however, production figures have not kept pace.

Oystering in Queensland has essentially developed around harvesting wild oyster stocks, particularly in the North Queensland waters. However, oyster cultivation techniques currently employed in New South Wales are slowly finding their way into southern Queensland, the result being that oystermen are gradually beginning to realize that the practice of intensive oyster cultivation employing sophisticated techniques and practical knowledge can be a lucrative commercial proposition.

Port	Oyster Banks	Oyster Boats	Oysterman's Licenses	Approximate Area under Lease (acres)
Brisbane ..	197	82	139	4,346.4
Maryborough ..	63	12	31	1,201.7
Bundaberg ..	6	1	7	69.0
Gladstone ..	4	2	4	80.0
Rockhampton ..	51	20	42	594.0
Mackay ..	46	12	37	791.1
Bowen ..	1	0	1	14.7
Townsville ..	9	4	8	190.8
Cairns ..	5	2	6	82.6
TOTALS ..	382	135	275	7,370.3

