

ANNUAL REPORT, 1966-67

Queensland Department of Primary Industries



Presented to Parliament by Command

ORGANISATION OF THE DEPARTMENT AS AT 30th JUNE, 1967

MINISTER FOR PRIMARY INDUSTRIES ..	Hon. J. A. Row, M.L.A.
CENTRAL ADMINISTRATION AND CLERICAL AND GENERAL DIVISION—	
Director-General and Under Secretary ..	J. M. Harvey, D.Sc., F.R.A.C.I.
Deputy Director-General	A. A. Ross, M.Agr.Sc.
Chief Advisory Officer (Administration) ..	C. L. Harris, A.A.S.A.
Assistant Under Secretary	H. Barnes
Director, Information and Extension Training Branch	C. W. Winders, B.Sc.Agr.
Accountant	E. C. R. Sadler, A.A.U.Q.
Executive Officer, Research Stations Section	G. H. Allen, Q.D.A.
DIVISION OF ANIMAL INDUSTRY—	
Director of the Division	A. L. Clay, B.V.Sc.
Deputy Director	C. R. Mulhearn, B.V.Sc.
Animal Research Institute—	
Director of Veterinary Research	J. W. Ryley, B.V.Sc.
Biochemical Branch—	
Director of the Branch	C. W. R. McCray, B.Sc., A.R.A.C.I.
Husbandry Research Branch—	
Director of Husbandry Research	J. G. Morris, B.Sc., B.Agr.Sc., Ph.D.
Pathology Branch—	
Director of the Branch	W. T. K. Hall, M.V.Sc.
Cattle Husbandry Branch—	
Director of Cattle Husbandry	G. I. Alexander, B.V.Sc., M.S., Ph.D.
Veterinary Services Branch—	
Director of Veterinary Services	L. G. Newton, B.V.Sc.
Sheep and Wool Branch—	
Director of Sheep Husbandry	A. T. Bell, B.V.Sc.
Slaughtering and Meat Inspection Branch—	
Director of the Branch	B. Parkinson, B.V.Sc.
Sections—	
Poultry Husbandry (F. N. J. Milne, B.Sc., Chief Poultry Husbandry Officer); Pig Husbandry (F. Bostock, Senior Pig Husbandry Officer).	
DIVISION OF DAIRYING—	
Director of Dairying	E. B. Rice, Dip.Ind.Chem., M.Inst.Biol.
Field Services Branch—	
Director of Field Services	W. D. Mitchell, B.Agr.Sc.
Research Branch—	
Director of Research	V. R. Smythe, M.Agr.Sc.
DIVISION OF DEVELOPMENT PLANNING AND SOIL CONSERVATION—	
Director	J. E. Ladewig, B.Sc.Agr.
Assistant Director	A. Hegarty, B.Sc.
Development Planning Branch—	
Director of the Branch	A. Hegarty, B.Sc.
Soil Conservation Branch—	
Director of the Branch	J. Rosser, B.Agr.Sc.
DIVISION OF MARKETING—	
Director of Marketing	D. P. Lapidge, B.Com., A.A.U.Q.
Assistant Director of Marketing	E. O. Burns, B.Com., A.A.C.A., A.A.S.A.
Economic Services Branch—	
Director of Economic Services	E. O. Burns
Marketing Services Branch—	
Director of Marketing Services	D. R. Lewis, B.Sc.(Econ.)
Standards Branch—	
Director of Agricultural Standards	A. C. Peel, Dip.Ind.Chem., A.R.A.C.I.
DIVISION OF PLANT INDUSTRY—	
Director of the Division	L. G. Miles, B.Sc.Agr., Ph.D.
Deputy Director	S. Marriott, B.Sc.Agr.
Agriculture Branch—	
Director of Agriculture	B. L. Oxenham, B.Agr.Sc.
Horticulture Branch—	
Director of Horticulture	J. H. Smith, N.D.A., M.Sc.
Agricultural Chemical Laboratory Branch—	
Director of the Branch	W. J. Cartmill, M.Sc., A.R.A.C.I.
Food Preservation Research Branch—	
Director of the Branch	S. A. Trout, M.Sc., Ph.D., F.R.A.C.I.
Sections—	
Botany (S. L. Everist, B.Sc., Government Botanist); Entomology (W. A. McDougall, D.Sc., Government Entomologist; A. R. Brimblecombe, M.Sc., Ph.D., Deputy Government Entomologist); Plant Pathology (G. S. Purss, M.Sc.Agr., Government Plant Pathologist).	

REPORT OF THE DEPARTMENT OF PRIMARY INDUSTRIES FOR THE YEAR 1966-67

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, 1967.

In a preliminary section, some of the more interesting aspects of the work have been selected for comment. This section is followed by a pictorial record, a summary of the Department's work during this year, and a survey of conditions in the main rural industries.

Yours faithfully,

J. M. HARVEY,

Director-General.

GENERAL COMMENTS

SEASONAL CONDITIONS

Though considerably better than in the previous twelve months, weather conditions during the year were not uniformly good.

Following the relief rains of early June 1966 in central and southern areas, further useful falls occurred in July on the eastern Darling Downs, southern coastal areas and the lower Burnett. This rainfall assisted winter crops, but widespread frosts cut herbage and grass in southern areas and caused further deterioration of dry feed in inland areas as far north as the Atherton Tableland.

Widespread and heavy rains in August brought relief to much of the central and southern portions. They relieved the drought situation in the St. George district and ensured spring growth of pastures and crops. Areas which did not receive relief included the drought-affected Charters Towers and Hughenden districts and much of the far western district, though the Channel Country benefited from flood run-off.

Scattered storms in September and October brought relief to some of the dry areas, including the Gulf-Peninsula, but the Townsville hinterland remained dry.

Very hot conditions prevailing during November and December in inland areas burnt off fresh growth of pasture and reduced surface waters. Drought continued and extended in the south-west, central west, and the Townsville and Cairns hinterlands.

The normal monsoon rains failed to eventuate in the early months of 1967, but these were marked by a succession of cyclonic disturbances which brought heavy rains to most coastal and sub-coastal areas and caused severe flooding in the far north. Relief rains were received in the Gulf and Peninsula and storm rains brought some relief to the south-west.

Good rains fell in coastal areas in March and drought-breaking falls occurred in much of the south-west, western Darling Downs, central lowlands and Cairns hinterland. Drought continued in the central-west and parts of the south-west. Dry conditions prevailed in portions of the central districts, Burnett and Upper Carpentaria.

April and May were generally dry months except in the south-east. A widespread rain influence moved in during early June, bringing good falls in the Central Highlands, the coastal plain, Charleville and Quilpie areas, and some falls around Longreach and Winton.

At the end of June, drought still existed in the western Darling Downs, the area south of Roma, and in large areas of the far west and central west; dry conditions prevailed in much of the Rockhampton and Townsville hinterlands.

DROUGHT MITIGATION

It was reported last year that an inter-Departmental Drought Mitigation Committee had been set up by the Honourable the Premier. Under the Chairmanship of the Department's Director of Cattle Husbandry (Dr. G. I. Alexander) the Committee reviewed the incidence and effects

of drought on the rural industries from the State and individual producer viewpoints as well as technical aspects of mitigation measures and future avenues for promoting mitigation.

The Committee made a series of recommendations having as their basic objective the stimulation of fodder production and storage both on-property and off-property. Financial stimuli by way of taxation concessions, loans and freight concessions were examined and reported as being the most useful methods. The Report has been subsequently considered at a representative meeting of producer organisations, commodity marketing boards and technical specialists, convened by the Honourable the Minister for Primary Industries.

A number of sub-committees have been set up to define detailed methods of implementing the recommendations and will be reporting back at a further meeting. In addition, a decision was taken to prepare a handbook on drought for the use of farmers and graziers, encompassing the major aspects of long-term and short-term planning together with technical aspects of the management and feeding practices that are necessary for the individual producer in minimising the effects of drought in the future.

A large-scale survey of the effects of the 1965-66 drought was commenced during the year. The project had its genesis in a decision of the Australian Agricultural Council to sponsor a survey of drought effects and the methods used to mitigate them. Producers in drought-affected regions, comprising dairy farmers, sheep raisers and beef producers, are being approached for data concerning their properties, their management policies and their financial records over a 5-year period. The field interviews in Queensland, which have been carried out by Departmental officers, are virtually completed.

Surveys of the drought situation in Queensland were made quarterly by Departmental officers. These were utilized by the Government in overall assessments of the effects of drought on the economy of the State and as a guide to the continuation of drought relief measures, including rebates of rail and road charges on stock and fodder, relief loans, remission of land rental in badly affected areas and extensions of Crown leases.

DAIRY PASTURE SUBSIDY

The detailed report on the first year's operation of the Dairy Pasture Subsidy Scheme, which appears later in this report, makes pleasing reading.

A scheme such as this was seen by the Dairy Industry Advisory Committee to have great potential as an aid to increased and more economic production of dairy products. This view was accepted by the State Government, which approved of a subsidy scheme in broad outline in May 1966. When the Scheme was drawn up in detail and inaugurated in September 1966, its benefits were made retrospective to May 1966.

Broadly, the Scheme is intended to encourage the planting of approved permanent pastures by granting a subsidy, on a dollar-for-dollar basis up to \$14 an acre, on such plantings. A limit of 20 acres a year and 100 acres over a 5-year period is imposed.

The response in the first year has been gratifying, 2,358 farmers applying in respect of plantings totalling 43,490 acres. Nearly one-fifth of the State's dairyfarmers participated in the Scheme.

The Department is geared to meet a doubling of applications during 1967-68, and it is confidently expected that this figure will be achieved if seasonal conditions favour planting.

COMMONWEALTH AID

The year marked the initiation of a greatly increased Commonwealth contribution towards the expansion of extension and regional research in the various States. For Queensland, this meant an immediate doubling of the annual grant of \$294,000 to the Department and the assurance of a progressive increase over a period of five years.

Some \$60,000 of the new grant was allotted to the provision of machinery and scientific equipment at seven of the Department's research stations, and various laboratories were also able to secure much-needed apparatus for investigations into production problems.

Several overseas study visits were supported by the grant, subjects of study being cotton breeding; grain and beef combinations; horticultural production methods; breeding of fruit and vegetable crops; and diagnosis of stock diseases.

Interstate study visits were made in connection with tropical agriculture, potato-growing, fruit and vegetable packaging, citrus production, nematode control, legume bacteriology, fruit and vegetable preservation, veterinary matters, poultry production, irrigation, agriculture, soil conservation, agricultural economics, information services, rice production, agrometeorology and land-use practices.

Several scholarships and cadetships were made available for studies at the University of Queensland and the Queensland Agricultural College.

Training of staff in extension techniques and farm management procedures was facilitated, and several branches were able to conduct refresher courses on specific subjects for their officers.

Additional staff were engaged to conduct and service such projects as regional crop, pasture and livestock investigations, to enable new extension and soil conservation centres to be opened, and to service an expanded central information service.

Though full implementation of the expanded programme was not achieved until late in the financial year, the groundwork was laid for a substantial improvement in Departmental services to the primary industries.

ORGANISATIONAL CHANGES

The Division of Plant Industry has been strengthened by the appointment of a Deputy Divisional Director.

The status of the two Branches within the Division of Development Planning and Soil Conservation—namely Development Planning Branch and Soil Conservation Branch—was raised during the year because of the expansion of activities and the higher degree of responsibility being assumed by the officers in charge.

Three Assistant Directors were appointed in Agriculture Branch to assume responsibility for the Agronomy, Agrostology and Extension Sections. The planning and supervision of research within the Branch has been decentralized, with six regional leaders in agronomy and agrostology nominated to organize regional planning and implementation of research programmes.

A section on Epidemiology and Statistics was formed in the Pathology Branch of the Animal Research Institute, as more adequate recording and increased use of diagnostic data, together with application of statistics to specific disease situations, are essential background for disease control purposes.

IMPROVED FACILITIES

Pleasing progress was made during the year in the provision of improved and additional facilities for research and services.

At the Animal Research Institute, Yeerongpilly, progress was made with construction of a metabolism unit, which will provide for individual housing of cattle, sheep and pigs used in intensive nutritional investigations and also for carcass composition studies.

Facilities to permit individual feeding of group-housed pigs were expanded at the Animal Research Institute and at Hermitage and Biloela Research Stations.

The Protozoology Section consolidated its occupancy of the Tick Fever Research Centre at Wacol. Group yards were built and a feed shed commenced.

The projected demolition of the Wool Biology Laboratory building at Head Office to permit expressway development

required that a new Laboratory be built and this was done at the Animal Research Institute at Yeerongpilly.

The Dairy Research Laboratory at Hamilton was brought close to completion and is expected to be occupied in August 1967. A decision has been made to name the Laboratory in honour of the late Otto O. Madsen, who was a leading figure in the dairying industry prior to becoming Minister for Primary Industries in 1957. A further Dairy Research Laboratory at Malanda is also approaching completion.

Further progress has been made in the provision of an animal isolation unit at the Animal Health Station, Oonoonba, and this will be completed in 1967.

CO-OPERATION WITH INDUSTRY

New links between the Department and primary industry bodies are being forged each year and existing links strengthened.

During the year, six primary producers active in primary industry organizations were invited to join with Departmental officers in constituting a Consultative Committee for the Biloela Research Station. The producers represent respectively the grain-growing, dairying, pig-raising, cotton-growing, lucerne-growing and beef production industries. It is expected that this Committee will act in a two-way capacity in bringing forward problems requiring research and in disseminating information on and encouraging the application of research findings.

The Poultry Advisory Board was reconstituted to provide wider representation for the industry on both a geographical basis and a sectional basis. Representatives of the table poultry and hatching sections have now taken their place on the Board.

The Liaison Committee set up in the Brisbane Valley to provide closer consultation and co-ordination between the Department and cattle owners on the problem of multi-resistant ticks is a type of committee that we may have to make greater use of in the future to meet emergency situations.

The Dairy Industry Advisory Committee, which had functioned as a fact-finding and policy Committee under the chairmanship of the Minister for Primary Industries, was reconstituted in May 1967 as a standing committee to advise on dairying industry matters generally. Its first task has been a re-examination of the recommendations of the earlier Committee and in particular those with a bearing on the need to strengthen Departmental extension and regional research facilities.

Another example of co-operation is noted elsewhere on the concerted action taken on multi-resistant ticks.

CO-OPERATIVE RESEARCH

Some people may be under the impression that the various organizations with research responsibilities operate in isolation from one another, with undesirable overlapping and duplication as a logical consequence.

It is true that there is no firm demarcation of limits of lines of research as between this Department, C.S.I.R.O. and the University, for example. This state of affairs is by no means necessarily an undesirable one. There are, in fact, advantages in it that are considered to outweigh the major disadvantages. One team, for instance, may tackle the pasture problem from the angle of modifying the environment to suit the plant; another may approach it from the angle of finding or breeding the plant to fit the environment. One team may be best equipped for basic research on plant physiology; another may have the talent and the special interest for adapting irrigation techniques in the field to principles of plant physiology.

Of course, there needs to be some liaison between workers in related fields. This is achieved generally through their participation in the affairs of professional bodies, and, more formally, through liaison bodies such as the Herbage Plant Liaison Committee.

There is also a measure of co-operative research, with two or more organisations pooling resources to achieve a well-defined end.

One such example is the soil fertility research programme being conducted on the Darling Downs. The participants are the Queensland Wheat Research Institute (operated largely by the Department of Primary Industries on behalf of the wheat industry), the University of Queensland and A.C.F. and Shirleys Fertilizers Ltd., a major manufacturer and distributor of fertilizers.

This programme, aimed at using soil analysis to predict requirements of nitrogenous and phosphatic fertilizers on wheat farms on the Darling Downs, embraced 105 trials on farms over the past two seasons. A further 55 trials are being conducted with wheat and 12 with barley in the current season.

PROFESSIONAL IMPROVEMENT

Opportunities for scientific and technical officers of the Department to improve their technical skills and widen their knowledge have been greatly increased following increased financial support from the Commonwealth.

In-service training was expanded during the year in several ways.

Regional schools and technical conferences of Departmental officers embraced such subjects as grazing property development, winter cereals, fruit and vegetable production, cattle husbandry, cattle tick control, wool production, pig production, soil conservation, farm economics, meat grading, extension methods and farm management.

Interstate study tours were made by specialist officers in connection with tropical agriculture, potato production, fruit and vegetable packaging, citrus growing, nematode control, legume bacteriology, food technology, cattle husbandry techniques, veterinary matters, poultry production, radio-isotopes in research, irrigation techniques, soil conservation, agricultural economics, information services, training techniques, rice production, agrometeorology and land-use practices.

Support was given to overseas study tours on cotton breeding, grain and beef combinations, fruit production, horticultural, plant breeding, diagnosis of stock diseases and grain storage plots.

Three officers were given the opportunity to undertake the 1-year Diploma in Agricultural Extension Course at the University of Queensland. A number of scholarships were granted for full-time study at the University and at the Queensland Agricultural College.

DEVELOPMENT PLANNING

The Department has extended its activities in various phases of development planning. It has been closely associated with other Departments in the past year in the preparation of Joint Reports on irrigation development and in the operation and expansion of the Fitzroy Basin Brigalow Land Development Scheme.

The following are examples of the way in which the Department has been involved:

(1) Land-unit mapping of a unique type embracing 105,000 acres at Emerald to indicate the acreage of land suitable for irrigation and the acreage that would be finally used on farms if the Emerald Irrigation Project is implemented.

(2) Land-use mapping of the lands to be commanded by the proposed Kolan Irrigation Project and the extent of cane assignments that would be involved.

(3) Checking of the soils map of the lands to be commanded by the Balonne River Project at St. George with a view to determining the general suitability of the soils for irrigated crop production.

(4) Use of linear programming techniques to derive optimum enterprise patterns and farm sizes for the proposed extension of the St. George Irrigation Settlement.

(5) Special cotton agronomy surveys in southern and central Queensland for the Department of National Development.

(6) Land-use land capability mapping as a basis for preparation of individual farm plans in a redevelopment area near Dalby.

(7) Preparation of physical inventories and property development plans on request for new settlers in Areas I and II of the Fitzroy Basin Brigalow Land Development Scheme.

(8) Sampling, testing and submission of recommendations concerning the purchase of pasture seeds for the aerial sowing of 101,600 acres in the Brigalow Scheme.

(9) Association with other Departments on Brigalow Co-ordinating Committees at Biloela and Emerald.

(10) Land-unit mapping of 215,210 acres in selected portions of Area III of the Brigalow Scheme.

The Department's Division of Development Planning and Soil Conservation has co-ordinated the Department's activities as outlined above and in addition has undertaken a good deal of the field work itself. In the short time this Division has been operating it has amply justified its formation.

PROPERTY ECONOMICS

Though not the first Australian Department to set up an Economic Services Branch geared to help individual producers to plan their property enterprises and operations on the basis of economics, this Department is well to the fore in providing such services.

Decentralisation of these services has been extending as staff and funds have become available, and Agricultural Economists are now stationed at seven country centres—Warwick, Toowoomba, Roma, Gympie, Rockhampton, Townsville and Atherton—as well as at Brisbane.

These officers are able to give some direct assistance to individuals in planning their future operations, and are also involved in the operation of Farm Accounting Groups, training other field officers in budgeting and other management techniques, and in providing short courses in farm management economics for groups of farmers. In these ways, the influence of their special training will be diffused among primary producers, and more efficient production on many properties may be expected.

EXTENSION PROJECTS

Mention was made in last year's report of new moves in extension within the Department. Useful experience was gained in the ensuing year.

