L. W. Winders

ANNUAL REPORT 1963-1964

Queensland Department of Primary Industries

Presented to Parliament by Command

, A.A.S.A.

..., A.R.A.C.I.

. 33—1964

ORGANISATION OF THE DEPARTMENT AS AT 30th JUNE, 1964

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

CENTRAL ADMINISTRATION AND CLERICAL AND GENERAL DIVISION—

Director-General and Under Secretary .. (Seconded as General Manager of the Public Abattoir and Chairman of the Queensland Meat Industry Board, 25-6-64)	W. Webster, B.V.Sc.
Deputy Director-General .. .. .. (Appointed Acting Director-General and Under Secretary, 25-6-64)	W. J. S. Sloan, M.Sc.Agr.
Assistant Under Secretary	H. Barnes
Special Administration Officer	C. L. Harris, A.A.S.A.
Officer in Charge, Information Services ..	C. W. Winders, B.Sc.Agr.
Accountant	E. C. R. Sadler, A.A.U.Q.
Director of Development Planning .. .. (Acting as Deputy Director-General, 25-6-64)	D. N. Sutherland, B.V.Sc.

DIVISION OF PLANT INDUSTRY—

Director of the Division .. .. .. (Appointed Deputy Director-General, 4-2-64)	W. J. S. Sloan, M.Sc.Agr.

Agriculture Branch—

Director of Agriculture .. .. .. (Appointed Director of Plant Industry, 6-4-64)	L. G. Miles, B.Sc.Agr., Ph.D.

Horticulture Branch—

Director of Horticulture	J. H. Smith, N.D.A., M.Sc.

Soil Conservation Branch—

Director, Soil Conservation Branch ..	J. E. Ladewig, B.Sc.Agr.

Science Branch—

Sections of Botany (S. L. Everist, B.Sc., Government Botanist); Entomology (W. A. McDougall, D.Sc., Government Entomologist); and Plant Pathology (B. L. Oxenham, B.Agr.Sc., Government Plant Pathologist).

Agricultural Chemical Laboratory Branch—

Director, Agricultural Chemical Laboratory Branch	W. J. Cartmill, M.Sc., A.R.A.C.I.

Food Preservation Research Branch—

Director, Food Preservation Research Branch	S. A. Trout, M.Sc., Ph.D., F.R.A.C.I.

DIVISION OF ANIMAL INDUSTRY—

Director of the Division	A. L. Clay, B.V.Sc.
Assistant Director	C. R. Mulhearn, B.V.Sc.

Veterinary Services Branch—

Director of Veterinary Services	C. R. Mulhearn, B.V.Sc.

Pathology Branch—

Director	L. G. Newton, B.V.Sc.

Biochemical Branch—

Biochemist	J. M Harvey, D.Sc., A.R.A.C.I.

Husbandry Research Branch—

Director of Husbandry Research	J. W. Ryley, B.V.Sc.

Sheep and Wool Branch—

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

Cattle Husbandry Branch—

Director of Cattle Husbandry	G. I. Alexander, B.V.Sc., M.S., Ph.D.

Pig and Poultry Branch—

Sections of Pig Husbandry (F. Bostock, Senior Pig Husbandry Officer); and Poultry Husbandry (F. N. J. Milne, B.Sc., Senior Poultry Husbandry Officer).

DIVISION OF DAIRYING—

Director of Dairying	E. B. Rice, Dip.Ind.Chem., M.Inst.Biol.

Research Branch—

Director of Research	L. E. Nichols, B.Sc.Agr., A.R.A.C.I.

Field Services Branch—

Director of Field Services	V. R. Smythe, M.Agr.Sc.

DIVISION OF MARKETING—

Director of Marketing	A. A. Ross, M.Agr.Sc.

Marketing Branch—

Director of Marketing	A. A. Ross, M.Agr.Sc.
Assistant Director of Marketing	D. P. Lapidge, B.Com.

Economics Research Branch—

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

Standards Branch—

Standards Officer	A. C. Peel, Dip.Ind.Chem., A.R.A.C.I.

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REPORT OF THE DEPARTMENT OF PRIMARY INDUSTRIES FOR THE YEAR 1963-64

To the Honourable the Minister for Primary Industries

Dear Sir,

As Acting Director-General of Primary Industries, I have pleasure in submitting herewith the Annual Report of the Department of Primary Industries for the year 1963-64.

This is the first report of the Department under its new name, the change from Department of Agriculture and Stock having been made on September 26, 1963.

The direction of the Department's operations changed hands twice during the year. Dr. W. A. T. Summerville left in February to become Agent-General for Queensland in London, and his successor (Mr. W. Webster) was seconded as Chairman of the Queensland Meat Industry Board and General Manager of the Brisbane Abattoir in June. This secondment is to be reviewed later in 1964.

Yours faithfully,

W. J. S. SLOAN,

Acting Director-General of Primary Industries.

A TIGHT SQUEEZE

The Divisional and Branch reports which follow reveal solid achievement during the year in most of the Department's operations. But attention is drawn to activities which had to be curtailed and to projects which failed to prosper.

Financially, it was a tight squeeze to accomplish what was done. The constriction of funds was felt all along the line and contributed much more than staff shortage to contraction of activities that might usefully have been expanded.

Excluding Sugar Bulk Handling Facilities expenditure, the expenditure for the year was £4,160,650. Approximately half of this was from trust and special funds earmarked for specific purposes. The chief funds of this nature are the Stock Fund, the Sugar Cane Prices Fund, the Poultry Industry Fund, the Commonwealth Dairying Industry Fund, the National Pleuro-pneumonia Fund, the Tobacco Research Fund, the Australian Cattle and Beef Research Fund, the Dairy Produce Research Fund, the Wheat Research Fund, the Wool Research Fund, the Brian Pastures Fund and the Buffalo Fly Control Fund. Consolidated Revenue Fund provided the other half of the expenditure.

The rate at which new buildings are being provided from Loan Fund to allow a reasonable improvement or expansion of research and other services is most disappointing. Not only are some approved buildings making slow progress, but other buildings regarded as necessary cannot be brought even to the planning stage because no early financial provision for them is in sight.

Fortunately, some outside funds have been made available for capital improvements on field stations.

THE WEATHER WAS PATCHY

The outstanding feature of the weather picture for the year was the drought conditions which prevailed in east-central Queensland, the Burnett and parts of the western Darling Downs in 1964. The main effects were felt in the beef, dairy and grain sorghum industries.

Conditions in the pastoral areas in the first quarter of the period were generally good, with useful rains in August in most of the eastern districts and part of the west. Rains in late spring and early summer were scattered, and parts of the north-west, central Queensland, the Burnett and the south-west were at that time very dry. The New Year began with pastoral conditions generally good, but the failure of the monsoon rains in February and March caused a deterioration in conditions, and a drought belt developed from central Queensland through the Burnett.

For crops, the year was one of extremes. Winter crops sown in June benefited from good general rains in August, but wet conditions around harvest time caused some trouble. A large area of summer crops went in on the early summer rains, but prolonged heatwaves and dry conditions in January and February greatly reduced the prospects of good crops and generally it turned out to be a poor year for grain sorghum and other summer crops. Production of most horticultural crops was maintained at or near average.

The patchy weather conditions in the agricultural and adjacent districts were reflected in a slight decline in yield of milk.

A GLANCE AT STATISTICS

At the time of writing, few statistics on the full year's production are available. The following figures and their variation from the previous year are, in the main, subject to revision:—

Wool sold ..	845,714 bales	Up by 6·4 per cent.
Slaughterings at works—		
Cattle	1,268,265	Up by 5·4 per cent.
Calves	347,419	Up slightly.
Sheep	1,311,564	Up by 23 per cent.
Lambs ..	315,350	Up by 11·9 per cent.
Pigs	520,789	Down slightly.
Poultry ..	8,032,523	Up by 44 per cent.
Dairy products—		
Total milk yield	237,400,000 gal.	Down by 2·3 per cent.
Butter	79,220,000 lb.	Down by 3·0 per cent.
Cheese ..	21,264,000 lb.	Down by 7·0 per cent.
Eggs received by S.Q. Egg Marketing Board ..	10,676,965 doz.	Up by 8 per cent.
Crops—		
Sugar cane, 1963	11,500,672 tons	Down by 4·9 per cent.
Raw sugar, 1963	1,651,831 tons	Down by 6·7 per cent.
Wheat	22,000,000 bus.	Up by 17·7 per cent.
Barley	5,000,000 bus.	Up by 25 per cent.
Linseed ..	800,000 bus.	Up by 38 per cent.
Grain sorghum (forecast)	3,800,000 bus.	Down by 40 per cent.
Maize (forecast)	3,700,000 bus.	Down by 16 per cent.
Peanuts ..	19,000 tons	Up by 19 per cent.
Tobacco leaf ..	16,000,000 lb.	Up by 12 per cent.
Cotton (forecast)	4,500 bales	Down by 27 per cent.
Apples ..	1,675,000 bus.	Up by 12 per cent.
Pineapples ..	72,000 tons	Up by 1,000 tons.

Plate 1: The trek through 120 acres of improved legume-grass pasture during a field day on Mr. W. Grant's dairy farm at Pinbarren, Pomona.

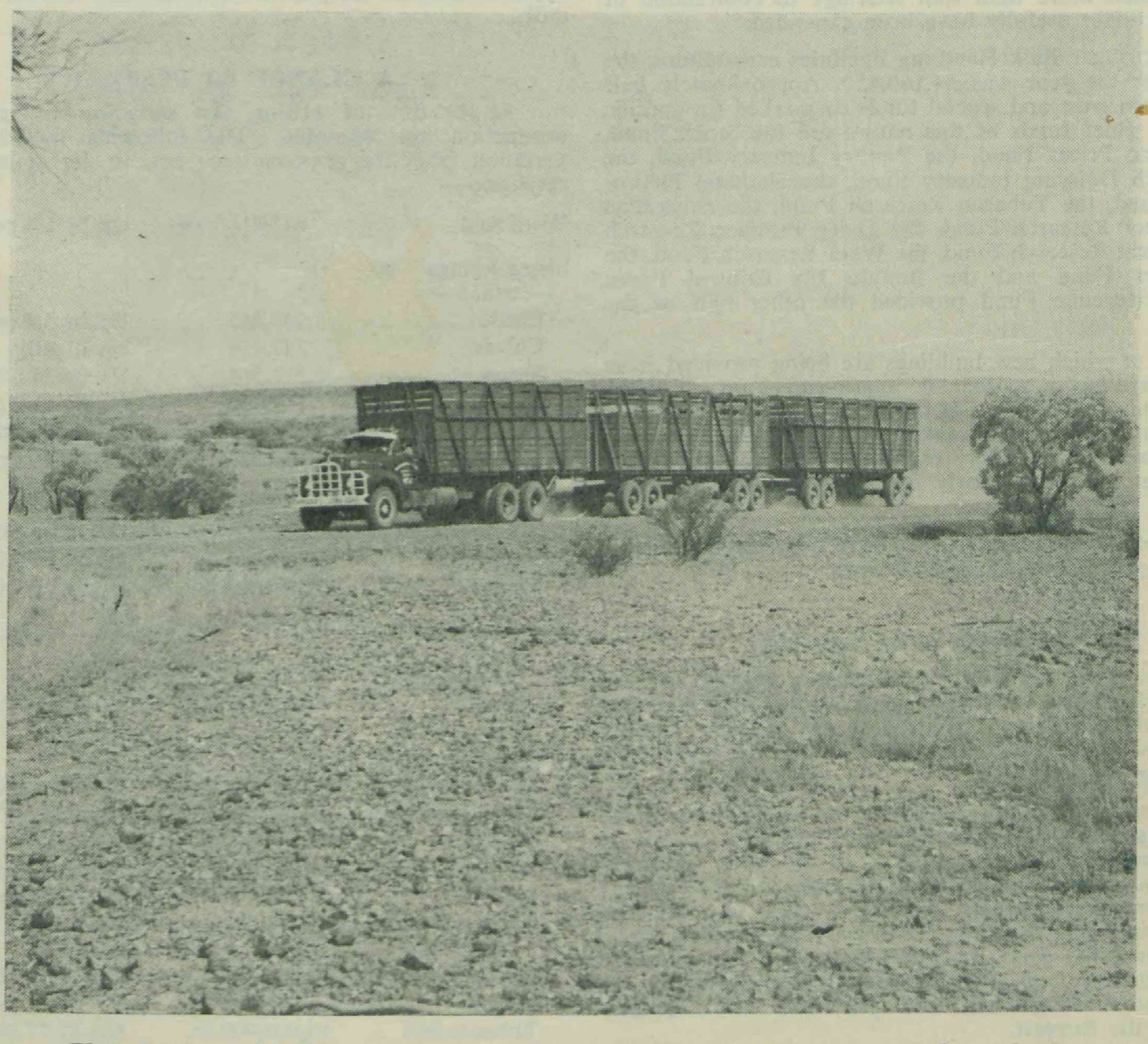

Plate 2: A road train on the move in the channel country of south-west Queensland.

"BEST EVERS"

Among the records established during the year were—

Poultry slaughtered	8,032,523
All crop area	3,638,512 acres
Sugar cane area	508,414 acres
Wheat planting	937,606 acres
Wheat crop	22,274,499 bus.
Green fodder area	Over 1 million acres
Linseed planting	83,336 acres
Fruit area	47,957 acres
Holdings with irrigation	8,915
Irrigated crop area	224,009 acres
Irrigated pasture area	27,360 acres
Artificial fertilizer used	3,666,531 cwt.

CROPPING EXPANSION CONTINUES

Ten years ago the area under crop in Queensland reached 2½ million acres for the first time. When the figures for the past year are known, it is certain that they will top the 3½ million figure.

A million acres in 10 years is a striking enough gain in itself, but the last two annual jumps have averaged over 200,000 acres. Is this rate going to be maintained? If it is, what are the implications for the Department?

The break-up among crops and the geographical distribution of new acreages provide grounds for speculation on the direction in which we are travelling in land utilisation.

In terms of acreage, wheat has shown the most spectacular increase. In two years, the area planted to this crop has risen by a quarter of a million acres to reach a total of 1 million acres. Compared with the other mainland States, we are very small fry in wheat production—even South Australia has over 2½ million acres—but at a conservative estimate Queensland could double its present acreage.

The limiting factor in wheat production is the ability of the farmer to conserve summer rainfall in the soil for winter use by the wheat crop. Grain sorghum, which at 30 years of age as a Queensland crop is virtually still an adolescent, does not face this disability: we have millions of acres of suitable soil in our summer rainfall districts. One can visualise millions of acres under grain sorghum, in contrast to the present 320,000 acres, even if its use is restricted to stock feed. If it became universally accepted for human food, its potential would be even greater.

The human food and stock feed grains between them are likely to account for the major part of the cash crop acreage expansion for many years to come.

Experience with the grain crops in Queensland has shown that once the practicability of profitable production in a new area is demonstrated, landholders will plant up without a great deal of persuasion.

The main jobs that fall to a technical agricultural department are not promoting grain planting but consolidating production methods and ensuring conservation of soil. The skill and enterprise of farmers will take them a long way, but they have to rely largely on technical and scientific authorities for soil conservation planning and in particular for varietal improvement.

The facility with which rust fungi can change their form to keep abreast of the plant breeders points up very vividly the need to devote adequate resources to plant breeding. And soil losses that have occurred in several developing areas, such as Wandoan and the Central Highlands, underline the other point made—that soil conservationists are a key factor in land-use planning.

The crops with a high cash value per acre will not expand to anything like the same extent as the grain crops, but some are making substantial acreage gains. With more irrigation opportunities opening up all the time, the high-value crops can be expected to march forward quite rapidly.

These high-value crops and new crops make heavy demands on research and extension services—perhaps even more than do the broad-acre crops.

If new crop areas are to be developed on the basis of sound land utilisation rather than exploitation, if a continuous improvement in production methods and production economics is to be maintained, then the necessary technical and scientific services must be provided.

They must be provided to a large extent on the spot. Basic research may be done at a regional level—but district testing and advice call for local staff and facilities.

EXPANSION IN SUGAR

During the year, sugar was rivalled only by oil in public discussion on the progress of Queensland. The recommendations of the Sugar Inquiry Committee set up by the State Government early in 1963 were endorsed by the Government shortly after the receipt of the Committee's report in October 1963.

As a result—

- The Central Sugar Cane Prices Board has granted assignments establishing almost 1,100 new farms totalling 62,000 acres.
- An additional 83,000 acres has been added to existing assigned land.
- The State's 31 sugar mills have become involved in expenditure totalling some £25 million.
- Bulk sugar installations at ports are being enlarged and improved.
- Seismic surveys have been commenced as a preliminary to the improvement of sugar ports.

The target of 2·43 million tons of raw sugar by the 1970-71 season is a long way in advance of the record of 1·77 million tons set in 1962-63. But the rapidity with which the initial phase of development was put in hand augurs well for the future. After all, the last expansion completed in 1953 raised annual output by 300,000 tons within three years.

While one can be optimistic about the availability of markets for the increased production, it would be unwise to base financial expectations on the overseas prices which ruled in 1963, which was a period of shortage.

The farmer buying into canegrowing at this stage could easily be disappointed with the return on his capital if he was tempted to pay an inflated price for land. The provision that all sales of assigned land must be approved by the Central Sugar Cane Prices Board operates against unrealistic land transactions.

The possible development of a substantial acreage of cane on the Ord River project in Western Australia has implications for Queensland and New South Wales growers, inasmuch as the domestic sales as well as the more profitable portion of overseas sales would have to be shared.

The current world situation of countries with latent capacity looking to increasing production could easily build up to burdensome surpluses of sugar. The situation is being examined by the International Sugar Council, but the reintroduction and operation of a fully effective International Sugar Agreement with quota provisions before 1966 seems unlikely.

For the present, increasing domestic consumption, existing Commonwealth quotas, a long-term contract with Japanese refiners, United States statutory and global quotas, a new market in Malaysia and other outlets are available to the industry.

TROUBLE IN TOBACCO

In the heat and bitterness that flare up when hard-working producers find that their product is not wanted by consumers, the underlying causes sometimes tend to be obscured. The 1964 tobacco leaf sales are a case in point.

At the north Queensland sales, 654 tons of leaf of a total of 7,406 tons offered remained unsold by reason of being passed in or attracting no bid. The unsold portion represented 8·8 per cent. of the total offerings. At the northern sales in the previous year, less than 3½ per cent. of the 6,115 tons offered remained unsold, and this was mainly leaf from the ill-starred Burdekin tobacco area.

Further, average price realised for the northern leaf in 1964 at 129·6d. per lb. was well below the averages of over 140d. per lb. for the previous two seasons and only slightly higher than in the disastrous selling season of 1961.

With production up by almost 1,300 tons in the main producing area of Australia, the quantity of Australian leaf available from the 1963-64 harvest would obviously be well in excess of the blending percentage for cigarette and cut tobaccos to operate during the manufacturing year commencing July 1, 1965.

Buyers were thus able to exercise considerable discretion in their purchases without sacrificing any of the benefit to which they would be entitled under the Commonwealth Government's system for encouraging the use of Australian tobacco leaf in blends. They were interested mainly in leaf of a quality suitable for their special needs and accordingly there was a considerable amount of "passed in" or "no bid" leaf.

The sales of southern Queensland and northern New South Wales leaf conducted later in Brisbane saw an even higher percentage of unsold leaf.

With a crop such as tobacco leaf, which requires favourable weather conditions and exacting care and skill at all stages of production, it is not surprising that a proportion of the cured leaf is sub-standard. No system of price stabilisation can take care of the unskilled grower. He either has to develop the requisite skills—and here the Department's extension service has a challenging task—or suffer the consequences.

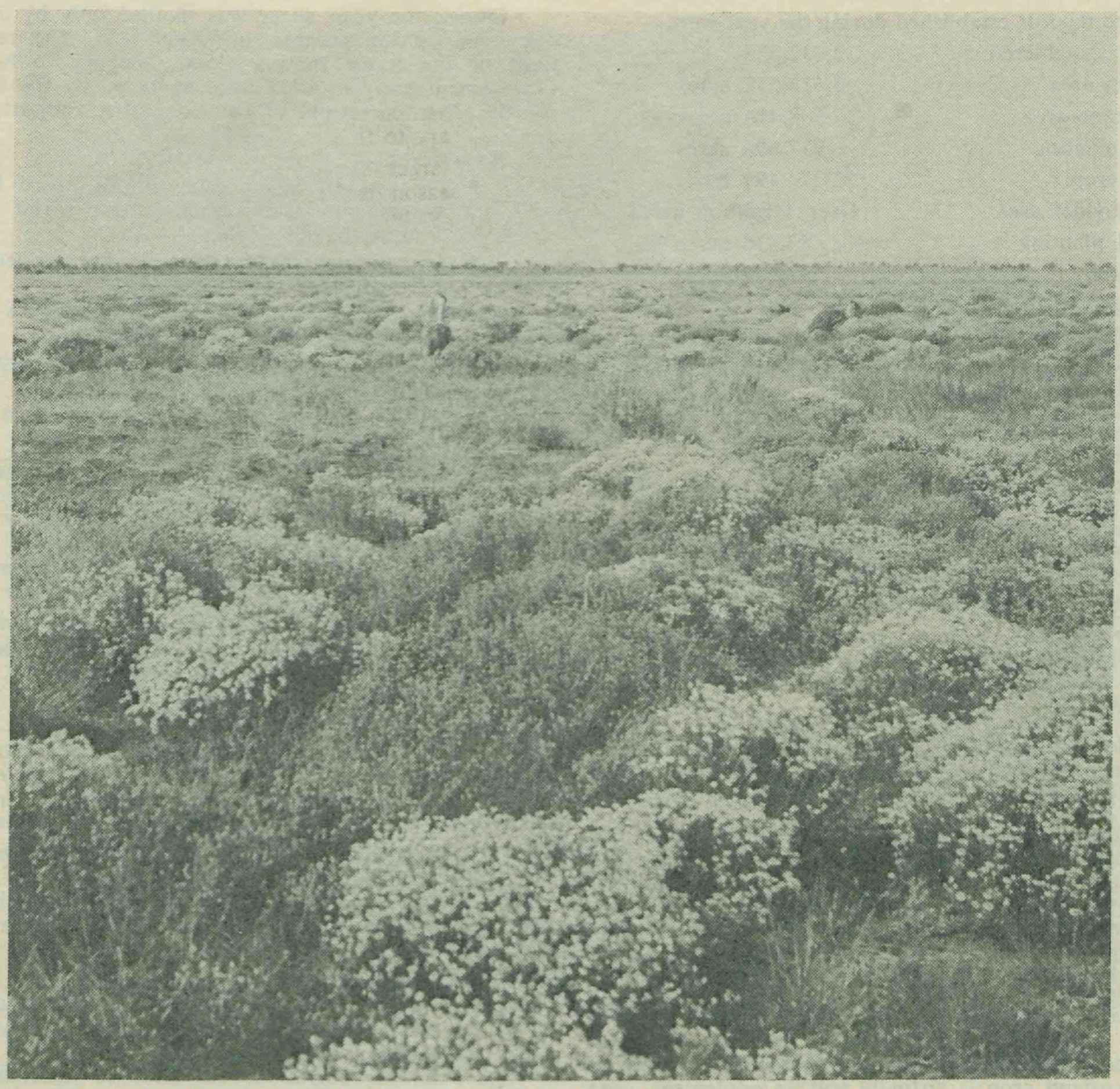

Plate 3: Herbage in the channel country of south-west Queensland.

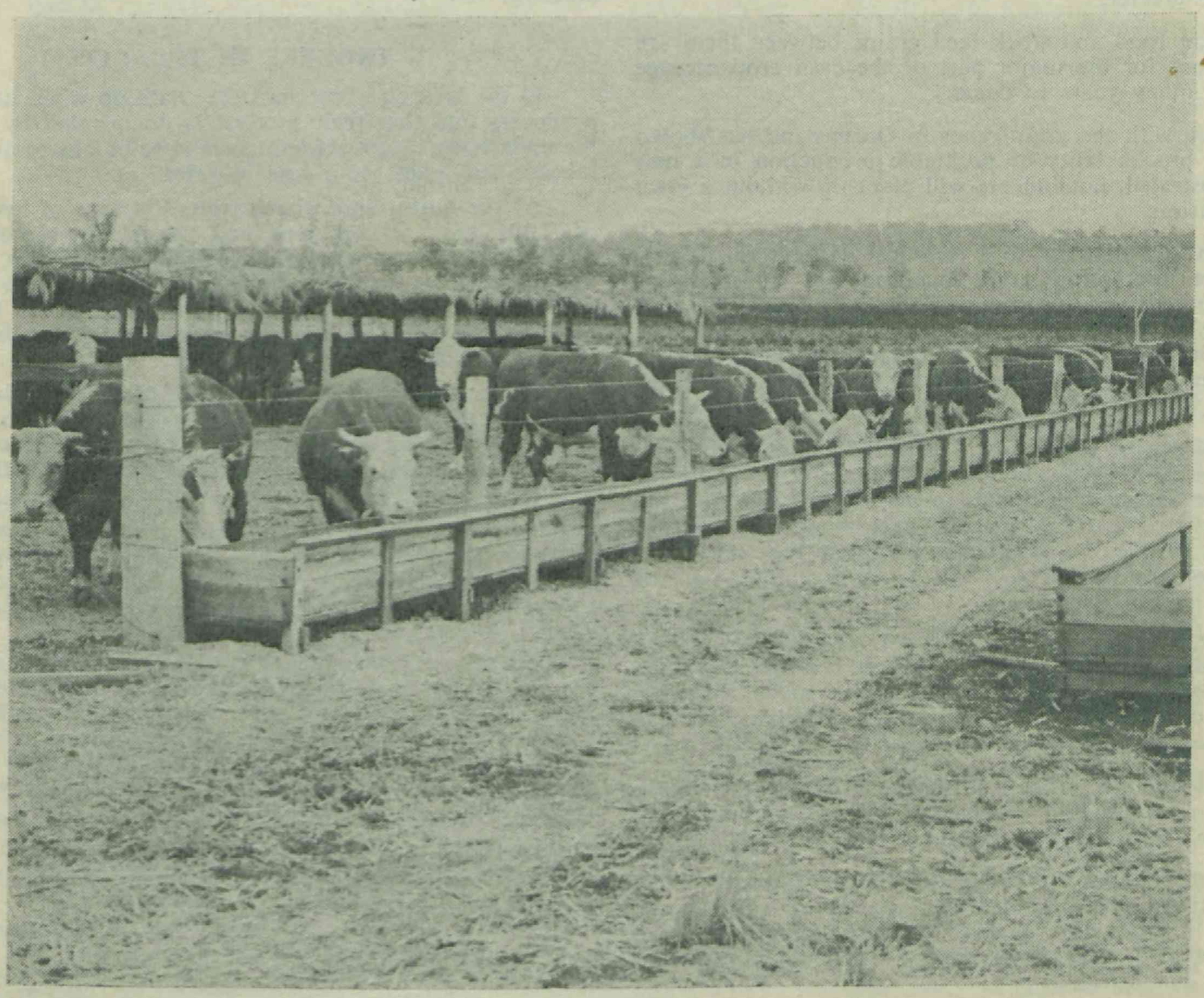

Plate 4: Newly established lot feeding at "Wealwandangie", Springsure.

Market stability, even in the best regulated industries, is a difficult thing to come by, and once achieved is often thrown away for a transient benefit. The canegrower, who has lived with stabilisation by regulation all his life, appreciates that in the long term it works greatly to his advantage. On the other hand, some sections of other industries have sacrificed the substance of stability for the shadow of a quick, handsome profit that eventually disappears in a general lowering of prices.

It will not be an easy task to devise and maintain a price stabilisation scheme for tobacco leaf. But it will be necessary to undertake this task in co-operation with the Commonwealth Government and other State Departments of Agriculture.

THE FUTURE OF COTTON

Is cotton following in the footsteps of the banana and migrating to New South Wales?

It would be a blow to the prestige of the State if we were to take second place to another State after pioneering the crop and giving it 40 years of intensive scientific investigation.

Yet the writing is on the wall! If we can't get a substantially increased acreage under irrigated cotton, then the irrigation areas of New South Wales are going to wrest supremacy from us.

Loss of prestige in such an event, serious as it would be, would not be as alarming as the threat to the economics of the industry here. With New South Wales growers producing a predominant portion of the Australian crop under fairly stable conditions, the voice of Queensland growers, and particularly of those producing erratically on rainfall alone, would be a rather feeble one when price guarantees and other incentives were being decided.

Queensland needs a stable and substantial cotton-growing industry if ginneries are to be operated economically. Only increased cropping under irrigation can ensure a regular substantial annual ginning.

The expansion of irrigation facilities in a number of districts widens the crop choice for numerous farmers. The cotton industry, in its own interests, must move into these districts and state the case for cotton. Last season's yields under irrigation from the Dawson to the Lockyer provide strong talking points on irrigated cotton. They need to be driven home.

APPLES v. PINEAPPLES

It is a paradox that the leading banana district in Australia should be Coff's Harbour, which is virtually the southernmost. It is noteworthy also that in subtropical Queensland the apple industry is striding firmly ahead while the pineapple industry is very restrained in its expansion.

The area of apples in bearing has jumped from 6,000 to 8,400 acres in five years and the 10,000-acre mark is due to be passed in 1967-68. Over the past five years, the pineapple crop has ranged around 40 million plants on some 12,000 acres.

The movement of the two crops relative to one another is indicative of the marketing prospects. There is, of course, no overseas export outlet for such a perishable fruit as the pineapple. The Australian fresh fruit market appears to be stabilised at some 20,000 tons, and the processing outlet remains at about 50,000 tons, mainly as canned pineapple, canned and bottled juice and tropical fruit salad.

It appears that prices paid for factory fruit in a particular year largely determine the volume of planting at that time. Since the low price year of 1961, returns have been higher and plantings have increased, but market prospects do not encourage substantial planned expansion.

Apple production has been favoured largely by an expanding market for Granny Smiths in particular in Great Britain and by the provision of cool storage facilities which enable marketing to be spread over months instead of weeks.

Growers are endeavouring to anticipate marketing troubles as the crop increases by exploring the potential of the processing industry. Some 800 tons of Granny Smiths from the 1963-64 crop were processed for juice and pie packs by the Northgate Cannery. The price offered to growers did not attract the 1,200 tons that the cannery required. The processing position is being now examined well in advance of next season's harvest.

In common with other horticultural crops, apples and pineapples are the subjects of considerable investigation by the Department, both in the field and in glasshouses and laboratories. Various sections of the Committee of Direction of Fruit Marketing have given much financial assistance to this investigation. The latest evidence of this is an undertaking to provide special facilities at the Granite Belt and Redlands Horticultural Research Stations.

FOREST TO FAT STEERS

Thirty years ago the late Brice Henry on a shoe-string budget pioneered the fattening of cattle on planted pastures on the wet tropical coast on his property at Euramo, near Tully.

Today, only a short distance away, a great deal of capital is being confidently poured into a development project that will test the faith and foresight of Brice Henry.

King Ranch Development Company Pty. Ltd., with American capital, is forging ahead with the development of a 51,000 acre special lease acquired from the Department of Lands. Some 17,000 acres of forest have been cleared and 11,000 acres grassed within the first year.

The years between Brice Henry's para grass stand and the modern mixed pastures of King Ranch Development have been years of painstaking testing and selection at the Department's Tropical Agriculture Research Station at South Johnstone, its sub-station at Utchee Creek, and on many district properties. Recent work of C.S.I.R.O. on tropical legumes has added its weight.

The accumulated experience of 30 years of local pasture research and testing has been drawn upon by King Ranch Development in planning and developing its bold project in the north. In combination with the modern clearing and planting methods adopted, it has enabled a flying start to be made.

There were times when it seemed that the practical application of research results of the South Johnstone station would never accelerate beyond a slow rate of diffusion. The large-scale project now in hand has changed the picture virtually overnight. Its progress will be watched with great interest by all concerned with northern development.

LIVESTOCK NUMBERS UP

The Bureau of Census and Statistics, in reporting livestock numbers as at March 31, 1964, reveals a total of 6,280,000 for beef cattle and the highest figure for sheep since 1943.

The beef cattle total is inflated a little by the inclusion of some 40,000 culled dairy stock that in previous census lists had been included as dairy cattle.

One hesitates to draw any firm conclusion from the census figure for beef cattle. The significant point, when it can be measured with some degree of accuracy, is not fluctuation in the aggregate number but whether there is a definite upward trend in turnoff of earlier finished beasts.

Better nutrition through pasture improvement, crop grazing and wider distribution of watering points on large properties; easier movement of stock from breeding to fattening country; earlier maturity through improved breeding programmes—all of these must inevitably lead to turnoff at a younger age.

The increase of over 1½ million in the number of sheep reflected the better seasonal conditions of the preceding few months. Permanent gains in carrying capacity as a result of property improvements no doubt contributed also to the increased total. On the other hand, the increasing intrusion of beef cattle onto sheep areas must have reduced the grazing area allotted to sheep rather significantly.

The decline in the number of dairy cattle during the year was some 33,000 when allowance is made for the transfer noted above. There appears to have been a deal of consolidation of herds as owners have gone out of dairying and sold their stock to other dairy farmers.

The drift away from dairy farming by many farmers is one of the subjects being investigated by the Dairy Industry Advisory Committee set up during the year and consisting of representatives of the industry, the Department of Primary Industries and C.S.I.R.O.

MOVE ON MEAT

After half a century or more of wallowing in wide troughs of depression between low peaks of prosperity, the beef industry quickened into life in the post-war years and there has been nothing static about it since.

One particularly dramatic change has been in overseas outlets: within a few years the United States has replaced the United Kingdom, the traditional market, as the major importer of Australian beef. The millions of State and Commonwealth monies earmarked for beef roads is another indication of change in the industry.

An advisory committee was set up by the State Government a few years ago to keep the Government informed of trends and desirable changes in the industry. But it could go only so far in collecting and analysing information and making recommendations.

Early in 1964, the Government decided that there was a need for a new and thorough examination of the position in the light of changing circumstances, and appointed a Committee of Inquiry to look at the livestock and meat industries and recommend steps that might be taken by the Government. The Committee has taken a considerable amount of evidence in many centres and its report is expected to be presented to the Government well before the end of the year.