The co-ordination of Departmental extension services in the Roma region was advanced considerably. A fixed programme of interchange of technical information is operating. Self-training has progressed to the stage at which the outlook and knowledge of the advisory and scientific staff have broadened to an extent at which most officers are competent to lead farmer rural science discussion groups and support them in a variety of activities. A survey of the region, which comprises seven shires, is in progress to define agro-social units or districts. It is on this basis that future extension programmes may be implemented.

The use of an extension officer with advanced training in extension to service a particular industry also has been studied both at the field level and in a guidance-leader capacity to field officers dealing entirely with the tobacco industry.

Another sphere in which the individual officer may play an important extension role is that of liaison between research and extension. At Townsville, a graduate officer has been able to ensure a close working relationship between this Department and C.S.I.R.O. The position should lead to a truly co-operative extension service in which the grazier-extension officer-industry representatives-research organisations operate to the mutual benefit of the grazier and those who provide services.

The unit demonstration farm project for the West Moreton, under which a number of dairy farms were to be operated by the owners to a plan devised by a panel of farmers and specialists, got under way with two farms actively co-operating. The preliminaries to setting up a farm as a demonstration of integrated planning and management have been found to be quite considerable.

INFORMATION SERVICES

A considerable expansion of State information services to primary producers was agreed to by the Commonwealth in its allocation of funds for the improvement of extension services.

During the year, the Department's Central Information Service was expanded by the appointment of additional journalistic and production staff and new equipment was purchased. An increasing volume of high-class advisory leaflets, research station brochures, newsletters, farmers' school reference notes, field day literature and other extension material has resulted.

Regional Information Officers were appointed to Toowoomba and Mareeba to assist regional advisory and research officers in using the various extension media to the greatest effect.

MULTI-RESISTANT TICKS

One of the most pressing and demanding problems facing the Department during the year was the control and containment of multi-resistant ticks. This proved a continuous strain on available finance and staff, particularly as outbreaks occurred in several widely spread new areas, ranging from Beenleigh to Mundubbera.

It is significant that most new outbreaks were traced back to introductions of cattle from the Biarra area made prior to detection of resistance and imposition of quarantine restrictions.

Some \$60,000 was expended during the year in charging dips in the Biarra-Crows Nest area with new medicaments which field trials had shown to be effective against the Biarra-type resistant ticks.

The conditions governing control programmes on resistant and adjoining properties, and restrictions on movements from these holdings, were under constant review.

A special committee was set up by the Australian Agricultural Council to consider the problem of resistance, and from this came the appointment of a Technical Sub-committee on the Control of Cattle Tick, consisting of officers of the Department of Primary Industries, C.S.I.R.O. and the New South Wales Department of Agriculture. This Sub-committee made recommendations from time to time for the easing of conditions governing movement from quarantine areas. A Liaison Committee comprising owners' representatives and Departmental officers was set up in the Brisbane Valley.

Later, a Joint Committee on Cattle Tick convened by the Minister made recommendations to Cabinet which have been adopted as a basis for future control in affected areas.

PROGRESS WITH PLEUROPNEUMONIA

The 1966 season was marked by very satisfactory progress in practically all aspects of the bovine contagious pleuropneumonia eradication programme. Almost 100% of herds in the South Western Queensland Infected Area were inoculated under supervision, but the finding of a viable B.C.P.P. lesion in a bullock from Innamincka in South Australia which was slaughtered at Beaudesert raised doubts on the status of the southern part of the area.

An intensive survey of the Townsville Division by the Huddart unit, field bleeding and meatworks examination and sampling of slaughter cattle indicated that this area was free of B.C.P.P.

Protected area status was extended to all the country south of the road from Camooweal to Cloncurry and the Great Northern Railway line with the exception of the portion of Bulloo Shire between the South Australian border and the Western Dingo Barrier Fence, which was retained as an infected area.

The area between the Seaview, Paluma and Hervey Ranges and the coast north of Townsville was also granted protected status, which therefore included all the eastern seaboard within protected areas.

Due to demands for field staff for control of resistant ticks and resignation or prolonged leave of staff connected with the Huddart unit, the unit was not put into the field until June.

A satisfactory response by stock owners was obtained to a drive for the institution of vaccination control programmes in the Georgetown area commenced in February. However, discovery of viable lesions in slaughter animals at Queerah in May indicated there are still foci of infection in northern areas.

Unfortunately, the origin of one affected animal in a mixed sales draft could not be definitely pinpointed, although suspected to be in the Kidston area. All properties represented in the sales draft are being surveyed. *Mycoplasma mycoides* was isolated from a lesion originating from a Kidston property and eradication procedures were commenced.

NEW PASTURES

In the past 5 years, over 2,000 new pasture introductions have been obtained by the Department. Collections made

overseas by Dr. B. Grof in 1965 and Dr. J. P. Ebersohn in 1966 provided valuable material for the wet tropics and for low-rainfall areas with mild winters. Our greatest need now is for species adapted to low-rainfall areas which experience winter frosts.

It is a long process from introduction to final commercial release of a new variety. An initial period of glasshouse quarantine may be necessary to guard against the introduction of disease. When released from quarantine, all introductions are sent to Research Stations for evaluation in nurseries, sward trials and finally grazing trials. The most promising varieties are finally released by the Queensland Herbage Plant Liaison Committee and seed is then made available to seed merchants for commercial production.

In the past 5 years, Departmental trials have resulted in the commercial release of six new grasses and four new legumes. These are Boorara buffel grass, Capricorn elephant grass, Callide Rhodes grass, Burnett makarikari, Pollock makarikari, Kennedy ruzi grass, Tinaroo glycine, Leichhardt biflorus, Dalrymple verna, and Archer axillaris.

It was found that shortage of seed invariably retarded the evaluation of new species. To overcome this problem, the Department established a small Seed Production Project at Beerburrum in 1964. This 20-acre area is now in full production and considerable amounts of seed have been made available for Departmental trials.

TABLELAND MAIZE

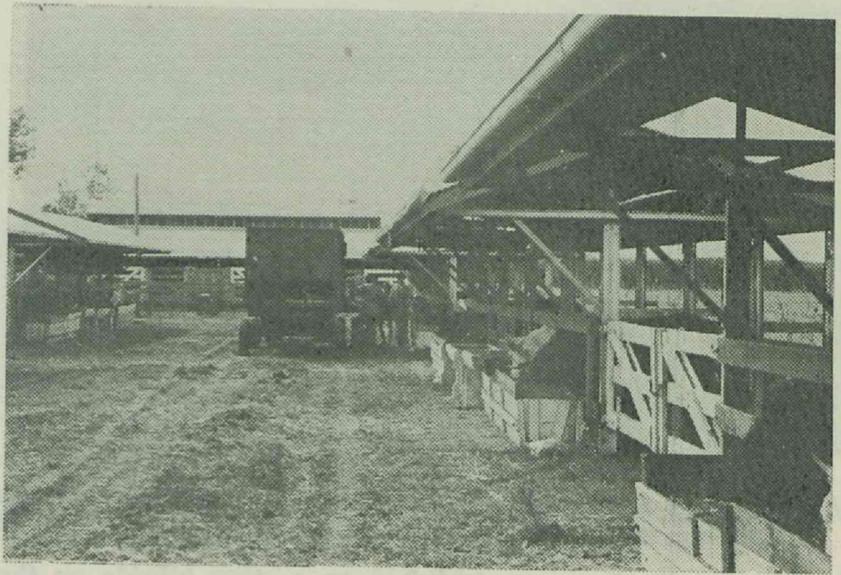
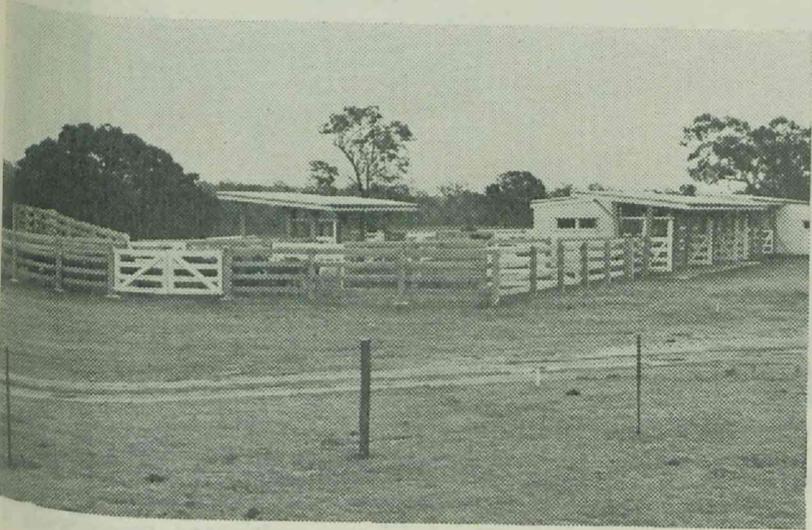
The Atherton Tableland maize industry has long had serious disease problems. Several years ago, a major disease, tropical rust, appeared in the area and added to the hazards of production. In 1962 a plant breeder was stationed at Kairi Research Station to commence the breeding of maize for rust resistance. Parental material comprised Australian breeding lines and resistant types obtained from Africa.

By 1965 two rust-resistant hybrids had been produced which showed sufficient promise to be included in district trials. Further extensive testing has confirmed this early promise and the experimental results provided sufficient evidence to warrant release of one of the hybrids for commercial production. Locally produced certified seed will be available for planting on a limited scale this year and seed production will be expanded next season.

The release of this hybrid is only the first step in the programme. More stable rust resistance with improved plant type and grain quality are the further aims. Breeding work is continuing, and the process of breeding and testing will be a continuous one for the foreseeable future.

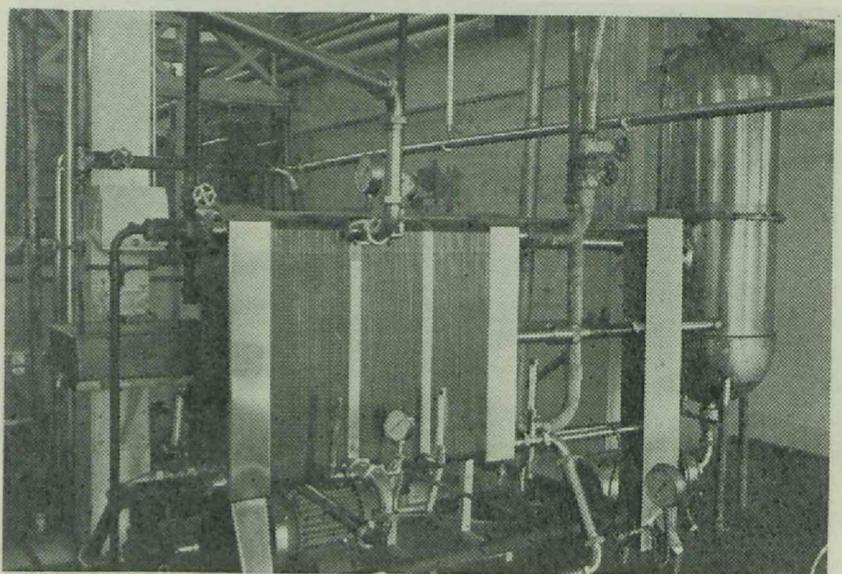
PICTORIAL RECORD 1966-67

RESEARCH FACILITIES



Left: Yards and spray dip at the Tick Fever Research Centre, Wacol.

Right: Experimental feedlot facilities at the Ayr Cattle Field Research Station.



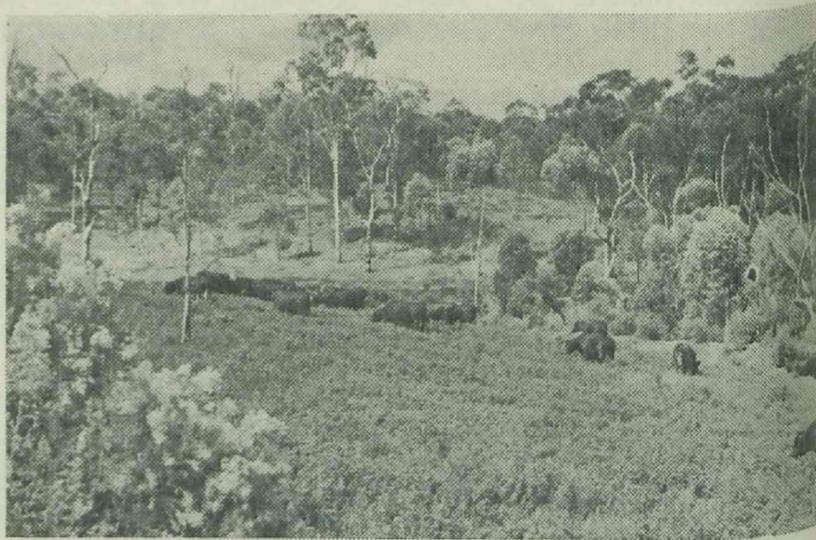
Left: Wool scour and drying oven in the Wool Biology Laboratory, Yeerongpilly.

Right: Experimental equipment for the removal of weed taint from cream. This is installed in the Department's Dairy Research Sub-laboratory at the Booval Dairy Factory.



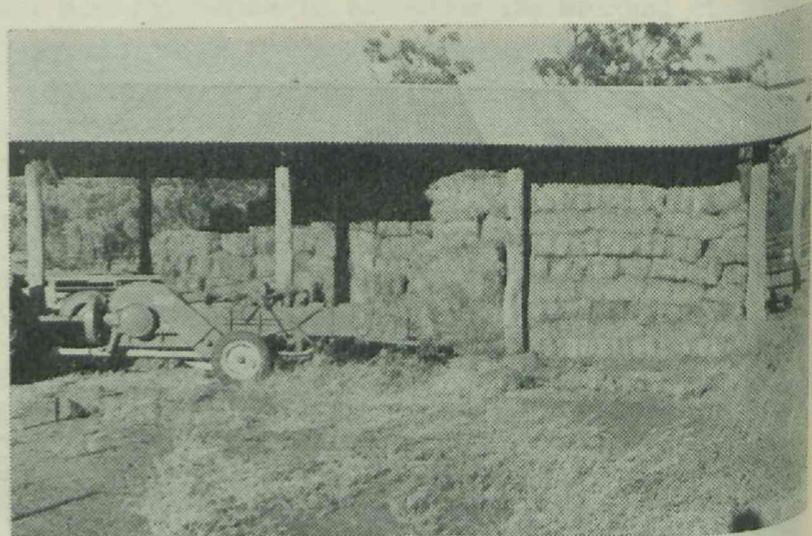
Virus diseases glasshouse at Indooroopilly.

PASTURE AND ITS USE



Left: Dense stands of termite mounds are common in northern beef pastures. As well as occupying a large ground area, these mounds are responsible for reduction of available organic matter in the soil.

Right: Grazing lucerne established on a steep hillside on the eastern Darling Downs. The land was cultivated twice with a chisel plough and 2 cwt. of superphosphate was applied when lucerne was sown.



Left: Conservation of surplus tropical pasture on a Cooroy dairy farm. Silverleaf desmodium was baled for hay.

Right: Townsville lucerne hay conserved on a Peninsula cattle property.

EXTENSION AND FARM MANAGEMENT



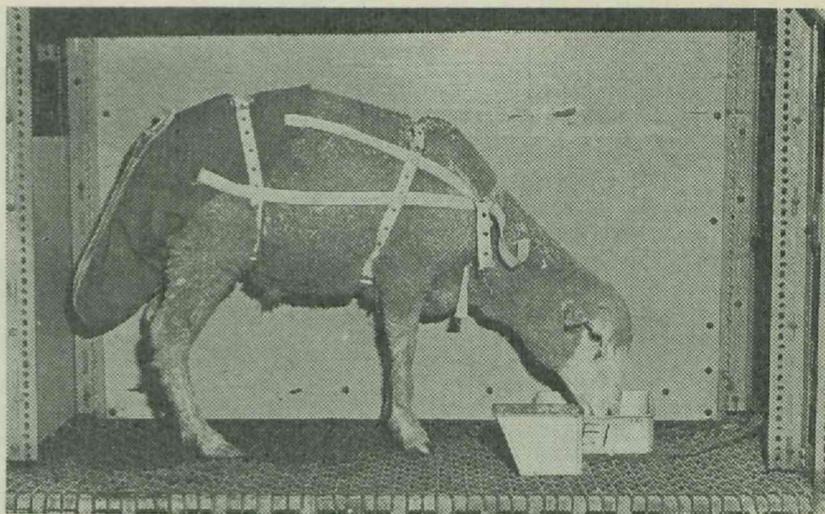
Left: A Departmental exhibit at the Bundaberg Show. This illustrated some recent developments in farming improvement.

Right: An Agricultural Economist at a computer. Records kept by members of Farm Management Accounting Groups are analysed regularly and the information passed on to Group members.

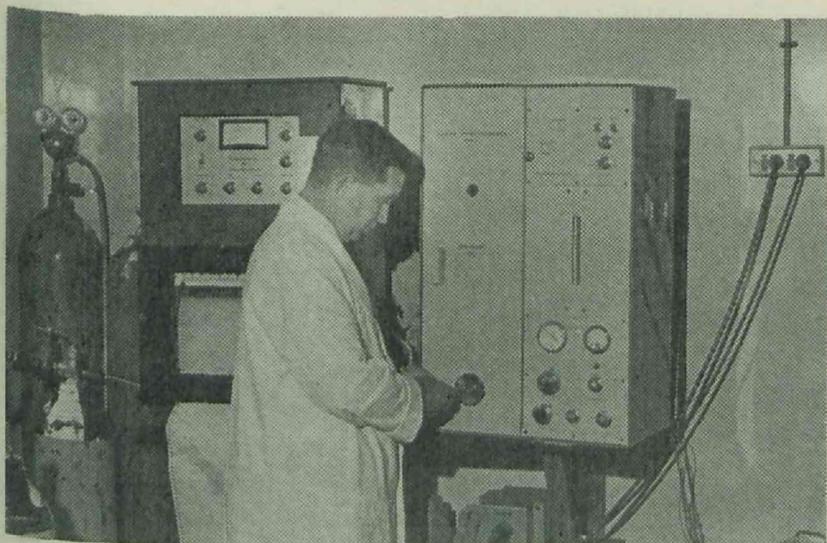
ANIMAL RESEARCH



Left: Harvesting *Dolichos lablab* for silage feeding. Animal Husbandry Research Farm, Rocklea.



Right: Sheep harnessed to allow complete collection of faeces. Chemical analysis of the faeces allows digestibility determinations to be made on silage and other feeds.



Left: Gas chromatograph in use at the Animal Research Institute, Yeerongpilly. Changes in the fatty acid composition of feedstuffs during digestion and absorption in ruminants are studied with the aid of this equipment.