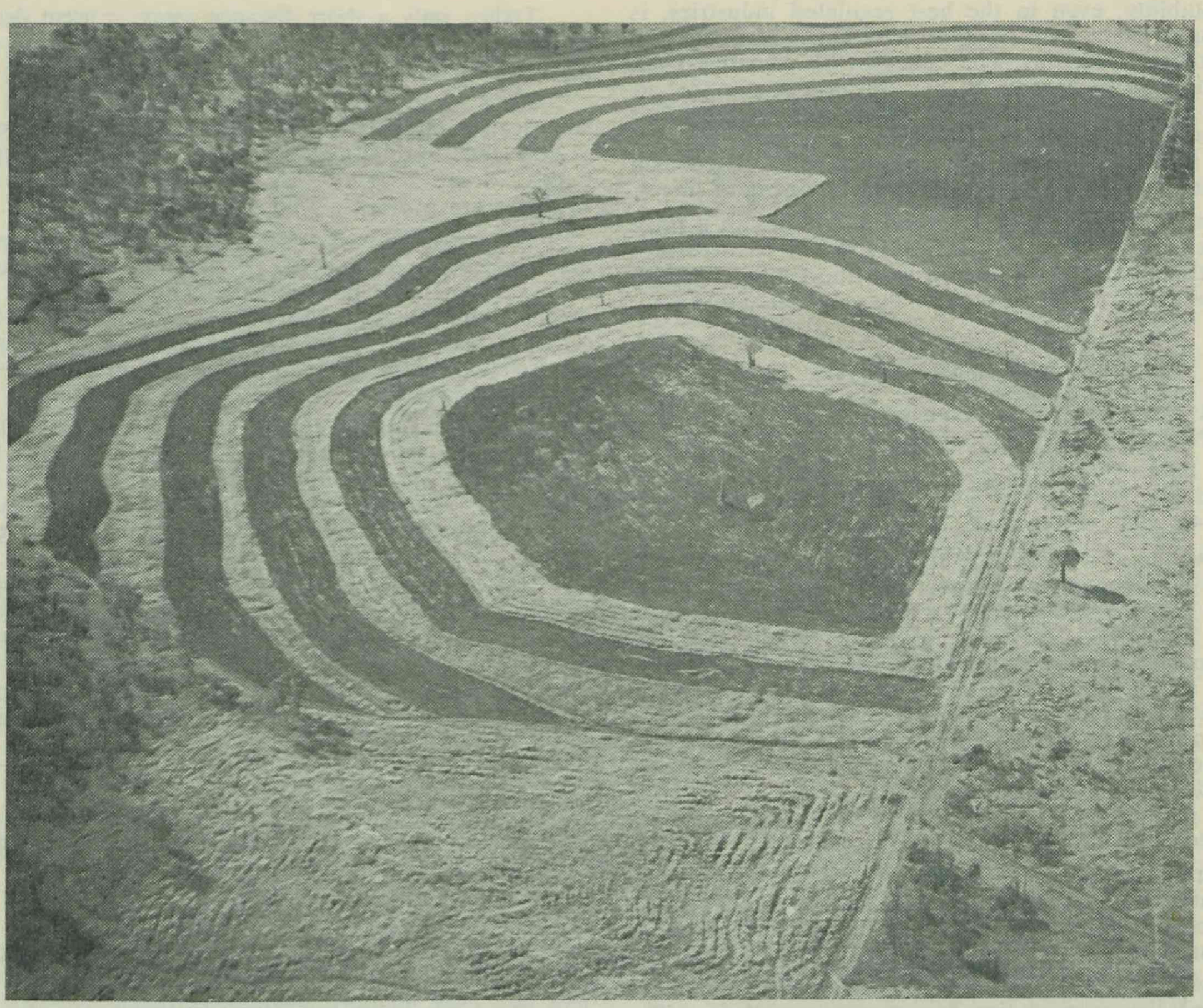

Plate 5: A 300-acre soil conservation project in a grazing area after the wet season. Note the parallel crop strips between contour-planted pasture strips.

Plate 6: A part of the breeding herd being mustered at "Brian Pastures" Pasture Research Station near Gayndah.

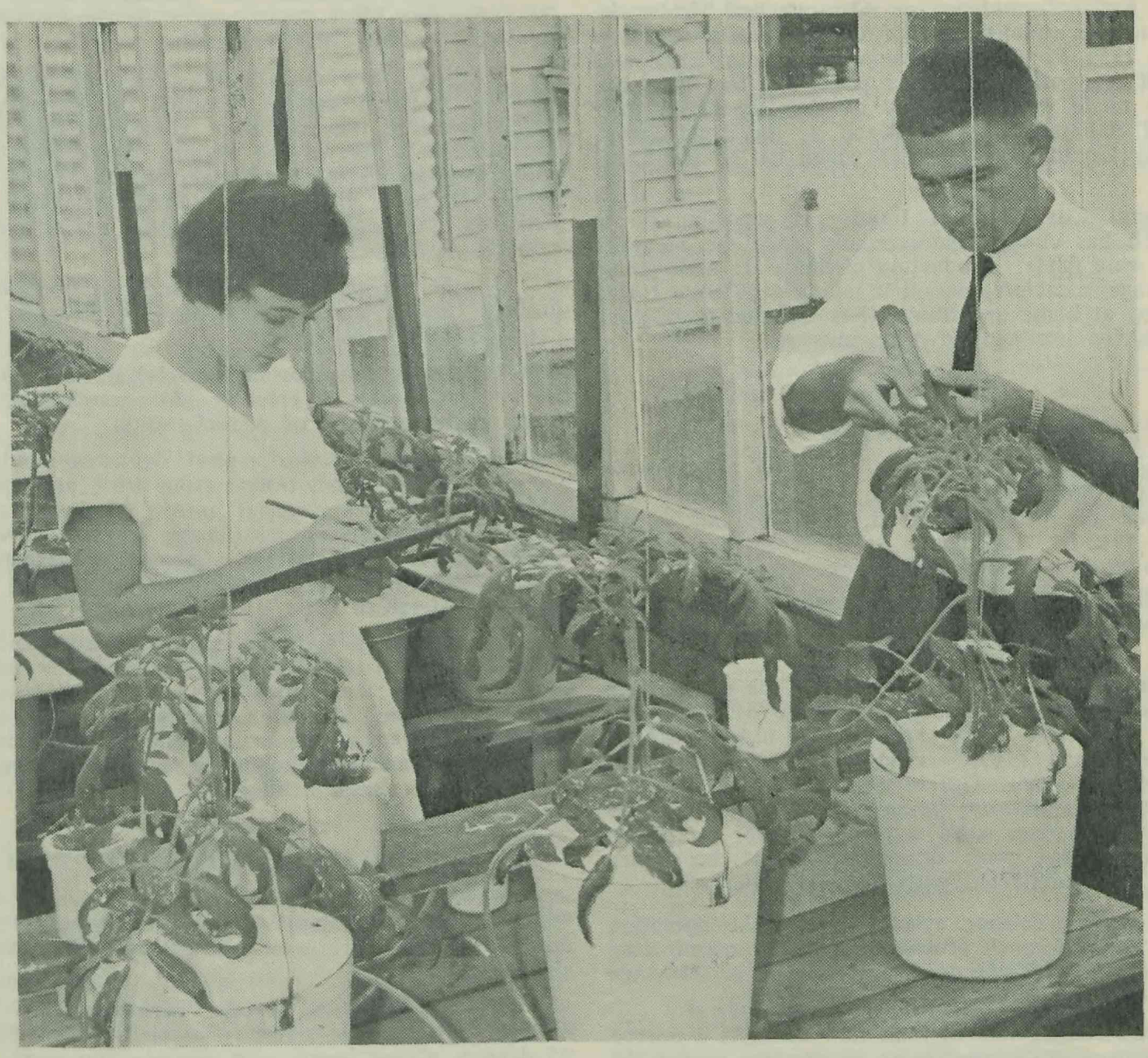

Plate 7: Pith rot investigations in tomatoes. Plant physiologists are investigating the effect of various nutrient solutions on the incidence of the disease.

Plate 8: Silver leaf desmodium and green panic in the Kenilworth district.

Three previous commissions had given attention to the livestock and/or meat industries in the post-war years. The report of the Royal Commission on Abattoirs and Meatworks in 1945 led to the establishment of District Abattoirs. The report of the 1951 Royal Commission on Pastoral Land and Settlement did not spark off any such positive action, but some of the points made were confirmed by the Report on Progressive Land Settlement in Queensland by the Land Settlement Advisory Commission of 1959 which led to the Land Act of 1962.

The present Committee of Inquiry is reporting on a situation which has changed substantially since the previous investigations were made. Production methods are undergoing a marked change, meat preparation is taking a different form, meat marketing at home and abroad has assumed a different face. Its findings are awaited with interest.

A. I. SNOWBALLING

When the Department opened its Artificial Insemination Centre at Wacol in February, 1963, there were only five A.I. groups operating in Queensland. At the end of the financial year 1963-64, the number stood at 15, and several others were in various stages of formation.

Nearly 58,000 doses of semen were supplied during the year. There were 61 bulls representing nine breeds of cattle at the Centre.

The overall response to the setting up of the new facility has been very encouraging, though relatively little use has been made as yet by one or two breeds. The biggest demand was for A.I.S. semen (16,000 doses), followed by Jersey (8,000), Friesian (4,400), Guernsey (1,500) and Ayrshire (250) among the dairy breeds. Some 3,700 doses of Hereford semen and 500 of Angus were supplied to beef producers. The Poll Hereford and grade Brahman bulls at the Centre were not used for commercial purposes during the year.

The bull proving scheme associated with the operation of the Centre involves much protracted work in inseminating selected commercial herds and recording progeny performance from year to year.

The Centre's complement of bulls now contains 4 proven Jersey and 2 proven A.I.S., and many owners are paying the extra cost of semen from nominated proven bulls. The other bulls used for semen have been carefully selected on factors pointing to their usefulness as sires, but the aim is to prove as many bulls as possible.

The training unit for artificial inseminators conducted by the Department is playing an essential part in the extension of artificial insemination, though the spasmodic nature of the training schedule throws an additional burden on the staff responsible for the instruction.

"RESEARCH STATION No. 23"

If this Department numbered its research stations, "No. 23" would be hung on the gate of the new Brigalow Research Station near Theodore.

Few people realise that the Department of Primary Industries is a major operator of research stations. The whole research and field station establishment is of considerable magnitude and diversity of interest.

The Department owns and operates the following research stations:

Northern—

Parada Research Station (Mareeba–Dimbulah Irrigation Area); Walkamin Research Station (Mareeba–Dimbulah Irrigation Area); Kairi Research Station (Atherton Tableland); Kamerunga Horticultural Research Station (near Cairns); Tropical Agriculture Research Station (South Johnstone); Animal Health Station (Oonoonba, near Townsville); Toorak Sheep Field Research Station (near Julia Creek); Ayr Cattle Field Research Station; Swan's Lagoon Cattle Field Research Station (near Millaroo, on the Burdekin River); Millaroo Research Station.

Central—

Biloela Research Station; Theodore Research Station; Brigalow Research Station (near Theodore).

Southern—

Coolum Research Station (near Yandina); Maroochy Horticultural Research Station (near Nambour); Animal Research Institute (Yeerongpilly, Brisbane); Animal Husbandry Research Farm (Rocklea, Brisbane); Redlands Horticultural Research Station (Ormiston); Gatton Research Station; Hermitage Research Station (near Warwick); Granite Belt Horticultural Research Station (Applethorpe); Inglewood Research Station.

In addition, the Department conducts "Brian Pastures" Pasture Research Station (near Gayndah), which is owned by the Australian Meat Board, and staffs the Queensland Wheat Research Institute at Toowoomba.

If there were any doubt at all about the economic value of research stations, it would be dispelled by merely listing some of the results of plant breeding and selecting conducted at a few of the stations: Spica wheat and hybrid grain sorghum from Hermitage, Biloela buffel grass from Biloela, Tinaroo glycine from Kairi, stringless beans from Redlands, and papaws from Maroochy are only a few of the valuable new types released.

On the animal side, new discoveries on poison plants, drought feeding, causes and control of diseases, and mineral nutrition can be listed.

The intricate division of financial and other responsibility for various aspects of erection and operation of the stations poses many problems of administration.

For example, some capital works are financed from the State Loan Fund, others from trust and special funds, and yet others from special grants. Industry organisations have been generous in contributing towards glasshouses and equipment for some stations. Salaries and general operating expenses are borne by Consolidated Revenue or trust funds or combinations of these.

The state of improvements of a research station and the volume and level of research carried out there are sometimes a reflection of the source of funds available for capital improvements and operating expenses. Too often these are inadequate for the purpose, despite the demonstrable fact that only an adequate input can ensure an adequate return in terms of research findings.

PROBLEMS IN THE NORTH-WEST

A climatic study of the Queensland sheep areas made by the Department about 15 years ago pinpointed the open downs of the north-west as perhaps the most difficult climatically.

In particular, an average period of six consecutive months with average monthly maximum temperatures over 95 degrees played havoc with reproduction rates.

The sheep population of the area is well over a million, and obviously even a small percentage improvement in reproduction rate, survival and fleece yield would be of importance economically.

The Department set out to deal with the problems of the region by establishing Toorak Sheep Field Research Station near Julia Creek in 1951.

Though numerous short-term investigations on a variety of subjects have been made, and main long-term projects relate to reproductive capacity and adaptation of different types to the environment.

The vagaries of the climate in the area have been reflected in the progress made to date: extremely dry conditions from time to time have upset programmes and limited the volume of useful data obtained.

But other agencies have also been at play. The isolation of the station, the infrequency of professional contacts, the lack of some of the amenities of living expected by professional men and their families, the slow pace of development of the station, the partial destruction of station premises by fire—all of these have militated against the prosecution of long-term scientific work by a competent and experienced team.

No one has been happy about this state of affairs. District graziers have expressed their concern and the station advisory committee, which contains some graziers' representatives, is working towards improvement.

It is natural for people in rather remote places to feel that theirs is a case of "out of sight, out of mind". In justice to its officers as well as to its clientele, a Department with officers as far afield as Normanton and Thursday Island must try to ensure equal opportunities for all to do a workmanlike job. Adequate facilities are essential.

ANGLES ON DEVELOPMENT

Development brings problems—not only to those engaged in production but also to those whose responsibility it is to service the producers concerned.

Usually the initial move towards expansion of an industry sets off a chain reaction. If there is a weak link somewhere, things do not go according to plan.

The upsurge in pasture improvement in Queensland provides an example of this. Half a million acres went down to sown pastures in 1962-63, possibly more in 1963-64, much of it to unusual species that were barely known here a few years

earlier. But it is safe to say that some of that half-million acres would have been sown two or three years earlier if ample seed had been available at a reasonable price.

It is often difficult to foresee the demand for seed, and many seed producers are reluctant to take the risk of growing seed for an uncertain market. Over the past couple of years, the Department has taken the initiative in this regard, and a special officer has been working with producers and distributors of pasture seed in an effort to overtake and keep up with the demand. As one aspect of this work, a special pasture seed production farm is being established.

Where attempts to develop land for new purposes could conceivably end in failure and perhaps disaster, a series of test plantings over a number of years prior to development is indicated. But time is often an over-riding consideration and development is put in hand with the chances favouring success but not assuring it.

In such circumstances it devolves upon the Department of Primary Industries to march in with the initial contingent of new producers and set out to define the elements of success.

In the case of the Fitzroy Basin Brigalow Development Scheme, the factors for successful development need to be spelt out a little more precisely than has been possible on the information available. Accordingly, the Department is consolidating on the spot its research on a variety of matters relating to the establishment and utilisation of pastures and crops in the area covered by the scheme.

The development of irrigation projects likewise ideally calls for the closest integration of investigation to ensure not only that it is feasible to deliver water to an area but also that the area is agriculturally suitable for commodities that can be produced and sold at a profit.

It is not always reasonable to expect that years of field testing should precede the initiation of an irrigation project. But it is often wise to pre-test on a commercial basis, and this is to be done by the Irrigation and Water Supply Commission, with the guidance of this Department, on pilot farms in the proposed Emerald Irrigation Area.

Also, concurrently with the extension of channels in the Mareeba-Dimbulah Irrigation Area, the Department is doing investigational work on its Parada and Walkamin Research Stations.

The Department was associated with the Irrigation and Water Supply Commission during the year in reporting on irrigation possibilities at Collinsville, the water resources of the Upper Burnett River and Stage II of the Leslie Dam project.

The current emphasis on increasing the irrigation water supply to existing agricultural areas calls for an extension as well as an investigational role for the Department. Many farmers in the area commanded by any new dam are new to irrigation—they require the assistance of Departmental extension officers in planning and carrying out irrigation farming. This is presently the case in the Mary Valley and Condamine River areas in particular.

AVOIDING INSULARITY

Research in a country as remote as Australia is from important research centres of the world could easily stagnate if freshening channels were not kept open.

One of the most important of these channels so far as Queensland is concerned is on-the-spot observation and study of techniques and achievements in the crop and animal sciences overseas.

This Department has taken every opportunity to advance the calibre of its research and extension services by facilitating overseas visits for study purposes.

Many of the visits are supported by Commonwealth Government and industry funds. Some officers obtain travel and study grants from various other sources; some accept teaching/research assistantships at overseas Universities. In a few cases the Department bears the whole of the cost of a study tour.

There is no doubt at all that the time and the money devoted to overseas study are well spent.

The following Departmental officers went overseas for study purposes during the year:

S. T. BLAKE (Research Botanist)—to United Kingdom as Australian Botanical Liaison Officer at the Royal Botanic Gardens, Kew.

D. B. COPEMAN (Veterinary Officer)—to U.S.A. to study under a Rotary Foundation Fellowship.

K. M. GRANT (Assistant Director of Veterinary Services)—to Canada to attend a school on exotic diseases.

T. McEWAN (Chemist)—to Canada for post-graduate study in the chemistry of natural products.

R. F. MOORE (Research Plant Breeder)—to U.S.A. to study hybrid sorghum breeding.

L. E. NICHOLS (Director of Research, Division of Dairying)—to New Zealand to attend a meeting of the International Dairy Federation and examine research work.

E. B. RICE (Director of Dairying)—to New Zealand to attend a meeting of the International Dairy Federation and to examine dairy matters.

P. G. TOW (Agronomist)—to the Netherlands to undertake research work in plant physiology.

TRIBUTE TO Dr. SUMMERVILLE

The scientific achievement of W. A. T. Summerville as an officer of this Department is recorded in a variety of scientific journals. This report is an appropriate place to put on permanent record a note on his administrative services.

After he stepped out of the field of research in 1945 into technical administration, Dr. Summerville rose quickly through a succession of directorships to become Assistant Under Secretary (Technical) in 1957.

He assumed the responsibilities of permanent head in 1958 at a time when the Department was experiencing the difficulties associated with an accelerated intake of staff and intensification of Head Office and field activities. At the same time, the outside commitments of the permanent head were increasing considerably as Commonwealth Government Departments, primary industry organisations and the Department became jointly involved in the planning and financing of research and extension.

On the home front, Dr. Summerville had the training and experience to enable him to take the administrative problems of a rapidly growing Department in his stride. In his official association with outside bodies he was able to state the Department's case in a convincing fashion and to stand up for its rights when necessary.

Dr. Summerville left the Department to take up the post of Agent-General for Queensland with the good wishes of the hundreds of officers with whom he had had personal contact during his 42 years of service.

DIVISION OF PLANT INDUSTRY

Plant Industry Responsibilities.—Statistical figures relating to land cultivation in Queensland show some startling changes from year to year. Figures are not yet available from the Bureau of Census and Statistics for 1963-64. However, the total area sown to all crops in 1962-63 was approximately 3,474,000 acres as compared with 3,203,000 for the previous year—an increase of 271,000 acres.

If the areas occupied by sugar-cane are subtracted from these totals, the increase in area devoted to other agricultural and horticultural crops was still greater than a quarter of a million acres. These figures for annual increase in area under crop compare with 150,000 acres the previous year and 50,000 to 75,000 acres per annum 10 years ago.

Such yearly increases in cultivation impose ever increasing demands upon Departmental services. The Division of Plant Industry is charged with the responsibility for providing advisory services for the production of pastures, all field crops except sugar-cane, and all fruit and vegetable crops, in addition to the ancillary services relating to plant protection, weed control and a number of other disciplines.

In order to provide the necessary advisory services much local research is essential. It is true that advisory officers can make use of many research results provided by other organisations, both in Australia and overseas. All such officers soon find, however, that the answer to many district problems can be obtained only in their particular districts. Hence the Division must do much of its own research if it is to provide the services desired, and demanded, by the rural communities.

The Division's greatest problem is that of finding sufficient finance to support the annually increasing demands for research and advisory services. It is a fact that, in recent years, the funds available to support the Division's services have not increased in proportion to the State's expanding agriculture and its concomitant service requirements. This problem is most serious in relation to the provision of office and laboratory accommodation, equipment and transport for the approximately 460 technical officers of the Division.

A number of agricultural and horticultural industries have realised that a measure of self-help is required if services are to keep pace with industry demands. The tobacco, wheat, beef, sheep, dairying, fruit and vegetable industries have all made valuable contributions towards the support of the Division's work—particularly in the fields of research but also, in some cases, to aid extension as well. If it were not for such contributions from industry, the Division's work must of necessity be very severely reduced.

RESEARCH FACILITIES AND CONTRIBUTIONS

In view of the overall problem of providing reasonable research facilities for technical staff, it is gratifying to be able to record progress in some important directions.

At Toowoomba, plans are being prepared for the completion of the second and third stages of the Queensland Wheat Research Institute at a cost estimated to exceed £40,000. This has been made possible by the continuing statutory levy upon wheat growers under the Wheat Research Act of 1957 together with an additional voluntary levy on growers (which in 1963-64 approximated £8,000) and an allocation of £5,000 from the Commonwealth Wheat Industry Research Council. An important contributory factor has been the excusing by Queensland Treasury of a sum of £40,000 previously provided as an advance against the completion of Stage I. The additions will provide a well-equipped soils laboratory together with ancillary rooms, and a smaller administration and library wing. An important project completed at the Institute during the year was a plant physiology glasshouse.

Working conditions at the "Brian Pastures" Pasture Research Station were greatly improved during the year by the enlargement of the office-laboratory and the provision of a research glasshouse. The total cost of this building programme was £20,000, a sum contributed to by grants from the Brian Pastures Trust Fund of the Australian Meat Board, and the Australian Cattle and Beef Research Fund.

Further progress has been made with the development of a Divisional Research Centre at Indooroopilly. Here a virology glasshouse-laboratory was completed to the stage at which it could be occupied by specialist staff of Plant Pathology Section. During the same period a plant quarantine house of special design was erected at this centre from funds jointly provided by the Commonwealth and State Governments.

Of special interest in the field of horticultural services were (*a*) the virtual completion of an office-laboratory at the Kamerunga Horticultural Research Station near Cairns, and (*b*) the commencement of a major laboratory and administration building at the Granite Belt Horticultural Research Station near Stanthorpe. Tenders have also been accepted for two additional glasshouses, one for peanut disease studies at Kingaroy, and the other for pasture plant introduction work at the South Johnstone Research Station. Part cost of the former was provided by the Peanut Marketing Board and of the latter from the Australian Cattle and Beef Research Fund.

A most important contribution announced during the year was that of £40,000 to be made available over a period of 10 years by the Vegetable and Other Fruits Sectional Groups of the C.O.D. The primary purpose of this grant was to provide additional research facilities at the Redlands Horticultural Research Station. Its first important application will be towards the building and equipping of new controlled environment chambers for plant breeding and plant physiological work.

STAFF

During 1963-64, the Division lost 21 of its technical staff; two by death, 18 by resignation and one by retirement. A considerable loss was sustained by the untimely deaths of Messrs. D. O. Atherton, Director of Tropical Agriculture, and R. B. Morwood, Senior Horticulturist. Both were senior officers of wide experience—Mr. Atherton particularly in the fields of entomology and tropical agriculture, and Mr. Morwood in plant pathology and horticultural crops.

Of those who resigned, 8 were graduate officers and 10 diplomates. Principal reasons for these resignations were (i) the offer of more lucrative positions elsewhere, (ii) the desire to gain additional experience, (iii) further study, and (iv) in the case of some female graduate officers, marriage. The retirement (through ill health) was that of Mr. N. E. Goodchild, Senior Adviser in Agriculture, Mackay, who had given sterling advice as an advisory officer, particularly in north Queensland.

On the credit side, 41 new appointments were made. Three of these were made at Division I level; Mr. J. F. Archibald, Agronomist; Mr. K. B. Addison, Agrostologist; and Mr. J. H. Barrett, Entomologist. Messrs. Archibald and Addison had seen previous service in Africa and Mr. Barrett in Papua and New Guinea. Their addition to the staff should add appreciably to the available fund of technical knowledge and experience.

Among 21 other graduate recruits, 10 were former scholarship-holders and three were Departmental science cadets. Three of the scholarship-holders have not yet commenced active duty, having been granted leave to pursue honours courses in Agriculture at the University of Queensland. The remaining 17 new appointees were of diplomate status and it is interesting to record that, of 12 Field Cadets in this group, five came by way of Departmental scholarships at the Queensland Agricultural College.

Of those graduates in Agricultural Science who were appointed at the beginning of 1964, three were granted honours by the University. Special congratulations are due to Mr. D. L. Lloyd for the additional award of a University Gold Medal. Further evidence of the academic standard of recent scholarship-holders is afforded by the fact that, for the last two years in succession, they topped the final year in Agricultural Science and were awarded the Philp and Munro Prize: 1962, Mr. D. L. Lloyd; 1963, Mr. M. M. Ludlow.

Seven new Agricultural Science scholarships were awarded to the University in 1964, including one by the Queensland Dairymen's Organisation and one by the Peanut Marketing Board. In addition, four new cadetships were awarded for part-time study in science.

Officers on Loan.—In March, 1964, Dr. S. T. Blake, Research Botanist, left to take up a 12-months position as Australian Botanical Liaison Officer at the Royal Botanic Gardens and Herbarium, Kew, England. During the past year, Mr. F. C. Sweeney, Agrostologist, was loaned to the C.S.I.R.O. Division of Land Research and Regional Survey for service as a member of a team surveying portions of the Fitzroy basin of central Queensland. Later in the year, Mr. L. Pedley, Botanist, was attached to another such team surveying the Belyando area. Both of these loans, which were for periods of 15 months, should prove of mutual benefit to the co-operating organisations.

AGRICULTURE BRANCH

The demands on Branch facilities of research and extension have continued to grow during the year. Because of lack of staff and funds, it has not been possible to meet all demands from industry, but the position would have been disastrous were it not for substantial financial assistance received from the beef, sheep, grain and dairying industries, from secondary industry and from the Commonwealth Extension Grants.

A feature of the year's extension work has been the interest by primary producers in discussion groups and a number of these have been formed under the guidance of Branch officers. The Maranoa district has been particularly active in this regard.

The growing awareness by the primary producer of the need for a better integration of property improvement and management programmes has increased the need for intra- and inter-departmental co-ordination and for the development of different extension techniques. These needs are being achieved in various ways.

For example, short inservice training schools have been held within Agriculture Branch in co-operation with other Branches to take advantage of assistance available from the Economic Services Branch for the study of methods for improving property management systems.

Important technical conferences attended by officers of the Branch were the Third Australian Grassland Conference convened at Warburton in Victoria, and the Australian Vegetable Research Conference held in Brisbane.

Specialist officers also attended a special Weed Control Seminar convened by private industry in Sydney.

AGRONOMY

Wheat.—Seasonal conditions favoured high yields at many centres as evidenced by results from a number of district trials quoted in Table 1. Rust was not a serious problem at most centres but valuable information was obtained on stem rust incidence in the new wheat strains released by Prof. I. A. Watson, of Sydney University.

While Mendos (Strain 16) performed extremely well at most centres, some concern is felt for the future of Strains 9 and 52 in Queensland because of a susceptibility to stem rust attack as evidenced in trials at Gatton Research Station and in the Allora district.

TABLE 1

RESULTS OF 6 DISTRICT WHEAT VARIETAL TRIALS, 1963

Yields in Bushels per Acre

Variety	District						
	Allora	Gatton R.S.	Jondaryan	Miles	Goondiwindi	Wandoan	Average
Mendos	82·3	79·3	46·6	37·2	31·5	21·6	49·7
Strain 16	72·8	73·3	36·8	42·8	33·3	21·5	46·7
Spica ..	70·3	77·2	37·2	36·9	37·2	21·6	46·7
Strain 52	78·3	67·7	36·7	37·4	32·9	17·3	45·0
Strain 9	73·9	46·7	47·1	40·0	38·6	21·5	44·6
Gamenya	72·5	73·6	42·0	29·8	32·7	15·4	44·3
Gala ..	57·8	64·9	34·4	38·9	35·5	21·6	42·2
Mengavi ..	65·2	43·8	Not included	32·6	32·9	22·3	39·4
Kenora ..							
Average	71·6	65·8	40·1	36·9	34·3	20·3	45·0

Gamenya when free from rust performed well in all trials while Gala and Spica continued to prove hardy and reliable in mid-season plantings.

At Hermitage Research Station, centre of the State's wheat breeding activities, the recently released New South Wales Department of Agriculture variety Festiguay (66·9 bus. per acre) and the unnamed Queensland variety LG5387 (65·4 bus.) and Windebri (61·7 bus.) gave the best grain yields in the slow maturing trial. Winglen (53·1 bus.), Hopps (48·0 bus.) and Lawrence (41·8 bus.) showed mediocre performances. Lawrence (6·5 tons green material per acre), Festiguay (6·2 tons) and LG5387 (5·9 tons) provided highest forage yields in the two grazings given the trial before the final grain harvest. In the mid-seasons trial at Hermitage Research Station all varieties performed well, only 6·1 bus. per acre separating the best variety LG5387 (52·8 bus.) and the poorest V²TCH5575 (46·7 bus.). The varieties Gamenya (67·5 bus.) and Strain 52 (65·2 bus.) yielded best in the Station's quick maturing trial (Spica 55·9 bus.).

Barley.—The outstanding feature of the 1962 malting barley time of planting trial at Hermitage Research Station was the failure of frost to cause damage in any of the six times of sowing made at monthly intervals from late March to late August. Grain yields were significantly lower in the March (45·4 bus. per acre) and August (46·9 bus.) sowings than in the other four sowings (average 54·7 bus.). Malting quality of the grain from the March and August plantings was also lower.

Maize.—Tropical rust (*Puccinia polysora*) and Diplodia ear rot (*Diplodia* spp.) were intensively active in maize crops on the Atherton Tableland in 1962-63. In environmental conditions which might have been expected to favour them, none of the 25 single crosses of inbreds included in a plant breeders trial on the Tableland outperformed significantly the standard hybrid GH.128 in any of the 3 criteria of judgment used—yield of shelled grain, percentage of healthy ears, percentage of barren stalks.

In the 1962-63 Atherton Tableland hybrid maize varietal trial, yield levels were low but the hybrid GH.170 (22·1 bus. per acre) topped varietal trial yields for the second year in succession. The standard hybrid GH.128 (12·7 bus.) gave disappointing performances in both seasons.

GH.128 with 61·9 bus. per acre at Walkamin Research Station and 83·3 bus. on Walsh Sandy Clay Loam at Parada, and Victory with 54·1 bus. on Dimbula Sandy Loam also at Parada, gave the highest yields in the Mareeba district.

Irrigation and nitrogenous fertilizer were used in a trial at Biloela Research Station in central Queensland in 1962-63 to demonstrate that early sowing of maize could be a profitable enterprise. When sown in mid-September and fertilized with 2 cwt. urea per acre, the hybrid Q692 yielded 143·1 bus. per acre. Unfertilized Q692 yielded 122·5 bus. The next variety, Q23, yielded 141·0 bus. and 122·2 bus. respectively. Average increase in yield of 14 bus. per acre due to fertilizer application for the trial was barely economic. Failure to achieve higher yield differences due to N fertilizer is attributed, however, to the previous pasture legume history of the site.

In a raingrown fertilizer trial at Kumbia, aqua ammonia at 1 or 2 cwt. per acre and ammonium sulphate at 2 cwt. per acre were most efficient economically.

In the 1962-63 fertilizer x plant population trial at Gatton Research Station, nitrogenous fertilizer failed to increase yield levels but actually caused a significant depression in yield. This depression was attributed to the fact that lodging was more severe in fertilized treatments. With regard to plant populations, the treatments involving 20,000 and 16,000 plants per acre (110·7 and 108·2 bus. per acre respectively) outyielded the 12,000 plants per acre treatment (102·8 bus.). In another trial where row spacing and plant population were studied, populations of 16,000, 20,000 and 24,000 plants per acre (113·8, 112·2, 111·4 bus. respectively) produced better yields than the extremes 12,000 and 28,000 plants (104·0 and 107·0 bus. respectively). The percentage of ears and weight of grain produced per ear decreased significantly with increase in plant population. Row spacing had no effect on yield.

Grain Sorghum.—Unfavourable seasonal conditions caused failure of at least 10 grain sorghum varietal trials during the 1962-63 season. Yield data provided in Table 2 for four district varietal trials stress the clear superiority of the hybrids Brolga and Texas 610 over the standard variety Alpha.

Performances of Texas 630, seed of which is difficult to produce, and Texas 608 were also creditable when compared with Alpha.

TABLE 2

RESULTS OF 4 DISTRICT GRAIN SORGHUM TRIALS, 1962-63

Yields in Bushels per Acre

Hybrid or Variety	District				Average	Per cent. Increase over Alpha
	Gayndah	Biloela	Kingaroy	Wandoan		
Brolga ..	91·2	47·2	35·8	31·5	51·4	41·2
Texas 610 ..	81·4	42·0	35·5	31·7	47·7	35·1
Texas 630 ..	86·5	35·0	31·4	28·3	45·3	24·4
Texas 608 ..	74·2	37·7	27·6	30·8	42·6	17·0
Alpha ..	75·8	23·2	24·2	22·5	36·4	..
Average ..	81·8	37·0	30·9	29·0	44·7	..

Cotton.—1962-63 cotton work was highlighted by yields exceeding 3,000 lb. seed cotton per acre in four varieties (Dunn 7, Fox 4, Acala 1517 BR, and D & PL Smoothleaf) in an unfertilized, irrigated trial at Brookstead even though 20-25 per cent. of bolls were lost by rots in excessive March rains (7·26 in. in 13 wet days). Excellent insect control was maintained using commercial field spray equipment. Unfortunately fibre quality was rather disappointing though this may have been a seasonal effect.

Irrigated nitrogen trials at Brookstead (yields to 3,350 lb. per acre of Empire) and at Forest Hill (yields to 2,568 lb. per acre) both gave yield increases to fertilizer application (significant at Forest Hill only). Recommendations are 2 to 4 cwt. of sulphate of ammonia per acre applied at sowing, though the latter amount may be split, half being applied at sowing and half at squaring.

The grade of machine-picked heavy yielding irrigated cotton was not affected by any defoliant treatment used at Brookstead in 1962-63. Considerable indirect benefits by way of planned harvesting (especially early commencement) are apparent from the use of selected chemicals.

AGRICULTURE BRANCH

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A feature of the year's extension work has been the interest by primary producers in discussion groups and a number of these have been formed under the guidance of Branch officers. The Maranoa district has been particularly active in this regard.

The growing awareness by the primary producer of the need for a better integration of property improvement and management programmes has increased the need for intra- and inter-departmental co-ordination and for the development of different extension techniques. These needs are being achieved in various ways.

For example, short inservice training schools have been held within Agriculture Branch in co-operation with other Branches to take advantage of assistance available from the Economic Services Branch for the study of methods for improving property management systems.

Important technical conferences attended by officers of the Branch were the Third Australian Grassland Conference convened at Warburton in Victoria, and the Australian Vegetable Research Conference held in Brisbane.

Specialist officers also attended a special Weed Control Seminar convened by private industry in Sydney.

AGRONOMY

Wheat.—Seasonal conditions favoured high yields at many centres as evidenced by results from a number of district trials quoted in Table 1. Rust was not a serious problem at most centres but valuable information was obtained on stem rust incidence in the new wheat strains released by Prof. I. A. Watson, of Sydney University.

While Mendos (Strain 16) performed extremely well at most centres, some concern is felt for the future of Strains 9 and 52 in Queensland because of a susceptibility to stem rust attack as evidenced in trials at Gatton Research Station and in the Allora district.

TABLE 1

RESULTS OF 6 DISTRICT WHEAT VARIETAL TRIALS, 1963

Yields in Bushels per Acre

Variety	District						
	Allora	Gatton R.S.	Jondaryan	Miles	Goondiwindi	Wandoan	Average
Mendos	82·3	79·3	46·6	37·2	31·5	21·6	49·7
Strain 16	72·8	73·3	36·8	42·8	33·3	21·5	46·7
Spica ..	70·3	77·2	37·2	36·9	37·2	21·6	46·7
Strain 52	78·3	67·7	36·7	37·4	32·9	17·3	45·0
Strain 9	73·9	46·7	47·1	40·0	38·6	21·5	44·6
Gamenya	72·5	73·6	42·0	29·8	32·7	15·4	44·3
Gala ..	57·8	64·9	34·4	38·9	35·5	21·6	42·2
Mengavi ..	65·2	43·8	Not included	32·6	32·9	22·3	39·4
Kenora ..							
Average	71·6	65·8	40·1	36·9	34·3	20·3	45·0

Gamenya when free from rust performed well in all trials while Gala and Spica continued to prove hardy and reliable in mid-season plantings.

At Hermitage Research Station, centre of the State's wheat breeding activities, the recently released New South Wales Department of Agriculture variety Festiguay (66·9 bus. per acre) and the unnamed Queensland variety LG5387 (65·4 bus.) and Windebri (61·7 bus.) gave the best grain yields in the slow maturing trial. Winglen (53·1 bus.), Hopps (48·0 bus.) and Lawrence (41·8 bus.) showed mediocre performances. Lawrence (6·5 tons green material per acre), Festiguay (6·2 tons) and LG5387 (5·9 tons) provided highest forage yields in the two grazings given the trial before the final grain harvest. In the mid-seasons trial at Hermitage Research Station all varieties performed well, only 6·1 bus. per acre separating the best variety LG5387 (52·8 bus.) and the poorest V²TCH5575 (46·7 bus.). The varieties Gamenya (67·5 bus.) and Strain 52 (65·2 bus.) yielded best in the Station's quick maturing trial (Spica 55·9 bus.).