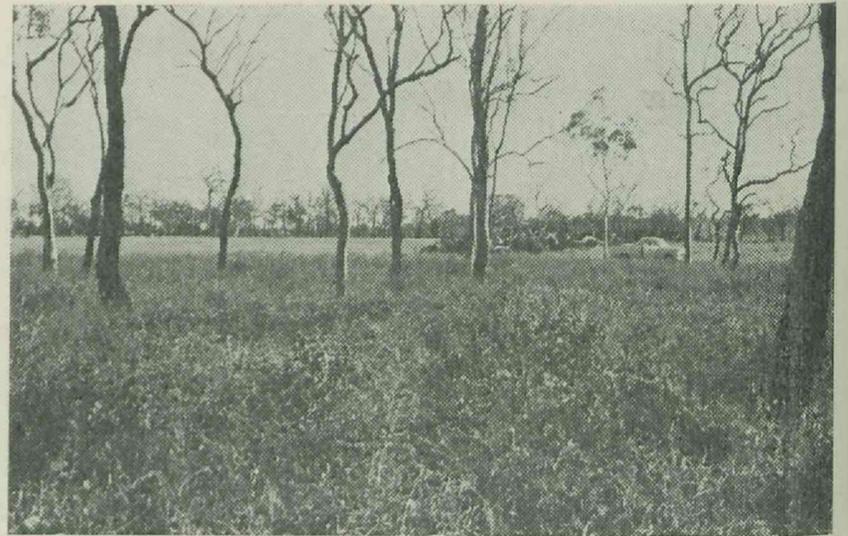
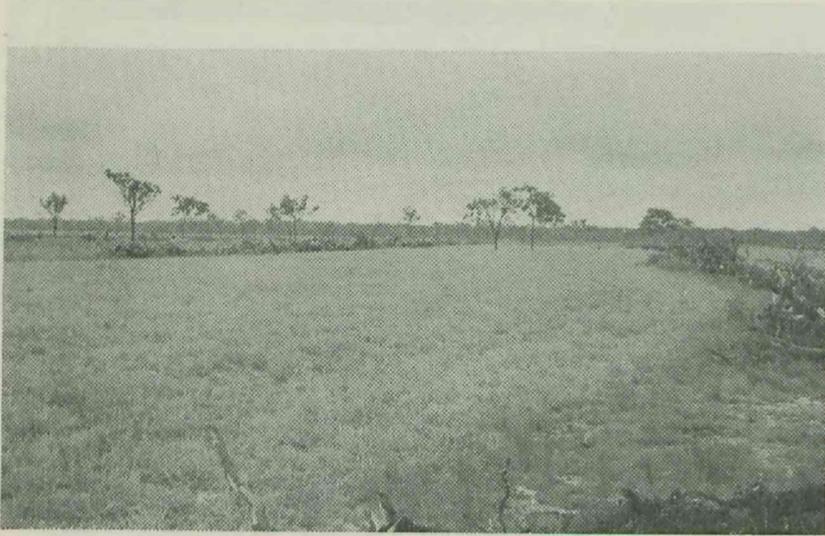


Right: Supplying nitrogen in a liquid supplement as a substitute for forage protein. Urea has been found to be the cheapest and most convenient form of nitrogen for supplementary feeding.

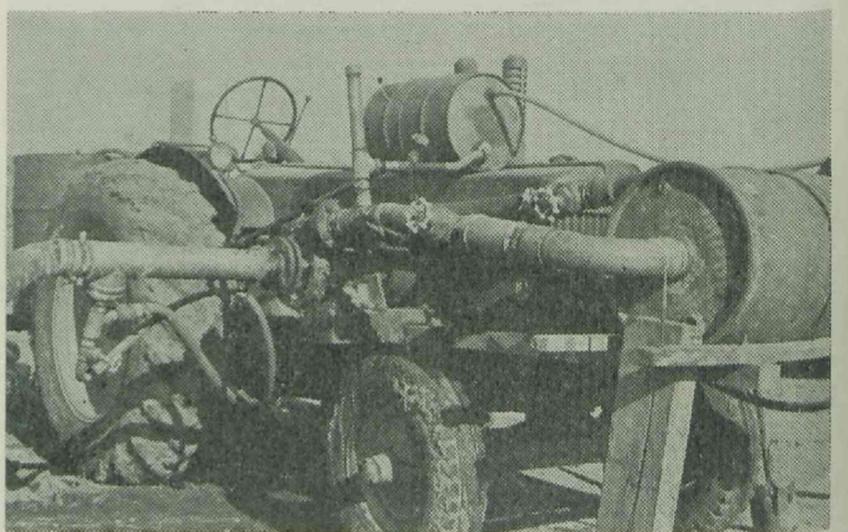


Experimental herd of exotic cattle at "Swan's Lagoon" Cattle Field Research Station on the Burdekin.

LAND DEVELOPMENT



Reducing the cost of wallum development. At the left is wallum sown to *Paspalum plicatulum* after clearing by pulling the trees and shrubs and pushing them into windrows for later burning. At the right is wallum sown to scrobic and siratro with a minimum of clearing.



Left: **Redevelopment planning.** This is part of the Glencoe redevelopment area, showing the typical farming pattern—round-and-round cultivation and stubble burning.

Right: **Burdekin irrigation development.** This equipment has been developed for adding metered quantities of powdered gypsum or dissolved salts to experimental irrigation plots.

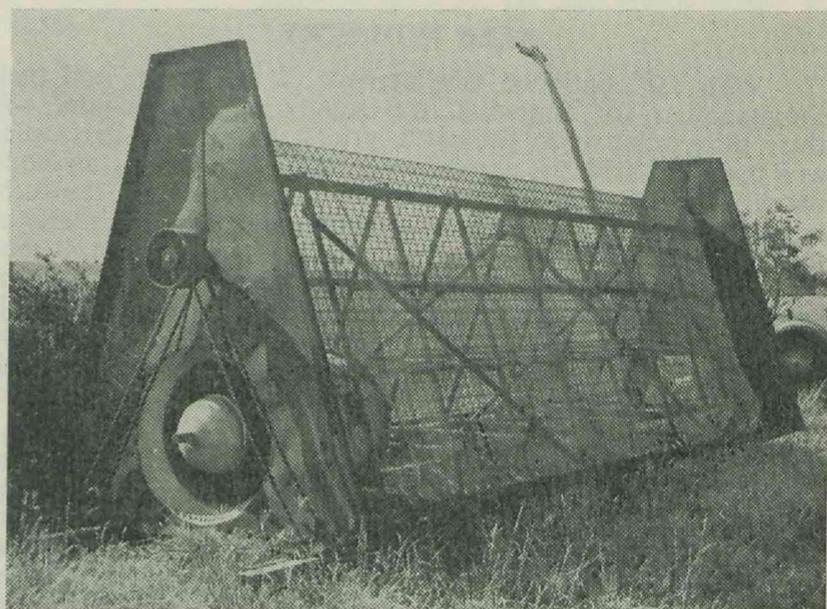


Brigalow development. This picture shows three phases of development. In the foreground is very dense scrub pulled; in the left background, virgin scrub; in the right background, established Rhodes grass.

CROPS AND THEIR UTILIZATION



Left: Mechanization is important in the tobacco industry. Insecticide is being applied by this machine.



Right: Seed producers are installing their own seed driers. This is a continuous flow drier which will be mobile when completed.



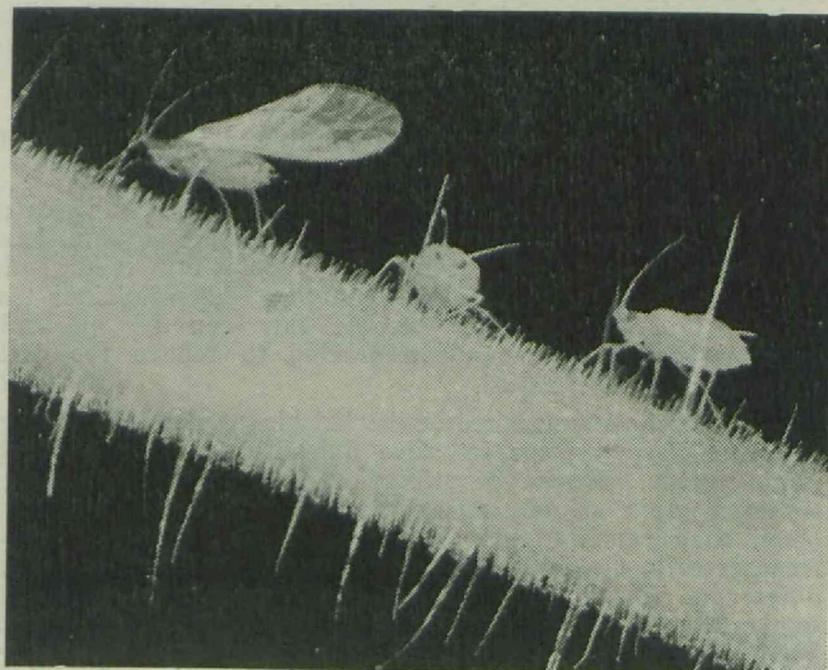
Left: Close-planted Jonathan apple trees established on the contour. If this practice proves successful, it could revolutionize the industry.



Right: Close-spaced Mons Mari bananas. This practice is popular where the crop is grown with supplementary irrigation.



Left: Freeze-dried foods are being prepared at the Food Preservation Research Laboratory for industry appraisal.



Right: Aphids under study as carriers of plant viruses.

SUMMARY OF DEPARTMENTAL WORK, 1966-67

BEEF INDUSTRY

With the continued development of new lands and their improvement for fattening, the supply of store cattle, and their price relative to fat cattle prices, have been developing as a problem. With the expansion of arable production methods, notably crop fattening, and the recent advances in the technology of improved pasture establishment and maintenance together with the development of new land by clearing, it may be expected that the present relativity between store and fat supply and prices may be maintained for a considerable period. The development of greater reproductive momentum in the breeding herds and improvements in the early growth phases of progeny are now relatively greater industry problems than previously.

While increased research resources are being devoted to problems in reproduction, a considerable amount of field work has been undertaken on those aspects of herd management that bear on the problem. This area of study has advantages in that, if demonstrated as being of utility, the modifications to management can not only be made reasonably quickly but often can be made at relatively low cost to the producer.

In reproduction, the core of the problem is the lactating cow and her subsequent timely rebreeding. The problem, in part, has a nutritional background. Female nutrition can be improved by either the supply of additional nutrients in one form or another or by the relief of part of the demand for nutrients. Both approaches have been the subject of field investigation.

The process of early weaning has been demonstrated, and is being accepted, as a valuable and important aid in relieving the burden of breeders and of predisposing them to improved reproductive performance. In addition, the strategic use of supplements is being increasingly adopted as an associated practice.

Over-mating of heifers, and following autumn or early winter pregnancy diagnosis of the breeding herd, are additional management techniques that are attracting interest and which can be expected to reach the adoption stage in the near future.

The pasture legume Townsville lucerne continues to attract the attention of producers and researchers in the north and experiences with the plant continue to give hopes of a major contribution to northern pastoral development. However, there are still comparatively few data from field-scale trials on the productivity of the plant under various management methods. In the grazing trial at "Swan's Lagoon" Cattle Field Research Station to obtain comparative productivity data on grazed stands of native pasture and Townsville lucerne with and without annual dressings of superphosphate, first-year performance of steers may be summarized as follows:

The effect of stocking rate was marked in all treatments except the native pasture treatments. On native pastures at both high (1 beast to 6 acres) and low (1 beast to 10 acres) stocking rates, gains of 150 lb. liveweight were made to March (1965), when peak liveweight occurred. Rapid weight loss commenced in June and the animals had to be fed supplements in September.

Heavily stocked (1 beast to 3 acres) but unfertilized Townsville lucerne treatments had liveweight peaks in April and a commencement of weight loss in June. At lower stocking rates (1 beast to 6 acres), the unfertilized Townsville lucerne maintained production better and weight loss was deferred till August. On fertilized Townsville lucerne, weight gains at both stocking rates were superior to other treatments. At the lower stocking rate there was a prolongation of the period of weight gain to August and a subsequent minimum period of spring weight loss. The total liveweight gain was highest on this conservatively stocked and fertilized area.

The trial needs, of course, to continue for several seasons before final results can be available.

Concurrently, at the Ayr Cattle Field Station, samples of Townsville lucerne hay, cut at different times in autumn, have been tested in digestibility studies. There seems little doubt from the first series of analysis and digestibility determinations that the quality of Townsville lucerne hay can be markedly improved by early wet-season grazing to reduce the grass component of the sward.

Studies have continued at the Rocklea Animal Husbandry Research Farm on the intensive finishing of cattle on high-grain rations. Groups of steers were fed wheat, barley or sorghum grain *ad lib.* and presented with 0, 1 and 2 kg oaten chaff per head per day. Half of the animals also had free access to coarse salt. There were no significant treatment differences in rate of body-weight gain or carcass gain. The intake of roughage by the steers presented with 1 and 2 kg per head per day was similar. The lack of response in body-weight gain to the addition of salt to high grain rations is in agreement with previous findings at this centre. The carcass weight gain represented 67% of the body-weight gain during

feeding. The change in carcass composition as measured by the shin dissection technique showed that 49% of the increase in carcass weight was muscle, 43% fat and 8% bone.

In another experiment at the Husbandry Research Farm, steers grazing green oats and receiving no supplement, supplements of 1 or 2 kg of a high-energy, low-protein meal or 1 kg of high-protein meal per day had similar rates of body-weight gain. This finding indicates that the supplements acted as replacements rather than true supplements.

Apart from further extensions of the areas previously infested in the Biarra, Crows Nest and Mt. Stanley areas, fresh outbreaks of Biarra-type resistance were detected at Bryden, Glamorganvale, Nambour, Kallangur, Beenleigh, Kilcoy, Bundaberg and Mundubbera, and an outbreak last year at Moogerah was confirmed. In addition, one property north of the Biarra quarantine areas has given definite field evidence of Biarra resistance.

To date, distribution of Biarra-type resistant properties (58 in all) is as follows: Mt. Stanley-Biarra 35, Crows Nest 8, Beenleigh 1, Bundaberg 1, Mt. Kilcoy 4, Glamorganvale 1, Bryden 4, Nambour 1, Moogerah 1, Kallangur 1, Mundubbera 1.

Most outbreaks in other areas were traced back to introductions from the Biarra area made prior to detection of resistance and imposition of quarantine restrictions. Others are still under investigation.

Field trials in June 1966 indicated that Dursban and Nexagan were effective in controlling Biarra-type resistant ticks, and with the registration of these medicaments in late 1966 most dips in the Biarra-Crows Nest quarantine areas were charged with these medicaments. One, however, is experimentally charged with Nankor. Some \$60,000 has been expended for this purpose.

The staff position in these areas improved early in 1967 and from March all properties in the Biarra, Crows Nest, Moore and Mt. Stanley areas have been under supervised treatments, and control has become well established on all of them.

Generally speaking, co-operation from graziers was very good, and no trouble was experienced in clearing cattle from affected areas.

As indicated earlier in this report, conditions governing control programmes on resistant and adjoining properties, and restrictions on movements from such holdings, were under constant review. Under recommendations adopted by Cabinet, some 15 properties will immediately revert to owner-controlled dipping schedules, with a further 20 to 30 to be released similarly in the next few months. Control will still be retained on all removals, to be reviewed from time to time in the light of the overall situation. In addition to providing medicaments for treating cattle in the resistant areas, blood has been supplied and cattle regularly inoculated to maintain immunity against tick fever. To date, 80,000 doses have been used in the Brisbane division alone, with no untoward results. Many owners in the quarantine areas have been agreeably surprised by the beneficial effects obtained from keeping their cattle free of ticks, and some have expressed a determination to continue with effective control measures when released from restrictions.

Movements from affected areas were normal during the year and two store cattle sales were held at Toogoolawah, drawing about 600 head from quarantine areas. Good prices were obtained for good quality cattle.

Investigations into Ridgeland resistance and suspect Biarra-type resistance have been pursued in all other ticky areas of the State, but apart from outbreaks associated with introduction of cattle from the Brisbane Valley, suspect multi-resistance has usually been due to faulty application of under-strength dips.

Ridgeland-type resistance was detected on 19 properties in the Rockhampton division during the year, three in the Maryborough division, and seven in the Brisbane division. Properties showing Ridgeland-type resistance at present are as follows: Ingham 2, Mackay 4, Rockhampton 37, Gladstone 15, Gympie 1, Maryborough 1, Tiaro 1, Biarra, etc. 6, Beaudesert 4, Toorbul Pt. 1, Wamuran 1, Woodford 1. Restrictions have been maintained on such resistant properties and control on the properties supervised as far as staff available permitted.

Since the initial diagnosis of Biarra-type resistance by Animal Research Institute workers in February 1966, laboratory testing associated with field surveys has involved most of the facilities of the Parasitology Section.

The introduction of a new range of pesticides aimed at control of multi-resistant ticks has increased the numbers and complexity of dips requiring analysis. The Animal Research Institute at present provides for the analysis of 11 separate acaricides, a much more complex problem than that of private organisations providing an analytical service for one or two

products. To provide methods that have speed, specificity and reasonable accuracy, methods based on the absorbance in various regions of the spectrum have been devised.

Following high incidence of tick outbreaks in clean country, steps were taken in 1965 to enforce more rigid conditions in regard to ticks on travelling cattle. Permits were endorsed "to be free of visible ticks" and ticky drafts at saleyards were withheld from sale, treated, and either returned to their properties of origin or held for 72 hours before release. With the increase in spread of multi-resistant ticks, conditions were tightened early in the year to require all cattle in ticky areas to take a treatment within 72 hours prior to movement. These requirements received wide publicity in the Rockhampton, Brisbane and Maryborough divisions, and were widely enforced, but lack of facilities in northern areas hampered their general adoption.

Over half a million doses of tick fever vaccine, an increase of 70% over 1965-66, were supplied by the Animal Research Institute in 1966-67. This vaccine continues to give mild reactions followed by a high degree of protection. The introduction during the year of the chilled pack for the despatch of the vaccine has allowed extension of the expiry date from 24 hours to 1 week after receipt.

Research at the Tick Fever Research Centre at Wacol indicates that the absence of a spleen in the animals used for passage is the main factor responsible for attenuation of the vaccine.

An experimental drug, which appears to be more effective than existing drugs for the treatment of tick fever, was tested extensively. At dosages of 2mg/kg or greater, this drug was found to sterilize infections and also to confer a marked protective effect for some weeks against inoculations with *Babesia bigemina*.

Investigations of the immune status of cattle bred in the enzootic area for babesiosis were begun with a view to determining how frequently vaccination should be performed. Preliminary observations are that mature (2½-11 years) animals may retain immunity to *B. argentina* for at least 6 months in the complete absence of ticks. Young (6-9 months) animals in tick-infested areas may be completely susceptible by the end of the winter. Vaccination at this time, however, confers immunity that lasts for at least 6 months in the absence of ticks. Cattle that still carry naturally acquired *B. argentina* infections 6½ months after their removal from tick-infested areas are relatively immune.

The number of sera tested in the laboratory in connection with the National Contagious Bovine Pleuropneumonia Eradication Campaign totalled 12,863 sera from 66 herds. Two isolations of *Mycoplasma mycoides* were made from lungs submitted from meatworks. Over 425,000 doses of B.C.P.P. vaccine were distributed from the Oonoonba and Yeerongpilly laboratories.

The completion of an experiment at the Animal Health Station at Oonoonba, which shows that immunity to botulism is present for at least 2 years after vaccination, brings to a successful conclusion a programme beginning with the isolation of *Clostridium botulinum* type D and ending with trials showing that cattle can be given long-term protection against botulism. Vaccination of cattle in the affected areas has become a well-established procedure for prevention of losses from this disease.

Widespread outbreaks of St. George disease occurred in the main enzootic areas (Goondiwindi, St. George, Bollon, Surat) and on five properties in the Charleville-Augathella area. Field observations are being continued. Three steers were maintained in a small paddock at Mitchell from April to November 1966, when two of the animals showed oedema and the other was scouring. On arrival at the Animal Research Institute very little clinical abnormality was noted in any of the steers but on histopathological grounds it was considered that two were affected with St. George disease. Attention has also been paid to treatment, although in the absence of any definite knowledge of causation, this is almost completely empirical.

A strain of *Leptospira* which probably belongs to the hebdomadis group was isolated from cattle for the first time in Australia, and its pathogenicity is being evaluated.

Pesticide residues induced by back-rubbers used to control buffalo-fly were examined. The use of back-rubbers charged with DDT, methoxychlor or coumaphos at 1% concentration in heavy (SAE 50) mineral oil did not induce residues in beef fat in excess of the limits imposed by major importers of our meat products.