Barley.—The outstanding feature of the 1962 malting barley time of planting trial at Hermitage Research Station was the failure of frost to cause damage in any of the six times of sowing made at monthly intervals from late March to late August. Grain yields were significantly lower in the March (45·4 bus. per acre) and August (46·9 bus.) sowings than in the other four sowings (average 54·7 bus.). Malting quality of the grain from the March and August plantings was also lower.

Maize.—Tropical rust (*Puccinia polysora*) and Diplodia ear rot (*Diplodia* spp.) were intensively active in maize crops on the Atherton Tableland in 1962-63. In environmental conditions which might have been expected to favour them, none of the 25 single crosses of inbreds included in a plant breeders trial on the Tableland outperformed significantly the standard hybrid GH.128 in any of the 3 criteria of judgment used—yield of shelled grain, percentage of healthy ears, percentage of barren stalks.

In the 1962-63 Atherton Tableland hybrid maize varietal trial, yield levels were low but the hybrid GH.170 (22·1 bus. per acre) topped varietal trial yields for the second year in succession. The standard hybrid GH.128 (12·7 bus.) gave disappointing performances in both seasons.

GH.128 with 61·9 bus. per acre at Walkamin Research Station and 83·3 bus. on Walsh Sandy Clay Loam at Parada, and Victory with 54·1 bus. on Dimbula Sandy Loam also at Parada, gave the highest yields in the Mareeba district.

Irrigation and nitrogenous fertilizer were used in a trial at Biloela Research Station in central Queensland in 1962-63 to demonstrate that early sowing of maize could be a profitable enterprise. When sown in mid-September and fertilized with 2 cwt. urea per acre, the hybrid Q692 yielded 143·1 bus. per acre. Unfertilized Q692 yielded 122·5 bus. The next variety, Q23, yielded 141·0 bus. and 122·2 bus. respectively. Average increase in yield of 14 bus. per acre due to fertilizer application for the trial was barely economic. Failure to achieve higher yield differences due to N fertilizer is attributed, however, to the previous pasture legume history of the site.

In a raingrown fertilizer trial at Kumbia, aqua ammonia at 1 or 2 cwt. per acre and ammonium sulphate at 2 cwt. per acre were most efficient economically.

In the 1962-63 fertilizer x plant population trial at Gatton Research Station, nitrogenous fertilizer failed to increase yield levels but actually caused a significant depression in yield. This depression was attributed to the fact that lodging was more severe in fertilized treatments. With regard to plant populations, the treatments involving 20,000 and 16,000 plants per acre (110·7 and 108·2 bus. per acre respectively) outyielded the 12,000 plants per acre treatment (102·8 bus.). In another trial where row spacing and plant population were studied, populations of 16,000, 20,000 and 24,000 plants per acre (113·8, 112·2, 111·4 bus. respectively) produced better yields than the extremes 12,000 and 28,000 plants (104·0 and 107·0 bus. respectively). The percentage of ears and weight of grain produced per ear decreased significantly with increase in plant population. Row spacing had no effect on yield.

Grain Sorghum.—Unfavourable seasonal conditions caused failure of at least 10 grain sorghum varietal trials during the 1962-63 season. Yield data provided in Table 2 for four district varietal trials stress the clear superiority of the hybrids Brolga and Texas 610 over the standard variety Alpha.

Performances of Texas 630, seed of which is difficult to produce, and Texas 608 were also creditable when compared with Alpha.

TABLE 2

RESULTS OF 4 DISTRICT GRAIN SORGHUM TRIALS, 1962-63

Yields in Bushels per Acre

Hybrid or Variety	District				Average	Per cent. Increase over Alpha
	Gayndah	Biloela	Kingaroy	Wandoan		
Brolga ..	91·2	47·2	35·8	31·5	51·4	41·2
Texas 610 ..	81·4	42·0	35·5	31·7	47·7	35·1
Texas 630 ..	86·5	35·0	31·4	28·3	45·3	24·4
Texas 608 ..	74·2	37·7	27·6	30·8	42·6	17·0
Alpha ..	75·8	23·2	24·2	22·5	36·4	..
Average ..	81·8	37·0	30·9	29·0	44·7	..

Cotton.—1962-63 cotton work was highlighted by yields exceeding 3,000 lb. seed cotton per acre in four varieties (Dunn 7, Fox 4, Acala 1517 BR, and D & PL Smoothleaf) in an unfertilized, irrigated trial at Brookstead even though 20-25 per cent. of bolls were lost by rots in excessive March rains (7·26 in. in 13 wet days). Excellent insect control was maintained using commercial field spray equipment. Unfortunately fibre quality was rather disappointing though this may have been a seasonal effect.

Irrigated nitrogen trials at Brookstead (yields to 3,350 lb. per acre of Empire) and at Forest Hill (yields to 2,568 lb. per acre) both gave yield increases to fertilizer application (significant at Forest Hill only). Recommendations are 2 to 4 cwt. of sulphate of ammonia per acre applied at sowing, though the latter amount may be split, half being applied at sowing and half at squaring.

The grade of machine-picked heavy yielding irrigated cotton was not affected by any defoliant treatment used at Brookstead in 1962-63. Considerable indirect benefits by way of planned harvesting (especially early commencement) are apparent from the use of selected chemicals.

At Walkamin Research Station, insects were satisfactorily controlled in the 1962-63 irrigated varietal trial. Yields of seed cotton varied from 2,536 lb. seed cotton per acre (Dixie King) to 2,039 lb. (Empire).

Miscellaneous.—The linseed variety Bonnydoon (26·1 bus. per acre) included for the first time in varietal trials in Queensland topped yields in the 1963-64 Hermitage trial. The oil content of Bonnydoon was satisfactory at 40·1 per cent. The best oil content was obtained from the Indian variety RR204 (42·0 per cent.) which yielded poorly (14·2 bus.) because of a poor stand.

Results from 1962-63 raingrown soybean trials were disappointing and indicated the fairly exacting climatic and cultural requirements of this crop. Interesting results (Table 3) were achieved in an irrigated varietal x time of planting trial at Gatton Research Station in 1962-63.

TABLE 3

IRRIGATED SOYBEAN VARIETAL X TIME OF PLANTING TRIAL GATTON RESEARCH STATION 1962-63

Yields in Pounds per Acre

Time of Sowing	Varieties					Average
	M.B.H.	Nanda	S999	Batavian Yellow	D.E.H.	
October 15–10–62	1,182	1,256	1,249	1,097	669	1,091
November 15–11–62	1,513	1,385	1,602	1,221	805	1,305
December 13–12–62	1,641	1,571	2,112	1,595	1,182	1,620
January 16– 1–63	1,400	1,420	1,707	1,501	665	1,339
February 11– 2–63	218	311	548	747	214	408
Average ..	1,191	1,187	1,444	1,232	707	1,153

Fodder Crops (Winter).—Some 50 winter cereals have been tested for fodder production in south Queensland Departmental trials during the past 2 years. Oats is still by far the most satisfactory winter grazing crop in south-eastern Queensland but, from trial results, it is obvious that at least half of the 30 oat varieties tested could be dispensed with.

The varieties Bentland and Benton perform well except where extreme frost or extreme rust conditions prevail. Prostrate varieties such as Fulghum, LK^{3}6053 (as yet unnamed) and Cooba perform well in extreme frost and low rust conditions such as were experienced at Hermitage in 1963. The variety Saia is an outstanding oat for use in coastal districts where rust is a problem.

Interest is increasing in the use of rape as a fodder crop. In a 1963-64 spring fodder trial in the Warwick district rape yields were increased four-fold from 3,580 lb. of green material per acre to 15,170 lb. by the application of 2 cwt. per acre of ammonium sulphate.

Fodder Crops (Summer).—*Dolichos lablab* (10·6 tons of green material per acre) and Malabar cowpea (8·5 tons) were outstanding in a production trial at Ayr Cattle Field Research Station and significantly outyielded the other cowpea varieties, Cristaudo (5·7 tons), Santiago (5·6 tons) and Reeves (4·0 tons). With poor growing conditions in the Emerald district, *Dolichos lablab* (1·9 tons) outyielded velvet bean (0·7 tons) and mung bean, Reeves, Phoenix, Cristaudo and Blackeye 5 cowpeas and guar bean, all of which failed.

At Hermitage Research Station, Sudax (22·0 tons of green material per acre) significantly outyielded all other varieties, Sugardrip (20·3 tons), Combine Kafir 60 x Sweet Sudan (17·9 tons), Martin x Sweet Sudan (17·0 tons), *Sorghum almum* (11·95 tons) and Sweet Sudan (10·7 tons) in a trial which experienced excellent growing conditions.

Nutritional Trials—Darling Downs.—Agronomic trials have helped solve some of the nutritional disorder problems which are a cause of major concern on the Darling Downs.

In maize, zinc deficiency symptoms have been accurately determined. Yields from affected crops have been increased from 27·1 bus. per acre to 47·8 bus. by applying 15 gal. per acre of 0·5 per cent. zinc sulphate solution.

With linseed, 1 per cent. zinc sulphate sprays applied 2 to 4 weeks after emergence can be expected to produce large increases in yield (25–30 per cent.) for a trifling outlay of 1s. per acre for materials on most soils of the Darling Downs. Only in the Mywybilla soil series where surface soil reaction was slightly acid were no zinc deficiency symptoms noted. On this soil series large and economic responses to superphosphate can be expected.

Experimental evidence has been obtained for the first time to show that wheat, as the first crop after a long fallow, can be severely affected by the nutritional disorder commonly associated with long fallows on the Darling Downs. In a trial on a "Waco" soil at Jondaryan, Spica wheat was planted in May, 1963, on an area which had been long-fallowed since December, 1961, following a crop of linseed. At the planting of the earlier crop in August, 1961, portion of the area had been treated with zinc sulphate at 1 cwt. per acre. The 1963 Spica crop yielded 46·9 bus. per acre where the zinc had been applied in 1961, as against 39·0 bus. where no zinc had been applied. The residual effect of the zinc treatment was also expressed in vigorous crop growth and freedom from disorder symptoms. Wheat on unfertilized plots showed very severe disorder symptoms and lacked vigour. A further finding of considerable importance from the trial was that double cropping with white panicum was as effective as zinc sulphate at 1 cwt. per acre in controlling the disorder under the conditions prevailing on this site.

Herbicides.—A marked increase occurred in the past year in the range of weed problems being investigated in Queensland.

Some highlights from a series of trials on tropical grasses and legumes in the Innisfail district are:—

(1) Siratro was highly susceptible to post-emergence applications of 2,4–D amine at 1 lb. acid equivalent per acre. Stylo was highly resistant. Centro and calopo were intermediate in resistance between these two.

(2) Post-planting applications of 2,4–D and 2,4–DB had no adverse effects on guinea grass yield.

(3) The final cultivation before planting guinea/centro pasture could be replaced by preplanting herbicide application using 2,4-D amine.

(4) TCA at 124 lb. a.e. per acre gave the best control of a vigorous and unpalatable strain of coarse guinea grass. It weakened the guinea sufficiently to allow an undercover of pangola grass to become dominant; it suppressed, but only temporarily, the tropical legumes growing in the trial site.

(5) Planting inoculated, scarified, ungerminated stylo seed $\frac{3}{4}$ in. below the soil surface immediately after spraying the soil surface with 2,4,5–T ester was reasonably safe.

In a pre-emergence trial on irrigated cotton at Forest Hill, prometryne at 3 and 4 lb. active ingredient per acre, ametryne at 3 and 4 lb. a.i. and monuron at 2 and 4 lb. a.i. all gave 97–100 per cent. control of morning glory (*Ipomoea purpurea*), bell vine (*Ipomoea plebeia*) and barnyard millet (*Echinochloa crus galli*) up to 46 days after sowing. Monuron at 4 lb. a.i. had the longest effective life and was still controlling weeds 59 days after sowing. All treatments used except monuron at 2 lb. a.i. caused early growth retardation in cotton but no herbicide treatment significantly affected cotton yields.

Dicryl at rates of 2 and 4 lb. a.i. gave 96·6 and 96·1 per cent. kill of *Ipomoea* spp. in another trial at Forest Hill without adversely affecting yields of irrigated cotton.

Populations of 40 or more stalks per sq. yd. of wild oats (*Avena ludoviciana*) caused significant reduction to 16·2 bus. per acre from 19·9 bus. per acre in control plots in Mengavi wheat in a wild oats population trial at Hermitage Research Station in 1962. The lowest yield (13·0 bus.) was obtained where the wild oat population was 96 stalks per sq. yd.

Potatoes.—Bungama (14·6 tons per acre) outyielded the popular variety Sequoia (12·3 tons) in a spring 1963 irrigated varietal trial on the Atherton Tableland. The top 6 varieties yielded in excess of 12 tons per acre and provided further evidence that yields equal to the best obtained from south Queensland are possible on Atherton Tableland scrub soils under irrigation.

In an irrigated potato method-of-cutting trial at Gatton Research Station planted February 20, 1962, and dug 112 days after planting, production from apical and basal cut sets was not significantly different, but there did appear to be a definite trend for apical sets to be superior.

Potato seed for the spring planting in the Lockyer Valley is generally imported from southern States as certified seed. A source-of-seed trial at Gatton Research Station, in which certified Sebago seed from six sources in southern States was included, gave significant differences in yield and size distribution and indicates that concern over the quality of some certified seed is not without justification.

Irrigation.—A series of trials is being carried out to determine the effects of varying frequencies and rates of irrigation application on the yield and quality of Sebago potatoes at Gatton Research Station. Two trials, the sixth set of the series, were carried out in the autumn of 1962. The results of these trials correspond with those of previous trials in general outline. An application of 1–1½ in. per week or 10 days gives the best yields commensurate with high specific gravity. An increase in water application over this amount will give increased yields, but can depress the specific gravity below what could be considered an acceptable level, namely 1·065 or 16 per cent. solid matter. Treatments employed in the first trial were combinations of 1 in., 2 in. and 3 in. of irrigation water applied every 7, 14 and 21 days.

Specific gravity ratings increased significantly and scab incidence ratings decreased significantly as rate and amount of irrigation decreased.

In the second trial, complicated variations of the fundamental treatments 0·5, 1·0 and 1·5 in. of irrigation per week were made but yield, scab incidence and specific gravity trends were similar to those reported in the first trial.

Agricultural Engineering.—The growth of agricultural production throughout Queensland has been accompanied by an increase in farm mechanisation and, during the period under review, an appreciable increase in numbers was recorded for most items of machinery and implements on rural holdings.

Successful negotiations with the National Institute of Agricultural Engineering, Bedfordshire, England, and Massey-Ferguson (Aust.) Limited, Melbourne, have resulted in experimental tie-ridging equipment being made available to the Department for tie-ridging trials to be conducted in this State.

As the result of the successful development of an auto-header 4 years ago by the Department for use on experimental plots, orders were placed with the Kingaroy Engineering Works, Kingaroy, for two additional machines for use at the Parada and Hermitage Research Stations.

Tobacco.—Emphasis in tobacco research continues to be placed on trials to clarify problems raised by the extension staff.

The major problems of the Mareeba area are associated with fertilizers and the differing characteristics of the soils used for tobacco. From last season's work it is evident that basal fertilizer applications are all-important and that seasonal weather conditions make it extremely difficult to maintain soil nitrogen levels at any predetermined level.

Extensive soil sampling during crop growth on the red sandy soils in the Beerwah area have revealed that the soil nitrogen contribution can be substantial on these soils, and that leaching is not a serious factor.

Weed control, particularly that of grass species, is often difficult and costly in tobacco. Most of the common weedicides are phytotoxic to tobacco, but the recently obtained Trifluralin has shown considerable promise in a trial at Bundaberg. This chemical together with others which have been successfully tested in the U.S.A. will be examined in further trials.

Sucker control in tobacco is also a costly operation, and a range of mineral desuckering oils is under test.

Cold injury in tobacco seedlings has been common in recent years in southern Queensland, and plastic film used for benzol application was evaluated as a means of protection. Various seedbed mulches were also examined, as it is known that certain types of sand can aggravate cold injury. It was found that fixed plastic covers were usable provided ventilation was adequate, and that peat moss and vermiculite stimulated early germination and seedling growth.

AGROSTOLOGY

Pasture Varieties.—During 1963-64 there was a very considerable increase in the area planted to improved pastures. Tropical legumes made a significant contribution and, in view of the 250 new legume introductions obtained during the year, it is confidently expected that this trend will continue.

Some of the more promising species obtained during the last few years are now undergoing advanced testing, and include the legumes, *Desmodium intortum, Dolichos axillaris, D. biflorus* and the grass, *Brachiaria ruziziensis.*

Apart from recent pasture introductions, some promising lines are being developed by means of selection from well-established material. The 9–7–2 variety of rye grass developed at the Biloela Research Station showed significant superiority.

Work with lucerne selections and introductions is being carried out in north and central Queensland.

The search for legumes capable of providing late autumn grazing is continuing. The Rongai strain of *Dolichos lablab* showed a capacity to remain green and palatable and to grow much later into the autumn than either velvet bean or cowpeas. It was compared with velvet bean in a trial at Cooroy and was superior in all respects. Rongai appears to be less susceptible to disease and pest attack than other annual forage legumes.

Many of our more promising pasture species have now been incorporated in mixed pastures and are being subjected to grazing. In the trial at "Taranga", Bloomsbury, the objective is to turn off steers dressing 500 lb. at 24 months. A pasture of angleton grass and Townsville lucerne was used until the end of July when the stock were moved to sugardrip sweet sorghum. Weight gain averaged 1·49 lb. per head per day during 1963. A control group on spear grass at a much lighter stocking rate gained only 0·77 lb. per head per day.

On a 40 ac. lotononis-pangola pasture at the Coolum Research Station, cattle have gained 1·6 lb. per head per day, that is 1 lb. per ac. per day, for the 7 months to the end of April.

Grazing has now commenced on an irrigated pasture trial established last year at the Walkamin Research Station. The species are stylo, Tinaroo glycine and siratro, each grown with para grass. The early growth of stylo has been much superior to that of glycine and siratro.

In sward trials in the Charters Towers district, Biloela, Nunbank and Boorara buffels were more productive than the Gayndah and American strains, which in turn were better than *Urochloa mosambicensis.*

At the Biloela Research Station, six grasses were each grown with siratro and with lucerne. Callide Rhodes was more acceptable to cattle than common Rhodes grass and was most productive.

The growth responses of eight tropical legumes to variations in temperature were studied, using controlled environment facilities provided by the C.S.I.R.O. Division of Plant Industry, Canberra. Seedlings were grown using a 16-hour day length for 41 days under eight different temperature conditions, ranging from 36 deg. C. (day temp.)– 31 deg. C. (night temp.) to 15 deg. C.– 10 deg. C. The optimum temperature combination for the whole plant seedling growth of each species is shown—

TABLE 4

Species	Optimum Growth Temperature, Deg. C.
Stylo	36–31
Townsville lucerne, calopo, puero ..	33–28
Siratro, Tinaroo and Clarence glycines	30–25
Cooper glycine	27–22

The growth of calopo varied little over the range 36–31 deg. to 30–25 deg., and siratro growth was less reduced by higher temperatures than the glycine varieties.

In south-western Queensland, the practice of diverting runoff from hard mulga ridges to gently sloping land has gained considerable momentum. The improvement of moisture status makes possible the growing of introduced grasses, and efforts have also been directed to finding suitable legumes for these situations. Species sward trials, each embracing 20 species, were sown on 10 different sites. Siratro showed promise in this first season.

Pasture Establishment.—Factors responsible for failures of small seeded summer grasses to establish on the black earths of the Darling Downs are now more clearly understood. In one experiment, 17 fortnightly sowings of Rhodes grass and of green panic were made at ½ in. depth. The average fate of the seeds in the 12 sowings which germinated is shown in Table 5:

TABLE 5

AVERAGE FATE OF SEED AFTER SIX WEEKS FIELD EXPOSURE

(Equivalent Percentage of Viable Seed Sown)

—	Rhodes grass	Green Panic
Field germination	75·2	65·8
Non-emergent seedlings	51·3	30·4
Crust impeded seedlings	6·5	2·8
Seedling mortality	9·6	4·3
Seedling survivors	9·4	28·2
Residual viability	10·7	8·6
Seed not recovered	0·8	3·0
Non-viable seed	13·3	22·6

A higher percentage of seedling establishment occurred in green panic, despite the better field germination of Rhodes grass. Moisture stress was the main factor which limited field germination, the extent of which was related to the depth of saturated soil promoted by any rain. In the five sowings which did not germinate, the loss of viability of seed in the soil was 12·9 per cent. for Rhodes grass, and 32·0 per cent. for green panic.

Failure to emerge through the soil was the main restriction on establishment. Occasionally crust impedance occurred, but emergence failures were normally due to mechanical impedance by the dry crumbs immediately under the crusts. This appeared to be aggravated by the development of the primary leaf of non-emergent seedlings, due to the penetration of light into the surface soil. Rhodes grass was more susceptible to impedance than green panic.

Seedling deaths in the first week after emergence were often high, and were caused by "recrusting" of the soil with light falls of rain. These light falls of rain caused the soil crusts to reform with a different cracking pattern. This led to emerged Rhodes grass seedlings being permanently obstructed. With heavy crust formation, green panic seedlings were constricted just above the primordia. In the instances where seedlings penetrated the surface before heavy crust development, the seedling crowns were embedded in the crusts. When the crusts curled upwards, many of these seedlings perished from root severance or desiccation.

Seedling deaths due to high temperature and moisture stress affected both species similarly, but these factors were not of primary significance.

The reliability of sowings can be improved by giving greater attention to seed quality, especially in relation to speed of germination. Experiments with pre-germinated seed showed promise. Depth of sowing is also critical. Rhodes grass is best sown at ½ in. depth, and green panic at ½–1 in. depth. The first requisite is a fine seedbed. Seedbed compaction prior to drilling is a further aid to placement of seed, but should be used with caution on erodible land.

The establishment and natural colonisation of buffel grass in the Charleville district were more successful under the drip ring of poplar box trees (*Eucalyptus populnea*). Soil analysis from 23 paired sites indicated average values of 156 p.p.m. available phosphate under box trees, and 51 p.p.m. on adjacent open areas away from box trees. Biloela buffel grass was more successful than Gayndah buffel grass in colonising acid soils of low fertility.

In an experiment at Cooran with Rongai *Dolichos lablab,* plant density was related simply to the number of seeds sown. The yield and leafiness of the different treatments are shown in Table 6:

TABLE 6

Seeding Rate	Yield	Percentage Leaf
lb./ac.	lb. dry matter/ac.	
5	1,530	56
10	2,780	59
20	3,920	51
40	4,560	51

Pasture Nutrition.—Investigations continued into the low productivity of kikuyu pastures on red krasnozem soils at Maleny (S.E. Queensland). Several treatments were applied and samples obtained for crude protein determination during April, 1963, when the kikuyu was making its most vigorous growth, indicated that renovation and overseeding with Ladino clover improved the nitrogen status of the grass. Management factors directed towards the encouragement of white clover, for example superphosphate application, could result in very significant nitrogen increments to the soil-pasture system.

The collection of data from cutting trials on the recovery of applied nitrogen by paspalum (Rocklea) and kikuyu (Tamborine) was completed over a 3-year period. The fertilizer used was sulphate of ammonia. The following table summarises the increase in dry matter yield per acre for each pound of elemental nitrogen applied to a paspalum sward at Rocklea:

TABLE 7

lb./acre N	Lb. dry matter per acre increase per lb. of N		
	16–2–61 to 26–10–61	26–10–61 to 5–11–62	6–11–62 to 14–10–63
47	23	39	33
94	19	30	17
141	20	26	17

Pot experiments were carried out at Gympie to provide a preliminary assessment of the nutrient status of several district soils in relation to the available range of tropical legumes. Results suggest that the capacity to extract nutrients from infertile soils is highly developed in siratro and *Desmodium intortum,* less so in silverleaf desmodium and in *Glycine javanica* (CPI–13300), while Tinaroo glycine was the least potent of those tested in this respect. Siratro responded to higher levels of phosphate application than did the other legumes. On two lithosols, siratro and Tinaroo glycine were the only cultivars to show a significant response to molybdenum and this occurred only at high phosphate levels.

Indications that potash deficiency is limiting white clover growth on at least one soil type were recorded from a Gympie field trial.

At South Johnstone, responses of puero and stylo to applied phosphorus were obtained in pot culture with four soils representative of the areas of coastal plain north of the Cardwell Range between the Tully and Murray Rivers.

A further pot culture study indicated a serious phosphate deficiency limiting seedling growth of tropical grasses in an open forest soil from the King Ranch property at Murray Upper.

Studies on the nutrition of stylo were carried out using a heavily leached coastal forest soil from Tully. Highly significant responses to phosphate application were recorded. A highly significant growth response to copper at the highest phosphate level indicated a marginal deficiency of this element.

A field trial at Echo Plains was carried out to gauge responses to combinations of superphosphate and rock phosphate in a mixed guinea grass—puero sward. The total yields from three samplings made over the first 2 years' growth are shown:

TABLE 8

YIELD, LB. DRY MATTER, PER AC.

lb. P_2O_5/ac.	Ratio, superphosphate: rock phosphate				
	0 : 1	1 : 3	1 : 1	1 : 0	Average
0	..	..	..	..	4,938
50	6,191	5,554	5,146	6,131	5,756
100	6,282	6,389	7,191	8,330	7,048
200	7,404	9,447	9,932	7,816	8,649
Average ..	6,626	7,131	7,422	7,425	..

In the first harvest, superphosphate alone was superior to mixtures with rock phosphate or rock phosphate alone, and responses in both guinea grass and puero occurred. In the second and third harvests, the responses to phosphate occurred irrespective of the fertilizer form in which phosphate was applied. The results suggest that admixture of superphosphate with the cheaper rock phosphate could be carried out without permanent detriment to pasture development.

Pasture Management.—Two complementary systems of grazing management are under study at "Brian Pastures," Pasture Research Station near Gayndah. Cattle are weaned onto sown pastures in May, and moved to native pasture in the early summer.

Sown pastures of green panic/lucerne are reserved from grazing from early summer to late autumn. The effect of making summer hay and of varying stocking rate is being investigated. Weaner cattle of 350 lb. liveweight entered the trial areas on May 29, 1963. Their performance until January 8, 1964, is summarised in Table 9:

TABLE 9

Treatment	Lb. Liveweight Gain	
	Per head	Per acre
A. 1 weaner/1 ac., no conservation	73	73
B. 1 weaner/1 ac., conservation	97	97
C. 1 weaner/1·7 ac., no conservation	140	84
D. 1 weaner/1·7 ac., conservation	176	106

Cattle were rotationally grazed on a system of 2 weeks' grazing and 6 weeks' deferment. The average yield of pasture presented to the animals each fortnight is summarised in Table 10:

TABLE 10

YIELD OF PASTURE, LB. DRY MATTER PER ACRE

Dates	Treatment			
	A	B	C	D
28– 5–64 to 10– 7–64	2,987	1,832	2,974	1,818
24– 7–64 to 4– 9–64	1,957	1,127	2,304	1,247
18– 9–64 to 30–10–64	1,295	902	1,605	1,054
13–11–64 to 23–12–64	771	652	1,127	782
Average	1,753	1,128	2,003	1,225

Although a summer hay cut reduced the yield of pasture present in May, the yield of lucerne was not reduced. Under the adverse seasonal conditions experienced, the yield of pasture available in the spring and early summer was not grossly reduced by previous summer hay cutting, at least in the more heavily stocked treatment.

Hay cutting improved the percentage crude protein of the grass on offer in May by about 1 per cent., and this difference was still maintained in October.

In treatments B and D, 1,220 lb. and 1,190 lb. per head respectively of hay were fed over the trial period. The yield of hay cut was 1,625 lb. per ac.; the average crude protein content was 7 per cent. The response to hay feeding, in terms of liveweight gain per unit of hay feed, was less at the higher stocking rate.

The value of supplementary lucerne grazed in conjunction with native pasture was again demonstrated in the second year of an experiment at Texas:

Acres per sheep		Fleece Weight	Wool per acre
Native pasture	Lucerne		
		lb.	lb.
2·0	nil	12·0	6·0
1·0	nil	10·8	10·8
0·83	0·17	11·7	11·7
0·55	0·11	10·7	16·0

SOIL CONSERVATION BRANCH

Soil conservation activity is rapidly expanding and landholders made 2,727 applications for technical assistance during the year. In order to meet these needs, 35 soil conservation extension officers are now stationed in 20 districts. These officers made 4,784 visits to farms for the purpose of providing advisory services, preparing farm plans and surveying sites for earthworks. New centres were opened at Rockhampton, Mundubbera and Brisbane.

There is no substitute for the farm visit in the preparation of mutually acceptable soil conservation plans and for the implementation of projects. However, mass media are used where practicable to convey information and stimulate interest. Twenty-four field days, schools or inspection tours were conducted, 25 radio talks were given and 45 press articles released. Eighty addresses were given at meetings of primary producers' organisations.

Contouring for Control of Runoff and Erosion.—Technical services provided by Departmental officers led to the installation of 1,900 miles of protective structures on 56,275 acres of eroded cultivation land. This is an increase of 44 per cent. on the total for the previous year. A total of 248,000 acres of eroded cultivated land has now been protected by the installation of structures.

The Eastern Downs and Burnett regions maintained satisfactory progress with 12,205 and 12,719 acres protected in the respective areas. The north Queensland and south-east coastal regions remained at approximately the previous year's figures.

However, outstanding progress has been made in central Queensland and the western Darling Downs regions. In central Queensland, the area protected was quadrupled to reach a total of 12,866 acres of which 6,998 acres was located in the Central Highlands and 5,868 acres mainly in the Callide and Dawson Valleys. In the western Darling Downs region, the area protected rose by 70 per cent. to a total of 15,570 acres and, of this, 8,426 acres were located in the Roma district where the area protected was doubled during the 12 months.

Significant increases in soil conservation activities are occurring in the areas of relatively recent development and this is in accord with the need to prevent deterioration of soils in these areas. There is an even greater need, however, to halt the accelerated erosion in the older districts.

There has been a discernible change in attitude to the use of contour cultivation and strip cropping procedures without the protection of contour banks. Though these measures were applied to 18,099 acres, an increase of 8 per cent., there was an actual decline in their application on the gently undulating lands of the Central Highlands and western Downs and a substantial increase in strip cropping to protect the near level areas of the plains country in the east Darling Downs region.

Surveys have now been made for the application of contour cultivation and strip cropping on 55,416 acres of land and of this total 11,222 acres are located on the Darling Downs plains country.

Conditions generally were suitable for the establishment of vegetation on the 130 miles of waterways constructed during the year.

Planning.—The 98,506 acres planned during the year is a great deal less than in the previous year but this was largely due to staff in southern regions being preoccupied with topographic mapping projects. Detailed 10 ch. to 1 in. plans have now been prepared for 746,000 acres of land.

The topographic mapping programmes directed by the Survey Office are proceeding nicely and vertical control surveys were completed on 400,000 acres of land during the year. These mapping programmes, leading to the production of 10 ch. to 1 in. contour maps, have now been completed for areas aggregating 940,000 acres and a further 450,000 acres is involved in projects of immediate interest.

In districts where they are available, topographic maps have proved to be a major aid in planning and in one instance saved up to 60 per cent. of an officer's planning time and in addition have aided in the production of better plans. One officer using topographic maps was responsible for one-fifth of the whole State output of plans.

Soil conservation plans are finalised for all the major sloping areas of the Mareeba–Dimbulah tobacco irrigation area. The aggregate area planned is 24,791 acres.

The Toowoomba office was further developed during the year as the main drafting centre and in the course of the year prepared base plans for 155,000 acres of land, completed 11 district reference maps and reproduced 2,200 maps or plans.

Special problems are involved in the preparation of soil conservation plans for the larger properties in the new development areas and steps were taken during the year to determine solutions. A special projection technique using high altitude aerial photographs offers promise.

Investigations.—Work continued on problems associated with water spreading and pondage systems on the Darling Downs. Water spreading on cropland is being studied as a means of minimising runoff. Possible benefits in enhanced crop yields as well as possible detrimental effects are being investigated.

Evidence of the benefits to an ensuing wheat crop from flooding during the fallow period was obtained at Moffat where water had been held in level contour banks for long periods during the previous summer. An average period of 18 days was required to wet the profile to a depth of 5 ft. Despite the fact that rainfall was above average during the growing season and yields on all plots were good, tillering, grain setting, vegetative yield and grain yield were all higher on the pre-flooded plots. A peak yield of 66 bus. per acre was achieved on the longest flooded plot. Average yield on non-flooded plots was 44 bus. per acre.

Observations on the effect of flooding on growing crops included the following:

(*a*) A crop of safflower was inundated for up to 10 days in the early heading stage. Plants stood up to approximately 5 days of flooding without obvious ill effect but, for periods in excess of this, high mortality rates were recorded.

(*b*) A crop of sorghum showing signs of moisture stress in the late vegetative stage was inundated for periods up to 7 days without obvious ill effect. On unflooded areas the crop further deteriorated. Areas flooded suffered a temporary setback but vigorous growth and full heading ensued, resulting in a good potential for yield.

Other aspects investigated were the relative merits of various water spreading techniques, and the effect of such factors as depth and length of flooding, initial soil moisture and soil cracking on the rate and depth of water movement into the soil profile.

Catchment runoff installations at Kingaroy and at Galligan's Gully, Pittsworth, were completed and the stations are now operative. The first flow (40 cusecs) was recorded from Galligan's Gully on December 1, 1963, and there were two subsequent flows in March (227 cusecs) and April (29 cusecs). At the Kingaroy station, only one very minor flow was recorded during the year. These are long-term projects designed to record basic data on which runoff estimates for small agricultural catchments can be based.

Plans were completed for the installation of runoff measuring flumes on three 30 to 40 acre catchments on the Brigalow Experiment Station, Theodore, and all concrete work for the flumes has been completed.

The project initially will involve the measurement of rainfall and runoff from undeveloped brigalow land. Later two of the catchments will be developed by clearing and grassing and finally one will be cultivated. Comparisons will then be possible between the developed and undeveloped catchments and an evaluation made of the effect of the differential treatments on runoff and erosion.

General.—The co-ordination of district extension programmes, problem resolution and extension staff training were further improved during the year through the systematic development of quarterly regional conferences and the provision of additional induction and in-service training facilities.

Surveys to determine the present and likely soil conservation needs were commenced. The initial work involved close examination of sample catchments, from which approximate assessments of district and regional needs were derived by extrapolation.

HORTICULTURE BRANCH

DECIDUOUS FRUITS

Nursery propagation at the Granite Belt Horticultural Research Station is planned to meet the requirements of stock-scion projects in deciduous fruits both at the Station and in the Stanthorpe district. Stocks of particular interest are Merton 778 which is currently recommended for all varieties of apple on replant ground and a range of Malling Merton stocks (including 104, 106, 113, 114, 115 and 193). MM104 appears to be susceptible to crown gall. MM106 has a very fibrous root system which may be correlated with the precocious bearing of trees grafted on to it.

Thinning trials in apples at Stanthorpe have been concerned with NAA (naphthalene acetic acid) and carbaryl. Of these two materials, carbaryl at 1,000 ppm. is the milder thinner, and greater latitude is permissible in times of application. Over-thinning has never been recorded with the carbaryl spray. Supplementary hand thinning may, however, be required in some years.

The standard pre-harvest drop spray for apples in the Stanthorpe district is 2,4,5-TP, which is applied about 2 weeks before the anticipated time of harvest. Treatment failures were recorded on a few orchards in 1963-64. These were associated with very early spray applications during periods of high temperature when the trees were under stress. Under such conditions, treatment should be delayed until fruit maturity is imminent, even if this entails the loss of a few early maturing fruit.