SHEEP AND WOOL

At Toorak Sheep Field Research Station, seasonal conditions were fairly favorable for the long-term research projects.

The Nucleus group was joined in spring for only the second time since the joining trial was begun in 1959. The percentage of ewes showing oestrus at joining was 94, and 84% were actually served for a lambing of 80% of those served. In a spring v. autumn joining trial, the group joined

in autumn 1966 had a marking percentage of ewes present at joining of 72, compared with 51 for the group joined in spring 1966.

In an oestrus trial, maiden ewes run continuously with teaser rams showed a low percentage of oestrus during the spring of 1966 when other ewes joined on the property at the same time showed a high incidence of oestrus.

Liver biopsy showed that the vitamin A content of adult wethers was never dangerously low during the year, in which unusual rains fell in August.

A pilot trial has been set up at Toorak to determine the variation in rectal temperatures of ewes during hot weather. The data will be used in a study of the influence of high temperatures during gestation on birth weight of lambs.

The synchronization of oestrus using a commercial vaginal sponge containing a synthetic hormone was assessed. Synchronization was obtained, but there was no significant difference between lambing percentages.

Work continued at the Animal Research Institute on evaluating newer organophosphorus insecticides for their potential in preventing blowfly strike in sheep. The results indicate that Bromophus and Dowco 179 are potentially useful for prevention of strike although the period of protection in the field will not be as long as that recorded under laboratory conditions.

Work on assessing the total grass seed infestation of sheep indicates that this is correlated with the number in a patch sample on the shoulder or mid-side.

It has been shown that the selenized area in north-western Queensland is not as extensive as at first thought. However, considerable numbers of sheep are exposed to an excess of dietary selenium. The effect on animal productivity of diets containing selenium was examined in a trial in which ewes were offered 1kg of a ration containing, 0, 20, 30, 40 or 50 p.p.m. selenium (as the selenate). Rations containing 40 or 50 p.p.m. selenium resulted in reduced feed intake, loss of body-weight and reduced viability of lambs. Effects could not be distinguished from those induced by under-nutrition.

PIGS

Departmental officers during the year evolved further modifications and improvements of basic pig-shed designs. New types of farrowing pens and farrowing crates were also developed.

Intensive penning of dry sows was studied during the year. Designs for pens, tethering harness, and management practices suitable for this method of handling breeding stock were evolved. The system is now in practical operation.

The present systems of factory grading of pigs on backfat thickness only proved unsatisfactory to many producers. The Department is working on analyses of various carcass measurements with a view to establishing measurements which will give a better indication of the meat content of carcasses. To assist in these investigations an Intrascope was purchased in Denmark.

In amino-acid supplementation trials, good growth rates have been obtained in pigs over 100 lb body-weight with 0.24 to 0.36% lysine hydrochloride monohydrate (feed grade) as a sole supplement to sorghum grain. Performance was similar to that of pigs fed a ration of sorghum plus 8% soybean meal but poorer in both feed efficiency and carcass quality than a ration of sorghum plus 12% soybean meal.

In another experiment, with rations based on sorghum and wheat, pigs gave similar performances from 40 lb to bacon weight with a supplement of 7½% soybean meal plus 0.24% feed grade lysine plus 0.20% DL methionine to those obtained with a supplement of 15% soybean meal.

In one experiment on feeding interval, feeding pigs every second day compared with daily feeding resulted in lowered daily gain from 1.33 to 1.22 lb. In a second experiment in which daily, every second day and every third day feeding were compared, results from 40 lb to bacon weight showed no differences between treatments.

Experiments showed that the growth rate of pigs in half-tank shelters in summer was approximately 15% poorer than that of pigs in wooden-walled sheds with galvanized iron roofs.

The most frequently diagnosed pig diseases associated with bacterial infection are oedema disease, salmonellosis and erysipelas. It is becoming increasingly evident from world literature that oedema disease is a toxæmia caused by specific strains of *Escherichia coli*. In order to determine the serotypes present in Queensland, 100 strains isolated at the Animal Research Institute have been typed.

A strain of aflatoxin-producing *Aspergillus flavus* has been isolated from a sorghum sample. As this grain had been suspected of causing abortion in sows, experiments have been commenced at the Animal Health Station, Oonoonba, to determine the effects on pregnant sows of ingestion of the toxin.

POULTRY

The ninth layer random sample test concluded during the year with 11 entrants, two of whom submitted two distinct commercial crossbreds each for testing. Generally, results were similar to those obtained in previous years, with at least seven random sample flocks achieving an overall rate of lay as indicated by "henday average production" in excess of 200 eggs per bird, while the remainder, with one exception, were within the 190 to 199 eggs per bird range. These results indicate that breeders have succeeded in lifting "egg number" markedly since the introduction of poultry improvement plan schemes based on genotype some 10 years ago.

However, there appears to be susceptibility to leucotic infection in the stock presented. Infection due to one or more diseases of the avian leucosis complex accounted for 70% of the total number of chickens dying at 10-17 weeks of age and 66% of all layers after 17 weeks and to the end of the test (66 weeks).

Layer random sample test No. 10 is now in progress. Compared with a similar stage of test No. 9, mortality is lower, the hen-housed average is similar, but profitability per bird is much lower because of lower egg weight, poorer feed conversion and increased levy per bird.

Broiler random sample testing was discontinued temporarily during the year under review, as under the organization of the broiler industry few growers can choose their source of chickens.

Controlled environment housing for broilers which provides relatively narrow temperature ranges within the broiler house and positive control over lighting is now being adopted widely in Western Australia and Victoria. An enterprising broiler grower close to Brisbane, following a visit to Western Australia, erected one of these sheds. Results to date have not been as good as those obtained in naturally ventilated sheds. He has invited the Department to make observations on its operations over a 12-month period so that we may be in a better position to assess its value under subtropical conditions. Equipment for measuring and recording temperature and humidity gradients and light intensities has been ordered for this project.

Because of marked increase in isolations of *Salmonella pullorum* in recent years, strains were submitted to analysis for XII₂ and XII₃ somatic antigens. The 54 isolates examined included 7 standard, 18 variant, 25 intermediate strains and 4 that gave anomalous results, so it is apparent that the stained antigen for the rapid whole blood test should contain both of these antigens.

At the request of Queensland broiler growers, the effect of delay between hatching and placement in brooders has been investigated. Deprivation of feed, water and artificial warmth for up to 36 hours after hatching had no significant effect on mortality, 10-week body-weights, feed consumption or feed conversion.

An experiment involving three levels of protein in the grower ration (11, 13 and 15%), two levels in the layer ration (13 and 15%), and two housing densities (2 and 4 sq ft per bird) indicates that restricting protein in the growing ration is a suitable method for retarding growth and delaying maturity of replacement pullets.

In an initial experiment on the inclusion of molasses in rations, satisfactory performance was obtained when levels as high as 16% molasses were included at the expense of the grain component in practical broiler starter rations of equal crude protein content. There was marked growth depression in the 32% molasses ration.

Levels in the drinking water of sodium chloride, magnesium chloride and calcium chloride as high as 1,402, 1,872 and 2,616 p.p.m. respectively had no significant effect on mortality, growth rate, feed consumption or wetness of faeces in chickens. Sodium chloride (4,206 p.p.m.) caused increased moisture in the faeces of chickens but had no effect on the other criteria. Chickens dying from high levels of sodium chloride in the water were markedly oedematous, while dead chickens from high levels of both calcium and magnesium chlorides were dehydrated.

The first case of avian tuberculosis in poultry in Queensland was detected in early 1966 in a backyard poultry flock at Yelarbon. There were 8 reactors among 23 hens of various ages kept in one run, and none among 68 cockerels in a separate run. One emaciated bird killed on the day of test had advanced lesions of disease in body organs. At slaughter some days later, eight of the hens which did not react to test had lesions.

As the owner had introduced birds from other farms, a survey was made of flocks in the surrounding area. Of nine country flocks with 309 birds, five were infected; 28 birds reacted and a further five cases were detected among non-reactors when the infected flocks were slaughtered out. Five Yelarbon flocks out of 17 tested were also infected; out of a total of 388 birds tested, 13 gave positive reactions, but all were negative on autopsy.

A policy of slaughter-out and burning of carcasses was adopted where avian tuberculosis is confirmed. Infected ground is to be left free of poultry for a period to be decided upon and quarantine imposed on infected premises.

FIELD CROPS

Wheat.—The pasture-wheat rotation trial at Jondaryan has entered its tenth and final year. The value of the pasture phase was again demonstrated, with the first crop after 4 years' lucerne-grass ley realising a 41% greater yield than the continuously cropped area. The sixth crop of wheat following a 3-year pasture gave a 34% greater grain yield than the crop following continuous wheat. All crops following pasture gave improved protein yield per acre and all had a lower incidence of black oat infestation. The soil pH was significantly lowered by the pasture phase and soil nitrogen levels were increased.

Stand reduction has again occurred when wheat has been sown with urea and the value of applying the fertilizer to the soil prior to planting has been shown.

In varietal trials, Festiguay, Gamenya and a variety not yet released yielded well.

Wheat varieties have shown variability in their reaction to 2, 4-D but this variability is largely dependent on seasonal conditions and the Departmental recommendation of $\frac{1}{2}$ lb. a.i. per acre at tillering has been shown to be the safest under most conditions. Climbing buckwheat has been shown to have little influence on grain yield through competition for moisture and nutrients: its main effect is mechanical impedence during harvest and grain contamination. Control studies of European bindweed suggest that a combination of intensive cultivation through the fallow and selective herbicide application in the crop may be necessary.

The soil fertility research programme in conjunction with A. C. F. & Shirleys Fertilizers Ltd. and the University of Queensland has continued and been expanded to investigate the possible interference of other elements in the nitrogen and phosphorus levels determined for fertilizer predictions. As found previously, the available nitrogen per acre-4 ft. of soil at planting again appears related to yield response despite a vastly different growing season. Evaluation of the degree of fertilizer response may need to take into account stored moisture and growing season rainfall. Mottling has been shown to be virtually eliminated by the use of nitrogen fertilizers at the levels giving maximum yield. Varietal behaviour in terms of response to nitrogen is to be investigated.

With phosphorus prediction trials the red brown earths continue to give anomalous results. If these are excluded, the bicarbonate extraction of soil phosphorus gives a better separation of responsive and non-responsive sites than the B. S. E. S. acid extraction method, using 30 p.p.m. phosphorus as the threshold level.

Quality assessments were undertaken for various Show Societies as well as for the Wheat Board.

Last season's field trials, in contrast to those of 1965, have shown no correlation between depth of planting and incidence of crown rot (*Fusarium graminearum*). The percentage of infected plants at maturity was shown in another field trial to be closely related to the time of sowing, being 59.5, 39, 28.5, and 12.5 for May, June, July and August plantings, respectively. Two varieties from the International Rust Nursery appear to be more resistant to crown rot than field-tolerant local varieties such as Gala.

The microbial populations of wheat stubble before and after heavy rain are being investigated in the light of the marked weight and nitrogen losses in the stubble when fertilizer trials are harvested after rain. Bacterial counts in the weathered stubble were 67,000,000 per gram and 6,500 per gram in the unweathered samples. Fungal counts were 420,000 and less than 500 per gram in the respective samples.

Barley.—The varietal testing programme is continuing. Fertilizer trials have further highlighted the danger of too high a protein level from excessive nitrogen application. The soil fertility research programme into nitrogen and phosphorus requirements has been extended from wheat into barley and 12 trials are planned for the current season.

Oats.—Oat breeding has been directed toward rust resistance, and varieties exhibiting stem and crown rust resistance are being crossed with Fulghum, the best yield parent available. Further crosses for yield and frost resistance have been made employing the varieties Cooba and Bundy for yield, and Fultex and Trispermia for frost tolerance. In the grazing trial comparing erect varieties, the top performers were Fultex, Kurri and Clinton.

Grain sorghum.—The regional testing programme for grain sorghum hybrids was continued. Some of the new experimental hybrids appear particularly promising. The Departmental hybrids 378 x Q6668, 378 x Q6669 and Texas 671 have yielded well, as have De Kalb Shand hybrids F64, C44B and E57. Pioneer 844 and 846 are the best commercial varieties of the Queensland Certified Seed Growers' Association. The currently popular hybrid Texas 610 gave good comparative yields.

Maize.—The first commercial hybrids to be released from Kairi Research Station were planted in small areas on approximately 80 Atherton Tableland farms. A certified hybrid maize seed production scheme has been established in the area and the mother seed required to service such an industry is to be produced at Kairi. K37, an initial release from the maize breeding programme for the Atherton Tableland, is exhibiting superior yields to the popular GH128 and is virtually free of tropical rust; the average yield increase is about 16%. New hybrids to be screened in the forthcoming season have a yield potential of 5-10% greater than K37 and also display more favourable agronomic characters such as reduction in ear height. GH128 has also been outyielded by the N.S.W. hybrid GH134 at Walkamin, where a yield of 108 bus. was attained under irrigation. At Warwick, maize yields with irrigation have increased along with plant population increase from 8,000 to 24,000 plants per acre; while at Gatton a plant population of 20,000 per acre has been demonstrated as the optimum level under irrigation for Queensland hybrids. A regional testing programme has been initiated to determine more accurately the varietal situation throughout the State and 19 hybrids (Q., N.S.W., Kairi, and De Kalb Shand contributions) have been incorporated in this series of trials.

Rice.—Yields of rice well in excess of 2 tons of rice grain per acre have been obtained under flood irrigation at Millaroo and on the Arriga soils at Mareeba. Varietal trials suggest that Blue Bonnet is the most satisfactory variety because of its resistance to lodging.

Tobacco.—Three years of testing indicate that a selection from American Broadleaf Hicks offers higher yield characteristics than the standard Hicks. It has good quality and uniformity and is expected to replace the existing cultivar.

A new sucker control chemical which has been tested over three seasons can be sprayed on the crop. It combines excellent sucker control with a greater ease of use than the hand methods or the mineral oils at present in vogue and has not exhibited any harmful side-effects.

After 2 years' work on foliar diagnosis, it is evident that this technique can define accurately the nutritional status of the tobacco crop at any given stage of development. The effects of varying land history and irrigation practices can also be assessed. The practical use of foliar diagnosis will be considered when it has undergone further evaluation.

Analyses of sponged flue-cured leaf show a possible correlation between nitrogen and calcium uptake. When sponging occurs there is a general depression in nutrient uptake, in which nitrogen is probably the controlling factor. Leaf manganese from crops treated with maneb and grown on a soil with fairly high available manganese was not regarded as reaching plant toxicity level.

Nitrogen release in a tobacco soil was shown to be much greater at higher levels of applied nitrogen. Recent cultural history of the plots has some influence on nitrogen uptake by the crop.

In a method-of-application trial on the use of fungicides against blue mould at Parada Research Station, "post wet period" sprays have shown considerable promise. By this method fungicide was applied after any recorded rainfall or after 40 points recorded rainfall within a period of three days. A comparison of rainfall-dependent treatments with weekly high-volume treatment (7 applications in all) revealed that results were very similar. The method offers hope of a considerable reduction in the number of applications of fungicide needed for mould control.

Bacterial wilt (*Pseudomonas solanacearum*), a disease new to Queensland, occurred in two areas during the period. In the Ingham area it appeared on quite a number of farms, and at least five farms near Mareeba were involved. The strain of bacterium causing the infection is not, however, thought to be the virulent type which causes Granville wilt in parts of the United States of America.

Studies on the biology, habits and field populations of the major tobacco pests were continued. Mercury vapour lights proved to be the most effective for field trapping purposes. These showed that peak occurrences of both sexes of leaf miner (*Phthorimaea operculella* (Zell.)) appear before midnight, whereas looper females (*Plusia argentifera* Guen.) are most active before midnight and males after midnight. A number of new materials were tested for pest control but standard materials in use continued to be best for field control.

Cotton.—Varietal assessments indicate that Dixie King will remain prominent because of its fibre quality. Deltapine Smoothleaf continues to be outstanding in respect of yield, even if a little suspect in quality, while Rex Smoothleaf shows all-round promise and adaptability.

The nature of the cotton yield increase associated with irrigation and nitrogenous fertilization has been analysed at Biloela in terms of the effects on plant characters which act as yield determinants. Trifluralin was shown to give an 80% control of grass weeds throughout a 10-week period from planting.

Peanuts.—Results from weed control trials indicate that 2,4-D is the most reliable and versatile herbicide for pre-emergence treatment and that trifluralin can give excellent results as a preplanting treatment. Varietal trials on Spanish-type peanuts show a high degree of yield variability with the current commercial variety well down on the list; the presence of white testas on the higher yielding varieties may preclude their commercial usage. Preliminary fertilizer studies have indicated the importance of fertilizer placement, and these investigations are continuing.

Oilseeds.—Soybean yields in excess of 2,000 lb. of clean grain per acre were achieved from the better varieties incorporated in trials and 19 gave over 1,500 lb. The top varieties were Hood, Hill, Dorman and Jackson. Varietal variation in response to change in row spacing has been demonstrated, but in general the greater yields come from narrower spacing. Experimental results at Hermitage and Gatton suggest that mid-December is the best planting time, but acceptable yields are obtainable for all planting times from the end of October to the end of December. Oil content also appears to reach a peak from December plantings.

From 4 years' linseed varietal trials at Hermitage, it appears that Bonnydoon is the most suitable variety available at present, although Walsh has performed well. An adaptation analysis has been conducted on linseed varieties tested at Hermitage and Bongeem in previous years and those with the characteristics of adaptability and high yield potential have been selected for consideration in the linseed breeding programme.

Work on linseed varieties grown at Hermitage and Walkamin has shown that the production of "quality oil" is dependent on both variety and environment. Fatty acid balance in the oils is also dependent on environment. The correlation demonstrated between iodine values and refractive index will enable the simple R.I. reading to be used in the laboratory to estimate iodine value.

Sunflower introductions and seed-increase programmes are in progress. Yields equivalent to 1,000 lb. per acre were obtained from small plots of Peredovik. Polestar remains prominent among the present varieties and has acceptable agronomic characteristics and oil content.

Potatoes.—The possibility of producing seed potatoes in Queensland is being explored. Seed was produced from high quality certified seed during the period September to March at selected sites at Killarney, Beechmont, the Darling Downs and Maleny, and tested in 1967 in March and May plantings at Gatton Research Station. Early results for Sebago appear disappointing and attention is directed to the possible need for use of later maturing varieties or the incorporation of some cultural techniques to reduce soil temperature. Gibberellic acid as a quick 1-minute dip for cut or pierced seed has given promising initial results in relation to the problem of breaking seed dormancy.

Onions.—Experiments over the past 3 years have shown that dimethal is the safest and most effective pre-emergence herbicide at present available for use in onions. While it does not control all the weeds encountered in the Lockyer Valley, it is generally very effective if applied at 7.5 lb. a.i. per acre before weeds emerge.

Miscellaneous.—Strict interstate quarantine against fruit flies is still being applied to Queensland fruit and vegetables consigned to markets in southern States. Interceptions have been concerned mainly with the cucumber fly (*Austrodacus cucumis* (French)) in pumpkins, marrows and zucchinis.

FRUIT AND VEGETABLES

Deciduous fruits.—Nutritional studies confirm an earlier observation that measles in pome and stone fruit trees is associated with either a deficiency of boron or an excess of manganese. Lime and dolomite, which raise the pH of the soil, may have a place in the control programme by decreasing the uptake of manganese by the tree.