Nutritional trials failed to demonstrate clear-cut responses to the major elements N, P and K at Stanthorpe. However, in one trial, a potassium response is apparent in the harvesting data. With the recent establishment of laboratory facilities for effectively servicing these trials, it is hoped to obtain a correlation between applied fertilizer, nutrient uptake, and nutrient utilization.

A new era may be dawning for Gravenstein, an early-maturing dessert apple of high quality, production of which is currently hampered by the disorder known as "flat limb". This disorder is due to a virus and the stage is now set for the propagation of virus-free trees. The release of this material should be followed by increased plantings.

The promising results previously recorded with gibberellic acid on staggy trees of the variety Granny Smith were confirmed during the year. Some time must necessarily elapse before the long-term effects of treatment can be assessed. Responses of this kind could prolong the life of the trees and increase production per acre.

In some seasons, berry quality in grapes grown in southern coastal Queensland is subnormal; the fruit lacks both skin colour and sugar content. Experimental work at Birkdale indicates that fruit quality can be improved by severe pruning of the vines in winter and berry thinning in the bunch. Coincident exploratory work on grape vine nutrition suggests that berry quality is better when a potassium foliage spray is applied before flowering and/or a side dressing of potash is used at fruit set.

A severe outbreak of "hen and chickens" disorder which occurred in Waltham Cross grapes at Stanthorpe prompted observational trials on the effect of gibberellin sprays. If applied at 10 ppm. when 80 per cent. of the flower caps have fallen, the response is good; seedless berries develop at much the same rate as berries carrying the normal quota of seed. The incidence of seedlessness or partial seedlessness in the berries is linked with cool, cloudy weather at flowering.

A one-third bushel volume-fill carton for apples was released for experimental use during the year. In transport trials, bruising was much the same as in the standard bushel case but its incidence was influenced by fruit size. In the cartons, bruising decreased with increase in fruit size; in the standard apple case, the position was reversed with maximum bruising in the larger fruit.

PLANTATION FRUITS

Pineapples.—An examination of pineapple production data over the past decade has shown that the production pattern on certain farms is representative of both the district in which they are located and southern Queensland as a whole. It should therefore be feasible to determine harvest peaks from observation on a limited number of properties. This finding should permit a better integration of cannery intake with the labour force available.

Coincident with this work, fruit development studies indicated that the fruit reaches its maximum T.S.S. content some 155 days after the flowers appeared in the heart of the plant. Using these data, the practicability of block harvesting was investigated in conjunction with the Food Preservation Research Branch. Results indicate that, given uniform planting material and effective flower induction, block harvesting could be a practical proposition on the farm .

In southern Queensland, pineapples are normally planted on raised beds in order to provide adequate drainage during the wet season when the risk of plant losses from top rot and root rot is high. At the Pineapple Research Laboratory, soil temperatures were recorded at a depth of 6 in. in raised bed plantings, furrow plantings and flat plantings. During the summer months, readings were much the same. However, in winter, differences in the diurnal temperature range varied from 8·4 deg. C. in raised beds to 2·4 deg. C. in furrow plantings. These differences could be significant for nitrogen uptake during the cooler months of the year.

Growth studies at the Maroochy Horticultural Research Station indicate an uptake pattern for N, P and K which is similar to that previously reported at the Pineapple Industry Farm, Beerwah. However, levels of all three nutrients were generally higher and this probably reflects the more fertile soil at the Station. Minor variations in N levels could be significant; concentrations in the tissues were maintained at peak levels in the second summer from December to May, a much longer period than at Beerwah.

In a nutritional investigation at the Pineapple Industry Farm, Beerwah, side dressing fertilizer schedules were compared with the currently recommended P-K basal fertilizer followed by routine applications of N as urea sprays. Magnesium treatments were superimposed. Significant effects were recorded from magnesium in the form of dolomite applied at a rate of 1 ton per acre. Fruit weight was increased by 6 per cent. It seems that, on this soil type, a deficiency of magnesium may adversely affect utilization of potassium by the pineapple plant.

Glasshouse trials at the Pineapple Research Laboratory compared nitrogen applied as ammonia, nitrate and ammonium nitrate. Marked differences in plant growth were recorded which demonstrate that the pineapple makes much better use of nitrogen as ammonia than as nitrate. Fruit quality was also affected; the sugar/acid ratio was lower in plants receiving ammonia than in plants receiving nitrate.

Formal trials with the several pineapple clones selected at the Maroochy Station continue. The best of these clones (Nos. 13, 14 and 23) are currently being placed in regional trials for further testing. All have the attributes of high yield and acceptable fruit quality.

Plant spacing treatments were superimposed on a nutritional trial at the Maroochy Station. Fruit size declined at spacings below 12 in. in the row but this was more than offset by the greater number of fruit and higher yield per acre at the closer spacings. In this trial, yields were directly proportional to the amount of N applied as a urea foliage spray.

Bananas.—Since it was established that the disorder in bananas known as "yellows" is linked with K deficiency, the fertilizer programme in north Queensland has been based on a 5/7/23 mixture. Further trials recently completed show a good correlation between the K status of the soil at the time of planting and the incidence of yellows. In a high K soil (0·5 m.e. per cent.) such as the Tully clay loam, the potassium component in the fertilizer has little effect on yield. Conversely in a red-brown loam near Innisfail with low available K (0·1 m.e. per cent.), 4 lb. of a 5/8/25 mixture per annum supplied insufficient potassium for maximum plant growth.

Four introduced varieties IC2, 2390-2, Sucrier and Lakatan (ex Philippines), have been cleared from post-entry quarantine at Rydalmere, N.S.W., and will be transferred to Queensland next spring. Ney Poovan and 879-2 ex Jamaica show some abnormalities in growth and require further checking before release. Mysore and Bodle's Altefort were lost in post-entry quarantine and replacements are being obtained.

Paraquat, one of the newer desiccants, may have a place in the weed control programme for banana plantations. Applied at 1 pint per acre of the 20 per cent. concentrate, commercial control was obtained in a trial at Slack's Creek where weed populations were moderately dense. Provided the rate per acre is maintained, the concentration of the spray is of little moment. All of the three herbicides likely to be used commercially—paraquat, amitrol and sodium arsenite—can be applied through full-volume or misting equipment provided the active ingredients per acre are standardised.

In the Cavendish strain trials at the Maroochy Station, plant crop bunches were harvested. Some strains show tolerance to low temperatures and this could be an asset on the cooler slopes of southern Queensland. Bunch and fruit quality characteristics are being assessed in terms of carrying quality and ripening behaviour. A similar trial was established with selected strains of the variety Mons Mari. Sufficient clonal material is now available to meet all experimental requirements at the Station.

Papaws.—Weedicide trials in papaws at the Redlands Horticultural Research Station confirmed an earlier finding that both monuron and diuron are efficient weedicides for established papaw plantations. However, both must be used with discretion during the first 6 months after planting; otherwise toxicity symptoms may develop even at the minimum effective concentration of 2 lb. active ingredient per acre. These symptoms include stunting with some chlorosis and distortion of the leaves. In young plantations, desiccants such as sodium arsenite and paraquat may be used, provided the plants are protected from direct contact with the herbicide.

Selection to the F4 generation within a range of Sunnybank plant types has produced uniform lines which should meet most of the industry's requirements in southern Queensland. Plant type and fruit quality are much better than in field run material, and cropping potential under irrigation is high. Fruit size varies with climatic conditions at flowering and the grower can allocate large fruit to the cannery and smaller fruit to the fresh fruit market.

SUBTROPICAL TREE FRUITS

During the past few years, some 15 stock-scion trials have been established in the main citrus growing districts. These are designed to check the performance of commercial varieties and strains of citrus on a range of stocks including types of potential value to the State. Some of these trials are now coming into bearing. Points which have emerged from these trials to date are: *a.* differences in tree vigour between strains of Glen Retreat mandarin with a high commercial rating; *b.* the indifferent performance of trees on trifoliata stock, particularly in areas where salinity problems are likely to occur; and *c.* the promise shown by Emperor stock not only for mandarins but also for sweet orange.

Some introduced varieties of citrus may find a place in the industry. One of the most promising is Kara mandarin which matures its fruit later than Ellendale and could therefore extend the limited season for mandarins. Another mandarin, USSR, shows unusual juice characteristics which may appeal to the Australian consumer.

Citrus nutritional trials are now in their third year. Tissue analyses indicate that nutrient levels for N, P and K established in California are generally maintained here with existing fertilizer recommendations. However, in the lighter soil types, nitrogen levels may at times become marginal. In a nitrogen nutrition trial at Gayndah with Navel oranges, yield and growth increment were directly correlated with the amount of applied nitrogen.

Work was continued on the reaction of the various citrus stock-scion combinations to salt in both the soil and in irrigation water. The data available to date indicate that sweet orange, Emperor mandarin and Troyer citrange absorb similar amounts of both sodium and chlorine from irrigation water applied to the leaves through intermittent sprays. However, Emperor mandarin takes up less chlorine from the soil than other stock varieties and also less sodium than sweet orange. Troyer citrange appears to be selective between sodium and chlorine.

Avocados.—Reconstruction of the avocado orchard at the Redlands Station, which suffered severely from root rot in 1962, is in progress. Some trees were lost and others obviously lack vigour. The effect of various pruning techniques on the weaker trees is being examined but the prospect of restoring normal production is only fair. The future of this block may therefore depend on the outcome of resistant stock investigations at Mount Cotton where various strains of the variety, Duke, have been propagated. Some of these may show sufficient root rot resistance for commercial purposes.

Fruit development studies are being continued in association with Food Preservation Research Branch. These indicate that oil content of the fruit can be correlated with the size of the crop. This finding is significant, since oil content is an official criterion of fruit maturity for marketing purposes.

Macadamia Nuts.—The Macadamia nut orchard at the Maroochy Station is currently receiving adequate irrigation and effective control schedules for the more important insect pests. Tree growth and cropping showed a corresponding improvement during the year and the prospect of evaluating the various stock/scion combinations is good. During the current season, *integrifolia* strains commenced flowering in early July while *tetraphylla* strains flowered later in mid-August. Scionwood of the following varieties was distributed to nurseries: *a. integrifolia* types—Rickard, Tinana, Keauhou, Kakea; *b. integrifolia-tetraphylla* hybrid—Teddington; and *c. tetraphylla* types—Elimbah, Howard, Collard and Sewell. *Tetraphylla* lines have outyielded *integrifolia* lines during the season.

Sizable commercial plantings of this crop on the North Coast are expected during the next few years.

Custard Apples.—Although plantings of custard apples increased in the Metropolitan district, production problems remain acute. These are mainly linked with zinc deficiency but root rots may be implicated.

At the Redlands Station, growth responses have been recorded after severe pruning and the application of zinc sprays to trees showing deficiency symptoms. However, routine foliage sprays do not fully correct the disorder. Current laboratory work is concerned with factors which influence the uptake of zinc from foliar sprays and the practicability of increasing absorption by the tree.

Mango.—With the increased grower interest in mangoes in the dry tropics, consideration is currently being given to widening the range of varietal types in Queensland. Introductions are channelled through post-entry quarantine at the Redlands Station. Recent introductions despatched to Millaroo Research Station for orchard appraisal include: Valencia Pride, Brooks, Karutha Columban, Manzana, Saigon, Wilson, Nelson, Karrie, Willard, Glen and Anderson.

MISCELLANEOUS FRUITS

Passion Fruit.—The passion fruit breeding programme designed to produce varieties with the Fusarium resistance characteristic of *Passiflora edulis* forma *flavicarpa* and the fruit quality of *P. edulis* is faced with technical difficulties in fixing desirable plant types. Procedures are currently under review.

Nevertheless, some hybrids grafted on to *P. edulis* are finding a place in the industry. Though plant and fruit characteristics are variable, growers find this material of value because of its consistent cropping and a capacity to retain and mature fruit even when infected with woodiness virus. Both processors and the fresh fruit market have accepted hybrid passion fruit even though skin colour and acidity of the pulp differ from those of the purple passion fruit.

Strawberries.—At the Redlands Station, the merits of the varieties Phenomenal and Majestic as well as of a number of selections from the breeding programme were investigated in association with the Food Preservation Research Branch. Yields in Phenomenal and Majestic were much the same, but differences in fruit quality could have commercial significance. One selection derived from Marion Belle x Klonmore was outstanding for yield, uniformity in fruit size and firmness of the fruit.

In the breeding programme, high yields early in the season were recorded in selections from Missionary x Phenomenal, Blakemore x Majestic and Marion Belle x Majestic. One selection from Marion Belle x Klondyke has a concentrated cropping period between September and November.

Steps have been taken to compare the merits of virus-free and standard field-run planting material at the Redlands Station. This project is designed to isolate the effect of crop management methods on plant performance and in particular, times of planting and fertilizer practice. The increased vigour of virus-free planting material could well involve modifications in production methods if its potential is to be exploited commercially.

Ginger.—With the stabilization of the ginger industry and the potential on the overseas market for the dried product, costs of production must be kept to a minimum. Commercial ginger is normally grown under a sawdust mulch to control weeds, and maintain soil moisture levels at optimum values for plant growth. Work at the Maroochy Station has shown that monuron is an effective weedicide when used at the rate of 4 lb. per acre. In many areas, costs of production would be substantially reduced by the use of this herbicide in place of the sawdust mulch.

VEGETABLES

Tomatoes.—A series of F1 hybrid tomatoes was investigated at the Redlands Station. In one trial where the crop matured in cool weather, few hybrids did well. The most promising were derived from Urbana x Ace and Salads Special x Ace. In a second trial, conditions were even more exacting and, in this case, F1 hybrids from Salads Special x Ace, Salads Special x Queens, Salads Special x Q2 and Rouge de Marmande x Rutloff showed characteristics which could be of commercial value. Salads Special x Ace and Salads Special x Q2 were outstanding for fruit quality.

Following the discovery that luxury phosphorus regimes increase fruit set in the early formed trusses, evidence has been obtained at the Redlands Station which indicates that nutritional disorders such as crease-stem and catface are due to nutritional disbalance. Under phosphorous-deficient regimes, the plants tend to become excessively vigorous and remain in the vegetative phase for long periods. Fruit set in early trusses is frequently abnormal and fasciation, loss of growing points and crease-stem follow. All reduce yields and adversely affect times of cropping.

In the red-brown loams, growth responses to applied superphosphate are obtained even where the available phosphate values are extremely high by normal standards. A recent study of phosphorus fixation in these soils shows that the rate of fixation is reduced by the application of mixed fertilizers over a period of years, that tomato plants exhibit symptoms of P deficiency even when the acid-extractable P in the soil is as high as 800 p.p.m. P_2O_5, and that the P content of the plant tissues is a good index of the phosphate status of the soil. Luxury phosphate nutrition in tomato seedbeds therefore pays dividends. It ensures that the seedlings have adequate reserves for the difficult period prior to the resumption of normal growth after transplanting. Half a pound of a 5/17/5 mixture plus ½ lb. superphosphate per sq. yd. of seedbed appears to be adequate for normal purposes.

Disorders in the tomato such as blossom end rot and pith rot are not necessarily associated with calcium deficiency in the soil. Rather they reflect environmental conditions which hamper calcium uptake from the soil and/or calcium translocation within the plant tissues. Investigations at the Redlands Station indicate that excessive NH_3+ ion concentrations in the soil are a contributory factor. This may be a legacy of over-liberal applications of sulphate of ammonia or the use of sulphate of ammonia in soils where the pH is too low for nitrifying bacteria to function normally. Translocation of calcium within the tissues, however, is upset when the plants are growing under water stress and cell membrane permeability is affected. In both cases, responses can be expected from calcium foliar sprays.

Beans.—Two advanced lines emerging from a stringless bean breeding programme have been subjected to formal trials and industry appraisal. Seed is now being bulked for commercial production under the names Redlands Pioneer and Redlands Autumncrop. The introduction of these varieties heralds the transition of the Queensland industry from string beans to stringless beans. The bean breeding programme is now concerned primarily with better inherent disease resistance and additional cold tolerance.

At the Millaroo Research Station, fertilizer requirements in the culinary bean variety, Saluggia, were investigated. Striking responses to basal nitrogen and phosphorus were recorded; optimum values appear to be 35 lb. N per acre and 50 lb. P_2O_5 per acre. It seems doubtful if basal applications of potash or side dressings of nitrogen are of any value in the Burdekin alluvials. The data also indicate that high levels of nitrogen can appreciably increase seed size. The economic significance of this finding is to be examined.

Other Vegetables.—Yellows, a fungal disease of cabbage, was recorded in some parts of the Redlands district a few years ago and may later penetrate the more important producing districts. Recently, a range of varieties was tested during the summer months both at the Redlands Station, which is free from the disease, and on an infected property. At the Station, pythium root rot was troublesome and only two varieties—Ballhead Hybrid and All Seasons—produced commercially acceptable heads. In the second trial, Ballhead Hybrid succumbed to yellows within 4 weeks of transplanting and the only worthwhile commercial variety was All Seasons. It would therefore appear that on yellows-infected properties, All Seasons should be planted during the summer months. Elsewhere, Ballhead hybrid is the better commercial proposition because of its more attractive plant type and larger head size.

Early Wonder is a popular beetroot variety but the roots lack adequate colour for processing. A range of new varieties and strains was therefore tested at the Redlands Station. Chieftain and two Detroit Dark Red selections outyielded all other varieties and root quality was excellent. Parramatta could be useful for processing were it not so susceptible to root cracking, a disorder normally attributed to boron deficiency.

Peas could become an important commercial crop in southern Queensland. Times of planting have therefore been investigated. At the Redlands Station, yields from successional plantings ranged from 2,964 lb. to 5,940 lb. of shelled peas per acre and the period from planting to harvest from 69 days to 92 days. Yields were reasonably well correlated with periods of growth and reached an optimum in the May-June plantings. Of the two Departmental strains under test, B27 appears to be the most adaptable type; A3 reacts more quickly to adverse soil and climatic conditions.

During recent years, vegetable responses to green manures and applied superphosphates have been studied at the Redlands Station. On the typical red-brown loam of the Station: *a.* yield increments were directly proportional to the amount of organic matter added to the soil in all crops other than cabbage; *b.* maximum yields were recorded where green manures were used in conjunction with applied superphosphate; and *c.* responses to green manures were especially marked in lettuce and cucumbers. The data suggest that the green manures increase the uptake of phosphorus by vegetable crops.

Sodium molybdate sprays are commonly used in both the seedbed and the field as a precautionary measure against molybdenum deficiencies in vegetables. Recent investigations at the Redlands Station indicate that the typical symptoms are similar to those recorded in plants grown in nutrient solutions containing toxic amounts of manganese. As these symptoms can be corrected by the application of sodium molybdate sprays, there appears to be a manganese-molybdenum interaction which varies with the pH of the soil.

Weedicide trials in lettuce indicate that a mixture of monuron, amiben and CIPC containing 1 lb. active ingredient of each material per acre could be commercially useful. It effectively controlled weeds in trials at the Redlands Station for periods of 10 weeks and yields were comparable with those in hand weeded plots.

SERVICE PROJECTS

Bunchy top in bananas was again effectively controlled during the year. The number of infected plants found by inspectional staffs was 2,132, and these were located on 155 properties. Growers co-operated well with the inspectional staff but, as usual when price levels for bananas are low, considerable attention had to be given to neglected plantations which are potential explosive points for outbreaks of the disease. New plantings are barely sufficient to maintain production and in some districts the area under crop has decreased. District boundaries have been redefined in terms of disease hazards and the inspectional commitment.

The Citrus Budwood Scheme was continued, the bulk of the budwood being cut in the Burnett District. Seed was obtained from Cairns (citronelle), Rockhampton (Emperor mandarin) and Nambour (sweet orange). Distributions during 1963 were: *a.* Budwood: Autumn, 54,382 buds; Spring, 42,830 buds. *b.* Seed: Citronelle, 133 lb.; sweet orange, 57 lb.; Emperor mandarin, 32 lb.

Orders placed by nurseries reflect current trends in the industry and indicate an interest in virus-free trees; a preference for certain strains of Valencia Late orange, for example, Newton; an expansion in the area under Ellendale mandarins particularly in the Gayndah district; and the growing popularity of Emperor mandarin as a rootstock. Some nurseries are currently supplying trees on Cleopatra mandarin and Troyer citrange stocks to special order.

Bean seed production was less than in 1962 with an estimated outturn of 11,466 bus. from 735 acres registered under the Bean Seed Approval Scheme. The Burdekin crops were satisfactory but climatic conditions in the Burnett were less favourable. In the Burnett district, yields were variable and some crops were rejected following outbreaks of bacterial blight. New acquisitions to the Scheme are the stringless varieties Redlands Pioneer and Redlands Autumncrop which have been granted certification rights.

Certified tomato seed production in 1963 amounted to: Q2, 5,804 oz.; Q3, Nil; Q5, 124 oz. With the increasing severity of mosaic and bacterial canker in the Stanthorpe district, steps have been taken to spread production risks by developing alternative sources of supply in the Burdekin Delta. Consideration is currently being given to expanding the Certification Scheme to all commercial varieties for which there is a demand in excess of 500 oz./annum.

Virus-free runners of the strawberry variety Phenomenal have been introduced into the Strawberry Runner Approval Scheme. The available material was bulked up in isolation at Nanango and *Elite* runners from this source were supplied to three growers for a March (1964) planting. From these, *Special* runners will be supplied to a selected panel of strawberry runner growers in March, 1965. 2,000,000 *Approved* runners from these growers should be available for commercial planting in 1966.

EXTENSION

Several staff transfers were made during the past 2 years and, as usual under these circumstances, an appraisal of existing services is in progress with the associated re-allocation of staff responsibilities in terms of crops and districts. Information and advice are supplied to growers through individual farm visits, group discussions on current production problems in particular areas, and advisory notes to the Press.

In the Preparation and Packing Section, the Senior Adviser will actively brief district extension personnel on principles and practice of packing and marketing. These officers in turn will then be responsible for packing instruction to growers and for school packing classes.

Special extension projects were concerned with harvesting and packing (Stanthorpe), new fertilizer schedules for tomatoes (Redlands), runner to runner propagation of strawberries (North Coast), soil conservation (Maryborough), land management in pineapples (Rockhampton), tomato seedbed management (Bowen) and crop control by spacing in bananas (Wet Tropics).

The normal group discussions at Horticultural Research Stations were supplemented by field days at Maroochy and Redlands. The programmes at these field days were designed to familiarize leaders of the associated industries with programmes of work and the results achieved during the past few years. Both were well attended.

The Industry Advisory Committees (vegetable, pineapple, banana, citrus and deciduous fruits) met regularly during the year to discuss research and extension programmes in their respective fields. The interchange of views helps to keep industry in touch with Departmental thinking. Steps have been taken to publicise Departmental submissions to these Committees which may be relevant to grower problems.

HORTICULTURAL RESEARCH STATIONS

The technical staffs at the Horticultural Research Stations were strengthened and the research programme expanded.

The Maroochy Station features a range of projects in plantation crops such as pineapples, bananas and papaws. The propagation and testing of clonal material in pineapples and bananas is now a major commitment which promises to yield worthwhile results. Nutritional and crop management studies also occupy a place in the programme. Field projects are well delineated and this is certainly appreciated by visitors. By courtesy of the Southern Electric Authority, supplementary irrigation facilities were installed for an irrigation study in pineapples.

A Horticulturist was attached to the Pineapple Research Laboratory staff to service nutritional projects in the field. Minor structural defects in the glasshouse were corrected and this unit is now functioning reasonably well. Automatic instrumentation to record temperatures and humidities in the several compartments of the glasshouse proved a major acquisition.

At the Redlands Station, research staffs are fully committed to plant breeding, nutritional and crop management projects, principally in vegetable crops. A recent grant of £40,000 from the Vegetable Sectional Group Committee and the Other Fruits Sectional Group Committee will prove invaluable for developmental works needed to make the Station fully effective. Provision is being made for: (*a*) construction of an environmental control chamber to expedite work on some aspects of the plant breeding and plant physiology programmes; (*b*) installation of surface water storage amounting to 11,000,000 gal. alongside Hilliards Creek.

Some progress was made in developing the Granite Belt Station into a fully integrated unit. The technical staff was augmented by the appointment of a plant physiologist and a plant breeder, and an office-laboratory building is being erected on the property. Long-range plans are being drawn up for work on varietal improvement in deciduous fruits, nutrition, tree management and soil management.

The Kamerunga Station functioned during the year as a clearing house for introductions and the maintenance of horticultural plants of potential value in the Tropics. The new office and laboratory building completed during the year should improve servicing facilities for projects both on and outside the Station.

PLANT QUARANTINE

Further restrictions were imposed under Commonwealth Quarantine Regulations on the introduction of nursery stock to Australia. These apply particularly to ornamental plants and involve a reduction in quotas to Approved Importers, a tighter screening of the credentials of importers, and the establishment of official post-entry quarantine facilities. A quarantine house is being erected at Indooroopilly and should be brought into operation during 1964.

Facilities for handling quarantinable goods introduced to Queensland from other States and overseas are quite inadequate. Recognising this point, an acre of land was set aside as a reserve for Departmental purposes near the Hamilton Wharf to meet future commitments. The more urgent requirements are storage space for seeds, modern fumigation equipment and office accommodation for quarantine staffs servicing wharves and the airport.

A resume of operative legislation in the Commonwealth which restricts the interstate movement of plants and planting material was compiled during the year. This proved of value to inspectional staffs and to trade and transport organizations who handle traffic in these commodities. The complexity of the legislation suggests a need for simpler methods of documentation.

Close collaboration with Customs staffs is an essential feature of the quarantine service. This is indicated by the emphasis placed on quarantine regulations in the training syllabus for Customs personnel, and by day-to-day working arrangements between inspectional staffs at the wharves.

EXPORTS

Fruit and vegetable exports continue to increase, the upward trend being most pronounced in pome and citrus fruits. The more important commodities exported during the year were: apples, 226,433 bus.; pears, 8,753 bus.; oranges, 46,278 bus.; mandarins, 4,373 bus.; tomatoes, 3,249 bus.; lettuce, 2,933 cases; potatoes, 11,180 bags and crates.

The apple export season proceeded smoothly. The work was facilitated by the introduction of a complete documentation system for fruit in transit from Stanthorpe to Brisbane and the availability of new cool stores near the Brisbane wharves. Fruit quality was better than last year. One significant development was the greater use of tray pack cartons for which premium prices are normally paid on overseas markets.

Some of the larger growers with the requisite equipment to prepare citrus fruit for export show a growing interest in the potentialities of the export market, both in Europe and Asia. Prospects for Ellendale mandarins, Navel oranges and Valencia Late oranges appear bright.

FOOD PRESERVATION RESEARCH BRANCH

Much useful information was obtained on the storage behaviour of the major fruits grown in Queensland and their processing characteristics. Pre-harvest sprays with calcium compounds reduced the incidence of bitter pit in Granny Smith apples picked for export, while storage in atmospheres containing less oxygen and more carbon dioxide than normally present in the air improved the storage quality of Delicious and Granny Smith apples.

Fundamental studies showed that the ripening behaviour of bananas is markedly affected by rates of ventilation, and the role of ethylene used as a ripening accelerator in commercial practice is now being investigated.

The beneficial effects of heat therapy in controlling the post-harvest development of brown rot in peaches and the use of ethylene for stimulating the ripening of Santa Rosa plums were further demonstrated.

Deterioration in quality of leafy vegetables was arrested by using a senescence inhibitor, while equipment was designed to study the changes in quality of beans at the retail level, particularly at interstate destinations.

Technological advances were made in the processing of peas, strawberries, macadamia nuts, ginger and beetroot and in the manufacture of vinegar from juice extracted from pineapple skins.

The concentration of pineapple juice on a pilot plant scale has now reached a stage where samples are being distributed for consumer appraisal.

Much information was obtained on the processing characteristics of fruit from selected pineapple clonal material and on certain citrus varieties grown in Queensland. Modern techniques were applied in the identification of the main constituents of pineapple flavour and in determining how these compounds are affected by processing methods.

The laboratory is keeping abreast of developments overseas in food processing, and equipment should soon be available for studying new techniques in freezing and freeze drying.

PHYSIOLOGY

Delicious Apples.—Experiments carried out with the 1963 apple crop confirmed previous findings that the storage life of this variety can be extended by storage at 32 deg. F. in an atmosphere containing from 2·5 to 5·0 per cent. oxygen plus 0·0 to 5·0 per cent. carbon dioxide. The treated fruit was considerably firmer and more attractive in appearance than similar fruit stored under normal atmospheric conditions. Success of the method depends on the use of an efficient scald inhibitor. Further investigations are in progress with the 1964 crop to determine the storage behaviour of this variety picked over a wide range of maturities and held at a range of temperatures.

Granny Smith Apples.—The results from three seasons' experiments showed that a pre-harvest spray of calcium chloride will considerably reduce the incidence of bitter pit in Granny Smith apples picked in February for overseas export. Co-operative experiments are being carried out with officers of the Horticulture Branch, to determine whether greater control of bitter pit can be obtained with post harvest dips of calcium compounds. Other investigations showed that when an efficient scald inhibitor is used, good storage results can be obtained by using a storage temperature of 36 deg. F. and an atmosphere containing 16 per cent. oxygen and 5 per cent. carbon dioxide. Experiments also showed that firmness decreases as fruit size increases but storage disorders are not increased until a size of 3 in. is exceeded.

Other apple varieties.—The optimum picking maturity and storage conditions for the Jonathan, Crofton, and Legana varieties are being determined.

Avocadoes.—In conjunction with officers of the Horticultural Branch, investigations were carried out to measure certain physical and chemical changes in Fuerte avocadoes during development and maturation. The results obtained showed that fruit volume, weight, and oil content are closely related to crop size.

Bananas.—The type of hormones present in bananas is being studied in order to determine whether the activity of any particular hormone is related to the ripening process. Further work with post-harvest dips of paraffin base wax emulsions showed that response to these dips of paraffin depends on the season during which the fruit is grown. Although changes in respiratory activity have been related to changes in colour and firmness during ripening, it has not been possible as yet to find any means of predicting how long green fruit will take to commence ripening. Unfortunately the time to ripen has been considerably affected by rates of ventilation and this could be due to the presence of ethylene, a ripening accelerator.

An officer was appointed from funds provided by the Banana Research Advisory Committee to study chemical changes during ripening, the influence of ethylene and other factors. Tests on the cooling rate of bananas in fibreboard containers showed that relatively higher temperatures are reached by fruit in cartons and their cooling rate is slower than in fruit packed in wooden cases. When fibreboard cartons are used, special precautions must therefore be taken to cut fruit at a suitable maturity and to cool it before consignment.

Citrus.—Storage experiments with Ellendale mandarins grown on different rootstocks showed that fruit from trees grown on trifoliata rootstock is much more resistant to mould development than fruit from trees grown on rough lemon, sweet orange or Emperor rootstocks. Investigations also showed that preharvest lead arsenate sprays affect fruit acidity but not its ascorbic acid content.

Grapes.—Investigations with Muscatel, Purple Cornichon, and Black Hamburg grapes stored in polyethylene liners showed that effective mould control can be obtained by the inclusion of small amounts of potassium metabisulphite in the liners. A pre-consignment treatment of 14 days at 30 deg. F. for sterilizing fruit against fruit fly resulted in no fruit injury, but an efficient mould inhibitor should be included in the package to control mould development.

Pears.—A study is being made on the effect of calcium nitrate applied as a post-harvest spray in relation to the incidence of core and blossom end breakdown in cool-stored WBC pears. The effect of watering practices during growth on the subsequent storage behaviour of Queensland grown WBC pears is also being investigated.

Pineapples.—Certain physical and chemical changes in pineapples are being determined with a view to predicting when a pineapple is sufficiently mature for marketing. Studies on the flavouring constituents of ripe pineapples measured with chromatography equipment showed that the same compounds are present in both winter and summer harvested fruit. There is, however, a greater concentration of total flavours in the summer fruit and this could account for its better palatability.

Stone Fruit.—Further investigations carried out in 1964 confirmed previous findings that the post-harvest development of brown rot of peaches can be effectively controlled by hot water dips. The experimental findings that Santa Rosa plums can be effectively ripened by exposure to 1,000 p.p.m. ethylene continuously for 24 hours were confirmed under commercial conditions.

Rockmelons.—Treatment with small concentrations of ethylene did not improve the external skin colour or accelerate the ripening of Hales Best rockmelons harvested at the green mature stage.

Tomatoes.—Treatment for 2 days with 1,000 p.p.m. ethylene accelerated the ripening of tomatoes and gave a very even colour. The role of the enzyme pectin methyl esterase in tomatoes is being studied in order to understand the mechanism of ripening.

Vegetables.—Treatment with concentrations between 5 and 25 p.p.m. of N^6-Benzyladenine inhibited loss of colour and changes in texture of leafy vegetables. Trials were also carried out to determine whether pre-consignment practices do affect the market out-turn of beans sent to interstate destinations. No apparent differences were observed between treatments because of the extreme variability in maturity at which the beans were harvested. In order to study changes after harvesting in beans of different maturity, an instrument was designed to measure shear strength of a bean. Experiments are being conducted with the 1964 crop to determine whether precooling will arrest deterioration in mature beans during transport to Melbourne. In another experiment, treatment of red capsicums with ethylene did not improve colour and resulted in subsequent rotting of the fruit.

FOOD TECHNOLOGY

Pineapples.—Locally produced pineapple juice wa successfully concentrated at a temperature of 130 deg. F. t a total soluble solids content as high as 75 per cent. Problem of protein precipitation, frothing, microbial development an erratic evaporator operation were overcome by carefull adjusting initial pasteurisation and clarifying with a pressur discharge centrifuge. Not less than 75 per cent. of the tota ester content is recovered during the concentration proces and an ester concentration equivalent to 25 p.p.m. in th single strength juice is added back to the concentrate. Thi ester concentration was determined by organoleptic test Pneumatic control equipment and a vacuum steam heatin system were designed to maintain evaporation temperature at 70 deg. in order to reduce heating effects on the juice A spin pasteurisation method is also being developed to enabl the concentrate to be stored without refrigeration. Seventee volatile flavouring constituents have been positively identifie out of a total of 35 so far isolated from pineapple juice Changes in flavour components are being determined in regar to processing methods, and analytical techniques were simpli fied by taking a sample of vapour immediately above th juice.

A laboratory scale experiment to convert waste pineappl juice to vinegar was completed. If inoculum is used, at th correct stage, a 6 per cent. vinegar can be prepared in 24 hour provided the temperature is maintained between 82 deg. an 85 deg. F. The addition of yeast extract and vigorous agitatio markedly improved the rate of acetification.

Techniques developed for the 1963 crop from th Maroochy Horticultural Research Station were applied to th 1964 crop for assessing the canning suitability of selecte clones. At least 50 individual fruits from each of the 1 selected clones were examined for fruit weight and shape, flesh recovery, external and internal colour, translucency, porosity break strength, internal defects, total soluble solids, acidity pH and ester content. The work is still in progress.

Pears.—Investigations on ripening of pears for canning ar assisting in the overall improvement of the WBC Stanthorp canned pears. The 1963 trials showed that the volatile flavour ing constituents reach a maximum after 5 weeks storage a 30 deg. F. The effect of ripening at 70 deg. for periods o 4, 5, 6 and 7 days is being determined.

Citrus.—The suitability of Joppa and Valencia oranges fo processing is being investigated on fruit selected from tree grown on trifoliata, sweet orange and rough lemon rootstock and picked over a 3 months' period. Soluble solids, titratabl acidity, pH and juice content are being measured on the fresh fruit and bitterness on the canned juice. During maturation soluble solids increased and acidity decreased at a fairly constant rate, but juice yield was stable. Tasting tests showe that Valencia oranges grown on trifoliata rootstock were fre of bitterness and that bitterness in other rootstocks decrease as the fruit become more mature.

Strawberries.—Previous trials showed that the Majestic i superior to the Phenomenal variety in certain canning character istics when the fruit is grown in the North Coast district. Th texture and drained weight of the canned pack were also influenced by processing methods. Further experiments were carried out to compare the processing characteristics of th Majestic and Phenomenal varieties grown at the Redland Horticultural Research Station. It was found that total soluble solids and acidity decreased during the peak of the season bu increased to the original values in late November. A replicate trial was laid down in 1964 to compare the two varieties in th North Coast district.

The mould causing spoilage of canned berries last yea was positively identified as *Byssochlamys fulva* and a process ing temperature of 203 deg. F. was necessary to destroy thes spores.

Apples.—Factory apples available in Queensland ar required mainly for the production of apple juice used as base in the manufacture of aerated drinks. There is, however a possible market for single strength canned apple juice i consumer packs. The quality of such a product depends largely on the variety and its stage of maturity at picking. Chemica changes in the Jonathan, Delicious and Granny Smith varieties were therefore studied during the 1964 apple harvesting season

Macadamia nuts.—Storage trials on the keeping quality o stored roasted tetraphylla kernels showed that rancidity of th nuts should not be a problem if good quality nuts are used cooking conditions strictly observed and the nuts packed i airtight containers.

Papaw.—Although papaws are generally used in fruit salad manufacture, some are required for a canned papaw pack. Experiments indicated that the texture of the canned pack can be improved by using a spin cooker in preference to the conventional atmospheric rotary cooker.

Peas.—Research projects on the evaluation of peas for processing have stimulated commercial interests in Queensland. The varieties A3 and B27 proved very suitable for processing, and yields equivalent to 5-6,000 lb. to the acre were obtained

at optimum harvest time when the crop was planted between mid-April and mid-July. Valuable information was obtained on maturometer indices, alcohol insoluble solids and vitamin C. Time from planting to harvesting varied from 70 to 100 days depending on seasonal conditions. The daily increase in maturometer index varied from 10 in the early July harvest to 30 in the October harvest.

Beetroot.—The commercial processing of beetroot is becoming a sizable industry in Queensland and about 6,000 tons are expected to be canned in 1964. Intensive studies were continued on the canning suitability of 10 new varieties, and the more promising types are being used in a trial extending over the whole of the 1964 growing period. The experiment showed that beetroot produced in the Lockyer district had a more intense colour than that grown in the Redlands area. In general, however, beetroot harvested in the summer months was of poor colour.

Ginger.—The optimum harvesting time of Queensland ginger for the production of dried whole ginger, oleoresin and volatile oil is being studied. It was shown that July is the best month to harvest the rhizomes for sale as dried whole ginger. However, yield of oleoresin and volatile oil based on green weight remains constant during the period April to July. The quality of acetone extracted oleoresin is superior to that extracted by alcohol, but the recovery is much lower. The possibility of using a blended solvent is therefore being investigated. Experiments are also in progress to improve the colour and flavour of the syruped ginger.

BOTANY SECTION

RESEARCH

Research work proceeded in the three main fields of taxonomy, ecology and vegetation mapping, and economic botany.

Taxonomy.—As a result of taxonomic studies, papers on *Acacia* and *Micraira* were published in the Proceedings of the Royal Society of Queensland. A revision of *Carpobrotus* and related genera was prepared for publication and typing was completed of important large papers on *Melaleuca* and *Plectranthus*. Publication of these last two papers has been deferred until the specimens in the Kew Herbarium can be examined.

A cyto-taxonomic study was begun of two apparently different plant forms known as *Solanum nigrum*. Up to date a hexaploid and a diploid and several apparent hybrid forms have been recognised but a great deal more work remains to be done before the various forms can be identified and their relationships clarified.

The identification of plants collected in Cape York Peninsula by the Archbold Expedition of 1948 was continued. Considerable progress was made in the identification of the large number of specimens collected during the brigalow control survey between 1958 and 1962. A large collection was made from the Stanthorpe-Wallangarra area where the native trees and shrubs flowered unusually well in the spring of 1963.

Ecology and Vegetation Mapping.—During the year, work was begun on detailed ecological studies of the vegetation and soils of the Brigalow Research Station. In this work, close co-operation was maintained with officers of the Agricultural Chemical Laboratory and the Soil Conservation Branch.

In the same region, a member of the staff spent some time with a C.S.I.R.O. land survey party. Another member of the staff was temporarily transferred to C.S.I.R.O. as plant ecologist for the Belyando survey.

In August, 1963, a visit was made to Coopers Creek to study plants which had come up after the very heavy floods in May of that year. Cooper Clover (*Trigonella suavissima*) was less abundant than usual and the commonest plant in the channel country was a variety of *Senecio lautus*. Analysis by the Biochemist of samples of these two plants showed that crude protein in the Cooper Clover was 25·5 per cent. (moisture free) but in the *Senecio* crude protein was only 11·3 per cent.

Economic Botany.—Research on brigalow advanced a step further with the establishment of the Brigalow Research Station, north-west of Theodore. Because accommodation was not completed on the station, it was necessary to conduct the 1963-64 programme from Brisbane. Despite this handicap, it was possible to begin three experiments. One of these will measure the effect of Rhodes grass in suppressing brigalow suckers. Another is designed to test the effect of several different chemicals on brigalow suckers of various ages when the chemicals are applied as an overall, non-directed, low-volume spray similar to that put on by aircraft. The third is an experiment to study the effect of a tree-crusher in treating whipstick and sucker brigalow of a type which is difficult to control with any other techniques. No final results will be available from any of these trials for at least 2 years.

In the Bungunya area, trials were continued using a misting machine for the application of 2,4,5-T as a directed spray on brigalow suckers. These experiments are supplementary to those begun in 1960, which have already shown that two treatments each with ¼ lb. 2,4,5-T in gal. diesel distillate per acre will kill these suckers if the treatments are applied at intervals of 10 to 12 months during the warmer months of the year. This new series extends these repeated treatments into the colder months.

In the same area, small-scale observational trials with the new chemical, Tordon, were laid down.

In continuation of ecological studies of limebush, the soils supporting this plant in parts of southern Queensland were examined in conjunction with an officer of the Agricultural Chemical Laboratory. Germination tests carried out on limebush seeds showed that they were viable immediately after the fruits matured.

Trials with Tordon were also laid down on this plant, and although no final results are available as yet, the chemical looks very promising for the control of this persistent, thorny shrub.

At the request of the Co-ordinating Board of the Department of Lands, visits were made to the Hughenden, Winton, Longreach and Barcaldine districts to inspect areas of prickly acacia which had been studied in 1958 and also to the Bowen and Rockhampton districts to report on the status of prickly acacia as a weed in those districts. Around Winton, there was no evidence to suggest that this plant had extended its range during the last 5 years, although there was evidence that many of the trees had grown larger. In all these western areas, the tree had only become dense in areas around the towns, chiefly on common land grazed by goats.

In the Bowen district, particular attention was paid to the potential fodder value of this plant. Observations indicate that prickly acacia alone is capable of carrying one bovine on less than 3 acres and that its productivity per unit area exceeds that from the best grass-legume mixtures so far planted in this region. However, young thorny plants can form dense thickets and can become a nuisance, especially in town areas and on unused land.

In the Rockhampton district, the plant was not encroaching on agricultural land but was limited to unused allotments in the vicinity of the town.

Recommendations were made to the Co-ordinating Board for some modification of the Stock Routes Acts to allow plants of this type to be grown as fodder under carefully controlled conditions.

Counts of regrowth shoots were completed in the Johnson grass trials at Kingaroy carried out in conjunction with Agriculture Branch but statistical analysis has not been completed. Inspection of the figures suggest that the results were not materially affected by the kind of wetting agents used, that split applications were more effective than a single application of 2,2-DPA and that the addition of amitrole did not improve the effect of 2,2-DPA.

In continuation of work on milk tainting weeds, estimations of the amount of bitter cress (*Coronopus didymus*) in a pasture at Bunya were made in July, August and September. During this period, the amount of bare ground decreased from 15·8 to 6 to 2 per cent. and the cover of bitter cress increased from 36 to 46 to 49 per cent. No correlation was established between the weight of bitter cress and the amount of cover or the percentage cover of sward. Further quantitative studies were begun in April, 1964.

In a small scale trial at Brisbane, a granular formulation of 2,4-D at the rate of 1 lb. acid equivalent per 200 sq. ft. of water surface gave good control of bottom-rooting weeds growing in still water. Species controlled included *Nymphaea mexicana,* a Yellow Water Lily (*Hydrilla verticillata*), *Potamogeton crispus,* and *Ceratophyllum demersum,* Hornwort. *Marsilea brownii* and *Pontederia cordata,* both of which occurred on the margins of the pond, were not affected by the treatment. Bioassay of the water, using cotton seedlings as an indicator plant, showed that the water became free from 2,4-D contamination at the end of the third week after treatment.

During 1963, the new chemical, Tordon, was released by the manufacturer for experimental work. Since overseas work indicated that this had many potential uses, an informal inter-departmental conference was held to allocate responsibilities for screening this material on about 300 species of weeds and woody plants. These trials are now in progress. In May, the manufacturers of the chemical convened a "workshop" in Sydney which was attended by research workers from all States, New Zealand and U.S.A. The properties of this chemical and its potential for use in Australia were discussed in detail.

IDENTIFICATION AND ADVISORY SERVICES

Approximately 11,000 specimens were received for identification and 140 samples of stomach contents were examined for suspected poisonous plants. Amongst the plants received were large collections from Charleville, Iron Range and Atherton.

One plant was received which had not previously been recorded as naturalized. This was tick grass (*Eragrostis superba*), which was reported to be growing spontaneously at Emerald.

Weeds.—Extensions of range were recorded for several noxious weeds, including Paterson's curse, clockweed, annual ragweed, balloon cotton and fierce thorn-apple. Notes were also recorded on some 50 other species of plants which were reported to be troublesome in different areas.

Poisonous Plants.—For many months, seasonal conditions over much of the State were dry. This was reflected in the unusually large number of stomach contents received for examination. About 60 new records were added to the poisonous plants files. These included some records of known toxic plants which had been further implicated in the field and records of possible poisoning by plants not previously suspected to be toxic. Amongst the more notable records were many cases of alleged wild parsnip poisoning from south-western Queensland and an unusually large number of cases of crownbeard poisoning in the Roma, St. George and Dirran-bandi districts.

In north-western Queensland, the flowering of gidyea was particularly profuse in the spring of 1963. The opportunity was therefore taken to send a botanist into this area to map more accurately the distribution of the toxic *Acacia georginae* and the non-toxic *A. cambagei*.

Schools and Field Days.—At a school for young graziers near Quilpie in September, plants poisonous to sheep were discussed and examples of nearly all the toxic plants of south-western Queensland were shown.

Contributions on weeds and weed control were made to the 2-day graingrowers' school organised by the Department and the Queensland Graingrowers' Association and attended by about 80 farmers.

Nearly 300 graziers attended a very successful brigalow field day near Bungunya in May. It was shown how the results of experiments could be put into practice in controlling brigalow suckers with 2,4,5-T applied with a misting machine.

HERBARIUM AND LIBRARY

During the year, 15,200 specimens were mounted; more than twice the number handled last year. Specimens received on exchange totalled 3,769 and 1,921 were distributed. Outward loans amounted to 2,205; 442 were received on loan and 286 specimens were returned from other herbaria.

Seventy-one new books and 85 reprints were received; 245 volumes were bound. Loans to other institutions numbered 179 books and 14 transparencies; 17 books were received on loan.

VISITING BOTANISTS

Thirty-seven visitors worked in the Herbarium during the year, including botanists from Canada, England, India, New Caledonia, New Guinea, Singapore, Switzerland and the United States of America, as well as from other Australian institutions.

ENTOMOLOGY SECTION

Pest incidence throughout the State was influenced by climatic conditions, chiefly lack of rain. Where winter crops were attempted in southern districts, the adverse conditions accentuated pest attacks. Mites on cereal crops on the Darling Downs were the worst for many years. On the Atherton Tableland the effects of pasture pests were further accentuated by frosts.

In central districts, dry conditions prevailed throughout the summer and autumn. Few crops dependent on rainfall were successful. Under irrigation, above average yields of cotton were obtained in both central and southern districts. In these crops pest control was economic, well-timed and successful.

Unusually high summer temperatures in the Granite Belt caused mite populations to rise sharply and these were difficult to control. Similar conditions in citrus areas interfered with scale control programmes.

Cotton.—In central districts, pest control in low-yielding cotton was uneconomic. High yields on irrigated crops favoured the rough bollworm, *Earias huegeli* Rogen., the most serious pest during the season. This insect and *Heliothis armigera* (Hubn.) required repeated sprays of DDT and endrin to protect high yields.

In studies with the rough bollworm, attempts are being made to correlate moth catches in light traps with seasonal conditions and larval populations in the field. New information on life history and survival under various temperature-humidity conditions was obtained.

Investigations on the pink-spotted bollworm, *Pectinophora scutigera* (Hold.), in central districts demonstrated that eggs, larvae and pupae occur in plant parts other than the fruiting forms. Slashing of crop residues with a rotary slasher does not kill many of the larvae but it facilitates the burial of residues by ploughing which if completed by July prevents early season build-up of pest populations.

Tobacco.—The new laboratory at Mareeba, now functional, has enabled an expanded research programme for north Queensland.

Leaf miner, *Phthorimaea operculella* (Zell.), showed a marked increase during late spring, solanaceous weeds at this period carrying heavy infestations. The pest was again active in December. There was periodic activity of *Heliothis* species, while green looper, *Plusia argentifera* Guen., increased in importance where only DDT and azinphos-ethyl had been used.

A contaminated batch of DDT caused serious phytotoxicity on a limited number of farms. Some deformity resulted from the use of azinphos-ethyl and isobenzan in seed beds, and instances of similar damage appeared early in transplant areas. Several new insecticides were submitted to taint tests.

Grain Crops.—Pest populations of the brown wheat mite, *Petrobia latens* (Mull.), in wheat and barley on the Darling Downs were favoured by continued dry winter conditions. Dimethoate proved entirely effective in trials, even at very low spray concentrations, and was used extensively by growers.

Owing to the dry conditions, early plantings of sorghum in the Callide Valley escaped damage by the sorghum midge, *Contarinia sorghicola* (Coq.). Hybrid sorghum growers on the Darling Downs made as many as five applications of DDT to ensure yields.

The corn aphid, *Rhopalosiphon maidis* (Fitch), infested both leaves and roots on seedling wheat and was widespread on the Downs. Increased populations of thrips, mostly *Haplothrips froggatti* Hood, infested wheat at flowering.

Other Field Crops.—Moth populations of *Heliothis* species in linseed on the Darling Downs were high but heavy damage did not eventuate. Many crops, however, were sprayed with DDT.

Control trials against the potato moth, *Phthorimaea operculella* (Zell.), in the Lockyer Valley showed that endrin and azinphos-ethyl significantly reduced damage. Azinphos-ethyl had no effect on the amount of damage to tubers by crickets, *Teleogryllus commodus* (Walk.), but marked benefit was shown by the endrin treatment.

Pastures.—Funnel ant, *Aphenogaster* species, investigations were expanded in the Evelyn and Ravenshoe areas. Studies showed that where large ant populations are present the soil is slightly alkaline and the consequent increased availability of P_2O_5 is responsible for increased plant growth evident in pot experiments.

Kikuyu bugs, *Halticus* sp., were numerous on Kikuyu grass over most of the Tableland before general rains set in. Cage studies showed that severe damage causes the appearance of a creamy white pasture. The general district effect was accentuated by dry weather.

Soldier fly, *Altermetaponia rubriceps* (Macq.), was again active. Adults were on the wing over a wide area of the Atherton Tableland during May. Chemical control trials were undertaken and may lead to improvements in means of dealing with this pest. Studies on pasture webworms, *Oncopera* species, were resumed. The aim of this work is to determine the species responsible for pasture damage, together with biological studies and control trials.

Citrus.—In the current survey of the citrus gall wasp, *Eurytoma fellis* (Gir.), the insect had not spread beyond the limits of previous years. Studies of the development of citrus fruit from flowers carrying large numbers of flower thrips, *Thrips imaginis* Bagn., showed that silver streaking on fruit is not caused by this insect.

White wax scale, *Ceroplastes destructor* Newst., continued to be a troublesome pest in the Gayndah district where mostly organophosphates form the basis of the citrus pest control schedule. The extended hatching of this pest gave rise to heavy infestations particularly where the usual summer sprays were missed or not thoroughly applied. Control trials showed sodium metasilicate to be comparable with washing soda for pest kills and caused only slight leaf fall from navel oranges when applied at a temperature of 80°F.

In north Queensland, citrus red mite, *Panonychus citri* (McGregor), and Maori mite, *Phyllocoptruta oleivora* (Ashm.), increased on young fruit. Sulphur gave best dual control. In the citrus decline trial at Koah, involving the root channeller, *Leptopius* sp., lack of soil moisture favoured the pest and definite treatment differences are expected.

Deciduous Fruits.—The apple dimple bug, *Campylomma* sp., was abundant during spring in wattle trees throughout the Stanthorpe district, and moved into apple and pear orchards in large numbers. In control trials, the usual one application of DDT was not sufficient. Additional sprays at flowering time are viewed with general concern.

The woolly apple aphid, *Eriosoma lanigerum* (Hausm.), has increased in importance in parts of the Stanthorpe district and required special consideration. Vamidothion was proved to be an effective control.

Following unusually high temperatures in late summer, mite populations, chiefly red spider, *Tetranychus telarius* (L.), and the European red mite, *Panonychus ulmi* (Koch.), rose sharply. Control under these conditions proved difficult. Experimental work has shown that winter temperatures in the Stanthorpe district are low enough to satisfy diapause requirements of the European red mite egg and thus ensure survival of the pest in this district.

In pest schedule trials, control of the major pests, codling moth, *Cydia pomonella* (L.), light brown apple moth, *Epiphyas postvittana* (Walk.), and fruit fly, *Strumeta tryoni* (Frogg.), was generally satisfactory but occasional serious losses in individual orchards emphasise the dependence on insecticides.

Tropical Fruits.—In field control trials on the banana weevil borer, *Cosmopolites sordidus* Germ., dieldrin sprays gave only moderate protection of plants during the first year from planting. BHC as a dust worked into the soil around the plants gave complete protection. In general, dusts were better than sprays.

Insecticidal dipping of banana fruit to kill larvae of the banana fruit fly, *Strumeta musae* (Tryon), was studied as a preliminary to more detailed work. Dimethoate and fenthion showed promise in these trials.

Vegetables.—Red spiders, *Tetranychus* species, were active on French beans but were well controlled. Trials with seed treatments of beans showed that endrin affords protection of seedlings against attacks by the bean fly, *Melanagromyza phaseoli* (Tryon), for 2 weeks after germination, but DDT sprays are still standard amongst growers. A similar treatment for cowpeas proved effective for protection of seedlings for 6 weeks after germination. Damage by bean fly to navy beans in the Kingaroy district stressed the importance of the insect in the establishment of this crop.

The centre grub, *Hellula undalis* (Fabr.), showed an upsurge in cabbages in the Stanthorpe district and in rape grown as sheep fodder on the central highlands. The tomato mite, *Aculus lycopersici* (Massee), was also unusually important on crops in the Stanthorpe district.

Forestry.—Defoliation in *Pinus radiata* plantations by the leaf bagworm, *Hyalarcta hubneri* (Westw.), was slight. The phasmid, *Ctenomorphodes tessulata* (Gray), was not prevalent in the Slacks Creek area. Most of the local features of the latter insect's biology have been determined.

Spraying to control the kauri coccid, *Conifericoccus agathidis* Brimb., in the Mary Valley showed that dimethoate prevented serious damage to new leaf for 2 to 3 weeks after application. A colony of the predatory ladybird, *Cryptolaemus montrouzieri* (Muls.), was liberated in areas heavily infested with the coccid.

Stored Products Pests.—Surveys of farmers' first deliveries of grain to central storage were carried out on lines similar to those conducted during the 1962-63 season. Of 647 samples, 5·6 per cent. were infested by major pest species detectable on immediate examination, and the total infestation after incubation was 25·9 per cent. These results are similar to general pest incidences in storage depots during the season, and indicate that there has been little improvement in farm hygiene, and therefore in the relevant commercial problem. Close attention has been given to malathion residues on grain from wheat storages and export shipment. Results of successful studies in the control of peanut storage pests during 1961-63 have been prepared for publication, and the chief interest in this problem at present is concerned with aeration. Compilation of annotated records of stored products pests was continued; some groups are now complete.

Insecticide Resistance Studies.—Resistance of *Sitophilus oryzae* (L.) to lindane, from 20 to 200 normal, was found in samples of certified seed treated with 0·5 per cent. of that material; none has been recorded in *Sitophilus zea mais* Motsch. in Queensland. Particular attention has been paid to *Tribolium castaneum* Herbst. in peanuts and grain where there is a general exposure to malathion; to date no resistance has been detected. Comparisons of reactions of adult and larval strains of *Phthorimaea operculella* (Zell.) with those of a susceptible strain from Victoria confirmed the presence throughout Queensland of high resistance to DDT (max. X500), and moderate resistance to endrin (X50). There have been no changes in tolerance levels for azinphos-ethyl after 10 generations. All this resistance work, as well as toxicity comparisons for DDT, endrin and azinphos-ethyl against these species of *Heliothis*, is being studied in detail.

Diseases of Insects.—Protozoans were isolated from several stored products pests, and attention was given to the causes of diseases in some pests of field crops. It is becoming increasingly evident that this neglected aspect of ecological studies warrants greater effort, and the results could be of distinct economic value.

Nematology.—The nematode survey throughout the State was continued, and recently the host records of 106 species of the order Tylenchia and the genera *Trichodorus* and *Xiphinema* were published. The pathogenicities of several species are being investigated. Field trials were concerned with either or both nematocides and the use of cover crops to reduce pest populations in tobacco, pineapple, strawberry and tomato crops, in vineyards and banana plantations. Experimental attempts at root-knot control in vineyards in the Stanthorpe district yielded disappointing results.

BEEKEEPING

Although in most districts, conditions generally throughout the year were favourable, only a moderate crop of honey was harvested.

Extension work covered 3,500 colonies in 19 districts. Two beekeeping schools and field days were held, group discussions, talks and film evenings numbered 18, whilst the total of press, radio and journal articles and agricultural show attendances was 24.

European foulbrood, *Bacillus alvei* White, was found in one hive at Monto; *Nosema apis* Zander was present in several districts; paralysis was recorded in a hive at Ellengrove; and 88 hives at Beerburrum, 15 at Stanthorpe and 42 at Mt. Edwards were suspected as having been affected by insecticides.

Exploratory work on colour standards for Queensland honeys was commenced, and honey flora surveys in the Rockhampton, Townsville and Atherton districts continued.

At March 31, 1964, 1,501 beekeepers (six more than the previous year) were registered.

FAUNA AND FLORA CONSERVATION

By the end of the marsupial skin year (December 31), 1,857 permits and licences were issued under *"The Fauna Conservation Act of* 1952". Extension activities covered six talks and film evenings, 64 press, radio, journal and other articles. Seven prosecutions for breaches of fauna laws were conducted.

An open season was declared for some waterfowl from July 6 to September 28 in northern and central Queensland, and from June 8 to August 3 in southern Queensland. As could be expected following a reasonably productive breeding season, bag surveys at a number of gun club management areas showed that moderate numbers were taken. The black duck, *Anas superciliosa rogersi* Mathews, again easily maintained its place as the major game bird sought and taken.

Some 65,000 acres north of Taroom were surveyed by air as a possible fauna reserve; preliminary fauna and flora surveys of the Cooloola fauna reserve were completed; and evaluations of some of the existing sanctuaries in the Moreton district were initiated. District fauna surveys of a detailed nature were commenced; the Warwick district was selected for purposes of establishing worthwhile methods; and an annotated list of "The Birds of the Townsville District, North Queensland" was published.

The first phases of research on wild duck and marsupials, covering a 5-year period of field and laboratory studies, are at the stage where evaluation and publication of data are desirable; these aspects and some confirmatory work are being advanced.

Further investigations of cormorants, *Phalacrocorax sulcerostris* Brand and *P. melanoleucus* (Vieillot), the brolga, *Grus rubicundus* (Perry), and some other native birds are in progress.

PLANT PATHOLOGY SECTION

The research, diagnostic and advisory work conducted by the Section continued to expand. This was made possible by an increase in technical staff and the effective operation of the new laboratories at the Queensland Wheat Research Institute and at Mareeba.

A small laboratory-glasshouse unit was constructed at Indooroopilly to facilitate plant virus investigations. New laboratory accommodation is under construction for the plant pathologists at Cairns and Stanthorpe.

The increase in soilborne disease problems in crops such as wheat, maize, peanuts and pineapples was again evident in the older farming areas of the State. The preparation of the Queensland Host Index of Plant Diseases is now well advanced.

FIELD CROPS

Wheat.—Crown rot (*Fusarium graminearum*) was severe on the heavier soil types of the Darling Downs. Good sowing conditions followed by drought again proved to be the combination of circumstances favouring infection. Shrivelling of the grain was a common end-point of infection and this could well be of greater economic significance than the more spectacular deadhead symptom.

Research work with crown rot revealed a number of points. Early plantings showed a higher incidence of the disease than later sowings. The onset of symptoms appeared to be correlated more with time of year than time after planting. It was possible to substantially increase the infection rate by artificial inoculation of the seed prior to planting. The variety Gala which exhibits field resistance to crown rot was very susceptible to the seedling blight phase in artificial inoculation tests, but appeared to have resistance to root infection. The addition of nitrogen to infested soil in pots increased infection in a subsequent wheat planting and there were differences in incidence with different forms of nitrogen.

Isolates of *F. graminearum* from the following grass hosts have proved to be pathogenic to wheat seedlings—*Agropyron scabrum, Dichanthium humilius, Avena ludoviciana, Danthonia linkii, Bromus catharticus, Panicum queenslandicum* and *Phalaris paradoxa.*

Stem rust (*Puccinia graminis*) occurred at Brookstead in a summer planting of the new wheat variety, Mendos. The identity of the race of rust is not yet known. This variety, specifically bred for stem rust resistance, had not yet been commercially released.

Cowpeas.—Stem rot (*Phytophthora vignae*) was severe in susceptible varieties following heavy rains on the Darling Downs. Race 2 of the pathogen was recorded on two farms in the variety Caloona which is resistant to Race 1. One of these farms was the site where Race 2 was originally detected in 1962. Another species of *Phytophthora,* as yet unidentified, was isolated from diseased cowpeas but the damage was slight.

Tobacco.—A race of blue mould (*Peronospora tabacina*) capable of infecting hybrid tobaccos with *Nicotiana debneyi* resistance became prevalent in the Moreton district. As these hybrids are widely grown in the area, considerable damage resulted. A similar pathogenic strain was detected by C.S.I.R.O. Plant Pathologists in field collections of blue mould from Mareeba. Ascochyta leaf spot (*A. arida*) caused severe damage on some farms in the southern Border district. Once again this disease spread rapidly during relatively dry weather and diseased seedbeds appeared to be a major contributing factor.

Blue mould was sporadic in the Mareeba district and incidence in the field control experiments was insufficient to give positive results. Samples of cured leaf from the various fungicidal treatments are being submitted to quality and taint tests. Benzol concentration measurements in fumigated seedbeds revealed some important points. Many seedbed covers used by farmers are not air-tight and fumigation is therefore ineffective. Undetected holes in plastic covers are often responsible, and the calico covers popular in some areas maintain only a fraction of the benzol concentration considered adequate for blue mould control. Four effective fumigations at 24-hour intervals and five fumigations at 48-hour intervals eradicated blue mould infection in seedlings inoculated 2 days before first treatment. However, a small amount of masked infection was detected in seedlings treated every third night, even after six fumigations.

Peanuts.—Verticillium wilt (*V. dahliae*) again caused severe damage on many farms with scrub soils. Varieties which were screened for wilt resistance in pot tests last year are now being tested in naturally infested field plots.

The long term Sclerotium rot (*S. rolfsii*) experiment is proceeding. Various methods of tillage and crop residue disposal are being tested. The obvious result so far is the increase in *S. rolfsii* attack following hilling.

A Cercospora leaf spot (*C. personata* and *C. arachidicola*) control experiment indicated that spraying is generally more effective than dusting and that maneb, Dithane M45 and Antracol are useful fungicides for controlling this disease.

Maize.—Tropical rust (*Puccinia polysora*) incidence was low in early maize crops on the Atherton Tableland but built up in later plantings. Race EA1 was the only one detected in the past summer.

A survey of stalk and cob rots was conducted on the Atherton Tableland as preliminary work to investigations of crop rotations, cultivation and crop residue disposal practices. The incidence of stalk rot due to *Gibberella zeae* was very high, with most farms showing an infection rate of 90–95 per cent. Most infection originated from the roots or basal nodes. The open pollinated variety, Atherton Dent, was less severely affected than the popular hybrid, GH128. Diplodia stalk rots were uncommon. Cob rots were mainly due to *Diplodia macrospora* infection but were only of moderate occurrence.

Cotton.—Isolates of the bacterial blight pathogen (*Xanthomonas malvacearum*) from Biloela, Walkamin and the Darling Downs all conformed in reaction to U.S.A. Race 1. In a variety trial at Hermitage Research Station Acala 1517 BR was highly resistant, Rex was intermediate and Paymaster 54–B was most susceptible.

VEGETABLES

Potatoes.—A target spot (*Alternaria solani*) control experiment was conducted at Atherton. Weekly spraying with maneb and Dithane M45 gave good protection against leaf spotting and extended the growing season by 3 weeks. Dyrene gave some control but was inferior to the other two fungicides.

Virus X infection of the seed did not significantly reduce yield in either a spring or autumn planting at Gatton Research Station. The variety used was Sebago and the strains of virus X were natural infections in southern seed potatoes.

Lettuce.—A bacterial disease previously unrecorded in Queensland was observed during the summer in three lettuce crops near Brisbane. The causal organism was identified as *Xanthomonas vitians* and the symptoms were consistent with those described from Victoria for the leaf spot and dry rot disease caused by this bacterium. Damage was severe on one farm but of minor importance on the others.

Tomatoes.—Two fungicidal spray experiments were conducted to test dichloran for the control of Sclerotinia stem rot (*S. sclerotiorum*) in trellised tomatoes. Regular treatment gave good control and increased yields by 50 per cent. in one trial where infection was early and severe. Unfortunately dichloran is of doubtful compatibility with some other spray materials, therefore upsetting combined spray schedules.

Bacterial canker (*Corynebacterium michiganense*) is commonly spread during transplanting operations. Addition of the antibiotic, centrimide, to the water in which the transplants are held has given promising control in a greenhouse test.

In a tomato spray trial at Kamerunga, maneb and Dithane M45 gave the best target spot (*Alternaria solani*) control. Antracol was reasonably effective but dichloran and salicylanilide were ineffective. Leaf mould (*Cladosporium fulvum*) did not occur.

Miscellaneous.—Cucurbit powdery mildew specimens were examined from various parts of the State. All collections conformed to the imperfect stage of *Sphaerotheca fuliginea.* This mildew was also found on French bean, *Phaseolus bracteatus,* mung bean, calendula, two *Physalis* species, cowpea and three other *Vigna* species.

White rot (*Sclerotium cepivorum*), which is usually an uncommon disease of onions in Queensland, was severe on a number of Lockyer Valley farms.

Dichloran, applied as a dust in the planting furrow or as a spray just prior to colyledon fall, gave promising control of bean seedling infection with Sclerotinia rot (*S. sclerotiorum*).

Verticillium wilt (*V. dahliae*) was identified from watermelons at Wellington Point. This was a new disease record for Queensland.

FRUIT CROPS

Strawberries.—The nucleus of heat-treated, virus-tested strawberry plants was multiplied in isolation at Nanango and the progeny have been distributed to three growers for further multiplication. These were the first steps in a scheme to feed sizable quantities of virus-tested runners into the commercial strawberry industry.

Fusarium wilt of strawberry was again prevalent on several farms in the Redlands district. The pathogen is a strain of *F. oxysporum* and the specificity of the strawberry isolates is still under study.

Peaches.—Brown rot (*Sclerotinia fructicola*) was severe in late peach varieties despite spraying with captan or dithianon. In brown rot experiments the best control was achieved by captan spraying followed by a post-harvest hot water dip at 50 deg. C. for 7 min. Although no fruit damage resulted from this treatment when applied experimentally to several varieties, there was skin damage in some varieties following commercial treatment. Further investigations will now be required.

Apples.—The apple virus indexing programme has continued. Present reactions indicate that the popular Merton 778 and 793 rootstock clones are infected with chlorotic leaf spot virus. Efforts are being made to free this material from virus with heat therapy. Other promising clonal rootstocks and Granny Smith scion material are also being indexed. Visual inspection of nursery scion sources is continuing until sufficient tested material is available.

Bananas.—An intensive screening of fungicides and heat treatments has been carried out in an endeavour to develop a post-harvest dip which will control fruit rots of bananas. The principal diseases involved are black end and anthracnose caused by *Gloeosporium musarum* infection. Of the range of fungicides tested, 0·5 per cent. sodium salicylanilide was the only one to give some control without phytotoxicity. The best heat treatment was a hot water dip at 55 deg. C. for 2 min. These two treatments reduced anthracnose by 50-75 per cent. in various experiments. Further investigations are proceeding to try and achieve more effective control measures.

Work at Cairns on banana leaf spot (*Cercospora musae*) control showed that the standard copper oxychloride/white oil/malachite green spray was superior to a range of other fungicides. Some commercial copper/oil preparations achieved a degree of control but straight fungicides without oils or waxes had little or no fungistatic action.

Citrus.—Further work on the causal agent of Emperor mandarin brown spot has verified that a strain of *Alternaria citri* is the pathogen. The following citrus varieties have proved susceptible in the field or in artificial inoculation tests: Emperor mandarin, Dancy tangerine, Calamondin, Sampson tangelo and Sovereign mandarin.

Brown rot outbreaks at Beerwah in the last 2 years were due to *Phytophthora citrophthora.* This disease is rare in Queensland and the pathogen has not been isolated here for many years, the common cause of citrus root and collar rot being *P. parasitica.*

FORESTRY

Experimental field plantings have been made with slash pines from healthy nurseries and from others infested with *Phytophthora cinnamomi.* The intention is to check the effects of the pathogen on the field performance of this pine. The infested plantings showed much higher establishment losses than the healthy plots and growth rates will be measured in future years.

In a nursery experiment at Beerburrum pre-planting soil fumigation with methyl bromide was significantly superior to treatment with vapam, dexon or nabam in preventing Phytophthora root rot. Vapam had an early effect but the disease built up later, apparently from residual populations of the pathogen in the soil. Commercial nursery treatment with methyl bromide has now been carried out in three Forestry Department nurseries.

In a greenhouse test *Pythium ultimum* and *P. splendens* produced severe root rot, chlorosis and some deaths in inoculated, 6 months old slash pine plants. These fungi are therefore capable of causing root damage in plants well past the stage of susceptibility to damping off.

LEGUME BACTERIOLOGY

Over 800 cultures of legume inoculants were supplied to farmers and distributed for use in Departmental field experiments during the year. Those supplied to farmers were of types not available commercially. Tested strains of Rhizobium for the important tropical legumes were again supplied for use in commercial inoculant manufacture.

Field trials on the Darling Downs verified reports of nodulation problems in some legumes on the black soils. Cowpea, phasey bean, lucerne and *Dolichos lablab* nodulated freely under a variety of soil conditions. Soybean, navy bean and mung bean nodulated poorly or not at all. The strains of Rhizobia used as seed inoculants have proved effective in greenhouse tests and exploratory work does not implicate possible causes such as high soil nitrogen or poor Rhizobial survival around the seed. Soil physical and biological factors are now being investigated.

The compatibility of fungicides with Rhizobial seed inoculation was checked on soybeans at Coolum. Satisfactory nodulation followed treatment with thiram, captan and chloranil and there appears to be reasonable compatibility if sowings are made promptly into moist soil.

AGRICULTURAL CHEMICAL LABORATORY BRANCH

The Branch is finding some difficulty in providing more services to meet the needs of the expanding agriculture of the State. There is an ever increasing demand for the field examination of soils to obtain information required for the planning of major development projects or to assess the potential of areas for agricultural development. The resources of the Branch have been heavily taxed in making necessary surveys for these purposes and the training of more personnel for this work is urgently needed. Expanding programmes of other Branches of the Division of Plant Industry have increased the requests for chemical data and some sections of the Branch have reached the maximum possible output with the available facilities.