A fertilizer trial on Jonathan apples indicates that the trees have high phosphorus and potassium requirements. A deficiency of phosphorus is characteristic of orchards planted on virgin land. Once the trees are established, a spring application of a 10/10/15 mixture should prove satisfactory. Rates of application are adjusted to the age and cropping capacity of the tree.

Rootstock trials confirm the merits of Merton 778 as a rootstock for apples. The most promising of the Merton-Malling rootstocks for apples are MM109 and MM105. Both confer vigour and early cropping on the scion variety.

Recent studies at Stanthorpe have shown the ability of the apple tree to withstand stress conditions even when soil moisture to a depth of 18 in. falls below wilting point.

To cope with the requirements of an expanding industry, studies of the post-harvest behaviour of the principal varieties of apples grown in the Stanthorpe district, particularly with regard to scald inhibitors and improved methods of storage, have continued. Diphenylamine has recently been released for use as a scald inhibitor and in order to determine optimum

dip concentrations with commercial emulsions now available, further trials are being carried out. A significant reduction of bitter pit which affects early shipments of Granny Smith apples has been obtained by treating the fruit after harvest with a solution of DPA and calcium nitrate. By warming apples to 70°F after 4 weeks' storage, a significant reduction of soggy breakdown has been recorded. The effect of warming on fruit held in controlled atmosphere storage is also being investigated.

Pineapples.—The Department's balanced fertilizer schedule has proved useful on a wide range of soils. Modifications to the schedule which permit the application of all nutrients in solution through boom sprays are currently under grower appraisal. This schedule supplies adequate amounts of the major nutrients for pineapple plant growth. However, trace elements sometimes become a limiting factor to production. Current work is concerned with the optimum levels of zinc, boron and magnesium. Significant responses have been obtained from both zinc and magnesium in recent trials.

Pineapple yields can be substantially increased by spacings of 5 ft. between double rows, 12 in. between paired rows and 9 in. between plants in the row. Close spacings are a commercial proposition when the crop is consigned to a cannery. They may, however, present problems to growers who supply the fresh fruit market, as planting material (tops) may fall below requirements.

Work at the Maroochy Horticultural Research Station has confirmed the superiority of Clone 13 over field-run planting material. Consideration is now being given to an industry-sponsored multiplication programme to replace existing stocks of planting material.

Early results from two field trials at Cooroy indicate that Dexon and Difolitan applied over the plants as a drench give outstanding control of top rot (*Phytophthora cinnamomi*). Dipping of planting material also afforded some early protection.

Because of their relatively short life, pineapples cannot be exported overseas in normal atmospheres. The shipping of perishables in bulk containers would make possible the use of artificial atmospheres containing sub-normal concentrations of oxygen and above-normal concentrations of carbon dioxide. Experiments have shown that the storage life of pineapples may be increased considerably by the use of these artificial atmospheres and overseas export may be possible. Further experiments have been carried out to determine the canning suitability of pineapples from selected clonal material and to investigate whether translucency is a suitable index of fruit ripeness in any one clone. Trials have also been conducted in co-operation with the Golden Circle Cannery to determine the effect of pre-harvest NAA sprays on canned fruit quality. Changes in the volatile flavouring constituents of pineapples during maturation have been further studied with gas chromatography equipment. The commercial canning of tropical fruit salad is proving difficult because of can corrosion due to the presence of excess nitrate in the papaws. Although the solution to this problem appears to lie in cultural practices, methods of preventing corrosion with special can lacquers are being investigated.

Various fruits are treated with ethylene in order to give a product of uniform ripeness. Experiments are being carried out to determine the optimum conditions of ripening in order to assist commercial ripeners.

Bananas.—Clonal testing in the Cavendish and Mons Mari varieties continues. The best of the available clones are superior to commercial field-run material and could be of commercial interest.

A preplant application of potassium has proved superior to side-dressings. Increased plant vigour is reflected in heavier bunch weights. This finding has been responsible for major changes in fertilizer practice.

A trial shipment of bananas treated with an experimental fungicide and packed in sealed polyethylene bags in cartons sent from North Queensland to Sydney indicated that this method could be used to transport bananas satisfactorily over long distances in the summer months. Its commercial use cannot be recommended until a suitable approved fungicide is available.

Studies of the effect of temperature on green bananas have shown that over the range 55°F to 71°F their storage life is increased by nine-tenths of a day for every degree Fahrenheit drop in temperature. The effect of reducing the temperature is much greater with green bananas than with fruit which has started to ripen. Studies to determine whether the stage of maturation of fruit at harvest affects this temperature relationship are now in progress. Because it is suspected that traces of ethylene in banana-packing establishments accelerate the ripening of green fruit, special equipment is being prepared and techniques devised to study this problem.

Papaws.—Nutritional schedules for papaws have been tentatively revised to cope with the problem of can corrosion in packs due to nitrate. Experimental data indicate that

the nitrate content of the fruit may be reduced by curtailing rates of nitrogen application. If the amended schedule which restricts the use of nitrogenous fertilizer to the November-February period proves unsatisfactory, it may be necessary to apply nitrogen through urea foliar sprays.

Citrus.—Trees in a number of stock-scion trials are now bearing fruit. Rough lemon has proved the outstanding stock for all varieties of lemons. Yields are high and fruit quality little if any inferior to that from trees on sweet orange and other stocks. Troyer citrange is the most promising rootstock for oranges; it could be valuable on replant land where tree vigour is essential. Emperor is probably the best stock for the Emperor mandarin.

The breeding programme in mandarins has been resumed in an attempt to develop early-maturing varieties which are superior to Imperial. Though it sells well on existing markets, fruit quality in this variety is only fair and much inferior to that of mid-season varieties such as Glen Retreat.

The Citrus Budwood and Seed Distribution Scheme had a quiet year in 1966. Nearly 100,000 buds were supplied to nurseries. Of these, some 86,000 were A grade varieties and the balance B grade varieties. Virus-free wood is available for Valencia Late orange and Ellendale mandarin. Seed distribution amounted to 177 lb. Noteworthy is the increased demand for Troyer citrange seed.

Some new insecticides show improvement over standard materials for the control of white wax scale (*Ceroplastes destructor* Newst.) but only against the immediate population of young insects. The long hatching period of this pest is still a complicating factor to efficient and economic control. The ability of the pest to increase the number of generations per year and to advance egg-laying in a mild spring are further complicating factors. Trial results again showed that control treatments should be withheld until most of the main summer emergence of crawlers has been completed.

Further experiments this year with citrus fruits have confirmed previous findings that the solids/acid ratio is a more satisfactory index of palatability than acid. Experiments have shown that the quality of canned juice prepared from Valencia and Joppa oranges is affected by fruit size, rootstock, cultural practices and climatic conditions. Quality can be considerably improved by delaying the harvesting date.

Strawberries.—The Strawberry Runner Approval Scheme operated in collaboration with C.O.D. made available some 250,000 virus-free runners for planting in 1967. The varieties Phenomenal and Majestic are included in the scheme and it is hoped to introduce Redlands Crimson next year. Runners are in strong demand as their performance in the field has been well up to expectations. They have set new standards for both growth and production.

Passionfruit.—The Redlands selections (Hybrids 3-1 and 3-26) have displaced the purple passion fruit from the Queensland market. Both are normally grown on *flavicarpa* stock. Off-types are, however, common in plantations with seedling hybrids rather than grafted hybrids on *flavicarpa* stock. The popularity of hybrid 3-1 is probably due to its high early production and tolerance to woodiness virus.

Avocados.—During the early summer months, fresh avocados are not available. Experiments have therefore been carried out using liquid nitrogen to determine whether a satisfactory frozen pack can be prepared and promising results have been obtained.

Wet weather contributed to rotting of early harvested fruit. Trials have shown that dipping of the fruit after harvest in a number of fungicides did not reduce rotting in storage. However, it was demonstrated that inadequate ventilation of fruit in standard fibreboard cartons was associated with a worsening of the rot position.

Peas.—Pea yields vary with time of planting, as seasonal conditions (mainly temperature) influence both plant size and the number of pods per plant. Recent work at the Redlands Station indicates that sowing rates should be increased in late-sown crops, which normally produce smaller plants than earlier plantings.

Beans.—Plantings under the Bean Seed Approval Scheme in 1966 were 1,169 acres. Yields were only fair, as late-planted crops encountered hot weather. As stocks of seed are low, targets for 1967 have been almost doubled but plantings may be limited by lack of sufficient fully accredited mother seed of some processing varieties. The existing rules have been modified to permit closer spacing in the field. This should reduce the inspectional commitment in terms of the volume of seed harvested.

Examination of bacterial blight affected specimens from North Queensland seed crops has indicated that a strain of the halo blight bacterium (*Pseudomonas phaseolicola*) was involved. This strain does not produce the broad lemon-coloured halo around the leaf spots characteristic of halo blight, and its presence in three areas required positive laboratory identification for the guidance of field inspectors. Since this disease has been subsequently detected in other

seedlines (including one from Idaho, U.S.A.) grown in various parts of the State, a first published description is being prepared for the benefit of workers in this field. Though not so damaging in its effect upon the plants, the strain is seed-borne and rejection of infected seed crops is justified.

Two North Coast *Sclerotinia* control experiments were completed. Dichloran field sprays provided better all round control than other fungicides tested.

During the winter months green beans from Queensland are transported over long distances to interstate markets. Experiments have shown that the outturn quality of the bean is affected more by the maturity of the bean at harvest than by transport conditions. It has been established that the development of both seed and fibre continue after harvesting.

Tomatoes.—Nutritional research has been concerned with the phosphorus requirements of the tomato plant. The need for a high phosphorus regime, particularly in the young plant, is now well established. If supplies are low, fruit set in the lower trusses is unsatisfactory. Radio-isotope investigations using calcium⁴⁵ confirm the low uptake of calcium from foliar sprays. Better results are obtained when the sprays are applied to young fruits some 12–15 days after anthesis. The commercial implications of these findings are being investigated.

Some introduced varieties and strains with disease-resistant characteristics show promise and the best are being grown commercially at Bowen. Others such as Floridel and Inamocolle have performed well at the Redlands Station and will shortly be placed in regional trials.

Post-harvest dips using dithiocarbamate fungicides have been tested for *Alternaria* fruit rot control in consignments of green-pack tomatoes from Bowen. In trial fruit consigned to Brisbane for storage and assessment, nabam reduced fruit rotting from 50% to approximately 10%.

Lettuce.—Tip-burn in lettuce is still a major problem. Heads which are apparently healthy when harvested often show tip-burn in the heart leaves and break down quickly. Calcium sprays are of value prior to hearting but have little effect later in the growing period.

Cauliflowers.—Hollow core is a major problem in the quick-maturing Snowball Y cauliflower. This defect is frequently linked with a premature breakdown of the curd. There is some evidence that a boron deficiency may be involved. Nutritional regimes which influence growth rates in the early life of the plant could influence the symptom picture. Investigations are in progress.

Tip-burn in cauliflowers is due to a deficiency in calcium in the leaf tissues. Losses have been substantially reduced since the introduction of foliar spray programmes based on calcium chloride.

Ginger.—Industry interest in mechanization has prompted further work on ginger spacing. The present 18 in. x 6 in. spacing is a compromise based on existing production methods. It would necessarily have to be reviewed if planting on raised beds became standard practice. Recent trials were therefore concerned with correlations between seed-piece size, spacing between plants, yield, and rhizome quality. The results suggest that closer spacings between rows and between plants in the row may increase yields. Further, there is some evidence that close spacing reduces losses from sunburn.

The Ginger Seed Approval Scheme was to have been initiated in 1966 but had to be deferred to 1967 owing to the lack of nematode-free and rootrot-free rhizomes in areas reserved as potential sources of supply.

As there is an increasing demand both overseas and in Australia for Queensland processed ginger, the extensive research programme into manufacturing techniques has been continued. Syruping investigations have indicated the importance of maintaining optimum sucrose-reducing sugar ratios in order to ensure maximum product quality. Trials have also shown that the ginger should be kept in weak syrup for a minimum time before concentration is commenced to achieve a maximum drained weight. The possibility of using objective methods to quality grade ginger is under investigation and promising results have been obtained experimentally.

Marketing.—The establishment of the Rocklea Packing Company Picking Over Shed at the Brisbane Market, has introduced improvements in the regrading and reconditioning of fruit and vegetables. Standards Branch inspectors have supervised picking-over and regrading activities and have advised Company staff on the general handling of horticultural produce. A total of 82,635 packages was regraded and reconditioned, compared with 73,423 packages in the previous year.

The testing of fruit for maturity standards was carried out on samples received from growers and on samples drawn from market consignments, 516 grape samples, 100 citrus and 107 avocado samples being tested. The prior testing of 282 samples of grapes on behalf of Queensland growers who forwarded a total of 712 consignments to New South Wales was continued.

Citrus growers submitted 51 consignments totalling approximately 10,000 cases of oranges, lemons, mandarins and grapefruit for ethylene dibromide fumigation for fruit fly control prior to export to Melbourne and Hobart during March, April and May. Supervision of fumigation and issue of appropriate certificates were undertaken by Departmental officers.

DAIRYING

In the course of duties undertaken under the terms of the Dairy Produce Acts, field officers supervised 12,127 dairy farms. A total of 23,941 farm visits were undertaken by officers and 4,185 visits to dairy product manufacturing plants were made.

Examination of the efficiency of milking machines was continued on an individual request basis and approximately 900 machines were examined.

Routine quality surveys were conducted in dairy manufacturing plants. Examination of butters packed for local sale was continued, 246 samples being obtained from 19 plants; 94% of samples complied with the regulations for quality.

Increasing participation by producers in agricultural extension programmes has been a highlight of field activities. In the South Coast district, five new discussion groups commenced operations and individual groups were established in other centres. The benefits of closer liaison amongst producers and between producers and Departmental officers is becoming widely appreciated and it is anticipated that this type of activity will expand in future years.

Under the Group Herd Recording Scheme, 44,125 cows completed lactations for an average yield of 4,614 lb. milk and 194 lb. fat and an average length of lactation of 261 days, both yield and lactation averages being records. The highest number of herds recorded during a single month was 960, which represents only 8% of the dairy herds of the State.

A total of 4,401 cows in 170 pure bred herds completed recorded lactations for an average yield of 6,793 lb. milk and 302 lb. fat with an average test of 4.4%. A total of 128 cows was credited with production yields of 500 lb. fat or greater. Twenty-seven studs qualified for merit rating, compared with 21 herds in the previous year.

The numbers of cows admitted to the various sections of the Register of Merit were as follows:

Breed	Section of Register		
	Elite	Lifetime	Intermediate
A.I.S.	8	56	107
Ayrshire	1	4	3
Friesian	3	33
Guernsey	1	9	17
Jersey	12	54	102
Total	21	126	262
Total entries in Register ..	130	837	1,720

A total of 86 sire surveys were prepared; they indicated that 35 bulls had plus ratings, 50 had minus ratings and one was maintaining production.

An increasing number of producers are availing themselves of the services of the Herd Recording Section in selection of bulls, and some owners of registered cattle are also seeking advice on their breeding programmes.

In view of the increasing importance of milk solids, pilot investigations were commenced into methods and procedures for recording of solids-not-fat of milk. A comparative study of the Golding Bead method was undertaken and will be continued.

Pilot studies have been commenced into systems other than monthly weighing of milk and butterfat determinations.

Only six herds of goats were recorded during the year; 26 goats completed recorded lactations for an average yield of 1,950 lb. milk and 65 lb. fat.

At the conclusion of the year, 113 demonstrations under the Commonwealth Dairy Industry Extension Grant were being conducted. These included pastures, water harvesting, fodder conservation, fodder crops, nutrition, and plaster water tanks.

The strategic use of high-protein fodder crops to arrest the usual autumn decline in production has been successfully demonstrated. There is now widespread acceptance of the use of cowpea varieties and *Dolichos lablab* on dairy farms for stemming this seasonal decline. One of the main reasons for low production of cows in Queensland is that cows calve in poor condition. Demonstrations to highlight the advantages of good pre-calving nutrition have been carried out in several districts.

Demonstrations designed to improve milk and cream by refrigeration, cow preparation and udder stimulation and the detection and treatment of abnormal milk due to mastitis were continued.

The programme of performance testing farm milk tank units was continued, 18 prototype units being examined.

An incidence of high free fatty acid values in milk from bulk farm milk tank units suggested that problems of lipase activity require more detailed study. Minimal quantities of daily milk production together with variable cooling and agitation and infrequent pick-up periods are regarded as predisposing factors.

The recordings commenced in 1965-66 in four factories to determine the economics of detergent usage were completed during the year. Preliminary analysis indicates an extremely variable control of detergent usage.

Continued work on butterfat losses in buttermilk indicates a considerable degree of dilution during cream processing and average butterfat losses of 1.4 to 1.8%. With a view to establishing a full-scale study of the economy of reclaiming butterfat from buttermilk, a pilot trial was undertaken at one factory.

With the increasing problems of disposal of factory wastes, examinations of the three systems of trickling filter, pond digestion and spray irrigation were continued. Recordings on one spray system discharging hydrochloric acid casein whey and wash water were completed and confirmed that where adequate land is available this is a most economical form of disposal.

The investigation into the spray washing of butter as compared with conventional washing methods commenced in 1965-66 was completed. Results indicated that spray washing provides butter of equal grade quality and with a slightly increased (0.17%) curd content. Cold water usage is reduced by 90%.

In view of the stringent quality standards for non-fat milk powder for Asian markets, technological studies of manufacturing processes have been made. Significant improvements have been effected.

A considerable amount of laboratory research has been carried out, much with the assistance of funds provided by the Australian Dairy Produce Board under its Research and Promotion Grant.

Extensive work has shown that the presence of residues of antibiotics, contamination with bacteriophage and early die-out of starter bacteria can be associated with the development of cheese defects. In circumstances where the cheese starter appears to die out early, there is nearly always an enormous increase in the numbers of other bacterial organisms.

Despite intensive work, it has been impossible to demonstrate a relationship between various organisms appearing in cheese and the development of off-flavours. Some new trends have shown up, however, which indicate that some strains of *Lactobacillus* are beneficial in the production of good cheese flavour.

Various aspects of the bacterial quality of cream have been examined. Bacterial counts on penicillin agar were shown to be a very sensitive indication of contamination of cream after pasteurization. By use of a nitrate reduction test it has also been possible to reveal the bacteriological quality of raw cream. Large numbers of organisms capable of reducing nitrate have been associated with low cream quality and bad flavours, and there has been a close relationship between the numbers of nitrate-reducing organisms and total bacterial counts on penicillin agar medium. It appears that the nitrate reduction test may be valuable in the determination of the bacteriological quality of refrigerated raw creams which show little development of acid-producing bacteria.

Earlier work on the weed taint problem had shown how weed taints may be eliminated or reduced by various feeding and husbandry practices on the farm. However, large quantities of weed-tainted produce are being received by many Queensland factories during the period July to December. Earlier work had also shown means by which weed-tainted butter could be freed of the taint to yield a high-quality butteroil. This process has been successfully applied commercially and butteroil to the value of approximately \$2 million annually is being recovered by this means.

Later work has been directed towards the removal of weed taint from cream, and experimental equipment has been devised in order to achieve this end. It has been observed during this research that weed taint could be reduced by heating to temperatures in the region of 340°F by high-pressure steam, followed by instantaneous cooling to 210°F by expansion. The study of cream and steam velocities, apparatus design and automatic control has yielded a process which has direct application in butter factories and is now being taken over commercially.

Economic advantages in fabrication, installation and operation of the experimental equipment indicate quite strongly that the apparatus designed primarily for the removal of weed taint may, in fact, become the prototype of a new method of cream pasteurization which provides for automatic controls within the limits set by predetermined intensity levels.