PLANT NUTRITION SECTION

A dissection of samples analysed in the Brisbane laboratory is as follows:—

Month	Soils				Vegetable Material	Total
	Dept. Trials	Tobacco	Farmer Samples	Sport Clubs		
June, 1963	185	31	204	19	3	442
July	68	37	191	11	3	310
August	147	41	189	7	5	389
September	244	43	282	13	2	584
October	48	8	182	14	2	254
November	188	2	133	28	22	373
December	120	..	170	3	3	296
January, 1964 ..	195	..	97	3	..	295
February	251	10	207	10	7	485
March	56	2	179	28	1	266
April	177	..	203	5	2	387
May	134	4	119	3	32	292
Total	1,813	178	2,156	144	82	4,373

Waters for Irrigation and Stock ..	1,177
Total	5,550

In addition, analytical data received from the Government Chemical laboratory for 1,592 water samples were reported on for suitability of the waters for irrigation and stock.

Soil Surveys.—Major detailed survey work has again been concentrated in the Mareeba-Dimbulah irrigation area where a further 27,000 acres were examined on the right bank of the Walsh River. Approximately half of this area has been classed as irrigable but, as the better soils are in separate widely scattered patches, the overall area would present problems for intensive development. Large scale clearing and cultivation of higher land in the Mareeba-Dimbulah area has upset the natural drainage pattern in some localities. Cases of severe erosion of surface soil have been recorded, while the distribution of subsurface water has altered to such an extent that soils on lower slopes are being exposed to heavy leaching. The boundary between the more poorly drained yellow transition soils and the better drained red soils appears to have shifted up-slope in recent years and reduced the areas of the red soils. These developments prompt consideration of the wisdom of wholesale clearing of native vegetation in these areas. Reconnaissance surveys in connection with irrigation proposals were made in parts of the Lower Burdekin Valley remote from the river, and in the Burnett and Nogoa River basins; and on a broader scale in the Comet, Dawson, and Condamine River catchments. A detailed soil survey of the Brigalow Research Station has been commenced and will continue so that the soils are mapped before the trees are pulled.

Soil Physics.—Detailed mechanical analyses were undertaken on 81 samples from the Fitzroy basin for the Land Research and Regional Survey Division of the Commonwealth Scientific and Industrial Research Organization. No correlation was found between texture and chloride content for a batch of soils from Quilpie; nor between the physical characteristics and the occurrence of limebush for several soils in the Goondiwindi-Meandarra area.

The flood plain soils of the Lower Burdekin have a very high bulk density (approximately 1·60), and as a consequence, water infiltration is very slow and aeration is grossly inadequate. Crops do not grow satisfactorily in this medium. Recent studies have shown that deep mechanical disturbance, and the stabilization by chemical means of the improved porosity thus created, will greatly increase the productivity of the soils, as the following data indicate.

Treatment	Rhodes grass lb./green weight (6′ x 40′ plot)	Dolichos lb./green weight (6′ x 40′ plot)	Soil Height in feet above bench mark
Ploughing	43	13	0·865
Ploughing + Gypsum ..	55	20	0·913
Deep Ripping	78	31	1·013
Deep Ripping + Gypsum	103	44	1·067

The greater soil heights reflect increased pore space, better drainage and aeration, and a parallel increase in plant growth.

These heavy soils tend to form a mechanically strong crust after wetting and this inhibits seedling emergence. Studies of this problem have shown that gypsum will considerably reduce the strength of the crust and improve seedling emergence, as revealed by the following data.

Treatment	Modulus of Rupture (Millibars)	Seedling Emergence per 180-feet row
Gypsum (5 tons/acre) ..	1,664	284
Nil	2,945	184

Pasture Investigations.—(*a*) Wallum. At the Coolum Research Station the two legumes lotononis and siratro were badly cut by heavy frosts in 1963 but made a good recovery. Productivity data for the two legumes after 18 months have shown the maximum yield of lotononis to be more than twice that of siratro under similar nutritional conditions (11·3 and 5·4 tons per acre dry material).

(*b*) Maleny. In a field trial of kikuyu pastures, nitrogen was shown to be the most limiting single factor, but sulphur and phosphorus were needed also to give maximum yields. Renovations increased the protein content of kikuyu pasture, but unrenovated areas treated with 100 lb. nitrogen per acre as urea had higher protein (17·4 per cent.). Renovation plus the same quantity of nitrogen raised the protein to 20·2 per cent.

GENERAL ANALYTICAL SECTION

A total of 3,705 samples was analysed comprising grasses and pastures, grains, oil-bearing seeds, stockfoods, fertilizers, pest destroyers and veterinary medicines. Approximately 35 per cent. of the fertilizers contained less than the declared amount of one or more constituents, and approximately 25 per cent. of the stockfoods contained less than the declared level of protein.

Several samples of linseed oil and safflower oil, extracted from the seed by hydraulic press, were examined for refractive index (at 25 deg. C.) and iodine number, and the results statistically correlated for each oil. The correlation coefficients were 0·9980 for linseed and 0·7521 for safflower. Soybean samples ranged in protein from 33·9 to 41·5 per cent. and in oil content from 14·3 to 19·8 per cent.

A high correlation between the protein and sulphur contents of lucerne was found in four of the five cuts of a sulphur fertilizer trial on this crop. Gypsum at 8 cwt. per acre increased the sulphur content of paspalum from 0·32 to 0·44 per cent. in a trial at Theodore, but no correlation existed between sulphur content and protein. Alpha sorghum from a trial at Allora contained more protein (9·4 per cent.) where it followed "panicum" than where it followed sorghum (6·6 per cent.). In the same trial the corresponding figures for Texas 610 were 7·9 and 5·8 per cent.

Samples of cotton petioles received from the Research Station, Biloela, were analysed for nitrate content. At the early squaring stage of the crop, when the samples were taken, fertilizer treatment had had no effect on nitrate content (0·8 per cent. for 150 lb. urea per acre and 0·77 per cent. for 300 lb. urea).

The estimation of vitamin A in stockfood supplements was subject to large variations in any one sample due to the uneven distribution of the vitamin A concentrate in the material. Methods of overcoming this analytical problem are being examined. A pest destroyer suspected of having caused damage to crops on which it was used was found to contain sufficient hormone herbicide to account for the effects reported. Investigations of the stability of the fungicide maneb have shown that storage at room temperature for 30 weeks can cause up to 60 per cent. decomposition.

CEREAL SECTION

Wheat.—Protein surveys were conducted on wheat from central Queensland during the 1963 season. The protein ranged from 9·1 to 15·9 per cent. (average 12·9). The overall quality was good and some very high quality flours were obtained. The results are most encouraging and compare very favourably with those for the best wheats of the Darling Downs.

From the previous season's survey of wheats from the Darling Downs, the protein ranged from 7·8 to 16·8 per cent. (average 12·4) and phosphoric acid (P_2O_5) from 0·45 to 1·10 per cent (average 0·75). Baking quality was of a high standard. Spica was the outstanding variety. Festival tended to be less overstable than in previous years. Mengavi gave a wide range in strength and baking quality.

In the competition wheats of the Toowoomba and Goondiwindi Shows, Spica was the outstanding variety in both competitions, in which a high standard was set. Maximum protein percentages were 18·7 and 19·3 respectively. The potential of the Goondiwindi area for producing good quality wheat is noteworthy.

In a trial on the Downs, the protein content of 11·3 per cent. where wheat was grown in successive seasons rose to 14·4 per cent. after 4 years of pasture. Wheat after lucerne invariably had a higher protein content and flour of better baking quality than where lucerne was not used.

Barley.—Investigations were continued in the series of fertilizer trials to determine the maximum amount of urea that could be applied to barley crops to increase yield without impairing the malting quality. At 0·5 cwt. per acre the nitrogen content of the grain was increased by a moderate amount (from 1·356 to 1·460 per cent.), but the yield increased by 44·0 per cent. This result was favourable as the predicted extract still remained high.

FIELD LABORATORIES

Mareeba.—Following the finding of a high pH value (11·0) of the water in the Mareeba main, an investigation was made of the effect on pH value of water stored in contact with cement pipes. Water was taken from Nardello's lagoon and stored in pipes with one end open. The following are some of the pH values found:

Hours of Storage	0	2	8	12	24	36	72	120	170
12-inch pipe	6·5	6·8	6·9	7·0	7·2	7·4	7·8	8·6	8·8
15-inch pipe	6·5	6·9	7·3	7·1	7·3	7·4	7·8	8·1	8·3

Storage under pressure or for a longer period could be expected to cause the pH to rise to higher levels.

In a tile drained area on soil type 111, a check was kept on rainfall, drainage flow, soil water, and chloride content of soil and effluent. The flow of effluent reached a peak of nearly 4,000 gal. per hour in the period March 6–13. A source of chloride was located at depth in nearby soil type 121, although there is little chloride in this soil type in the top 2 ft. Analysis of soil samples stored at Atherton for some years suggests that major changes have occurred in the content of available plant nutrients. This raises a question of desirable storage methods and the period for which samples may be stored without significant changes occurring in their composition.

Atherton.—Work in this laboratory was concerned with the physical and chemical examination of soil samples taken in the continued survey of soils in the Mareeba-Dimbulah irrigation area, and of some samples submitted by the Irrigation and Water Supply Commission.

Parada Research Station.—Investigations were made of the chloride content of tobacco leaf, soil, water, and fertilizer, and determinations made of the nitrogen status of soils in various trials. The chloride content of a range of fertilizers commonly used on tobacco was considered to be but a minor source of chloride in the soil. Colour measurements of ground tobacco leaf, using a special colourmeter, were completed on 362 samples. The data have yet to be analysed.

Tropical Research Station, South Johnstone.—Soil studies of the pasture paddocks at Utchee Creek substation reveal that nitrogen fixation by the legume centro is equivalent to 92 lb. of nitrogen per acre per annum over a 16-year period. This compares favourably with figures reported for legumes in temperate areas. There appears to be no similar data in the literature for permanent tropical pasture covering such a long period.

The phosphorus requirements of tropical legumes are currently under study. A forest soil near Tully showed marginal copper deficiency.

Research Station, Millaroo.—Analytical data for tobacco leaf and soil samples from a nutrition trial on the Station support the theory that low levels of nitrate-nitrogen nutrition result in increased chloride uptake by the tobacco plant. Tobacco following Rhodes grass was of better quality, higher in yield, and lower in chloride than after centro pasture or sorghum. Leaf from plots irrigated only with stored rain water contained up to 60 per cent. less chloride than leaf from river-water plots and contained acceptable levels of chloride (0·66–1·12 per cent.).

Early land preparation for tobacco results in a large build-up of available nitrogen. This causes uncontrollable growth and often produces poor quality, trashy leaf. Soil studies of early and later land preparation showed that 38 lb. more nitrate-nitrogen was produced per acre in the top 9 in. of soil in the former areas in the absence of any fertilizer. If plant usage is taken into account, it is probable that under normal district practice the soil alone contributes two or three times as much available nitrogen as does the basal fertilizer treatment.

Wheat Research Institute, Toowoomba.—Methods of estimating and determining available soil phosphorus continue to be examined for the purpose of finding a method that gives results that correlate satisfactorily with observed field responses of wheat on the Darling Downs soils. Studies of total nitrogen and carbon in soil after 5 years of rotational cropping have shown that (a) lucerne-prairie grass pasture causes a sharp upward trend in total nitrogen in 1 year, and a very significant increase in nitrogen and organic matter in 2 years, (b) the nitrogen increase after 4 years of pasture is equivalent to approximately 350 lb. of nitrogen per acre-4-in., (c) the nitrogen build-up after 3 years of pasture is dissipated after two successive wheat crops.

In a trial at Norwin, 0·5 cwt. per acre of urea increased grain yield by 4·5 bus. per acre, and boosted the grain protein from 9·8 to 11·0 per cent. Higher amounts of urea did not improve yield, but the protein continued to rise with each increment of fertilizer until 12·5 per cent. was reached at 2 cwt. of urea.

Determinations of zinc in plant tissue, using an atomic absorption spectrophotometer, have so far indicated that the zinc contents of healthy and of severely zinc-deficient linseed plants do not differ markedly. This suggests the possibility of some factor, such as the balance of nutrients within the plant, affecting the capacity of the plant to utilize zinc. This work is progressing.

Northgate Tobacco Laboratory.—Analysis of leaf, after removal of the mid-rib, from a copper deficiency trial at Bundaberg gave the following results:—

	p.p.m. of copper
Control	3
Chelated copper (2 sprays)	6
15 lb. per acre of bluestone + chelated copper (1 spray) ..	14
30 lb. per acre bluestone	20

Suckering and topping caused significant changes in the composition of leaf from a trial at Bundaberg. The constituents most affected were the total alkaloids, reducing substances, potassium and chlorides.

DIVISION OF ANIMAL INDUSTRY

The more optimistic note struck in last year's report in relation to staff unfortunately cannot be repeated this year. There have been many resignations at nearly all levels of the Division and the position can be viewed only with great concern. Each year the hard core of experienced staff becomes smaller and the filling of the more senior positions in the Division becomes more difficult. It has to be recognized that the level of experience of Divisional staff is falling, even though numbers are rising. The increase in numbers is a consequence of the intake of young inexperienced officers. These people all too often are drawn away from the Department as soon as they acquire enough experience to attract the attention of other employing bodies requiring the services of biological scientists.

One pleasing feature of the year from the staff point of view has been the number of officers either already overseas acquiring post-graduate training or arranging to go early in 1964-65. If this remains a feature, it is obvious that a major contribution will be made towards a higher standard of service by the Division to the livestock industries. This is especially important at a time when farmers and graziers are themselves acquiring new skills at an ever increasing rate. It is essential for our advisory services to be able to offer something above and beyond what the livestock owner is already applying successfully.

Laboratory and Field Station Facilities

No real progress can be reported with the proposed erection of a Biochemistry-Husbandry Research and Metabolism Block at the Animal Research Institute, Yeerongpilly. While planning of the building is understood to be in an advanced stage, there is still no clear indication when a start on construction will be made. This is particularly unfortunate, as staff at the Institute are working under crowded and unfavourable conditions. Valuable equipment too, in some instances, is of necessity housed under unsatisfactory conditions.

A fire at the Toorak Sheep Field Research Station added to the already difficult situation over facilities there. There is evidence of concern in the sheep industry that development

of this station is not proceeding at a satisfactory pace. Some individual sheep men have stated that while they acknowledge Toorak has an important role to play for the betterment of the industry, nevertheless if the necessary facilities are not to be provided it would be better to close the station down and give it over to commercial sheep raising.

At Swan's Lagoon Field Cattle Research Station developmental work has proceeded according to plan and very satisfactory progress can be reported. This has been due in large measure to financial support obtained from the Australian Cattle and Beef Research Committee.

Some progress can be reported with the erection of facilities for a tick fever research project at Wacol. The cattle yards and spray race are in position but a start has yet to be made on the laboratory and a staff residence. Here again the Australian Cattle and Beef Research Committee has been the key to such progress as can be reported. The property on which this project is to be conducted is close by the Artificial Insemination Centre at Wacol.

Disease Situation

There is nothing further to report where swine fever is concerned other than that another 12 months' observations have failed to show any evidence of the clinical disease.

Of major importance was the follow-up of the discovery made the previous year that the toxin of type D *Clostridium botulinum* is a cause of cattle mortality in coastal and north-western Queensland. Large scale vaccination against this infection has been carried out with encouraging results.

The national pleuropneumonia of cattle eradication programme was continued on much the same basis as the year before. It is clear that the disease must now be regarded as a rare one in Queensland. A few isolated pockets of infection appear to remain but these come under notice only as a result of careful examination of cattle lungs and application of complement fixation testing at point of slaughter. An active case of the disease in the field has not been seen during the last three years. The volume of C.F. testing carried out for this disease has put a severe strain on the staff and facilities at the Animal Research Institute, Yeerongpilly.

A happening that caused much concern was the finding of ticks resistant to certain of the organo-phosphorus compounds that have taken the place of chlorinated hydrocarbons for tick control. However, the problem so far has been confined to a restricted area in the central coastal districts of the State. It may nevertheless be a foretaste of things to come.

There was further evidence during the year of the ever-changing scene where diseases of livestock are concerned. As previously imperfectly understood diseases give up their secrets to the patient and skilled research worker, new disease conditions have the unhappy knack of putting in an appearance. It all emphasises the need for a large and well trained group of research workers with proper facilities at their disposal if we are not to drop behind in the struggle against diseases of livestock. Reference to the Pathology Branch report this year will reveal a particularly good record of achievement in the face of many difficulties.

Artificial Insemination

The growth of artificial insemination in the dairying industry exceeded anticipations. The output of semen from the Wacol Centre more than doubled. The indications are clear enough that the Centre will have to meet a further much increased demand in 1964-65. Demand for Australian Illawarra Shorthorn semen has so far exceeded that for all other dairy breeds combined.

Slaughtering

Activity connected with the slaughtering of livestock in the State was greatly heightened by the introduction by the U.S.A. of new standards of hygiene and inspection in meatworks wishing to export to that country. Although the administration of the changes is primarily a matter for the Commonwealth Department of Primary Industry, there were repercussions at the administrative and technical service levels for this Division.

A further major event was the setting up by the State Government of a committee to enquire into a number of aspects of the meat industry in Queensland.

It is an era of great change for the livestock and meat industries. It is fitting therefore that the decision should have been taken at this time to set up a Meat Control Branch within the Division. Slaughtering has previously been administered and serviced from within the Veterinary Services Branch, but henceforward the Meat Control Branch will attend to these matters. Some re-arrangement of staff will be necessary and difficulties may arise at times because of the necessity for some officers to function as inspectors of both stock and slaughtering. However, it is confidently anticipated that these can be overcome and that time will establish the new move as a progressive and successful one.

VETERINARY SERVICES BRANCH

SEASONAL CONDITIONS

Failure of the normal monsoon rains resulted in irregular seasonal conditions throughout the pastoral areas of the State during the year just ended.

Although drought raged in the Boulia area when the year opened, most areas of the State had adequate grass and water, until severe frosts in late June and July extending as far north as the Atherton Tablelands rapidly dried off grass and herbage and caused severe setbacks to fodder crops. Good rains fell during August over an area extending from the Carpentaria Division through the central west and Central District as far south as St. George. The Goondiwindi-Texas area missed these rains.

Although patchy relief rains fell over wide areas of the Burnett districts during September, drought conditions continued in the area south from Urandangie almost to Birdsville, and prevailed in the Chillagoe-Walsh area, which had received little rain since March. The central coastal area extending 100 miles inland from Rockhampton missed the August/September rains and was droughted when the first quarter ended.

Southern Queensland experienced above average rainfall, particularly the coastal and south-west regions, during October/November, but dry conditions prevailed throughout the remainder of the State. Areas of the Burnett, Central District and Townsville Division were droughted when relief rains fell in December. These eased conditions as far north as the Townsville district, where scattered storms brought only localised relief. Drought continued unabated in the Boulia and Chillagoe-Walsh areas and built up in the western Gulf, with dry conditions generally throughout the remainder of the Mt. Isa district. The eastern Gulf, Atherton Tablelands and Cairns coastal areas received useful rains in December.

In those areas which missed relief rains, pastures deteriorated and surface water supplies seriously diminished. Heavy losses were reported among stock in droughted and near-droughted areas of the north-west, accentuated in some instances by botulism and in others by gidyea poisoning.

Two cyclonic disturbances during the March quarter brought torrential rain and flooding to rivers within the area of their influence, which included all coastal areas and the Carpentaria and western Darling Downs Divisions. The usual monsoonal rain pattern, however, did not eventuate, and those areas beyond the scope of the cyclonic disturbances received only scattered relief.

Drought conditions continued in the Boulia area and built up rapidly in an area extending from Wandoan-Wallumbilla northwards through the upper Burnett and Dawson-Callide Valleys to the Clermont district. Conditions in areas of the southern Darling Downs varied from dry to droughted, and the far south-west received only patchy storms which afforded limited relief. The dry and droughted conditions in the Central District and Darling Downs resulted in large-scale movements of cattle to slaughter or to relief country, which became more difficult to obtain as the season progressed. Southern coastal areas experienced some very heavy falls of rain during late March, but unfortunately these did not extend far inland.

Many areas received sufficient rain to provide an abundant growth of grass, but not enough to replenish surface and underground water supplies, and when present supplies are exhausted the outlook will be grim unless unseasonal rains fall.

Little useful rain was received during April; droughted areas were unrelieved and near drought conditions prevailed on some properties in the Ayr, Bowen and Charters Towers areas, with actual drought in the Mt. Coolon area. Here, stock losses were reported. Late rains in the Hughenden-Richmond areas caused blackening and deterioration of pastures.

Fairly general useful rains were received in late May in an area extending from Charleville to the coast and extending northwards to the Clermont area: however, further follow-up rains are required to bring any lasting relief to droughted areas or to ensure that green fodder crops can be planted with any assurance of success.

During early June, above average rain fell in the Rockhampton coastal area, and torrential rains fell along the coast between Townsville and Cairns, with above average falls right across the northern portion of the Peninsula.

In general, the outlook as the year ended was most unpromising, with large areas in the grip of drought or near drought, and others facing great uncertainty in regard to water supplies to last through the winter.

STAFF

Two Divisional Veterinary Officers resigned during the year. However, an officer who resigned last year was re-appointed to Divisional Veterinary Officer status. A Divisional Veterinary Officer (Poultry) was appointed to fill a vacancy created by a resignation early in 1962. Six graduates were appointed Veterinary Officers, Division II. One Veterinary Officer, Division II, has been on study leave during the major part of the year.

The services of one District Inspector of Stock, one Senior Slaughtering Inspector and six Stock and Slaughtering Inspectors were lost during the year due to resignations and other causes. Thirteen Inspectors, Division II, were appointed, one of whom was seconded to quarantine duties.

DISEASES OF CATTLE

Bovine Contagious Pleuropneumonia

For the third year in succession, no active case of this disease was reported in either paddocked or travelling cattle in Queensland. Though this situation is highly satisfactory, there is little room for complacency, as laboratory examination of lesions from slaughter cattle confirmed that the disease continues to smoulder at a very low rate in remoter areas of the State.

A viable lesion in an animal from a Charters Towers fattening property was detected on slaughter at Townsville and quarantine measures were imposed. Control measures in force on the holding were stepped up, and following negative tests from some 900 herd and slaughter cattle, restrictions were raised after being in force for nine months.

A second viable lesion was discovered in an animal from a Channel Country property killed as a "stranger" in a draft from a neighbouring holding. As the area is largely unfenced, quarantine was imposed on both holdings and control measures instituted. Subsequently, another property, under the same ownership as that from which this animal originated, was also placed under quarantine due to recent movement of cattle between the two.

Only one property was under quarantine on July 1, 1963, and restrictions were retained following confirmation of an active lesion in an animal detected by blood testing a section of the herd. Thus the year closed with four properties under quarantine.

Totals of suspect lesions detected at export meatworks during the 1963 season were lung lesions 106, confirmed sequestra 2, pleural adhesions 4,975. The total cattle inspected was 1,020,930.

Positive reactions to the precipitin test were returned in lung lesions from cattle from one Channel Country property, all associated with *Actinobacillus* sp. infections. Other organisms isolated from lung lesions included *Pasteurella multocida, Corynebacterium* sp., *Mima* sp., and *Staph. aureus.*

A total of 41,388 blood samples from slaughter and herd cattle was submitted for C.F. testing.

The majority of positive and suspicious reactions to test were traced to drafts of slaughter cattle containing recent inoculates; however, positive and suspicious reactions were obtained from uninoculated slaughter cattle submitted from four herds in the Alpha-Springsure area and 10 herds from the south-west.

During follow-up bleeding of herd cattle, one positive was obtained from each of two of the herds in the Alpha-Springsure area but no active evidence of pleuro could be detected in these herds. The other positives in herd cattle were detected in three individual drafts tested in the Townsville Division for entry to New Guinea. Here again, follow-up investigations failed to give any indication of B.C.P.P. The positives could have been due to non-specific reactions.

Approximately 80 per cent. of travelling cattle within the endemic area were inoculated under supervision of Departmental officers—144,102 by B.C.P.P. staff and 158,818 by Stock Inspectors. A further 79,319 were inoculated by owners or agents. In addition, 71,920 inoculated cattle entered Queensland from the Northern Territory during the 1963 season.

Paddocked cattle inoculated numbered 333,600, of which 32,825 were inoculated under supervision of Departmental officers. In all, a total of 715,839 cattle were inoculated, an increase of over 100,000 on the previous year.

A total of 1,014 properties were visited by B.C.P.P. Extension officers. About 70 per cent. of these properties either have or are about to commence control programmes.

Tuberculosis

A considerable number of changes took place in tuberculin testing contracts. At the end of the year there were 48 approved veterinary surgeons, 34 three-year contracts, 3 one-year contracts under the assisted milage scheme, and 4 temporary contracts.

Heavy incidence of tuberculosis was again detected in slaughter cattle from Northern Territory holdings and associated Queensland properties. Testing of a beef herd in the south-west which commenced last year reduced incidence of reactors from an initial 25·6 per cent. to 1·6 per cent. on the fifth test. Two other herds in this area have also shown a very high incidence of T.B. in slaughter cattle: control measures are being considered. Another beef herd on the southern Darling Downs returned 59 reactors in 700 tested, an incidence of 8 per cent.

Coast Disease (Botulism)

Very heavy losses attributed by field observation to botulism occurred on properties in the north-west during dry conditions late last year. Seasonal conditions were adverse at the time. Losses ranged from 100 to 800 head on individual properties, a total of 2,100 dying on seven affected holdings. Owners were advised to burn all cadavers and supply a phosphate supplement. A vaccination trial with bivalent toxoid is planned on a badly affected holding.

A phosphate supplement trial in the Townsville area progressed satisfactorily; losses were more numerous in the controls than in the treated stock. Properties in the Charters Towers and Townsville areas reported good control following vaccination with bivalent toxoid and the results, although not conclusive at this stage, are very promising. Unfortunately, bivalent toxoid has been in short supply but indications are that when it becomes freely available, it could play a significant part in controlling this disease.

Although botulism has been suspected of causing regular losses on properties in the area north of Alpha for a number of years, it was not until late 1963 that a case was confirmed by isolation of Botulinum Type D toxin. Over 400 breeders were lost during the year on another property, and although toxins could not be demonstrated, brain lesions supported a diagnosis of botulism. Both properties have commenced a vaccination programme using bivalent toxoid. Botulism was diagnosed on clinical grounds during the loss of 20 breeders within 3 weeks on a Miriam Vale property where sporadic losses had occurred for 6 months. Losses ceased after vaccination of the remaining 200 cattle.

Surveys recently completed in central Queensland, covering country from Gladstone to Mackay on the coast and inland to Jericho, have indicated that botulism is more prevalent than was anticipated. Vaccination programmes are being introduced on several properties. They will be extended as additional supplies of vaccine become available.

Isolated losses consistent with botulism were reported from coastal areas near Maryborough but were not confirmed by the laboratory. Morbidity was generally low, and vaccination is being increasingly used by stock owners.

Losses from botulism also occurred in the Brisbane area in dairy cattle fed very old silage from the bottom of a silage pit.

Infertility

Infertility problems continued to occupy much of the time of veterinary staff in principal dairying areas; in addition, limited checking of infertility in beef herds was carried out in all Divisions.

In northern areas pregnancy diagnosis was demonstrated to graziers anxious to improve calving percentages and to reduce infertility disease incidence.

Anoestrus, probably of nutritional origin, was encountered frequently during infertility investigations on the Atherton Tablelands, and a longstanding infertility problem possibly associated with ingestion of toxic plants was encountered in the Central District. Further feeding trials are in hand to test the abortifacient effect of *Salvia coccinea* at Biloela.

Brucellosis incidence was encountered in all areas tested; incidence was high on the Atherton Tableland and the disease appeared to be spreading in the Rockhampton and Wandoan areas.

Testing of randomised blood samples from 65 beef cattle herds in the Central District revealed eight positive herds, one of which had a high incidence of infection. Strain 19 vaccination is being increasingly used for control purposes in beef herds in this district.

Although there has been some increase in Strain 19 vaccinations in dairy herds, the overall position is still far from satisfactory, as large numbers of dairy heifers reared as replacements are not vaccinated.

Vibriosis continued to be a major problem and was the most common cause of early abortions and returns to service. Treatment of infected cows and bulls is being adopted as a control measure with satisfactory results.

Leptospirosis caused calf losses and infertility and appeared prevalent in Darling Downs herds. Very high titres to *L. pomona* were demonstrated following a violent abortion storm in a Rockhampton beef herd, in which 160 cows among 600 breeders lost their calves during a six-weeks period.

A fresh outbreak of trichomoniasis in the Dayboro area resulted in quarantine of two properties late in the year. Restrictions were raised from a Brisbane farm after slaughter of the last suspect bull; control measures, including use of artificial insemination, were maintained on all other quarantined properties.

Tick Fever

Anaplasmosis appears to be increasing. Cases were reported from several areas of the Atherton Tableland, Charters Towers, several portions of the Central District (including unusual losses among calves 3 to 4 months old) and all marginal areas from Wandoan to the New South Wales border.

Losses from babesiosis were reported from all Divisions; it was regarded as the most important disease in the Rockhampton Division and a cause of serious economic loss in other areas. Moderate to heavy losses were reported in travelling mobs in the north-west, some of which occurred in cattle untrucked for spelling in clean country.

Dry seasonal conditions and low tick populations led to loss of immunity and deaths in bullocks up to 4 years old on the coast north of Rockhampton. In the Central District there is an increasing tendency to inoculate at weaning to prevent losses, and large scale inoculation is carried out in marginal areas with more reliance on laboratory blood rather than introduction of bleeders.

Miscellaneous

Aphosphorosis was accentuated by dry and drought conditions in the Central District. "Blight" was widespread during the latter period of the year. Mucosal disease was suspected in herds in the Biloela and Clermont areas. Cytotoxic tests from suspect material incriminated C.24 virus as the cause of this disease. Jaundice caused condemnation of 130 and 55 head of cattle in two mobs slaughtered at Lakes Creek. The origin of this condition is obscure but it has occurred repeatedly in cattle held more than 10 days prior to slaughter.

DISEASES OF PIGS

Swine Fever.—Regular and concentrated observations on piggeries during the year failed to reveal any evidence of swine fever in Queensland herds. Swine fever was not confirmed in the two suspect herds in the Townsville area which were quarantined early in 1963 and they were released.

Restrictive interstate movements on pigs and pig meats were gradually eased and the remaining restrictions are now being rescinded.

Inclusion Body Rhinitis.—This disease was confirmed in only five instances during the year. Incidence and mortality were low, and restrictions were not imposed.

Oedema Disease.—Losses were reported from all pig raising areas, in some cases with mulberry heart lesions. Husbandry methods appear to be most important in control of outbreaks of this disease.

Erysipelas was confirmed in various areas, and implicated in arthritic lesions which increased in importance as a source of economic loss. Control by vaccination became more widely accepted and applied.

Melioidosis was detected in slaughter pigs at Mareeba and Townsville.

Miscellaneous.—Metritis and piglet enteritis were common. Glassers disease was reported from several districts. Virus pneumonia, salmonellosis, mastitis, ringworm, parakeratosis, avitaminosis A, encephalitis, sparganosis and spirochaetosis were among conditions causing economic losses.

DISEASES OF SHEEP

Infertility problems were evident in many areas. Testing of British breed and Merino studs for incidence of brucellosis and actinobacillosis continued during the year. Although incidence in general was low, a high level of brucellosis was found in two flocks on the Darling Downs and one at Rockhampton. In western areas rams were checked for epididymitis and vasectomies carried out in an endeavour to reduce infertility and raise lambing percentages.

Pregnancy toxaemia caused loss of 500 ewes at Julia Creek, and hypocalcaemia was prevalent among yarded sheep in the Longreach area, due to prolonged submaintenance diet.

Humpy-back was investigated in the Julia Creek, Capella and Goondiwindi areas. In the last area a trial is in progress using selenium injections in pregnant ewes.

Salmonellosis caused losses in rams at Julia Creek some days after completion of a long train journey.

Erysipelothrix insidiosa was isolated from joints of lame sheep from a St. George property.

Tetanus caused heavy losses of lambs following marking at Longreach, St. George and Meandarra.

DISEASES OF HORSES

Quarantine restrictions for equine infectious anaemia on an Adavale property were raised early in the year.

Abortions in mares on the Peninsula were considered to be of viral origin; however, sera for check testing have not yet been obtained.

Botulism in horses at Lake Nash was reported by the Northern Territory A.I.B. Sporadic cases of tetanus were reported from various areas, and strangles appeared fairly widespread in the central-west and south-west.

DISEASES OF POULTRY

The bronchitis-nephritis syndrome is widespread in broilers in the State, producing losses as high as 30 per cent. in some affected groups on certain properties. A serological survey indicated this disease was present in the great majority of flocks sampled.

Leucosis, in its various forms, is widely reported, with losses as high as 30 per cent. in some flocks. In certain broiler establishments, the disease becomes apparent at 5 to 6 weeks of age.

Day-old vaccinations with pigeon pox virus as a precautionary measure against fowl pox is widespread and appears, in the main, to be effective. A few outbreaks of fowl pox, however, in laying pullets, accompanied by the customary losses, have occurred.

Epidemic tremor has occurred sporadically. Routine vaccination against infectious laryngo-tracheitis continues on properties where the disease has been identified.

Success has been reported with a programme of depopulation and restocking with isolation, in the control of mycoplasmosis (C.R.D.).

A number of cases of infection with *Salmonella pullorum* were detected on routine blood testing of breeding flocks. Not all of these "breaks" were referable to sources in other States.

Cases of pasteurellosis, staphylococcosis and haemophilus coryza have occurred. Avian vibrionic hepatitis has been identified.

Coccidiosis, caecal and intestinal, is still commonly occurring. In the main, outbreaks of this disease occur in birds older than heretofore, due, it is considered, to the indiscriminate use of efficient coccidiostats.

Deaths in poultry have occurred due to botulism, and the ingestion of certain flying ants (*Monomorium* spp.) and the seeds of toxic plants.

EXTERNAL PARASITES

Cattle Tick

The season was favourable to build-up of ticks in the Gulf and northern areas following heavy rains early in 1964, but numbers did not build up in the Townsville area until April. In the Central coast, numbers were below normal due to dry conditions, but were active in southern central areas throughout the summer months.

Some extension of tick infestation to previously clean properties occurred in the Kingaroy, Toowoomba, Warwick and Wandoan areas, associated in some cases with outbreaks of tick fever. The illegal movement of ticky calves to New South Wales and their subsequent return, led to infestation of three properties at Mungindi; however, this outbreak was soon brought under control.

A dipping programme for control of ticks was recommended in the Ironpot-Chahpingah area in February last and has continued satisfactorily to date. Control measures in other areas resulted in raising of restrictions from a large number of previously infested holdings.

Grave concern arose from apparent failure of organo-phosphorus tickicides to control ticks in some areas, including difficulties associated with clearing ticky cattle to clean country. In most cases, investigation revealed that management practices were at fault, and heavy winter coats and failure to wet heads properly were factors delaying cattle at clearing dips.

Ticks resistant to organic phosphate insecticides were detected in the Rockhampton district. This resistance followed dipping in Delnav over several years. There was also cross resistance, in some cases high, to other related insecticides. The cross resistance in three commonly used insecticides, however, was of a low order and of little significance at this stage.

Resistance was investigated and confirmed on 10 properties, all within 30 miles of Rockhampton. An extensive survey over the whole State, however, has failed to confirm O.P. resistance in any other centre.

Rigid control measures to eliminate the ticks from confirmed properties have been introduced with satisfactory results. Insecticides other than those to which resistance has been demonstrated were used. Cattle are cleansed of ticks before being released from these properties.

The problem is being kept under observation and will receive special attention in the 1964-1965 tick season.

Buffalo Fly

Infestation was heavy in northern areas following early summer rains, moderate in the Townsville area and the area south to Rockhampton. Trials with sevin and methoxychlor in the Townsville area gave reasonably satisfactory results.