The procurement of a high vacuum distillation unit operating as a cold finger molecular still at extremely low

pressures has facilitated the extraction and study of the tainting material from weeds. Taints produced by *Lepidium* have been examined by this technique and a flavour concentrate obtained, the tainting substances of which have been shown by gas chromatography and infra-red spectroscopy to be skatole and indole.

By a similar technique, the tainting substance from *Coronopus didymus* present in unheated cream has been examined. Results suggest that benzyl thiocyanate is the major tainting substance. This substance has been fed to dairy cows and has yielded weed-tainted milk and cream resembling those produced by *Coronopus* weed. These results support previous work which indicates that benzyl thiocyanate is the tainting material from *Coronopus* which passes into milk unchanged after ingestion of the weeds. During vacreation or other heat treatment of the cream this substance is converted to benzyl mercaptan. The biochemical reduction involved has been studied.

Several bacterial organisms producing lipolytic enzymes have been isolated from cheese for the study of the enzymes and their activity.

A new project has been commenced to obtain information on the role of proteolytic bacteria in cheese ripening and spoilage of milk from a study of their proteolytic enzymes. Several micro-organisms have been isolated from milk and cheese and their proteolytic activity as determined by separation and estimation of amino-acids and soluble peptides investigated.

Following a renewed and serious outbreak of the flavour defect in butter made from factory-separated sweet cream, one batch of butter was selected for study. The butter was low in copper content and possessed a flavour described as oxidised and stale. The flavour principles have proved to be substances of very high molecular weight.

Variations in the proportion of non-casein protein to casein in milk used for cheesemaking have shown that the proportion of non-casein protein may be quite important in cheddar cheesemaking and that under certain circumstances appreciable quantities of this protein are incorporated in the cheese and are not lost in the whey.

The production of cheese of standard weight is a matter of some importance in marketing. Trials to produce standard weight cheese were conducted at a number of factories. From the results of these trials it would appear impossible to produce standard weight cheese under our present factory system without some period of pre-pressing and subsequent adjustment of weight.

Work has continued in the production of Blue Vein, Cheshire, Gouda, Edam, Romano and Smokey cheese at various factories. Gradually the difficulties experienced in adapting the manufacture of these cheese varieties to Queensland conditions are being ironed out and cheese true to type is being marketed. Blue Vein, Gouda, Edam and Cheshire cheese are now in commercial production and demand is steadily increasing.

Intensive work on the composition of milk has been carried out at the Malanda laboratory. Changes in milk composition due to season, to feeding and to breed of cattle have been revealed and are being used as a basis for advisory work aimed at improving the overall composition of milk.

An extensive investigation into the incidence and economic significance of mastitis in dairy cattle in Queensland has been completed. The mass of data obtained is being prepared for computer processing.

The quality of milk has been maintained at a high level by the continuance of a State-wide quality service. During the year, 110 instances of sub-legal milk composition were recorded, while 80 samples of milk contained extraneous water. This work has been facilitated by means of a Cryoscope purchased for the Branch by the Brisbane Milk Board.

For many years the coliform test has been used as a measure of the post-pasteurization contamination of milk and cream in dairy plants. Recent work has shown that this test is not completely satisfactory for the purpose and a new test involving counts of organisms resistant to penicillin has been devised and has proved to be a very sensitive indicator of plant contamination.

Over the past decade much work has been conducted aimed at reducing the bacterial content in market milk. High counts arise almost entirely from contamination on farms with thermophilic organisms which will withstand pasteurisation. During the year by the imposition of a more stringent penalty system for farm milks, a very marked improvement in milk quality has been obtained with the result that more than 90% of all pasteurised milk samples now comply.

The original Australia-wide survey of pesticide residues in butter carried out since 1962 was terminated in June 1966. However, following the placing of large orders for Queensland unsalted butter for manufacture into Junex destined for the United States market, the Branch has been requested to recommence pesticide analyses. This work is important and continuing; several hundred samples have been analysed.

Traces of copper in dairy products accelerate the breakdown of butter fat with resultant off-flavours. Consequently analyses of dairy produce, particularly butter, for copper content have been continued. During last year, the average copper content was 0.06 p.p.m. which represents a significantly lower level than the average for the previous year, 0.08 p.p.m., and reduced the average level below that believed to be critical—0.07 p.p.m. This reduction in copper content has been due to the replacement by stainless steel of copper and brass equipment in factories and on farms. It is clear, however, that there still remain many instances, particularly on farms, where produce may be severely contaminated with this metal, and in consequence work in this regard should be continued and if possible, intensified.

SOIL CONSERVATION

Technical services provided by the Department led to the installation of 3,733 miles of contour guide lines on 128,425 acres of cultivated land. This is an increase of 8,000 acres on the area treated in 1965-66. Approximately 80% of the guide lines were in the form of level or graded contour banks and the remaining 20% were for strip cropping and contour cultivation not supported by banks. The strip cropping is confined mainly to the Western Downs and the Central Highlands. The cumulative total of land treated for control of runoff is now 642,434 acres.

A steady increase was evident in all regions except North Queensland and West Central Queensland. The reduction in North Queensland was due to a falling off in the tobacco areas, where many planted for the second year in the same paddocks and did not require new areas marked out. In West Central Queensland, there has been a general air of "wait and see" in regard to all agricultural development in the past year. The drop from 26,000 acres surveyed in 1966 to 19,000 acres in 1967 reflects this attitude.

In other regions, breaking up of land for cropping goes on apace and current rate of agricultural development still exceeds the rate of control achieved. It is estimated that 70% of the area of over a quarter of a million acres being prepared for new cultivation each year is prone to erosion and on this basis some 195,000 acres of new cultivation area needed treatment. Total area treated, including new and old land, was 128,425 acres.

The Wellcamp No. 1 Soil Conservation Project Area was proclaimed on September 1, 1966. Subsequently, a meeting of the landowners was held and the procedure for the co-operative development of the Project Plan was outlined. During the year, the various alternative conservation plans have been considered in conjunction with the landowners and the most acceptable overall drainage plan has been finalized.

During the year, applications from 14 landholders for financial assistance under the Soil Conservation Act were examined, bringing the total number of applications received to 27. Applications totalling \$24,062 were approved and advances totalling \$14,828.28 were made by the Agricultural Bank. The availability of finance for soil conservation work is appreciated by farmers, particularly those in the Central Queensland area. It appears to be most attractive to the man attempting to develop a large property in the face of drought. He is thinking of large-scale work when income is low and credit restricted. In general, however, the smaller man on the developed property still regards a conservation programme as a current expense rather than a capital cost.

Vertical control surveys covering an additional 427,000 acres were completed, bringing the progressive total area to date to 2,481,000 acres. Surveys completed during the year were Drayton (375,000 acres) and the remainder of the Barlil area (52,000 acres).

Further investigations on the performance under water flow of the commonly used Queensland waterway grasses were made during the year. Kikuyu grass, African star grass, Rhodes grass and Queensland blue grass were subjected to the tests at a range of effective heights. Aspects of grass performance studied in detail included vegetation density counts and stiffness of cover, velocity distribution and retardance curve fit.

A tie-ridging trial at Kingaroy on a red earth indicated that the treatment on this red-earth soil is capable of improving moisture storage under certain conditions of runoff under crop. In these conditions, the moisture stored is available for crop growth and may result in increased yields where moisture is limiting crop growth.

A Kingaroy krasnozem was examined for erodibility, the aspects studied being the mechanisms of erosion on a krasnozem and the effects of increasing duration of cultivation on these mechanisms. Field observations suggest that erodibility of the soil does vary with age of cultivation. It appears, therefore, that it may not be the ability of the soil to resist movement which is important in the erosion process, but the soil's ability to absorb the rain falling onto it. It may therefore be possible to explain erodibility of a krasnozem entirely in terms of its infiltration performance under rainfall.

To investigate this finding further, a study was made of the factors affecting the magnitude of infiltration. It became apparent that the soil's ability to resist erosion may be directly related to its ability to resist breakdown under conditions of rapid wetting.

Accumulation of stored moisture has been studied during the short summer fallow period on an Irongate clay soil. The trial was commenced early in the 1966 fallow period and results from two fallow periods are now available. Moisture accumulation during the 1966 fallow period followed a similar pattern on plots burned and retained. Moisture levels at the first sampling were relatively high due to rainfall at harvest of the 1965 wheat crop. No differential treatment of plots was applied prior to burning in late December. Subsequent accumulation of water in soil wet prior to harvest was therefore little affected by stubble treatment.

In 1967 the plots were relatively dry at the time of stubble burning. High-intensity rainfall in the late December-early January period resulted in a marked difference in moisture accumulation due to stubble retention. At the sampling on January 12, average moisture percentage 4 in. to 4 ft. on stubble-retained plots was 32.8%, compared with 28% on burnt plots. A moisture level of 32.8% was not achieved by the bare plots until 4 months later.

Rainfall later in the fallow period resulted in a continuing increment on bare plots with significantly low or no increment on stubble plots. The lower rate of increment could be explained by the reducing infiltration rate with increased depth of wet soil reported in previous investigations, but losses which occurred in the 1-3 ft. levels are not explained. Moisture storage levels at planting showed little difference between stubble and bare plots.

DAIRY PASTURE SUBSIDY SCHEME

The Dairy Pasture Subsidy Scheme was designed by the Government to promote greater use of improved pastures in the dairying industry as a means of increasing production. It came into operation on September 26, 1966, with provision for the acceptance of approved plantings made subsequent to the announcement of the Scheme by the Honourable the Premier on May 9, 1966.

The Scheme provides for a subsidy to all registered dairy farmers currently supplying milk or cream on a commercial basis of a dollar for dollar payment, up to a maximum subsidy of \$14 per acre, for plantings of approved perennial pastures.

The maximum area which can be planted under the Scheme on any one registered dairy farm is 100 acres. The minimum area which can be planted in any one year is 5 acres, while the subsidy is not payable on more than 20 acres a year, subsidy payment on any area in excess of 20 acres being deferred until succeeding years.

The Scheme is administered, under the direction of the Honourable the Minister for Primary Industries and the Director-General of the Department of Primary Industries, by a Central Committee. This Central Committee consists of the Deputy Director, Division of Plant Industry (Chairman), the Director of Dairy Field Services (Deputy Chairman), the Director of Cattle Husbandry, the Director of Economic Services, the Sub-Accountant, and the General Secretary of the Queensland Dairymen's Organisation, with a District Adviser in Agriculture as Executive Officer.

Local administration is obtained through Co-ordinating Committees at Brisbane, Ipswich, Toowoomba, Dalby, Warwick, Gympie, Kingaroy, Bundaberg, Rockhampton, Mackay and Atherton, and 45 District Committees. Each of these committees comprises Departmental officers and a dairy industry representative.

The functions of the District Committees are to maintain contact with farmers participating in the Scheme; to advise on and assist in the preparation of applications to make pasture plantings under the Scheme and in the completion of claim forms after the pastures have been planted. These local committees also recommend to the Central Committee whether applications and claims should be accepted, modified or rejected. All recommendations involving rejection of applications must be agreed to by the industry representatives. Less than 0.2% of applications have required this decision.

Since the Scheme involves a subsidy based on cultivation work performed and seed and fertilizer purchased, rather than a grant, claims must meet the requirements of the Auditor-General before payment is made. Procedures have been developed which satisfy these requirements.

Standard costs for cultivation operations have been determined and lists of approved seed and fertilizer mixtures have been prepared for each dairying district. Provision has also been made for land preparation and sowing techniques in difficult environments, so that special arrangements exist for steep lands, aerial agriculture and soil conservation.

Booklets and information sheets explaining the Scheme in detail are available in all districts for all dairy-farmers.

Results for the period from initiation of the Scheme on May 9, 1966, to June 30, 1967, have been most encouraging and the number of applications rejected totals only 4. The following table illustrates the progress achieved up to June 30, 1967:

Total number of approved applications to plant	2,354
Total area involved	43,490 acres
Average area per application	18.5 acres
Number of claims for subsidy received	985
Number of claims for subsidy paid	785
Total amount of subsidy paid	\$139,828.98
Area covered by subsidy paid	11,569.5 acres
Average subsidy per acre	\$12.08
Area deferred for subsidy payment	1,194.5 acres
Amount of deferred subsidy	\$14,429.57
Number of applications rejected	4

Applications have been most numerous from the higher rainfall areas, where the size of the farms and the difficulty of cultivation have made extensive use of annual fodder crops more costly and in some cases hazardous. In addition, the practical proof by the Department in recent years by demonstration plantings that large-scale sowing of tropical grasses and legumes could be successfully carried out with resultant increases in production has stimulated farmer interest in these areas.

Increased research work being carried out by State and Commonwealth research workers, together with the active interest by seed firms in the production and sale of these newer pasture species, has stimulated increased farmer activity in pasture improvement.

This widely publicized interest in the tropical and subtropical pasture species has unfortunately tended to overshadow the major role which lucerne, green panic, Rhodes grass, buffel grass, paspalum and white clover still have under the Subsidy Scheme in many of Queensland's important dairying districts. It must be emphasized that at present lucerne is still Queensland's major pasture and forage legume.

The distribution of the applications to plant which have been approved, and details of the area involved, are shown below. Areas involved in single applications vary from 100 acres to 5 acres.

District	No. of Registered Dairy Farms	No. of Applications Approved	Percentage of Registered Farms	Total Area Approved	Average Area per Application
North Queensland	628	283	45	6,273	22.1
Central Queensland	757	80	10.6	1,839	22.9
North Burnett	1,249	191	15.3	4,033.5	21.1
South Burnett	1,300	187	14.4	3,256.75	18.5
Wide Bay	2,042	754	36.9	14,017.25	18.6
East Moreton	1,632	350	21.4	5,906.75	16.9
West Moreton	1,981	250	12.6	3,361.5	13.4
Eastern Downs	2,068	228	11	4,079.25	17.9
Western Downs	479	31	6.4	723	23.3
Grand Total	12,136	2,354	18.4	43,490	18.5

It is anticipated that the number of applicants will increase greatly in 1967-68 in view of the good winter rains received in most of the dairying districts and the successes obtained during the first year of the Scheme.

The field work involved in servicing the applications and claims has meant that normal extension and inspection services have been reduced. New appointments to field staff are planned in order to ensure that routine services are maintained in addition to the extra duties involved in the Subsidy Scheme.

The checking of claims in preparation for audit and payment, which will involve a final sum of approximately \$414,000 for plantings made in 1966-67, has necessitated the appointment of an additional three members to Accounts Branch.

It is possible that applications could double in 1967-68 for a total subsidy commitment of more than \$800,000. The modified procedures which have been introduced will be of great advantage to both farmers and Departmental staff in reducing the work involved, but the demands on Departmental staff will be very heavy and further staff adjustments may be necessary.

PASTURE RESEARCH

Pasture work has included introduction and evaluation of new species, studies to define some of the nutritional problems restricting growth of pasture plants, and trials involving grazing management practices.

Several hundred new pasture plants were introduced into Queensland during the year. These include the collections made by Dr. J. P. Ebersohn in low-rainfall areas of Peru, Brazil, Ethiopia and Rhodesia. Already the grasses are being grown at the "Brian Pastures" Pasture Research Station at Gayndah, and at the Department's new laboratory and nursery at Charleville. Legumes are being grown in the Commonwealth quarantine glasshouse at Indooroopilly, but lack of space has made it impossible to grow the entire

legume collection this year. Many of these plants are quite new to Queensland and it is hoped that some will prove to be of real value in the low-rainfall parts of the State.

The testing of earlier introductions has continued at many centres. The performance of *Dolichos axillaris*, particularly under drought conditions in the Cooroy district and at "Brian Pastures", led to the formal release of the cultivar "Archer" by the Herbage Plant Liaison Committee in 1966.

Molopo buffel and Bambatsi panic have done well at the Department's Research Stations at Biloela and Theodore, and can be regarded as promising species for cleared brigalow country. At Biloela they were compared with green panic and Biloela buffel. In early spring molopo had the highest protein percentage and also the highest yield of protein (323 lb. per acre). Bambatsi had the second highest percentage protein. Molopo has been regarded as a shy seeder but research at Biloela has shown that by the application of substantial dressings of nitrogen it is possible to obtain over 400 lb. of seed per acre. On flooded country in Brigalow Area III, Biloela and molopo buffel grasses, Bambatsi-Kabulabula-green panic and Callide Rhodes grass are showing good promise.

Phaseolus bracteatus, *Dolichos axillaris*, *Clitoria ternatea*, and on lighter textured soils fine-stem stylo, are showing sufficient nursery promise to warrant field testing within the central brigalow areas.

On the paperbark tea-tree low-woodland country in the Normanton area, a yield of three-quarters of a ton of Townsville lucerne per acre was obtained where 1 cwt. of superphosphate was applied on the infertile, seasonally waterlogged sands. This was the first attempt at introduction of Townsville lucerne into this area.

The most interesting fact to come out of the great deal of work on soil fertility problems done at the Tropical Agriculture Research Station, South Johnstone, and elsewhere on the humid coast of North Queensland, is the existence of a fairly widespread copper deficiency and to a lesser extent a zinc deficiency. Lack of potash is also indicated in some soils. Addition of copper has sometimes produced 50% increases in pasture yield and, indeed, it almost doubled the yield on one rather sandy soil in the Tully area. Addition of zinc has also produced highly significant yield increases in a number of cases.

The use of nitrogen fertilizers on grass has given excellent pasture yields and liveweight gains in cattle. The annual yield of raingrown kikuyu grass on the Atherton Tableland was raised from 6,000 lb. dry matter per acre to 15,000 lb. by the application of 400 lb. per acre of nitrogen. Pangola grass grown under irrigation on non-tobacco soils at Parada Research Station and fertilized with 300 lb. nitrogen and 2 cwt. muriate of potash produced 1,880 lb. liveweight gain per acre or 977 lb. of beef. The grazing rate was 3 steers per acre, and 9 steers were finished off per acre per year in three drafts.

At South Johnstone, *Brachiaria decumbens* fertilized at the very moderate rate of 175 lb. of nitrogen per acre per annum was stocked at nearly 2 beasts per acre. The liveweight gain for 11 months was 806 lb. per acre. *Brachiaria decumbens* is a very promising grass. It has been grown at South Johnstone for over 30 years and the only obstacle to its wide use has been the belief that it produced very little viable seed. Research has shown that seed production is satisfactory but that seed must be stored for some time before it will germinate.

Seed production of para grass has also been investigated at South Johnstone. This grass is usually propagated by means of runners. It has now been found that seed yield can be increased by means of fertilizers. An increase from 12 lb. to 33 lb. of seed per acre was obtained by using 100 lb. of nitrogen and 250 lb. of superphosphate per acre.

The effect of heavy summer stocking rates on spear grass is being investigated at "Brian Pastures". Native pasture has been grazed at the rate of 1 steer to 1, 2 and 3.3 acres for the period December to May. After 5 years, mostly of below-average rainfall, some interesting trends have emerged. The main effect of the heaviest stocking rate has been a marked decline in spear grass. Queensland blue grass has shown some increase, while forest blue grass has been practically unaffected. In terms of pasture yield and quality, the most heavily stocked paddocks have the lowest yield but the highest percentage crude protein. Animal performance for the five summer periods may be summarized by saying that weight gains per head have been best in the most lightly stocked paddocks (1 beast to 3.3 acres) but gain per acre has been greater at the intermediate stocking rate of 1 beast to 2 acres. Conversely, on all-summer spelled native pastures weaner steers receiving 0.5 lb. digestible protein per day gained 94 lb. during winter.

Mulga pushing for drought-feeding also provides a golden opportunity for pasture establishment. In south-western Queensland, repeated success has been achieved on three experimental sites during the very dry 1965 and 1966 seasons where the establishment of buffel grass cultivars under lopped or pushed mulga is under investigation on low phosphate soils.