Sheep Lice

Mainly due to lack of co-operation by owners, sheep lice appear to be a permanent problem on some properties, and their movement to sale or other destinations presents a perpetual risk of infesting clean holdings. Infestations were reported from the Julia Creek district, the desert country of the Longreach district, particularly Blackall, and widespread areas of the Darling Downs, where stringent measures have been introduced to prevent sale of lousy sheep through saleyards.

POISONING

Arsenic

Numerous light losses were reported; heaviest losses occurred at Goomburra, where 15 cattle in a mob of 30 died, and at Kunwarara, where 10 stud Braford heifers died after access to an old rusted poison tin.

Light losses from lead poisoning, principally in calves, occurred widely. Losses from urea were light, probably due to more care on the part of owners and a change in formulation of the blocks: however, 45 sheep were lost in the Townsville Division within a day of blocks being made available to them, and urea was suspected in sickness of a pony at Charters Towers.

Sporadic losses and sickness, principally in calves, followed treatment in organo-phosphorus tickicides in widespread areas. However, in most cases where losses occurred, management was at fault. Early treatment with atropine was most effective in halting losses and promoting rapid recovery of affected animals.

One hundred cattle on the Darling Downs suffered toxic effects after mistaken treatment with parathion. Prompt treatment with atropine saved heavy loss.

Endrin caused heavy mortality in fowls at Biloela. Incidence of sawfly poisoning appeared lower than in previous years. However, deaths in cattle were reported from the area Augathella to Taroom, extending into the southern parts of the Emerald district, and some sheep losses occurred at Surat.

Lantana (*Lantana camara*), poison peach (*Trema aspera*), grass tree (*Xanthorrhoea*), bracken (*Pteridium aquilinum*), and noogoora burr (*Xanthium pungens*) caused sporadic losses in coastal areas, with some heavy losses from lantana among droughted cattle introduced onto Rockhampton coastal areas.

Yellow-wood (*Terminalia oblongata*) caused losses in the Central Highlands. Cattle on a droughted Nebo property, which grazed yellow-wood regrowth to the ground, developed nervous symptoms similar to those seen in yellow-wood poisoning of sheep.

Eight cattle died and another 12 were affected after gaining access to zamia regrowth through a burnt-out fence in the Boyne Valley. Rubber Vine (*Cryptostegia grandiflora*) caused death of 19 cattle on two associated holdings at Gilbert River.

Symptoms of hypocalcaemia developed in starving cattle untrucked at Cramsie onto lush growth including saltbush and pigweed; twenty were affected, four of which went down and died when yarded for retrucking. Spelling for another day cleared up the condition.

Weir Vine (*Ipomoea calobra*) was responsible for light losses in cattle and sheep in the Surat–St. George area, and wild sunflower (*Verbesina encelioides*) was responsible for heavy losses of sheep in the Roma area and light loss among cattle at Boondooma.

Sorghum regrowth and *Sorghum almum* were again implicated in losses from HCN poisoning in several districts. Feeding of mouldy corn to cattle in the Burnett during the winter of 1963 resulted in one heavy mortality at Gayndah with numerous small losses in other centres.

INTERNAL PARASITES

Stomach worm (*Haemonchus* spp.) was again the principal problem in dairy calves and to a lesser extent, in young beef cattle, particularly in coastal areas. However, lung worm (*Dictyocaulus* sp.) infestation was heavier than usual in calves on the Atherton Tableland, and heavy infestations of hook worm (*Bunostomum* sp.) were reported from the coastal area near Rockhampton; here losses were not confined to wetter areas, as mortalities occurred also under near drought conditions.

The use of injectable anthelmintics found widespread and ready acceptance as it overcomes objections many cattle owners had to drenching their stock. This resulted in further advances in application of strategic worm control measures in beef and dairy herds in all Divisions.

Thiabendazole was the medicament of choice for treatment of internal parasites of sheep, and excellent results following its use were reported from all sheep raising areas.

Liver fluke (*Fasciola hepatica*) caused concern in cattle and sheep in the Killarney and Stanthorpe areas.

A campaign was carried out in the Mount Isa and Cairns Divisions to demonstrate and encourage drenching of horses for worms; thiabendazole gave excellent results. Trials at Mareeba indicated that thiabendazole is slightly superior to phenothiazine for treatment of worms in horses, and is probably safer and therefore to be preferred for treatment of weak, pregnant or valuable animals.

These trials also indicated that neguvon is highly effective against bots, but disappointing for control of the more serious Strongylus of horses.

Heart worm (*Dirofilaria* spp.) in dogs was particularly prevalent in Peninsula areas, extending down the coast as far as Innisfail, and was also reported in the Charleville district.

Graziers instituted control measures following detection of pathogenic burdens of *H. placei* and *Oesophagostomum radiatum* in adult cattle running on desert country north of Alpha.

Coccidiosis occurred spasmodically in dairy stock in the Maryborough Division, and was also confirmed in one instance in losses among beef calves.

An organo-phosphorus anthelmintic Neguvon gave excellent control of large round worms in pigs in the Cairns and Atherton areas.

BRANDS

Following are details of registrations, transfers, &c., of brands and earmarks for the year 1963-64.

TABLE 1

Item	Number	No. since Inception of Legislation
Ordinary three-piece horse and cattle brands registered	..	92,242
Cancelled horse and cattle brands re-allotted ..	706	23,942
Horse and cattle symbol brands registered	158	4,334
Horse and cattle brands transferred	1,748	98,757
Cattle earmarks registered	578	42,629
Sheep brands and earmarks registered	12	16,599
Sheep brands and earmarks transferred	246	11,936
Distinctive brands registered	3	1,409
Alterations of address	128	..
Brands cancelled	24	..
Earmarks cancelled	164	..

The number of registrations of cancelled brands was approximately the same as the previous year. There was, however, an increase in the number of transfers of horse and cattle brands and sheep brands and sheep earmarks. Registrations of symbol brands and cattle earmarks also showed a marked increase.

Very few reports of irregular branding and earmarking have been received and owners generally appear to be observing the requirements of the Acts. However, one owner was successfully proceeded against for using earmarking pliers of which he was not the registered owner.

Preparations are being made for printing of a revised edition of the Horse and Cattle Brands Directory showing additions and alterations to the end of 1962. It is hoped to commence reprinting during the 1964-65 financial year.

Returns of Brands and Earmarks as prescribed in Section 18 of *"The Brands Acts,* 1915 *to* 1945" are to be called for the years 1965-67 to enable registration records to be brought up to date. These returns are to be furnished by every owner of a registered brand or earmark simultaneously with his return of stock.

STOCK MOVEMENTS

Interstate stock movements are set out:

—	Cattle	Sheep	Swine	Others
Entered from Northern Territory	62,985	..	..	218
Entered from New South Wales	101,535	776,286	6,628	2,489
Removed to Northern Territory	626	..	264	67
Removed to New South Wales	302,904	748,770	24,699	9,170

EXTENSION AND TRAINING

Selected senior veterinary officers attended a post-graduate course on diseases exotic to Australia held in Sydney during April. An induction course for new recruits to the B.C.P.P. extension staff was held prior to commencement of field duties in April, and various staff members attended regular extension schools at Alexandra Headlands. Full use was made of all means of mass media, including preparation of numerous press articles, regular topical radio talks by local officers over regional stations, and also television appearances in larger centres. Producer meetings were attended and addressed by local officers, who also arranged and attended field days in all areas throughout the State. An inservice school for stock inspectors from central Queensland was held at Rockhampton.

SLAUGHTERING SECTION

The Slaughtering Section, by virtue of the meat inspection service, provides a safeguard to public health. Carcasses of stock slaughtered at some 20 odd centralized killing establishments distributed throughout the State are inspected for freedom from disease and for wholesomeness. Part-time inspection is also maintained at all country slaughterhouses, about 350 of which are licensed in the State.

A difficult period was experienced during the 6-weeks-long strike at Cannon Hill abattoir. Slaughtering Inspectors were charged with the task of ensuring that all meat for consumption in Brisbane was hygienically slaughtered and inspected for freedom from disease conditions. Further, it was necessary to ensure that all meat remained wholesome in the course of transit and delivery to the Cannon Hill meat hall. The Inspectors themselves gave an excellent service in spite of the difficult conditions and hours of work.

Totals of stock slaughtered for local consumption at various establishments were: Cattle, 488,334; calves, 305,210; sheep, 1,800,036; swine, 504,694.

Figures representing the condemnations of stock slaughtered show the significance of several diseases as major causes of economic loss to the industry. Tuberculosis remains as a major source of loss, condemnations for this disease far exceeding any other condition. Other major causes are fever, bruising and gangrene, mostly associated with transit.

The practice of farmers consigning newly born calves for slaughter reveals itself in the number of condemnations of calves for immaturity and underweight.

Arthritis stands out as being the major cause of economic loss to the pig industry. Erysipelas, an infectious disease of swine, is suspected as being the major cause of septic forms of arthritis. It is interesting to note the low incidence of tuberculosis in pigs, brought about by the tuberculosis eradication scheme for dairy cattle, which has been in process for many years in Queensland. The incidence of sparganosis is associated with the slaughter of feral pigs.

The information gained on disease incidence at slaughter is of considerable value to the animal disease control service. Very close liaison exists between this service and the slaughtering service, to enable early action to be taken in the field to control any serious incidence of, or unusual, disease detected at slaughter, thereby limiting its spread and economic loss. The assistance of officers of the Commonwealth Department of Primary Industry in the disease control aspect of meat inspection is gratefully acknowledged.

Local consumers are continuing to show preference for young, tender and palatable meat with a minimum amount of waste fat. The type of carcass most likely to produce this meat forms the basis of the standards for the Department's voluntary grading scheme; that is, carcasses of yearling with an even but light finish of fat and weighing about 400 lb. and carcasses of ox and heifers up to 3½ years of age weighing up to about 520 lb. The voluntary grading scheme has maintained its popularity with the trade and consumers. It is being conducted at Cannon Hill, and District Abattoirs at Townsville, Ipswich and Toowoomba, and also at one large company meatworks in Brisbane. About 95 per cent. of all meat slaughtered for local trade at these premises is subjected to grading. Between 40 and 70 per cent. is graded "choice" or "prime," this percentage varying with the quality of the stock, mainly influenced by seasonal conditions.

The demand for lambs of high quality continues. This can only be met by the introduction of large quantities from interstate sources. Because of the favourable rate for transport of dressed carcasses versus transport of live lambs, the introduction of large numbers of lamb carcasses from northern New South Wales meatworks has become a constant feature. All carcasses on arrival are subjected to a necessary inspection for detection of any abnormalities arising from transport over long distances.

The Mackay District Abattoir is nearing completion, delay having been occasioned by the necessity for higher standards required of meatworks to meet export market requirements, with the consequent higher costs. The Gympie District Abattoir has reached the final planning stage. The operations of the four District Abattoirs functioning (Toowoomba, Bundaberg, Ipswich and Townsville) were economically sound during the year, being helped considerably by increased prices obtainable for by-products (mainly tallow and oils).

The Government set up a Committee of Enquiry into Matters concerning the Development of the Livestock and Meat Industry, and this Committee commenced its enquiries in the last quarter of the year.

Automation in the meat industry continued to expand (in slaughtering, boning and by-products sections) and has assisted considerably in raising standards. However, difficulties have occurred with the changeover to automation, with the necessity for workers skilled at their previous tasks to acquire skill at new tasks. As hygiene is closely associated with the skill of the operator, as well as the equipment, the full effects of automation on hygiene and inspection have probably not been fully experienced to date.

Poultry slaughtering undertaken at some 175 licensed poultry slaughterhouses in the last 2 years are shown:

Year	Chickens (Broilers)	Hens	Total Slaughtered (Including Ducks, Turkeys.)
1962–63 ..	4,906,304	659,620	5,586,773
1963–64 ..	6,221,604	657,549	6,946,318

PATHOLOGY BRANCH

The importance of having our own facilities for specific projects was well demonstrated by the work on leptospirosis at the Rockangle Farm. Acquisition of this area enabled the setting up of an experimental herd from which much useful information on the epidemiology of the disease has been obtained.

Yards were completed at the Wacol Tick Fever Research Centre and construction of the laboratory will shortly commence.

A highlight of the year's work was the testing of unprecedented numbers of sera for contagious bovine pleuropneumonia in connection with the National Eradication Campaign. Nearly 50,000 tests were done.

There was an increasing call for testing of animals for export. Tests for pleuropneumonia, leptospirosis and brucellosis are required for certification of freedom from these diseases. A total of 6,499 tests was done on cattle for New Guinea and Thailand, pigs for the Philippines and Japan and sheep for Britain. A decision was taken to make a charge for this work in April, 1963.

An important development in testing for disease was the decision by the Biennial Conference of Commonwealth and State veterinarians to adopt the Weybridge technique for routine brucellosis tests throughout the Commonwealth (except Tasmania). Both Departmental laboratories changed over to this method of testing bovine and pig sera from July 1, 1963.

It was decided during the year to introduce a new strain of *Babesia argentina* into the tick fever vaccine. Experimental work had shown that the strain used for many years is not transmitted by ticks and therefore ticks were unable to boost the immunity of cattle following inoculation. By substituting a strain which ticks can transmit, it is believed that the immunity following blood inoculation will be reinforced and extended. The new strain originated from Beaudesert in 1958, and has had a number of passages through cattle in the interim.

A total of 269 stud cattle was immunized by the two laboratories during the year, 100 of them at Oonoonba.

The change over to ordering pleuropneumonia vaccine in millilitres and supplying to users in syringe doses, operative since January, 1963, is working satisfactorily.

DIAGNOSTIC WORK

More than 7,000 batches of specimens were received for examination. As in other years, diseases not previously recognized in this country were diagnosed, for example, ringworm in camels, cryptococcal infection in a sheep, and erythrozoonosis in cats. New techniques were devised for our work and techniques not previously used were adopted. A satisfactory gel-diffusion test for diagnosis of fowl pox and infectious laryngo-tracheitis was developed; several special staining procedures were put into use in histology and procedures for testing ticks for resistance to insecticides were developed.

Amongst the diseases diagnosed, the following are of particular interest:

Cattle

Tick Fever.—A total of 133 outbreaks of *Babesia argentina*, 15 of *Babesia bigemina* and 16 of *Anaplasma marginale* were confirmed by laboratory examination of smears.

Cysticercus bovis.—A viable cyst with an evaginated scolex was detected in the cheek muscle of a cow killed at a Brisbane abattoir. The origin of the beast could not be traced. This is the first case seen since 1948.

Cryptococcosis.—A section of bovine lung submitted for histological examination showed organisms typical of cryptococci. Only preserved material was available and no further tests could be done.

Otitis media.—Two affected calves 4 months of age were examined from two properties where for several years calves and older cattle have shown rotation of the head. Both had foul smelling purulent infections of the external middle and inner ear.

Encephalitis.—Five cases of the non-purulent sporadic type of encephalomyelitis which has been recognized in calves in this State for some years were examined. An outbreak of the classical disease sporadic bovine encephalomyelitis associated with serositis occurred in the south-west near the New South Wales border. This is the first occurrence of this condition which we have recognized. A case of purulent encephalitis, also from this area, in a 16 months' old calf showed multiple abscesses in the brain in which were found acid fast organisms with the morphology of *M. tuberculosis*.

Mycotoxicosis.—Four of 50 dairy weaners placed on corn stubble developed proppy gait, went down and could not rise. They had irregular heart beat and hypersensitivity. Corn cobs to which they were exposed were badly infected with fungi. Several species of fungi were isolated but none likely to be the cause of the trouble.

Botulism.—Sixteen batches of specimens were examined from suspected outbreaks of botulism mainly in the north-western portion of the State. Although no laboratory confirmations were obtained (in a few cases the urine samples gave a positive sugar test), the clinical syndromes observed so closely resembled those produced experimentally at Oonoonba that there was no doubt that the disease was botulism.

Mycotic abortion.—Aspergillus fumigatus was cultured from the liver, lung, stomach and skin of a 5 months' old foetus. There were numerous, round 2 m.m. plaques, sometimes confluent on the poll, withers, ribs and rump and subcutaneous haemorrhages were present.

Plant poisoning.—Hoya australis caused deaths of three of 30 Hereford cattle at Mundubbera. The animals were down for 24 to 36 hours and autopsy showed excess pericardial fluid, mycocardial haemorrhages, and this plant was identified in the rumen.

Sheep

Cryptococcosis.—A sheep which had been kept for 8 months in a building previously occupied by dogs and native animals at Yeerongpilly, developed symptoms of pneumonia and later signs of central nervous system involvement. No response followed therapy with tetracycline for 3 days so it was killed for necropsy. Plaque formations in the mucosa of the nasal turbinates and septum, pneumonia and subleptomeningeal oedema were found. *Cryptococcus neoformans* was recovered from the lung and microscopic examination showed the lesions in the lungs, nose and brain to be due to this fungus.

This is believed to be the first report of this disease in sheep.

Diseases of Muscle.—A degenerative condition of skeletal muscles particularly those of the hind limbs has appeared regularly each year in lambs in a flock in the Goondiwindi district. It was diagnosed also on one occasion in sheep from a flock in the Texas district. Last year the disease reappeared in the Texas flock and was diagnosed in two new flocks in the Goondiwindi district.

The aetiology remains obscure but trials are in progress to determine the efficacy of parenteral selenium for therapy and prophylaxis.

Hypotrichosis.—In a flock of Dorset Horn sheep, several lambs were born with incomplete coat development. Some of the lambs died soon after birth but two survivors were examined at the laboratory. In these lambs, the fleece wool was of low density, and the face, and legs below the knees and hocks, were completely bare. This was due to a cystic condition of the wool follicles. It is believed to be of genetic origin.

Poison plants.—These continue to be important as causes of death. During the year, deaths were reported due to wild parsnip (*Trachymene ochracea*), rock fern (*Cheilanthes* sp.) and Ellangowan poison bush (*Myoporum deserti*).

Infectious labial dermatitis.—Scabs were examined from sheep in two flocks in which shearing had been suspended. In both instances the virus was recovered.

Mycotic dermatitis.—This was confirmed in two flocks. Mycotic dermatitis is readily recognized in the field and the number of laboratory confirmations is no indication of the prevalence of this disease.

Pigs

Botulism.—Pigs are generally considered to be relatively insusceptible to botulism and the disease is certainly not common in them. An outbreak due to type C toxin was confirmed in pigs at Theodore which were eating dead fish in a dried-up lagoon.

Salmonellosis.—Salmonellosis was confirmed as the cause of death in nine outbreaks and was isolated from pig tissues on five other occasions.

Melioidosis.—Pseudomonas pseudomallei was isolated on 11 occasions from abscessed organs submitted from abattoirs. Of these, four were diagnosed in July, and one in September, 1963, and three each in March and April, 1964. The case in September came from a property on the Atherton Tableland. Four of the 20 pigs of porker age sent to Mareeba for slaughter were condemned because of the presence of multiple discrete abscesses in various organs. The organism was recovered from lung and spleen abscesses of the pig examined. In one case in March, the pig was trucked from Biloela some 10 days before slaughter at the Townsville abattoir.

Brucellosis.—Porcine brucellosis still occurs in some commercial piggeries near Townsville and *Brucella* sp. was isolated from a splenic abscess at the local abattoir. *Brucella suis* was recovered from the testicle of a boar with orchitis.

Oedema disease.—Altogether, 120 cases with symptoms suggestive of oedema disease were examined. Of these, 102 were within the age group of 6 weeks to 6 months. In at least 94 cases, there was sudden death or acute onset of disease; scouring was reported in 25 cases and symptoms of ataxia, paralysis, convulsions or other nervous signs were seen in 56. The mulberry heart syndrome was seen in eight. In 29 cases, typical lesions of oedema were seen and in 32 inflammation or haemorrhages of the intestines were observed.

One case showed a haemorrhagic syndrome. Haemorrhages were present in subcutaneous tissues, lymph nodes, heart and urinary bladder. The haemoglobin level was 5·5 g/100 ml while clotting and prothrombin times were normal. Platelets were absent from smears. The liver was deficient in vitamin A and 11 p.p.m. of copper were present. This haemorrhagic type of the disease has been reported from the Darling Downs and the Burnett.

Haemolytic *E. coli* were recovered from 25 of the cases.

Erysipelas.—Five outbreaks of septicaemic disease were encountered and on four other occasions organisms were recovered from joints or in association with other diseases.

Streptococcosis.—Streptococcus equisimilis was twice recovered from pigs 2 to 3 weeks of age. It was associated with pericarditis on one occasion and with arthritis on the other. Group C streptococci were isolated from three cases of arthritis in bacon weight pigs and also young piglets with purulent arthritis. Group L streptococci were isolated from a carcass condemned for arthritis.

Rhinitis.—Five outbreaks of inclusion body rhinitis were confirmed.

Vitamin A deficiency.—Deficiency was confirmed on five occasions and levels of liver storage were marginal in one other.

Posterior paralysis.—Four cases of posterior paralysis were recorded with liver copper levels of 9 to 14 p.p.m. Demyelination of the spinal cord was seen in three of these.

Skin disease.—Parakeratosis was confirmed in three cases. Ringworm due to *Microsporum nanum* and sarcoptic mange were diagnosed and one case thought to be *Pityriasis rosea* was seen.

Discolouration of carcasses.—Reports were received from Brisbane and Toowoomba abattoirs of excessive pallor or white muscle in pigs after slaughter. This condition has received attention overseas and is considered to be due to metabolic changes in pig muscle.

Excessive yellow discolouration of the skin and bones of pigs from three Chinchilla properties resulted in condemnation. The cause was not determined.

Poultry

Pullorum disease.—This disease has been kept at a very low level over the years as a result of the Department's policy of testing all breeding flocks. The picture could rapidly change through the introduction of infection from other States. During the year, *S. pullorum* was isolated from two batches of chickens from the same hatchery. Adult birds from 10 farms giving positive reactions to the rapid whole blood test were examined bacteriologically. In several instances these birds had originated from other States.

Infectious bronchitis.—In our previous report, attention was drawn to the isolation of viruses similar to those of infectious bronchitis. It was considered desirable that local strains be sent to overseas laboratories for precise identification. Two strains, one from a respiratory and the other from a nephritis outbreak, were sent to Professor Cunningham of the Michigan State University, who advised that both are strains of infectious bronchitis virus.

Fifty-nine outbreaks of the nephritic form of the disease were investigated during the year. Chickens up to 12 weeks of age were affected and deaths reached 20 per cent. in some outbreaks. Nineteen strains of virus were recovered.

Infectious encephalomyelitis.—Eighteen outbreaks were confirmed. What appear to be residual lesions are seen in birds up to 8 weeks of age and there has been a tendency for the disease to occur in older chickens than previously.

Vibrionic hepatitis.—Necrotic liver lesions slightly resembling those of histomoniasis were found in a flock of 2,000 chickens in which losses of 10 to 30 per week were occurring. Vibrios were isolated but transmission tests were negative.

Cats

Cryptococcosis.—The first recorded case of cryptococcosis in a cat in Queensland was mentioned in our previous report. Another case was diagnosed at Oonoonba this year. The cat had shown epileptiform convulsions for 10 days. Numerous gelantinous spots were seen on the brain surface and *Cryptococcus* sp. was isolated. Histological examination showed meningitis and many yeast-like organisms in the sections.

Eperythrozoonosis.—Eperythrozoon felis was seen in blood smears of a cat at Townsville which showed ascites, pale mucous membranes, anorexia and dehydration. The blood cells showed anisocytosis and polychromasia.

DISEASE SURVEYS AND CONTROL SCHEMES

Contagious bovine pleuropneumonia.—Participation in the National Eradication Scheme called for a great deal of work at both laboratories. A combination of complement fixation testing, pathological examination of lungs and the precipitin test and cultural examination was used to reach a diagnosis.

Never before have such large numbers of complement fixation tests been done; 47,432 sera, most of them from slaughter cattle, were treated. This amount of testing completely extended our resources and called for a great effort by the staff of both laboratories.

Seventy-eight lung specimens with pneumonic lesions were examined pathologically and bacteriologically. *Mycoplasma mycoides* was recovered from two. A variety of organisms including actinomycetes, actinobacilli, corynebacteria, pasteurella, mycobacteria, mimeae, fusiforms and some strains difficult to identify in the pasteurella-actinobacillus groups were also found. This work has pointed up the presence of species of mycoplasma other than *M. mycoides* in bovine lesions, two strains being recovered from calf pneumonias and one from the joints of calves with arthritis.

Fifty-five lungs were examined by the precipitin test, 11 giving positive reactions. From two *M. mycoides* were recovered. From four others an actinobacillus was isolated and histological material only from one was received. Of the other four the lesions in two were suggestive of pleuropneumonia.

Two lungs from one mob were of particular interest. These showed foreign body pneumonia apparently due to the lodging of stems up to 3 in. long of the thorny shrub *Capparis lasiantha* deeply in the terminal bronchii.

Two points emerge from this work. It is surprising that individual animals only have been found with lesions of pleuropneumonia; it might have been expected that if one beast was infected, others in the same group should also be. Perhaps lesions persist longer than has been believed. Secondly, the value of a comprehensive range of tests in reaching a diagnosis is emphasised. It is essential, especially with lesions from isolated cases, that adequate material be sent to enable a reliable result to be obtained. It is equally important that where such large numbers of sera are being tested, some selection be practised to enable valid results with a minimum of testing.

Infertility diseases in cattle.—The survey of dairy herds carried out in conjunction with the Cattle Husbandry Branch continued. There was little change in the incidence of brucellosis. No trichomoniasis was detected. There was a marked increase in the number of reactors to the test for vibriosis but the number of reactors to the leptospirosis test fell to half that of the previous year.

At Oonoonba, 49 bovine genitalia were examined. Vaginal cysts were found in three, vaginitis in two, metritis in two, uterine hypoplasia and ovarian aplasia in two and fallopian tube cysts in two. *Vibrio fetus* was isolated from one of 10 which were cultured.

Infertility diseases of sheep.—Results of the previous year's work indicated that brucellosis could be eradicated from British breed flocks. With this in mind, preliminary steps were taken to formulate an eradication scheme for this disease in British breed sheep in this State.

Leptospirosis survey.—A total of 858 bovine sera from 51 north Queensland properties was tested for the presence of anti-bodies to *L. australis* and *L. broomi.* Six sera were positive for *L. australis* and one for *L. broomi.* Tests on 651 of these sera for *L. grippotyphosa* gave negative results but five were suspicious for *L. kremastos.*

Infectious bronchitis.—To ascertain the prevalence of this disease on a flock basis, sera were collected from flocks located from the Darling Downs and Brisbane north to Townsville. Of 45 flocks tested by the serum neutralization test, 41 were positive, one was suspicious and three were negative. Approximately 10 sera were collected from each flock.

RESEARCH

Tick Fevers of Cattle

Vaccine experiments.—Work continued on the development of more effective tick fever vaccines. Experiments were carried out using a dose of 10,000,000 *B. argentina* organisms injected subcutaneously. This number was chosen since it represents approximately 100 infective doses. When given by the subcutaneous route, this dose produces reactions after an incubation period of 9 to 10 days. After storage at 5 deg. C. for 5 days the incubation period increases to 12 days and after 10 days storage, the blood is still infective but the incubation period is further increased to 14 days.

A dose of 10,000,000 *B. bigemina* given subcutaneously produces reactions in about 5 days. After storage for 5 and 10 days it is still infective with incubation periods of 7 and 8 days respectively.

In a reacting animal, from which blood vaccine is drawn, only a small quantity of blood, for example, as little as 0·2 ml (3-5 drops), may contain the number of organisms stated previously. For practical purposes, the dose should be preferably not less than 1 ml. Dilution is therefore necessary. Of the various diluents used, blood from an uninfected bovine has proved the most satisfactory. Until a more suitable alternative medium can be devised therefore, blood can be used as a diluent.

Tests showed that the vaccine can be packed in an insulated container for despatch and for economy reasons a 1 ml dose is preferable to the 5 ml dose used currently. Tests are therefore being made with multidose syringes delivering small quantities.

The effect of anticoagulants on the infectivity of blood was also studied. The anticoagulant E.D.T.A. appeared to have more deleterious effects than sodium citrate on both *B. argentina* and *B. rodhaini*. It was found that this was due to a pH effect. When the pH was adjusted by buffering to approximately eight, the infectivity of blood collected in E.D.T.A. was comparable with that in citrate.

In vitro culture of B. bigemina.—A start was made on the *in vitro* culture of *B. bigemina*. Results are encouraging in that parasites retained the capacity for normal staining for 24 hours. Some unusual (not degenerating) forms were seen. This work is of importance from the vaccine point of view.

Infection of abnormal hosts.—(*a*) *B. bigemina* were again found in blood smears of a sheep on which infective ticks were engorging.

(*b*) Over 30 alternate (calf-mouse) passages were performed with a strain of *B. argentina* and the organism was recovered after serial passage through three litters of mice. It may be adapting slowly. Tests on virulence and antigenicity are to be performed.

Chemoprophylaxis.—We have been interested in the development of a chemoprophylactic as a means of preventing tick fever in susceptible cattle awaiting slaughter at abattoirs in ticky areas and in clean cattle travelling through tick infested areas.

A commercial firm formulated a preparation for us and experiments with both *B. bigemina* and *B. argentina* were carried out.

B. bigemina failed to become established in calves injected with the drug at 1, 2 and 3 weeks before the organisms were inoculated. These calves were susceptible to infection when challenged at a later period.

B. argentina infection was able to establish in calves injected with the drug from 1 to 5 weeks prior to inoculation but no clinical signs of illness were seen and only six of 18 showed parasites in blood smears. On the other hand, one of five control calves died and the other four had severe parasitaemias and loss of haemoglobin.

It seems, therefore, that the drug may have a use in protecting valuable cattle from the serious effects of *B. argentina* whilst allowing immunity to develop.

Immunofluorescence studies.—The technique of immunofluorescence tracing is being used in the study of babesia infection.

Resistance of Cattle Ticks to Organic phosphorus Insecticides.—In August, 1963, difficulty in controlling ticks with Delnav was reported by an owner near Rockhampton and in November a commercial firm advised that it had confirmed that ticks on another property in the same area showed resistance to the same preparation. This owner had used this insecticide for about 6 years, good results being obtained till the spring of 1962.

Samples of ticks were examined in this laboratory from several properties. Resistance to Delnav appears to be localised to an area in the Rockhampton district. However, there are still a number of dips in this area charged with the same medicament which are giving good results. Recent laboratory tests suggest that resistance to Delnav may also be present near Capella. There is some indication from some areas that Trithion is not giving good control.

Bovine botulism.—Results of experiments with *Cl. botulinum* type D toxin administered by injection were discussed in our previous report. Work was continued during the year using doses of from 0·01 ml/kg to 0·1 ml/kg by the oral route.

Two animals receiving 0·01 and 0·025 ml/kg survived after developing chronic botulism. Another given 0·02 ml/kg daily for 5 days suffered chronic botulism and recovered. Two others dosed with 0·05 and 0·1 ml/kg developed acute and peracute disease and died in 60 and 20 hours respectively.

The signs exhibited by these animals agree very well with those reported in the field in outbreaks of coast disease and there is now little doubt that botulism is the major component in this syndrome. The chronic forms in particular are of interest in that they may explain the cause of staggering and weakness sometimes followed by death when cattle are being mustered.

A vaccine prepared from type D culture was shown to be efficaceous in protecting against the disease. Some young cattle receiving one injection were protected up to 6 months; tests have not proceeded beyond this point.

Experimental work showed that in vaccinated cattle neutralizing antibodies are present in the serum at the fourth week and they persist at high levels up to 9 months.

Mucosal disease.—From various areas of the State, reports were received of outbreaks of disease in cattle resembling mucosal disease. Usually only a low percentage of animals in the herd was affected and these showed mild pyrexia, loss of condition, conjunctivitis, ocular and nasal discharge, salivation, ulceration of the oral mucous membranes, coronitis and muscle tremor.

Tissues from affected cattle were examined by passage into susceptible calves and by inoculation into tissue culture monolayers. The tissue culture examination was done by the virology staff of the University Veterinary School.

On two occasions calves so inoculated had a pyrexia for 24 hours on the seventh day after inoculation and also showed changes in the white cells of the blood.

A cytopathic agent was recovered on one occasion and when the tissue culture fluid was inoculated into a calf it reacted similarly to the calves inoculated with tissues from affected cattle.

Serelogical tests were done on blood samples from the experimental calves by the staff of the C.S.I.R.O. Animal Health laboratory in Melbourne. These tests indicate that the calves were probably infected with a virus similar to the C24U mucosal disease virus which affects cattle in America.

Spread of leptospirosis.—When the Rockangle farm became available, 25 disease-free heifers were introduced and five of them inoculated in August with a culture of *L. pomona*. Two of these excreted the organisms in their urine, and one of the 20 in contact animals became infected as a result, 12 days after a heavy fall of rain coinciding with the first peak of excretion by the experimentally infected heifers. No further spread occurred from September to November which were dry months even although two more experimentally infected, excreting cattle were placed in the herd.

Three more cattle shedding the organism in their urine were introduced early in November. The first natural cases were detected 30 days later and the disease maintained itself by natural means through the subsequent wet summer months. Infection showed a wave-like pattern, the majority of new cases appearing 3 weeks after the maximum excretion by those cattle shedding organisms in their urine.

Fresh animals were introduced periodically and in all 115 were used. The work showed that contaminated water is extremely important in the spread of leptospirosis; it also showed that infection can occur, though somewhat less readily, solely as a result of contact comparable with that during milking in dairy yards. The most important factor in maintaining a high level of spread is the number of organisms being excreted. Exposure of groups of five animals each for 1 week over a period of 8 weeks when the excretion rate of organisms in the infected herd was declining resulted in infection of only one animal even though heavy rain fell and excretion did not cease till the seventh week of the period.

Sheep blow-fly investigations.—A trial comparing three organic phosphorus and two carbamate insecticides in preventing sheep blow-fly concluded.

The efficacy of the insecticides was judged by the implant and tube techniques described in our previous report.

The insecticides were trithion (C2446) (0·1 per cent.), U.C. 20047 (0·1 per cent.), U.C. 16888 (0·2 per cent.), U.C. 10854 (0·1 per cent.), sevin (0·5 per cent. and 0·3 per cent.). They did not give long protection in relation to the reference insecticide diazinon.

In a previous trial, U.C. 16888 showed some promise at 0·1 per cent. In the present trial, 0·2 per cent. proved too toxic for use as six of 10 sheep died following jetting.

The carbamates were disappointing. In a previous trial, U.C. 10854 was efficient for 19 weeks but in this test it was not efficacious beyond 10 weeks. There was little difference between sevin at 0·2 per cent. and 0·3 per cent.

Ovine toxoplasmosis.—Merino sheep were experimentally infected with *Toxoplasma gondii* to provide serum of known status for the development of a test more satisfactory than the "dye test" for use in survey work and at the same time to enable further information to be collected on the infection as a cause of infertility in Merinos.

Four ewes pregnant about 100 days, two non-pregnant ewes and one ram were inoculated intravenously with *T. gondii* while another pregnant ewe received drops of inoculum into the conjunctival sac. The five pregnant ewes and the inoculated ram were housed as one group and the non-pregnant ewes were housed with an uninfected ram.

None of the ewes aborted but of the eight lambs born at term three were weak and died within 24 hours and one was stillborn. No toxoplasmas were recovered from any lamb born alive but they were recovered from the stillborn lamb. Toxoplasmas were recovered from membranes of two of the ewes which had healthy surviving lambs. The uninoculated ram became infected during the course of the experiment.

Swainsona luteola.—In 1961-62, we reported changes in the brains of sheep naturally affected with Swainsona poisoning. Since then, identical lesions have been produced in sheep experimentally fed this plant at the laboratory. The lesions are characterised by marked vacuolation of the cytoplasm of neurones in all parts of the central nervous system and in ganglia. Brain tissue has been examined by various histochemical techniques but none have demonstrated what material, if any, is in the vacuoles.

Trachymene ochracea.—This plant has been suspected of producing two syndromes (acute and chronic) in sheep in the field. In the acute syndrome, sheep which appear normal except for pallid mucous membranes and skin collapse die when mustered. In the chronic syndrome, there is malformation of the legs of lambs (bent leg).

Both syndromes have been reproduced experimentally in the laboratory by feeding this plant.