The initial results of the entomological survey in brigalow development areas in the Theodore-Moura districts have yielded information on the likely pest population structure during the establishment of properties for primary industries. The volume of material accumulated, however, is greater than can be immediately sorted, mounted, identified and indexed. In the old established southern brigalow areas in the Jandowae-Chinchilla districts, the black soil scarab (*Othnonius batesii* Oll.) has affected beef pastures to the extent of reducing stock carrying capacity by one-quarter. A sound laboratory breeding technique for the species has been established and biological details are being elucidated. Preliminary studies on larvae susceptibilities to a number of likely insecticides have shown promise, and provided a suitable application method and a sampling technique are evolved, field testing of insecticides will follow.

A study was commenced on non-veterinary pests affecting the beef cattle pastures of north Queensland. A wide survey is being undertaken which early pointed to the major importance of termites (several species) infesting pastures, buildings, yards, fences and airstrips. Details are being accumulated on the species involved, population densities and aspects of biology. Control trials have already shown promise that suitable materials other than chlorinated hydrocarbons may be found.

At the request of the poultry industry, poultry manure was used on grasses in the wet wallum. At 12 tons per acre it gave better yields than 6 cwt. of an ammoniated superphosphate potash mixture with trace elements (copper, zinc and molybdenum).

TIMBER CONTROL

Three main aspects of timber control have been under investigation. These are (a) clearing of existing scrubs and forests of brigalow, gidyea, eucalyptus and tea-tree for new development, (b) control of regrowth of the originally dominant trees, and (c) control of native woody plants, such as limebush and sandalwood, which are minor components in the original stand but which become abundant at some stage after the land is put under pasture.

After 16 years of research, the main requirements for the successful development of brigalow country have now been determined. The current research programme at the Brigalow Research Station at Theodore and on private properties on the Western Darling Downs is aimed at quantitative evaluation of the many factors involved in brigalow control.

Studies on chemical control of limebush, and of the ecological factors which govern its distribution and its tendency to become aggressive in old cleared brigalow country, were continued. One chemical (picloram) kills the plant but it is relatively expensive and in addition could have undesirable side-effects.

BOTANICAL STUDIES

Over 10,000 specimens were identified by the Botany Section during the year. Many of them were weeds. Six naturalized plants were recorded for the first time in Queensland; one of them (brown-rayed knapweed) appears to be aggressive and action is being taken to eradicate it.

Vegetation and floristic surveys were carried out at five localities in the State Forest on Fraser Island, in an area of 1,400 sq. miles in the Simpson Desert which has been declared a National Park, and in a wallum area set aside as a wild-flower reserve by the Gold Coast City Council.

Botanical surveys were made of some areas where losses in stock had occurred as a result of suspected plant poisoning.

DEVELOPMENT PROJECTS

The Department co-operated actively with the Irrigation and Water Supply Commission in the field investigations and economic studies which preceded the submission to Cabinet of Joint Reports on the Balonne River Irrigation Project at St. George, the Lower Lockyer Irrigation Project, the Emerald Irrigation Scheme and the Kolan Irrigation Scheme.

Technical assistance was provided to the Land Administration Commission with respect to the Fitzroy Basin Brigalow Land Development Scheme. Departmental officers co-operated in the sampling, testing and submission of recommendations regarding the pasture seed for the sowing of 101,600 acres. Two officers were engaged with land unit mapping activities in selected portions of Area III, mapping 215,210 acres.

As a pilot study, the classification of 12,000 acres in the Glencoe Catchment, near Oakey, was undertaken. This catchment represent a redevelopment community of 40 farmers, most of whom are involved in dairying, pig raising

and grain production. A major erosion hazard has been created by concentration on cropping for many years on the vulnerable slopes.

FARM MANAGEMENT

During the year, Economic Services Branch conducted its fourth school in farm management for Departmental personnel. On this occasion the course was expanded to cover 2 weeks' instruction in basic farm management techniques. The student response to this extra instruction was most gratifying, and the success of the school has helped to ensure that similar courses be conducted annually until all Departmental field staff have received this training.

The Farm Management Accounting Groups Scheme has continued to enjoy interest from many sections of primary industry. Several new groups were formed during the year and initial steps taken towards forming further groups. This is a scheme under which farmers are assisted in keeping and analysing their records, with the aim of improving their management.

The new groups include three from the West Moreton district comprising dairy and agricultural farms; and a small dairy group in the Central Burnett. In addition, a study of the banana industry in Queensland is using the facilities of the scheme to obtain data on financial returns and physical production. At the end of June approximately 170 farmers were recording in the scheme and represented the dairying, agriculture, fruit, grazing and poultry industries.

Further progress has been made in employing a computer to process the monthly returns from farmers and to carry out the annual analysis. The system should become fully operational within the next year and will reduce manual processing to editing of the returns as they are received.

The posting of Agricultural Economists to a further four districts has made farm management advice now available at seven Queensland country centres. Additional postings are planned for the coming year and these, in conjunction with the Accounting Groups Scheme and the training programme proposed for field officers, should make it possible to provide more and more primary producers with a service to which they have previously had only limited access.

The report of the joint committee on farm management accounting was released during the year. A national conference representing all Australian organizations concerned with this subject was held at the University of New England in August, and with a few minor modifications endorsed the findings it contained. The first edition of 2,000 copies, issued as a book under the title "Accounting and Planning for Farm Management", was sold out in 6 months, and reprinting was necessary. Sales of the second printing are continuing at a steady rate.

MARKETING SERVICES

A survey into the quality of eggs entering into consumption in the Brisbane area was extended in an endeavour to ascertain the extent of egg quality deterioration after delivery from the farm. In general, the results were not conclusive in establishing appreciable differences which could be related to the source of supply, regularity of delivery or conditions of storage. The survey pointed to the necessity for greater improvement on the farm, and for better and more regular delivery to the point of sale, before major gains could be obtained from improved storage conditions at retail outlets.

Preliminary work on statistical data relating to broiler production in Queensland has been completed and further work on a survey of the Queensland broiler industry is proceeding.

A study of the market milk situation was commenced during the year. Particular attention is being given to cost of production on farms, transport costs from country factories to Brisbane, and distribution costs to consumers in Brisbane and large country centres.

A study was carried out of factors influencing world cotton production, consumption and prices, and a report on the situation has been published. The report indicates that the future for cotton is not nearly as pessimistic as has been suggested in some quarters.

Investigations into the supply position of vegetable oil-seeds and oils in Australia were made. This study arose primarily from concern in the various oilseed-growing industries that a position of surplus production might be reached following record Australian harvests in 1966 of safflower seed and cotton. The study indicated that the position for the main oil crop, safflower, was still quite sound.

As a part of the general survey of markets in North and Central Queensland, a report dealing with the marketing of dairy produce in the area was issued during the year and work on a study of the potato industry has also been completed.

A further investigation of the income/cost position of agency businesses at the Rocklea Market was completed in May 1967. This investigation revealed that definite problems are arising through the failure of market turnover to increase and the generally low level of fruit and vegetable prices in comparison with rising prices in the rest of the economy. The increasing tendency to by-pass the market is a contributing factor.

Preliminary studies have been made of likely outlets for rice which may be produced in North Queensland. These studies are continuing but at this stage it seems inevitable that the major part of any large-scale production would have to be exported.

Market analysis in respect of crops and livestock products likely to prove agronomically suitable in various irrigation areas, including the St. George and Lockyer Valley project areas, was made. These studies provided a basis for assessment of the economic feasibility of various enterprise patterns in the project areas concerned.

During the year, advice on financial, administrative and marketing matters was given to commodity marketing boards by officers of the Marketing Services Branch. In addition, marketing advisory services to individual producers, producers' organizations and firms dealing in rural produce and farm requirements were continued at a high level.

As in recent years, monthly reports were issued on production trends in the State and on the potato and onion situation in the eastern States. Detailed forecasts of likely production were issued at the appropriate times for wheat, barley, maize, safflower, grain sorghum, linseed, canary seed, white french millet, panicum seed, potatoes, onions and peanuts. Quarterly reports on trends in egg production were also issued. Monthly intelligence reports on overseas grain markets gave growers a current picture of movements in world grain and seed prices. Daily and weekly market reports were issued on prices for fruit, vegetables and produce at the Brisbane market, and the weekly market reports were extended to include additional lines of produce. During the year the market reports on fruit and vegetables were extended to the Toowoomba market and bi-weekly reports were published. Daily reports were also issued on the fish market.

MEAT INSPECTION AND GRADING

Full-time inspection was carried out at all major establishments and part-time at the smaller ones. The industry has continued to outlay considerable expenditure on improvements to meet modern standards required of export establishments, which are also desirable for local trade. As well as slaughtering establishments, many improvements were effected by smallgoods processors, by butchers' shops licensees and to meat delivery vehicles.

Tuberculosis was by far the greatest single source of condemnation of beef cattle and weighed heavily on those herds in which the disease is endemic. Septicaemic conditions in pigs, many associated with arthritis, are a major cause of economic loss in the pig industry.

In spite of adverse seasonal conditions, high quality stock for the local market (though at increased prices) was put up for slaughter, and the majority in most centres met qualifying grade standards.

A successful three-day conference on grading, classification and appraisal of beef and pig carcasses, attended by some 20 officers, was held.

Carcass appraisal duties were carried out by officers at Brisbane R.N.A., Toowoomba, Ipswich, Goomeri, Murgon and Ayr Shows.

Some improvements have been carried out to the Townsville District Abattoir but modification (necessary for adequate inspection and hygiene) of the small stock slaughter floor is still awaited. Bundaberg District Abattoir has undertaken extensive plant modification to provide satisfactory inspection and hygiene. Plans for re-building of the Toowoomba District Abattoir small stock unit are awaited. Existing facilities are adequate at reasonable throughput, but are inadequate at peak slaughtering. Provision of suitable equipment at Ipswich District Abattoir has considerably facilitated inspection procedures. Arrangements for centralized killing by the Rockhampton District Abattoir Board by agreement with C.Q.M.E. Co. and Fitzroy River Abattoir commenced and operations under the agreement have been satisfactory. Inspection facilities and hygiene at Mackay District Abattoir are quite satisfactory.

PLANT QUARANTINE

The improved facilities now available at Port Alma made it possible to authorize the entry of sawn timber from overseas. This now gives Queensland three major ports—Brisbane, Townsville and Rockhampton—for the traffic.

A number of tropical pasture legumes and grasses of potential value to Queensland have been added to the restricted list. This places an embargo on bulk importations of seed but does not preclude the introduction of nucleus stocks of particular varieties or strains for establishment in Queensland. The restriction should prove a stimulus to local production of the seed.

In collaboration with the Forestry Department, steps are being taken to eradicate the exotic West Indian drywood termite recently located at Maryborough. The preliminary survey revealed infestation in eight houses and these are to be fumigated. An extension of the survey to other parts of Maryborough is planned.

The presence of prohibited grain in overseas cargoes is becoming a serious quarantine problem. Treatment is both costly and cumbersome.

ENTOMOLOGY STUDIES

In addition to the field investigations outlined elsewhere in this report, special entomology studies were made at the Department's Science Laboratories at Indooroopilly.

Dichlorvos and fenitrothion have been shown to offer prospect of application in stored grain and seed pest control. Further resistances to the commonly used insecticides have been recorded and data gathered on the cross-resistances and the reasons why the resistances occurred, with a view to offering alternative controls when present methods become ineffective.

Investigations have continued on insecticide resistance in pests of tobacco both in the field and in storage. No new resistances have been recorded. The role of diseases, particularly fungi, in limiting the abundance of tobacco insects is under examination.

Studies were made of polyhedrosis viruses affecting outbreaks of *Heliothis*, armyworms and the cotton looper, and of granulosis viruses affecting codling moth and the cabbage butterfly.

Studies on nematodes infesting deciduous fruit and vines, citrus, peanuts, pineapples, strawberries and bananas were carried out. Peanut yields were increased 16% by applying a granular formulation of DBCP at planting. A hot-water tank for on-the-farm treatment of banana planting material was developed and is now available commercially.

SEED CERTIFICATION AND TESTING

During the year the scope of the Department's seed certification scheme was extended with the inclusion of oats seed in the scheme, with Minhafer as the first variety. At the same time, an Oats Seed Certification Sub-committee was formed.

Seed certification work was also increased when a hybrid maize seed production scheme was commenced on the Atherton Tableland and surrounding areas to provide hybrid maize seed for farmers in those areas. The variety being produced by all growers is the tropical rust-resistant Kairi hybrid K37.

The Queensland official seed-testing laboratory within the Department has endeavoured to improve seed-testing services by introducing more mechanical aids in purity analysis and germination work. Mechanical seed dividers standardised on an international basis and a modern seed blower have been imported. Mechanical vacuum counters to speed up germination work have also been installed.

EXPORT INSPECTIONS

Inspection of export wheat under the Commonwealth Exports (Grain) Regulations was maintained by Standards Branch inspectors at the two major exporting ports of Brisbane and Gladstone. Efforts to clear the record 1966 wheat harvest resulted in a busy shipping programme when 57 vessels, 36 more than in the previous year, shipped a record 414,101 tons of wheat. The cleanliness of the wheat, as regards insect infestation, improved to such an extent that no rejections were necessary.

As from September, 1966, the Standards Branch undertook the responsibility of inspecting flour under the Commonwealth Exports (Flour) Regulations. These inspections had previously been carried out by the Dairy Produce Section of the Commonwealth Department of Primary Industry. A total of 950 consignments of flour, consisting of 505,050 packages aggregating 21,974 tons, was inspected prior to export on 136 ships.

REVIEW OF THE PRIMARY INDUSTRIES IN 1966-67

LIVESTOCK INDUSTRIES

Beef.—Decreased production in Queensland, the main producing State, was reflected in overall Australian production in 1966-67 being below that of the previous year. Production of beef and veal in Queensland for the year was 254,611 tons, compared with 271,045 tons in the previous year.

Although exports since June 1966 increased in comparison with the period 12 months earlier, it is unlikely that the year's total exports will reach the 1965-66 level due to the smaller overall slaughtering. A feature of the export market was the increase in shipments to the U.S.A. During the July-November period of 1966 these represented some 64% of total beef and veal exports while exports to the United Kingdom, formerly the most important market, fell from 41,900 to 28,000 tons. Exports also increased to Japan, where trade has been expanding in recent years.

The future for beef depends on the continuation of demand from the U.S.A. The United Kingdom is still a valuable outlet and the loss of this market would create difficulties. The U.K. 15-Year Meat Agreement is due to expire in October, 1967.

During spring many breeders in northern areas were in very backward condition and deaths were occurring at an increasing rate. Where early supplementary feeding had been practised, however, actual losses were negligible. In autumn, supplementary feeding was again being practised in some regions. The notable and significant facts are that producers widely appreciate the utility of early action when feed shortage threatens; they have acquired skill and experience in the use of supplementary feeding methods; and the price of non-protein nitrogen makes supplementary feeding economically feasible for most producers.

Following the late winter rains of 1966, unfinished cattle were taken off the market, with the result that store cattle prices rose. The price of store cattle has been high in relation to fat cattle prices for a number of years and has frequently been in excess of fat prices. In the year under review and especially in this period following the late winter rains, the price of unfinished cattle was frequently 50% higher than the price for finished cattle for slaughter.

The Federal Minister for National Development announced on March 9, 1967, that \$35 million would be lent by the Commonwealth to the State Government over a 7-year period for the construction of major beef roads in the State. The conditions for servicing this loan are now being negotiated, as this new advance is additional to the current Beef Roads Agreement which has provided finance for a number of development roads during the past 4 years.

The emphasis on this extra road construction programme is for those areas with the highest beef potential. It is thus expected that the greatest contribution will come from roads giving better access to the Cape York Peninsula, the Gulf country and the cattle country running down through the Burdekin district to the Fitzroy Basin in Central Queensland. Priority roads under consideration include Laura to Mareeba; Conjuboy to Townsville; Nebo to Mackay; Dingo to Mount Flora and Dajarra to Mount Isa.

In conformity with State Government policy of opening parcels of coastal lowlands (wallum) for development with private capital, several blocks were released by public tender. Incoming settlers confidently expect that the results from the pasture grazing trials established at the Department's Coolum Research Station, with some possible amendments to fertilizing and pasture management techniques, will be applicable to the blocks, which are situated in the Noosa, Tin Can Bay, Maryborough, Isis Junction and Bundaberg districts.

Wool.—The quantity of wool sold in Queensland during 1966-67 was 636,883 bales, for a total realization of \$95,280,680. Average price per pound was 46.95 cents, compared with 48.52 cents in 1965-66. The highest price for a Queensland-grown fleece was 90 cents per lb.

Wool research and promotion over the next 3 years will benefit from new arrangements under which the Commonwealth Government will contribute for research and promotion on the basis of matching dollar for dollar moneys paid by woolgrowers for these activities by levy on wool sold, subject to the Government's contribution not exceeding \$14 million in any one year. The new arrangement will mean an increase of three million to four million dollars per annum in the sum available.

Following the excellent August 1966 rains the sheep market was mainly a sellers' market. Many lines on offer prior to August were withdrawn by owners who sought to breed quickly from all available ewes to recoup drought losses. Market activity was curbed by continuing dry conditions towards the end of December. Through the following three months there were many forced sales from south-western areas and from the Roma district.

Pigmeats.—Except in Central Queensland, seasonal conditions were favourable to pig-raisers throughout the State. Good winter cereal crops, followed by equally satisfactory summer grain harvests, provided ample feed grains at economic prices.

Changes in the dairying industry are forcing pigs off many farms, but increases in herd sizes, and the entry of more specialist pig-raisers into the industry, more than counterbalance these losses.

Prices received by growers were generally steady between 25 cents and 28 cents per lb. and could be regarded as satisfactory. In North Queensland, in the area from the Atherton Tableland to the coast, marketing difficulties arose as a result of a decline of production in the area which necessitated the introduction of increasing numbers of live pigs and carcasses from outside sources. The position is being investigated with a view to improving the situation in the area.

Eggs.—The operation by the Egg Marketing Boards of Australia of the scheme commonly known as the C.E.M.A. Plan has achieved a large measure of stability in the industry. This stability has resulted in the virtual removal of unnecessary competition between the various Boards themselves on the one hand, and between the individual Boards and groups of their suppliers on the other hand. Average returns to growers increased and this has stimulated expansion which, in the face of rapid reduction of export markets, could lead to embarrassing surpluses. The problem of expanding production is therefore receiving serious consideration by industry leaders.

In 1966-67 Queensland recorded egg production reached 20.7 m. doz., an increase of 3.25 m. doz. on the estimated level for the previous year, and it is considered that production will be increased by a further 2 m. doz. during 1967-68. The Queensland increase over the 2 years was almost 20% in comparison with a Commonwealth average increase of almost 10%. Returns to suppliers to The Egg Marketing Board, despite an average increase of 3 to 4 cents per doz. in the local market price, averaged 36.2 cents per doz. after the deduction of hen levy and Board charges, which is almost $\frac{1}{2}$ cent below 1965-66, and reflects the influence of the weakening of overseas markets.

Following a survey of egg quality at retail outlets, carried out with the co-operation of the Egg Marketing Board, the Board is now giving consideration to ways and means of improving egg quality. As a first step, emphasis has been placed on improvement of yolk colour, with incentives for those producers who maintain a standard colour.

Table poultry.—Production of broilers increased by 21% during the year. There was a marked fall in liveweight wholesale and retail values, with chicken available to consumers at prices competitive with other meats. This fall in price appears to be a feature of a developing broiler industry, where mass production methods are part and parcel of the operation and where some degree of automation can be applied in the processing and packaging stages of production. It is estimated that over \$15 million would have been invested by processors, feed millers, hatcherymen and broiler growers during the past 6 years, to produce an annual gross return of some \$10 million. This has, in turn, provided jobs for over 500 people in the processing, packaging and distribution fields. Despite this massive input of capital and payout in wages, chicken is now cheaper to the housewife than ever before.

The impact of lower prices and temporary over-supply on the interstate market from July 1966 onwards had serious financial repercussions for two reasonably large broiler processing groups. One of these groups sold to the largest processor in New South Wales, while the other was purchased by the major broiler processing company in Queensland. This did not affect individual growers greatly, as their contracts were honoured by the purchasers. Some 95% of all broiler chickens grown in Queensland are now produced under contract. Although the grower no longer exercises choice in regard to purchase of chickens or feed, he does have far more security than before. This applies particularly to new contractual arrangements, where the integrator retains ownership of the flock being reared and pays the grower a set "rearing" fee and a bonus based on results. Nevertheless, the profit margin is not wide and outbreaks of disease such as pullorum consequently could mean the difference between profit and loss.

The processing field has not been without its problems, particularly in relation to water content of deep-frozen chickens. The wide fluctuations in "water" content in chickens has been brought to the attention of some State Departments of Agriculture and it would appear that a Commonwealth-wide approach to the problem will be adopted.

DAIRYING

Seasonal conditions in all dairying districts were generally favourable, though in the Central Queensland and Upper Burnett regions rainfall patterns were erratic.

Levels of production recovered significantly from the previous year, which was characterized by severe drought conditions in most of the dairying districts. Total butter production was 33,202 tons, in contrast with 31,334 tons in 1965-66. Cheese production reached a level of 10,239 tons, which was the highest quantity for 5 years. Total market milk sales remained static at approximately 40 million gallons. Powdered milk products showed a slight increase.

As a result of an increase in butter stocks on hand in the United Kingdom at June 30, 1966, the market was weaker but prices for Australian butter remained steady at stg. 300s. per cwt., which ruled since February 1966. Cheese exports enjoyed better markets. United Kingdom prices were steady at stg. 240s. per cwt. for rinded cheese since April 1966. Difficulty was experienced in meeting this market's requirements due to the expanding markets in Japan and the Philippines, initially pioneered by the Queensland Butter Marketing Board. This was occasioned by the shortage of supplies of milk, particularly in southern States, as a direct result of continuing high export values for casein.

Australian per capita consumption of butter continued to decline, having fallen from 29 lb. to 22.6 lb. per annum over the last 10 years. Per capita cheese consumption, however, has increased from 5.7 lb. to 7 lb. (approx.) per annum.

Legislation enacted by the Commonwealth Government extended the Dairy Industry Stabilisation Plan for another 5 years from July 18, 1967. The features of the plan which have so far been announced continue bounty assistance at a level of \$27 million per annum and guarantee a minimum return of 33.3 cents per lb. to producers for 1967-68. Assistance to exporters of processed milk products is to be continued at a level of \$600,000 per annum. This grant enables manufacturers to meet competition on export markets.

The realization by the industry of the need to expand domestic butter sales led to the decision to allocate 0.75 cents per lb. commercial butter for intensive promotion within Australia. The continued uncertainty of the United Kingdom as an outlet for surplus milk production in the form of butter has focussed attention on the urgency to diversify the manufacture of dairy products and the development of alternative outlets.

The quality of Queensland dairy produce showed an improvement on previous years. Of butter submitted for official grading, 55% was classified as choice grade, compared with 50% in 1965-66. Of the cheese examined by graders, 5% was of choice quality and 89% of first grade standard. A highlight of the year was the exceptionally high percentage of choice grade cheese manufactured by the Millaa Millaa Co-operative Dairy Association.

Considerable interest has been evident among dairy associations in the benefits of amalgamation and diversification and negotiations have been proceeding in several regions.

A total expenditure of \$925,329 was incurred by processing plants in the purchase of new equipment and renovation of existing plant and premises. The greatest proportional development occurred in the cheese industry with an expenditure of \$208,079. Sums amounting to \$281,564 for butter plants, \$292,832 in milk pasteurisation plants and \$142,854 in milk product factories were expended. Two developments of special mention are the plans of the Atherton Tableland Co-operative Dairy Association to instal the first continuous buttermaking machine in Queensland and the Queensland United Food Company's decision to embark on the production of ultra high temperature milk for export sales. Both processes will introduce new technological techniques to the industry.

The number of farmers supplying dairy produce for processing continued to decrease. A total of 12,127 farms was supervised by officers in contrast to 12,946 in 1965-66, a decline of 6.3%. It is evident, however, that the average production per producer continues to increase, suggesting increasing economic stability for those remaining within the industry. The total number of producers consigning milk for both the market milk trade and for manufacturing purposes continued to remain relatively stable.

There was a significant increase in the number of producers and processing plants participating in bulk milk storage and collection. At the close of the year, a total of 592 bulk milk tanks was in operation in 16 districts serviced by a fleet of 41 tankers. Two more associations plan commencement in 1967-68.

CROPS

Sugar.—The 1966 sugar crop produced 2,202,236 tons of sugar from a crushing of 15,507,300 tons of cane. Despite unfavourable weather in some areas, sugar production was 319,000 tons higher than in the 1965 season, and was the highest recorded production. The overall average price was \$83.00 per ton, compared with \$84.58 in 1965. Sugar within peaks averaged \$85.69 and the return from excess sugar was \$35.50. The final price included \$8.56 per ton 94 n.t. from the \$19 million loan to the Sugar Board negotiated by the Queensland Government with the Commonwealth Government.

The sugar industry derives considerable benefits from the protected domestic market to the extent of about 600,000 tons and the U.K./Commonwealth Sugar Agreement provides an assured market for 335,000 tons at satisfactory prices. However, almost two-thirds of Australian exports are at the mercy of free market prices.

The 1966-67 season emphasized the benefits of these protected markets, as free-market prices fell to some of the lowest on record. At the beginning of the year the price was stg. £17 per ton and in December 1966 the price fell to between £13 and £14 per ton.

Negotiations between the State and Commonwealth Governments resulted in ameliorating action being taken. Bounty on nitrogenous fertilizers was raised to \$60 per ton and the Commonwealth Government made available a repayable grant of \$19 million. This enabled the 1966 No. 1 Pool sugar price to be sustained at about the same level as in 1965.

The U.K./Commonwealth agreement was extended to 1974, but the industry is very concerned at the implications Britain's proposed entry into the European Economic Community will have on this agreement. Negotiations were continuing at the end of the year for a new International Sugar Agreement.

Wheat.—In contrast to the previous year's drought-affected crop of 17.4 m. bus. from 950,000 acres, the 1966-67 harvest was estimated at a record 34 m. bus. from 1.1 m. acres, average yield of 30.9 bus. per acre also being a record. The large crop posed serious storage and handling problems for the State Wheat Board. The main increase in production came from new areas planted to wheat in the western and south-western Downs. These areas were formerly grazed for wool, but returns from wheat have been found to be more attractive, at least until sheep losses suffered in the recent drought have been made good.

The favourable growing conditions in South Queensland affected grain quality. The bulk of the best crops was classified Q2A, a feature directly attributed to increased acre/yield. The failure of many crops to achieve higher grading was due chiefly to mottling.

Export sales from the 1966-67 crop were a record and should approach 300 m. bus. out of a record Australian crop of 462 m. bus. China alone purchased over 122 m. bus., and new markets were established in South America.

The International price agreed upon at the Kennedy Round of Tariff Negotiations in May provided for an increase in the minimum return from the export market equivalent to 19-20 cents A.C. per bus. for Australian f.a.q. wheat.

Barley.—The production of barley in Queensland was estimated to have reached a record 11 m. bus. in 1966-67, continuing the trend to larger crops which has been evident since 1961-62. The previous year's crop was 9 m. bus.

Board receipts totalled 7.2 m. bus., of which about 75% is estimated to be of malting quality. A major marketing development during the year was the decision by a Southern maltster to establish a malt-house in Queensland. This will result in freight savings to growers as well as assuring them an increased local market. Queensland barley continued to enjoy a ready acceptance by maltsters, and prospects for increased sales are good.

Grain sorghum.—The 1967 grain sorghum harvest was estimated at 9.5 m. bus., more than 1 m. bus. less than the 1966 harvest.

Conditions in the main production areas were generally favourable and the average yield was estimated at 28.8 bus. per acre sown, one of the highest for 5 years. Export sales were made to Japan, which offers an excellent long-term market for Queensland grain sorghum. The demand from export markets resulted in prices on both the local and export market being higher than those realised from the 1966 harvest.

Alpha remains the main variety in the Callide and a swing back to it in the South Burnett is reported. The best performances on the Darling Downs came from the fast-maturing varieties, with Texas 610 and Texas 608 more popular than Texas 671 and Dekalb material.

A number of firms processing and packaging certified sorghum seed have installed slurry (wet dressing) machines for disease and insect control treatment of seed. These machines were introduced following Queensland experiments which showed that treatment of seed with the compound TMTD resulted in field strikes in cool weather being superior to those of seed treated with organic mercury preparations. TMTD is also more compatible than mercury compounds with maldison.

The mechanical drying of freshly harvested seed has attracted the attention of seed producers. Fourteen growers have arranged to install driers and two firms processing certified seed have also installed driers.

Maize.—Maize production in Queensland in 1967 is estimated at 4.3 m. bus., compared with 5.4 m. bus. in 1966. The estimated yield of 26 bus. per acre is slightly below the average for the last 5 years, but well below the average of 31.8 bus. per acre recorded for the 1966 season. Adverse conditions were experienced on the Atherton Tableland early in the season but conditions elsewhere were good.

Tobacco.—Plantings for the 1966-67 season were some 400 acres more than the previous year. Favourable growing conditions resulted in improved yields and quality in the north, but southern crops suffered from wet weather and hail. Following upon the successful introduction of the tobacco stabilisation scheme, Queensland tobacco growers sold 14,284,690 lb. of quota leaf from the 1965-66 crop. The excess over the Queensland quota of 14 m. lb. resulted from a shortfall of 696,000 lb. in the New South Wales quota, caused by drought. The average price realised was 113.7 cents per lb., compared with an overall Australian average of 116.3 cents. The average price realised in Queensland for the 1964-65 crop was 98.3 cents per lb.

During the first sale series of the 1966-67 crop in Mareeba some selling difficulties were experienced, with large percentages of leaf remaining unsold at auction. However, most of this leaf was subsequently cleared under the terms of the stabilisation scheme. Overall, clearances appear satisfactory. However, there is some disquiet among growers at the apparent continuing downward trend in prices, and the fluctuations in prices received at auction resulting from decreased competition at auction.

Cotton.—Major changes took place in the Queensland cotton industry during the year.

Following upon an analysis by the Marketing Services Branch, in conjunction with The Cotton Marketing Board, of ginning and marketing costs for South Queensland cotton, it was decided to move the Board's ginnery at Brisbane to Cecil Plains, the centre of the growing area on the Darling Downs. This move has resulted in lower freight costs to South Queensland growers, and should encourage further expansion of cotton-growing on the Darling Downs, which is now the largest single production area in the State. The Cecil Plains ginnery handled the record 1967 South Queensland crop without difficulty.

In 1966-67 the Cotton Marketing Board adopted a zone basis for delivery of cotton and also for accounting purposes, ginnery operating costs and sales realizations. Zoning provisions of The Primary Producers' Organisation and Marketing Acts were invoked, and for these purposes the State was divided into two zones, one based on Rockhampton and the other on Cecil Plains. At the same time, grower representation on the Board was increased from six to seven through the creation of a new district.

Queensland cotton production in 1967, estimated at 13,000 bales of raw cotton, was the highest of the post-war years, and the increase can be attributed to the expansion of irrigated production in the major cotton growing areas of the State. The season's planting comprised 6,000 acres irrigated in the Darling Downs/Lockyer, 3,000 acres irrigated in the Dawson/Callide, and 1,500 acres raingrown in Central Queensland.

Peanuts.—Total production from the 1966-67 peanut crop is forecast at a record 36,000 tons of nuts in shell. The area finally planted is now estimated at 69,000 acres, of which 67,000 acres is expected to be retained for harvest. This season's tonnage is 33% higher than the 27,187 tons officially recorded last year from 57,298 acres, and nearly 16% higher than the 31,084 tons recorded in 1959, the greatest so far. The estimated acreage will, if realised, also constitute a record but the yield per acre sown, 1,169 lb., has been exceeded on several occasions.

Southern and Central Queensland sources are expected to provide 24,500 tons of Virginia Bunch and 9,300 tons of Red Spanish, or 33,800 tons from 64,400 acres, while North Queensland production is estimated at 2,200 tons from 4,600 acres sown.

Navy beans.—A good navy bean harvest is expected from the 1967 season. Production is estimated at 1,500 tons from about 8,000 acres and indications are that the crop is of high quality, in spite of considerable losses due to heavy rain in June. Australian requirements are of the order of 5,000 tons per annum, and this is increasing steadily.

Oilseeds.—Soybeans dropped further in popularity in the past season, with total planting limited to 1,000 acres, virtually all in the South Burnett, compared with 3,000 acres in the previous season. The loss of popularity is due to the poor yields and low per acre returns of recent seasons. Growing conditions were favourable, and total production is estimated at 16,000 bushels. Semstar variety, a selection by a farmer in the South Burnett, is gaining popularity in the South Burnett.

The 18,000 acres of linseed harvested in 1966 was well below the figure for several years past, except 1965. Prospects for expansion under the current price structure are not bright. It is unfortunate that the demand for linseed should fall away just at the point where Departmental research has brought out ways of correcting nutritional problems associated with the production of the crop on the Darling Downs. However, it is possible that research findings of this nature could restore profitability to linseed growing.

Safflower seed production in Queensland from the 1966 harvest established a new record at about 30,000 tons, almost three times the size of the previous largest crop. This resulted from a record planting of over 100,000 acres and record

yields following good seasonal conditions. The big increase in safflower plantings may be attributed partly to the sponsoring and handling of the crop by the Queensland Grain Growers' Association acting as agents for a processor. Another factor was the absence of planting rains for the main wheat crop on the Central Highlands, where growers planted large areas of safflower in August. Plantings on the Darling Downs were small.

Deciduous fruits.—The Stanthorpe apple industry was poised for a further production increase following a recovery in 1966 from the disastrous drought and hail losses experienced in 1965. However, hail damage was widespread and reduced both the size and the quality of the crop. Export fruit was reduced to a meagre 50,000 bus., compared with 200,500 bus. exported in 1966. However, the stone fruit harvest was very favourable as regards both price and quality.

Cultural practices continue to improve. Of particular interest is the use of irrigation to improve both the size and the quality of pears and stone fruits. Mechanization of harvesting operations is becoming streamlined to speed the handling of the crop. This is essential for the efficient marketing of early-maturing varieties and the organization of export consignments through the port of Brisbane.

Pineapples.—The pineapple industry continued to expand and production in 1966-67 was about 10% higher than the 1965-66 harvest of 4,588,000 doz. Some industry leaders view the continued expansion with concern, as the additional harvest requires that much more fruit be placed on the highly competitive export market, with a consequently lower unit return to producers.

Mechanized equipment for spraying, harvesting and transport is coming into general use in the industry. This has little effect on production costs but it reduces the physical demand on the labour force and permits an increase in plantation size.

Bananas.—Banana prices were not as high in the second half of 1966 as in 1965, but nevertheless were well above levels for previous years. The market situation in the first 6 months of 1967 was favourable and the industry generally showed a sound recovery. An otherwise bright picture was spoiled by severe flood damage to North Queensland plantations in February.

Banana production per acre is high in plantations which are efficiently managed. The quality of the fruit placed on all markets is good and the industry is probably more stable than it has been for some time past.

Crop control is an important factor in plantation management but it must be supplemented by precision harvesting if the "mixed-ripe" fruit problem is to be kept to a minimum. The bunches must be cut at a relatively early stage of development when the fruit is to be consigned to distant markets.

Citrus.—Harvesting of the 1967 citrus crop was well under way by the end of June. Quality of the Navel variety has been very good but prices have been slightly less than in 1966. The early market for Queensland citrus was affected somewhat by the later marketing of Valencias from southern States. A heavy lemon crop may find market outlets insufficient.

Avocadoes.—Though plantings of avocadoes are comparatively heavy, the future for this crop is not bright, mainly because of tree losses from root-rot fungi. However, some large speculative plantings are now bearing. Production from these could have a major impact on southern markets and may expand outlets for the fruit.

Passionfruit.—The reduced demand for passionfruit by processors has been followed by a decline in the area under crop.

Strawberries.—Strawberry production in 1966 was about average but fruit losses late in the season were high following frequent rains which favoured the development of grey mould. The performance of virus-free runners has been generally better than that of field-run planting material and the available stocks are in keen demand. Typically, the plants are more vigorous. This gives some latitude in times of planting and opens up the possibility of retaining part of each annual planting for a ratoon crop.

Papaws.—Processors now impose minimum standards for nitrate in papaw fruit delivered to canneries. As compliance with these standards may prove difficult, a decline in the area under crop is expected.

Vegetables.—Potato production in 1966-67 remained at the comparatively high level of about 100,000 tons. However, the recovery of potato-producing areas in southern States brought about a general decline in values in 1966-67 and the gross value of the 1966-67 Queensland crop, estimated at \$6,000,000, was only half that of the previous year. The Lockyer Valley remains the largest production area, growing more than half the State crop. The autumn crop in both southern and northern areas was seriously damaged by heavy rains.

The 1966-67 onion crop was about normal at 25,000 tons from an area of 3,500 acres. This represented a complete recovery from the drought-affected harvest of 17,728 tons from 2,748 acres in 1965-66. More than half of the crop was planted for the mid-season harvest. As a result, supplies reached glut proportions and prices were low.

Production of tomatoes during the year was in excess of demand. Fruit quality in autumn was variable, as diseases and physiological disorders were more troublesome than usual.

It seems only a question of time before stringless beans will replace string beans on the fresh vegetable market. They are in strong demand and command premium prices. Production of stringless beans for processing is now an established industry at Bundaberg, where some 1,000 acres were grown under contract last year. Further expansion can be expected, as production hazards in the Burnett are fewer than in the southern States.

The Department's bean breeding programme aims to produce both flat-podded and round-podded varieties of stringless bean with acceptable agronomic characters. It is assumed that, in time, the consumer will prefer the round-podded bean if quality is comparable. Parental material with the necessary plant and pod characteristics is available.

Peas for processing are grown mainly in the Lockyer Valley. In 1966, some 800 acres were planted and yields were generally satisfactory. The bulk of the crop was planted in June for an early summer harvest. Rain disrupted harvesting operations and some crops had to be left in the field for seed.

Cauliflower production at Stanthorpe is expanding now that growers have the technical skills to handle the crop efficiently. The crop is marketed in late summer and autumn before the coastal crop matures and the heads command a ready sale.

Ginger.—Plantings for the 1967 ginger crop were down by about 25 acres on the 1966 record of 301 acres. This is expected to be no more than a temporary reversal of the expansion recorded over recent years. Production also will be down on 1966, as a bigger percentage of the crop was harvested at an early stage, with a consequent reduction in the size of the higher yielding late crop. The market for early crop ginger continues to expand and no difficulties are expected in disposing of the crop. Market prospects for dried ginger from the late crop are uncertain but the reduction in the 1967 crop will allow the clearance of carryover stocks from the 1966 crop. Further expansion of the late harvest ginger crop will depend upon the outcome of the Tariff Board enquiry on Essential Oils.