It had been thought necessary for the pregnant ewe to eat the plant for the lamb to be affected subsequently and in an earlier trial "bent leg" was produced in a lamb from a mother fed the plant during pregnancy. More recently this condition has been reproduced in a lamb first drenched with extracts of the plant when it was a week old.

Melioidosis.—The possible need for an effective vaccine for this disease has been kept in mind and preliminary attempts were made during the year to develop one.

Heated and unheated formalized cultures were used with and without adjuvants in an attempt to produce immunity in guinea pigs. Challenge doses ranged from approximately 1,000 to 1,000,000 organisms. In all cases three doses of vaccine were given 14 days apart, and the animals challenged 3 to 8 weeks after the final injection.

Two strains were used for vaccination, G432 isolated from a sheep and G264 from a pig, but only the first strain was used for challenge. There was no evidence of immunity developing.

Dysentery syndromes in pigs.—Work was undertaken during the year to elucidate the cause of enteric diseases in pigs. Nine pigs were used in these experiments. One was placed in contact with a field case, one was injected intravenously with filtered intestinal content from an affected pig and a third was dosed orally with colon content from the same animal. Four other pigs were given colon content from the third pig which had developed the disease. The material given to one of them was treated with an antibiotic while for another it was filtered. Two other pigs were dosed with a culture of vibrios recovered from a natural case.

The disease was reproduced in the pig given orally, untreated intestinal content from a natural case and in the two pigs receiving similar material in serial passage. They developed colitis and proctitis as seen in field cases. Haemolytic *E. coli* was isolated from the small intestine and *Vibrio* sp. from the mesenteric lymph nodes and large intestine of the first of these three pigs.

The pig placed in contact with a natural case had two short febrile periods but no other signs of illness were noted.

The work is continuing.

Infectious laryngo-tracheitis.—Because of the occurrence of outbreaks in young chickens on certain commercial farms, attempts were made to immunize chickens at day old. Cloacal vaccination proved impracticable so the follicle route was used. Well-defined takes occur and useful protection is obtained for 5 weeks. This practice has the advantage that it can be combined with pigeon pox vaccination.

A comparison of protection following vaccination of older birds by the cloacal and follicle routes suggests that whilst both routes give good protection for at least 4 weeks, thereafter a considerable degree of immunity is lost in birds vaccinated by the follicle route.

Avian leucosis.—The infective agent mentioned in our previous report was successfully passaged a second time but failed to produce detectable disease at the third passage. Negligible evidence of transmission was obtained using day-old cockerels from random sample entries infected as described in our previous report but with a different strain of organism. In a more recent experiment, however, 20 per cent. of birds showed lesions up to 19 weeks of age while none of an equal number of control chickens was affected.

Staff

The problem of maintaining staff numbers sufficient to cope with the volume of work is still a real one. Three graduate officers resigned during the year and three technical staff resigned and the death occurred of Mr. A. McNeill, a laboratory technician. At the close of the year the staff numbers are, 18 graduates, 28 technical staff and 28 others, whereas the Branch complement allows for 98.

Dr. Callow returned from a 12 months' study term at the Rice University in December and resumed duties in the Protozoology Section. Mr. M. D. McGavin, Senior Histopathologist, is due to return from Michigan University and Mr. M. D. Connole, Bacteriologist, from the University of Glasgow later in the year.

HUSBANDRY RESEARCH BRANCH

The functions of the Branch can be broadly classified into two categories, namely research into animal husbandry and the operation of the Wacol Artificial Insemination Centre with its associated bull proving projects and commercial semen supply. The staffing and facilities available at the A.I. Centre are, in general, satisfactory. Substantial intensive-type facilities for experimentation with cattle in stalls and yards are controlled by the Branch at the Animal Husbandry Research Farm, Rocklea. Facilities for work with the other species are either limited or provided in collaboration with other Branches. Some alleviation will be afforded when a unit for metabolism and carcass composition studies is provided. This unit, together with a laboratory and administration building for the Biochemical and Husbandry Research Branches at Yeerongpilly, is in an advanced stage of planning.

The graduate staff number in the Branch has declined, present staffing being seven graduates—a Director, two working on nutrition of ruminants, two stationed at the A.I. Centre, one in the field of genetics and one on overseas study leave. Technical and ancillary staff number 11 and 14 respectively.

Experimental work in progress or completed during the year includes feed lot studies with cattle; utilization of urea; techniques for measuring feed intake in grazing animals; studies on nitrogenous fertilization of paspalum pastures; effect of pregnancy in cattle on feed intake, rumen volume, and rate of passage; and the effect of processing grain when fed to cattle and sheep at survival levels. Studies with pigs include a gentic analysis of the Large White breed and utilization of sorghum grain. With poultry, meat chicken breeding techniques and the effect of hormones on body and carcass composition were investigated. At the A.I. Centre the effect of environmental temperature and tick fever on semen quality, and the use of dyes in deep frozen semen, are being studied.

Results of some of this work and data pertaining to artificial insemination are outlined.

INVESTIGATIONS

Feed Lot Studies.—The results of two previous experiments were presented in the 1961-62 and 1962-63 reports. In the experiment completed this year, eight groups each of 10 Santa Gertrudis cross steers approximately 20 months of age were fed on final rations of 90 per cent. sorghum grain—10 per cent. sorghum silage (dry matter basis). A further 10 were slaughtered before feeding. The comparisons made on the fed groups were two types of silage (sweet sorghum and grain sorghum), two levels of urea (60 g and 120 g head/day), and two levels of Vitamin A supplementation (0 and 40,000 I.U./head/day). Half of the animals in each group received cobalt supplementation as a cobalt oxide pellet. The mean initial body weight of all animals was 549 lb. The average number of days in the feed lot was 121. Animals were slaughtered as they reached 900 lb. live weight.

The essential findings are:

(i) The average live weight gain of all animals was 2·92 lb./head/day. There was no significant difference between those fed sweet sorghum silage and those fed grain sorghum silage as the roughage component.

(ii) There was no significant difference between those receiving 60 g and those receiving 120 g urea per head daily. A marked response to 60 g urea compared with no urea was obtained in 1961-62 and 1962-63 and prompted the examination of higher levels.

(iii) In these animals with average initial vitamin A concentrations of 223 μg/g of liver, there was no significant response to vitamin A supplementation. The oral supplementation at the level of 40,000 I.U./head/day was not sufficient to maintain initial vitamin A reserves in these rapidly growing animals.

(iv) The average growth rate of steers receiving cobalt (3·06 lb./head/day) was greater than those not receiving cobalt supplementation (2·69 lb./head/day).

(v) The average efficiency of feed conversion as unit feed dry matter intake/unit of body weight grain varied from 6·29 to 6·98.

(vi) Average carcass gain expressed as a percentage of body weight gain in the feed lot was 62·8 per cent.

In the 1964 experiment it is planned to compare three sources of roughage—sorghum stubble, sorghum silage and lucerne chaff—evaluate the addition of salt to these high grain rations, and re-examine the effect of cobalt, vitamin A and urea supplementation.

Utilization of Urea.—In general, the experimental results obtained at Rocklea using urea as a supplement to sorghum silage for sheep were not so encouraging as those with cattle. Cattle receiving urea with these rations showed a marked increase in feed intake, whereas sheep fed urea ate little more than unsupplemented animals. In an experiment undertaken this year, the effect of urea and carbohydrate (glucose) on the intake and digestibility of sorghum silage by sheep was studied. In order to provide the best opportunity for response and to obviate palatability effects, the urea and glucose were administered continuously by a slow infusion into the rumen. A latin square design was used. Results given in Table 1 indicate a depressing effect of glucose on intake and digestibility, and a moderate increase in intake on urea alone. When urea was added to glucose, the effect of glucose alone on depressing the intake and digestibility was corrected.

TABLE 1

EFFECT OF UREA AND GLUCOSE ADMINISTRATION ON FEED INTAKE AND DIGESTIBILITY

Recording	Water (control)	Glucose	Glucose and Urea	Urea
Average Daily Silage Intake (g D.M.)	479	272	526	602
D.M. Digestibility (%) ..	49·4	38·9	51·1	52·0

Studies on the mechanism of response to urea by cattle on a sorghum grain (80 per cent.)—sorghum silage (20 per cent.) feed lot-type ration indicated a marked increase in digestibility of the energy components of the ration and an increase in the rate of cellulose digestion in the rumen. On these rations the rate of passage of ingesta did not appear to be significantly increased with urea.

Toxicity of Urea.—Progress studies on the effect of urea on the foetus of pregnant animals were reported in 1962-63. To date, six animals have received doses slightly below the M.L.D. at three stages of pregnancy (average 149, 217 and 263 days). All produced healthy calves. A further group of 11 pregnant heifers in very poor condition received one dose 34 days (average) prior to calving. No abortions occurred after dosing. Two still births associated with difficult parturition in these poor animals were recorded. Comparable calving results were recorded in a group not receiving any urea. Further studies with a continual high level of urea feeding are planned.

Effect of Fertilized Pasture on Animal Production.—The effect on animal productivity of the application of nitrogenous fertilizers (2 applications each of 65 lb. nitrogen per annum) to paspalum pasture is being studied at 2 stocking rates (1 and 2 cattle per acre). Average body-weight gains per acre for the 54 weeks from November, 1962, to December, 1963, were: No nitrogen 1/ac.—345 lb., nitrogen 1/ac.—400 lb., no nitrogen 2/ac.—312 lb., nitrogen 2/ac.—398 lb. The main findings for this period can be summarized as follows:

(i) At both stocking rates there appears to be an advantage from nitrogen fertilizer. At 1/ac., cattle gained faster in untreated paddocks than in fertilized paddocks from December to mid-February and slower from March to August. At 2/ac., weight changes in cattle in the fertilized pastures were either comparable or slightly better than those in cattle on untreated paddocks. Results of protein analysis on faeces indicated that the quality of pasture being eaten by cattle in unfertilized paddocks was better from December to February, comparable from mid-February to mid-April and lower from April to mid-September than that grazed by the animals on the fertilized areas.

(ii) In summer, the nitrogen application gave a yield response with protein content of available feed being similar to that in untreated paddocks. A higher protein content of available feed with little or no response in yield appeared to be associated with the April application. Yield of pasture was always much lower in 2/ac. paddocks than in comparably treated 1/ac. paddocks.

(iii) At both stocking rates, addition of nitrogen increased paspalum and decreased white clover and couch grass. Increased stocking rate decreased paspalum and increased white clover and couch grass in both fertilized and non-treated paddocks.

Technique for Determination of Body Composition.—Techniques have been developed for grinding the whole bodies of cattle, sheep and fowls to allow accurate sampling for chemical analysis. The methods allow determination of the chemical components (moisture, fat, protein and ash) of both the whole bodies and carcasses of these species.

Changes in Composition of Sheep during Drought Feeding.—The change in chemical composition of the bodies of sheep during drought feeding and subsequent recovery has been studied. During the early stages of drought feeding, the decline in total body fat was of greater magnitude than that of body protein. After 6 months' drought feeding, the bodies of sheep had lost twice as much fat as protein. Changes in total body water paralleled changes in total body protein. The ash content exhibited only minor changes.

The dry weight of certain dissected muscles has been shown to bear a close relationship with total body protein. The use of muscle weight to predict carcass composition is being further examined.

Effect of Hormone Implantation on Composition of Poultry.—The recent introduction of legislation precluding the sale of hormone implants for poultry prompted an examination of the benefit derived from the implants in terms of additional poultry meat to the consumer. Broiler-type chickens 8 weeks of age were randomized into three groups of 12. One group was slaughtered to measure initial body composition, each chicken in another group received a 15 mg implant of hexoestrol, while a third group acted as a control. The slaughtered group was replicated twice, while the other groups were replicated four times. The hormone-treated and control groups were slaughtered at 12 weeks of age. Commercial-type dressing was carried out, and the carcass and ingesta-free offal processed and analysed.

Body weight gain (1239 g v 1101 g), carcass weight gain (822 g v 725 g), and gain in ingesta-free offal weight (317 g v 244 g) were higher in hormone treated than in control groups. There was a markedly higher percentage of fat in both the carcass (18·4 per cent. v 12·1 per cent.) and offal (22·8 per cent. v 11·0 per cent.) of the hormone treated groups. This higher fat percentage accounted for all of the advantage of the carcass and offal weight gains due to hormone implantation. The poorer feed conversion rates of treated birds (3·54 v 3·26) is at least partially attributable to the higher energy content per unit weight of fat. A dressing percentage of 65·2 per cent. was comparable for both groups.

Genetic Analysis of the Large White Breed of Pigs in Australia.—A genetic analysis of the Large White breed of pigs in Australia was carried out using data sampled from herd book registration and sow litter records. Conclusions from the study are summarized as follows:

(i) The breed has expanded in Australia by an increase in number of herds, herd size and geographical distribution. In 1960, the breed comprised 169 pedigree herds registering 595 males and 1,004 females, and was concentrated around the major cities in all States. Numerical growth has been marked by wide fluctuations, periods of rapid increase decline and stability. The breed has been established by frequent importation of males and females from the United Kingdom, New Zealand and Canada.

(ii) Inbreeding had risen to 7·5 per cent. from 1905 to 1960. The development of strains within the breed was indicated by high strain inbreeding (6·41 per cent.) and resulted from restricted migration of stock within Australia.

(iii) Individual pedigree herds varied in their influence on the breed. They were broadly classified into the more influential breeders' herds which provided sires for other pedigree herds, and multipliers' herds selling only to commercial producers. Herds were further assigned to six strata of a hierarchy in which there was a downward sale of stock. This meant that genetic improvement of the breed was largely the responsibility of a relatively few herds in the top stratum. The main hierarchy tended to be split on a regional basis.

(iv) Despite some evidence of an attempt at selection for litter size by pedigree breeders, the size of litters producing registered animals has remained constant at 11·2 ± 0·2 over the last 30 years. The average age of sows producing litters in the pedigree population was 16·1 months; however, those producing pigs selected for registration averaged 28·3 months of age, indicating that breeders were making some attempt at sib-testing.

(v) The majority of herds register both sexes but introduce stock too often, and are too small and too short lived to have efficient breeding programmes. The most important breeders' herds are best able to contribute significantly to breed improvement since they are the largest, longest lived and the most popular sources of stock. These should be encouraged to establish a widely sampled herd; close it, and use scientific selection techniques.

Meat Chicken Breeding Techniques.—Replicated comparisons with controls are being made of four selection-mating techniques. These are:—(i) 8-week mass selection with random mating, (ii) 8-week family selection with random mating, (iii) 8-week family selection with assortative mating, and (iv) 4-week mass selection with random mating. So far, one generation of selection under techniques (i) and (ii) has given approximately 10 per cent. increase in 8-week growth (87 g).

The influence of speed of feathering and plumage colour on 8-week growth was investigated on 4,000 chickens from the breeding programme already mentioned. There was an 8-week growth superiority of fast over slow feathering and coloured over white birds. Selection on growth rates alone will probably increase the proportion of birds with carcasses desirable for fast feathering but undesirable for coloured pin feathers.

ARTIFICIAL INSEMINATION

General.—The year under review is the first full year of operation of the A.I. Centre, Wacol. The number of commercial units regularly supplied from the Centre has increased from 5 to 15. For the year ending June 30, 1964, 57,631 (27,138 chilled, 20,794 deep frozen, 9,699 nominated) doses of semen were supplied from the Centre. This amount is more than twice that supplied for the previous year, most of the increase being in commercial usage.

Data on the number of inseminations, conception rates and breed distribution for the 12 months ended February 29, 1964, are given in Table 2. As the bull proving projects at Nambour and Kingaroy involve mainly Jerseys and A.I.S. respectively, the better guide to breed usage is afforded by the commercial units. The average conception rates are considered to be satisfactory.

The numbers of bulls stationed at Wacol are: A.I.S., 21 (2 proven), Jersey, 28 (4 proven), Friesian, 5, Guernsey, 1, Ayrshire, 2, Polled Hereford, 1, Hereford, 1, Brahman (grade), 1 and Aberdeen Angus, 1. A continuity of proven bulls of the A.I.S. and Jersey breeds is being ensured by the bull proving projects. These projects continued during 1963-64 on the same basis as in the previous year.

Experimental.—Data obtained in the experiment on the effect of tick fever on semen quality in bulls are being examined. Results calculated to date indicate that significant rises in scrotal temperature occurred during the thermal reaction associated with the disease.

Studies with dyes used for breed identification in deep frozen semen indicate that they have no deleterious effect on semen quality as measured by laboratory techniques and by conception rate.

Under Queensland conditions where chilled semen is not used until the day after collection, any diluent likely to increase storage time is worthy of consideration. Laboratory studies with an egg yolk—glycine buffered citrate diluent (Cornell University Extender)—indicate higher survival rate of spermatozoa with storage than in the routine egg yolk—sodium citrate diluent. Split ejaculate trials involving limited usage at the Samford Experimental and Training Unit are in progress to compare the two diluents under field conditions.

TABLE 2

SEMEN USAGE FROM WACOL, CONCEPTION RATES AND BREED DISTRIBUTION FOR 12 MONTHS ENDED FEBRUARY 29, 1964

Distribution Centre	Chilled			Deep Frozen			Breed						
	Insemination		First Insemination 60–90 day N.R. (%)	Insemination		First Insemination 60–90 day N.R. (%)	A.I.S.	Jersey	Friesian	Guernsey	Ayrshire	Hereford	Aberdeen Angus
	First	Total		First	Total								
DEPARTMENTAL													
Samford	1,028	1,724	68·3	738	1,168	64·9	2,539	153	150	36	..	14	..
Kingaroy	874	1,301	52·4	367	637	47·7	1,923	..	..	..	..	15	..
Nambour	1,171	1,606	59·0	435	650	52·9	..	2,030	..	..	..	226	..
Beaudesert (disease control)	93	158	66·6	..	..	..	158	..	..	..	..	..	..
Total	3,166	4,789	60·0	1,540	2,455	57·4	4,620	2,183	150	36	..	255	..
COMMERCIAL													
Beaudesert	2,389	3,678	63·3	671	1,035	60·0	3,364	483	603	75	71	107	10
Killarney	..	..	..	1,240	1,805	66·4	1,072	511	74	54	..	40	54
Kilcoy	787	1,208	66·4	775	1,183	62·6	890	929	..	99	..	401	72
Dayboro	1,605	2,911	57·0	2,726	5,012	55·0	2,263	961	2,194	426	148	1,770	161
Gympie	77	152	66·2	702	1,069	64·9	70	960	9	76	..	106	..
Tablelands*	..	..	..	86	125	61·6	87	6	18	..	1	..	13
Bundaberg	..	..	..	651	911	62·5	366	162	133	111	..	100	39
Beenleigh	516	851	61·23	484	705	63·5	571	232	460	50	4	222	17
Toowoomba	..	..	..	1,222	1,778	60·1	1,177	99	248	31	26	170	27
Mundubbera†	..	..	..	831	1,145	65·5	534	341	12	167	..	91	..
Gold Coast	94	108	47·87	714	1,157	62·0	391	157	416	102	..	185	14
Monto†	..	..	..	670	971	61·3	497	312	52	80	..	30	..
Wondai	..	..	..	934	1,441	56·7	215	748	40	116	..	203	119
Canungra	..	..	..	219	291	61·2	113	33	13	102	..	30	..
Total	5,468	8,908	61·7	11,925	18,628	60·8	11,610	5,934	4,272	1,489	250	3,455	526
Grand Total	8,634	13,697	61·5	13,465	21,083	60·3	16,230	8,117	4,422	1,525	250	3,710	526

* Chilled semen supplied from A.I. Centre, Kairi.

† Results not available for the month of February, 1964.

BIOCHEMICAL BRANCH

Two members of the graduate staff were given leave and financial support to undertake advanced training appropriate to their field of chemistry, one in Canada partly at Dalhousie University and partly at the Canadian National Research Council, and the other at the Biochemistry Department of the University of Queensland. Another staff member successfully completed the Honours Qualifying examination and had his thesis on the isolation and identification of the toxic principle in *Acacia georginae* accepted by the University of Queensland for the degree of Master of Science. One Departmental scholarship holder completed his Bachelor of Science Degree at the University of Queensland, majoring in biochemistry, and was appointed to the Branch in January. At present there are a further four students on Departmental scholarships, undertaking full-time Science Courses selected with particular emphasis on biochemistry and chemistry. All technicians made satisfactory progress in their training at the Central Technical College and in this laboratory. A further two cadet technicians were appointed in January. One member of the graduate staff resigned to accept an appointment in industry.

Additional major units obtained this year include a gas chromatogram with electron capture and flame ionisation detectors and equipment for thin layer chromatography, electrophoresis and fluorimetry. Basic equipment for work with radio-active isotopes was ordered.

With the increase in staff and the ever increasing variety of investigations requiring new and more complex chemical measurements, the problem of inadequate laboratory space has become even more serious. A major difficulty is the necessity of using sensitive and costly equipment in general purpose laboratories. Corrosion is inescapable. Already it has become necessary to return two major units to the manufacturers for complete overhaul. In each case damage was attributed solely to corrosion. Apart from the cost of repairs, which is considerable, the absence of such units seriously interferes with the functioning of the laboratory. Additional and improved laboratory space is clearly an urgent necessity. With the allocation of some moneys for this purpose from the Australian Cattle and Beef Research Fund, the Department of Works has collaborated in the preparation of detailed plans

for a new building at Yeerongplily to house the Husbandry Research and Biochemical Branches. A rapid implementation of these plans is essential to the functioning of all Branches within the Animal Research Institute.

The Branch at present consists of Toxicology, Nutritional Biochemistry and Clinical Biochemistry sections. Some details of the analyses of diagnostic specimens and their interpretation and on current research studies are presented in the reports of each section. Officers of this Branch have had senior or associate authorship in 12 papers accepted for publication in scientific journals during the current 12 months.

TOXICOLOGY SECTION

Diagnostic Service

A total of 1,050 specimens was received from 444 cases where poisoning of livestock was suspected. Analyses confirmed arsenical poisoning in 49 cases, lead in 20, phosphorus in 1 and strychnine in 1. In cases where the source of the toxin was subsequently investigated, arsenical poisoning was usually associated with careless disposal of residues of weedicides or acaricides and lead poisoning with the indiscriminate use of paints containing lead.

Toxins found in plant specimens in concentrations which could be dangerous to livestock were nitrate, oxalate and hydrocyanic acid. Further plant specimens were collected in connection with a more detailed survey of a known seleniferous area in north-western Queensland. Significant selenium levels were found in the 52 samples examined so far.

Miscellaneous analyses were concerned with suspected poisoning from creosote, chlorinated hydrocarbons, organic phosphorus compounds and urea.

Samples from dipping vats located throughout the State totalled 1,147. This service is designed to allow producers to use chemical analyses to maintain vats at an effective and economic strength. Of these samples, 59 were arsenical preparations, 52 were based on the carbamate sevin and the remainder were a variety of organic phosphorus compounds. Since the prohibiting of chlorinated hydrocarbons as acaricides, no such vat samples have been submitted for analysis.

Investigations

Pesticide Residues.—Initial studies were concerned with determining the magnitude of the residues in body fat of cattle following exposure to acaricides based on chlorinated hydrocarbons. Subsequently the residues resulting from the use of acaricides based on some of the organic phosphorus compounds were determined both in body fat of beef cattle and in butter fat of dairy animals. Current studies are related to the measurement of residues in both body fat and in butter fat following the use of the carbamate sevin as an acaricide.

All studies necessitated considerable research to develop micro-analytical procedures, which can be adapted to the particular problem under investigation. The magnitude of residues resulting from exposure to chlorinated hydrocarbons facilitated the application of published analytical procedures. However, the development of analytical procedures to measure the comparatively small residues following the use of acaricides based on the organic phosphorus compounds proved most difficult. Suitable analytical procedures were developed for Bayer 21/199 and for Delnav and it is apparent that a significant residue occurs only for a limited time after exposure of the animal to these compounds. The development of suitable micro-analytical procedures for the determination of other organic phosphorus compounds in animal fats is still not satisfactory. Some success was achieved in the determination of carbamate residues. Experimental cattle were subjected to what must be considered to be the maximum exposure likely to occur in this State, namely, three sprayings in 5 days prior to slaughter, and residues are being determined in fat and some organs.

Poison Plants.—The toxic principle in *Gastrolobium grandiflorum* was identified as fluoroacetic acid. This plant occurs mainly in inland districts of Queensland, the Northern Territory and northern parts of Western Australia, and has been responsible for serious losses in livestock. It has been described as the most poisonous to stock of any of the Queensland flora. Separation of the toxic principle was by continuous extraction firstly with ethanol and subsequently with sulphuric ether. Purification was by preparative scale gas chromatography. Identification as monfluoroacetic acid was by infra-red spectroscopy, gas chromatography and micro-analysis. This is the second occasion in which this toxin has been shown by this laboratory to occur in a poisonous plant in Queensland. The other toxic plant was *Acacia georginae* which has been responsible for serious stock losses in north-western Queensland and in the Northern Territory.

Studies are in progress on the isolation and identification of the toxic principle in a number of plants known to cause serious stock losses. These include *Phalaris tuberosa, Cestrum parqui, Trachymene glaucifolia,* and *Cheilanthes tenuifolia.*

Chemical analyses related to the survey of allegedly toxic and non-toxic areas of the Georgina River watershed in north-western Queensland have been delayed pending the delivery of a gas chromatogram with electron capture detection which will facilitate this work. A variety of botanical specimens of seed, pod and leaf of *Acacia georginae* and *Acacia cambagei,* collected in two seasons, were dried and milled prior to analysis.

NUTRITIONAL BIOCHEMISTRY SECTION

Diagnostic Service

Partial or complete stock food analyses were made on 2,500 samples. These include pasture and crop silages, individual pasture and crop species, experimental rations and ingredient of rations, faecal samples as an index of pasture selected by grazing animals and a wide variety of samples from field trials by the husbandry branches.

A number of additional measurements were made on certain fodders. All silage samples were analysed for pH and acid and base composition as indices of the effectiveness of the silage conservation process. These quality tests played the major role in deciding the order of merit in silage competitions intiated by a Dairy Extension Advisory Committee. Trace element analyses were made on a number of pasture samples. Bomb calorimetry was used as measure of energy value of certain fodders.

There was a further expansion in the use of chemical analysis as a quantitative measure of carcass composition. Analyses totalled 2,000 and included a complete evaluation of all procedures. Suitable processing, sampling and analytical techniques were developed for the determination of carcass composition of cattle, sheep and poultry.

Investigations

Silage Studies.—A number of investigations were made using small concrete silos with a capacity of 0·75 tons of green matter. The objectives of these investigations were: to evaluate the need for additives in the production of pasture silage; to compare sodium metabisulphite and two levels of molasses as additives; to determine the influence of two widely used harvesting procedures, one based on a flail system and the other on the use of fine chopping by means of a cutter bar; to measure the effect of nitrogenous fertilizers on pasture quality and the influence on silage quality; and to extend all findings to the problem of making good quality silage from lucerne under Queensland conditions. All analytical data related to these investigations are virtually complete. The second of a series of papers on grass silage was accepted for publication. A further two papers are nearing completion.

Nitrogenous Fertilizers and Animal Production.—Investigations have been in progress since 1961 to examine the effect of top-dressing with ammonium sulphate on the productivity of cattle grazing on pastures in which *Paspalum dilatatum* is the dominant species. Applications at the rate of 65 lb. of nitrogen per acre were made in spring and autumn. Stocking rates were 1 and 2 Hereford weaners per acre and all treatments were replicated. Measurements included bodyweight, faecal composition as an index of the composition of the selected diet, faecal output as an index of pasture intake, and quadrat yield and chemical composition of total available pasture. Results have been similar in each year although the order of magnitude has varied. Essential findings are:

(1) The application of nitrogen increased the yield of pasture, the increase being greater in the spring.

(2) Initially quality, as judged by the protein level in pasture, was improved but as yield increased, quality deteriorated.

(3) During periods of minimum pasture growth there is evidence of a response in animals from the nitrogen treatments. This has been attributed to the greater quantity of pasture in nitrogen treated paddocks at a time when the amount of available feed is limited.

(4) During periods of maximum pasture growth there is evidence of an adverse response in animals from the nitrogen treatments. This has been attributed to the greater overburden of mature pasture of lower quality in treated paddocks.

(5) Similar effects are evident from the two stocking rates.

(6) All findings suggest that a major response in animal productivity from nitrogen application in this environment would require either a variable stocking rate or the conservation of excess pasture when quality is high.

Nutritional Status of Grazing Cattle.—Earlier experiments at "Brian Pastures" in the Gayndah district enabled the development of a satisfactory regression relating food and faecal composition for cattle grazing on native pasture

in this environment. Application of this regression to analytical data on faecal samples collected monthly showed that the protein level in the diet selected by cattle on native pasture is below maintenance requirements for a considerable proportion of the year. There was evidence also that the energy value of the selected pasture could be limiting production. These aspects are now being evaluated in an extensive study which commenced in January and involves the daily supplementation of replicate groups of cattle. Supplements are pelletted and have been compounded to supply 20, 35, 50 and 65 per cent. protein respectively. The rate of supplementation is based on the analyses of representative faecal samples from the untreated control groups, the object being to ensure that the protein content of the diet in all treated groups does not fall below 9 per cent. on a dry matter basis. As the amount of protein fed to all supplemented groups is constant it follows that the rate of energy supplementation is inversely related to the protein content of the supplement.

Nutritional Status of Grazing Sheep.—Earlier experiments at Toorak Sheep Field Research Station near Julia Creek yielded valuable data on seasonal variations in diets selected by grazing sheep in this locality. The present investigation commenced in October, 1963, and involves two groups of approximately 200 weaner sheep, one with continuous access to a meatmeal supplement and the other an untreated control. The stocking rate approximates the district average of one sheep to 4 acres. To minimise paddock differences, sheep are alternated between the two paddocks at 6-weekly intervals.

Faecal output and composition were determined on a representative number of animals at monthly intervals. The data so far obtained tend to indicate an increased feed intake and an enhanced protein level in the diet of sheep from the supplemented group. Seasonal variations in the quantity and quality of the diet are also evident.

The Development of Techniques to Measure Feed Intake in Grazing Livestock.—A series of pen trials were completed with sheep on a variety of diets. Daily faecal output was measured during controlled feeding and during 5 days' starvation. Data are being evaluated statistically to determine if there is a relationship between faecal output during and prior to starvation.

CLINICAL BIOCHEMISTRY SECTION

Diagnostic Service

Blood inorganic phosphate analyses were made on 511 samples. Phosphate deficiency was confirmed on 12 properties while on a further two the phosphate status was marginal.

Blood copper levels were determined on 490 samples. Copper deficiency was confirmed on 23 properties. Liver copper analyses were made on samples from 140 cattle and 81 pigs. Findings indicated a low copper status on a further 17 cattle properties and 18 pig farms.

Liver vitamin A analyses confirmed vitamin A deficiency in fowls from three properties and pigs from nine properties. A marginal vitamin A status was indicated on a further two poultry and three pig farms.

Other suspected metabolic disorders involved the analyses of 436 sera for calcium and 354 for magnesium. Hypocalcaemia was confirmed on 66 occasions of which 17 were in association with hypermagnesaemia and 9 in association with hypomagnesaemia. Uncomplicated hypermagnesaemia was found in 17 cases and hypomagnesaemia in 11.

Of the further 4,000 miscellaneous samples analysed, some 500 were concerned directly with the diagnostic service and the remainder with collaborative investigations with the Animal Husbandry Research, Pathology and Field Branches. Most of these investigations originated as a direct result of the diagnostic services. The variety of analyses included: blood haemoglobin, haematocrit, copper, ammonia, inorganic phosphate and pyruvic and lactic acids; plasma sodium, potassium, vitamin A and carotene; serum calcium, magnesium, total protein, albumin, globulin, uric acid, glutamate oxalacetate transaminase and bilirubin; liver copper, manganese and vitamin A; blood plasma and extra cellular fluid volume; rumen volatile fatty acids, molar percentage of individual fatty acids, ammonia, pH and volume; body fats for iodine number and fatty acid composition; semen fructose; urine for a variety of tests; bones for ash, mineral content and fluorine; and miscellaneous samples for copper, zinc and manganese.

Investigations

Vitamin A Requirements of Cattle.—Earlier investigations at the Animal Husbandry Research Farm, Rocklea, showed a marked fall in liver vitamin A reserves in cattle on feed lot fattening experiments with high grain rations. This was investigated further in a lot fattening experiment with 90 steers in which half the animals received 40,000 I.U. vitamin A per head per day in the ration. Final rations contained 90 per cent. grain, 10 per cent. silage and urea. Liver vitamin A levels were determined in all animals initially on biopsy samples and subsequently at slaughter after an average period of 121 days in feed lot. Essential findings were: a considerable fall in vitamin A reserves even in supplemented animals; low liver vitamin A levels in some animals at slaughter in spite of high initial reserves (average 223 μg/g); no effect of vitamin A supplementation on overall rate of gain in bodyweight but an improved feed conversion ratio in three of the four groups receiving vitamin A.

Biochemical Changes in Non-pregnant Heifers in Drought-feeding Experiments with All-grain Rations.—Treatments included the feeding of restricted amounts of whole and cracked sorghum grain, daily and intermittently, for 26 weeks. Body fluids and some blood constituents were determined initially and at the conclusion of the experiment. Essential findings were: a decrease in haemoglobin and packed cell volume; little change in serum protein; an increase in blood and plasma volume per unit of bodyweight; a slight decrease in red cell mass; no marked differences between treatments.

Changes in Blood Constituents in Relation to Some Disorders of Livestock.—Measurements included pyruvic and lactic acids and glutamate oxalacetate transaminase in connection with investigations on poison plants and uric acid in relation to nephritis in chickens. Extensive analytical data in connection with experimentally induced nephritis in chickens have not shown a clear cut relationship between serum uric acid levels and the incidence of the disorder.

Utilization of Urea by Ruminants.—A number of aspects of urea utilization are under study. These include the effect of urea on fatty acid metabolism in the rumen, the influence of urea on the composition of body fat in feed-lot cattle, factors affecting the toxicity of urea and biochemical changes associated with urea toxicity.

Evaluation of Meat and Bone Meals.—Studies on the biological value of meat and bone meals were extended to the influence of varying levels of sodium and potassium on the growth rate of chickens fed isoproteinic broiler rations containing 9·5 and 15·5 per cent. meat and bone meal. The experiment was duplicated at two research centres. At 4 weeks of age, chickens at one centre were challenged with an infectious bronchitis type virus. Significant findings were: greater weight gains in chickens on rations containing the lower level of meat and bone meal; a decreased weight gain and food conversion rate due to the infectious bronchitis virus; maximum growth in chickens on rations containing no additional sodium and potassium chlorides; minimum growth and food conversion on rations containing additional 2 per cent. sodium and 2 per cent. potassium chloride; a direct relationship between water consumption of chickens and the level of salt intake.

Findings from this and previous studies on factors influencing protein quality are being assembled for publication.

Trace Elements.—A number of field trials to evaluate copper and cobalt therapy of beef cattle on marine plains in the Rockhampton and Townsville areas have now been completed and the data assembled for publication. In both areas there was a significant response to copper in the growth rate of weaners and in the fertility of heifers. From the more detailed studies in the Rockhampton district, there was also a significant response in the growth of calves supplemented prior to weaning. No response to cobalt was obtained in the Townsville experiments but there was an indication of a growth response to cobalt in weaners in the Rockhampton area in some seasons.

SHEEP AND WOOL BRANCH

EXTENSION

The Branch now has a graduate staff of five. A further scholarship holder should graduate at the end of 1964 and further strengthen this section of the staff which has been below requirements for some years. A scholarship, provided by the Wool Research Committee, has allowed an experienced veterinary officer to attend a University course in extension training. Branch officers attended "Brigalow Conferences" at Miles and Biloela; a refresher course for Sheep and Wool Extension Officers organised by the Wool Research Committee; Sheep and Wool Conference at Leura and the Grasslands Conference at Warburton.

An in-residence school for young graziers was conducted at "Greenmulla," Quilpie, by Branch officers. About 170 graziers attended an "Open-day" held at the Toorak Sheep Field Research Station.

Twenty-three field days were held during the year. The total number of recommendations and demonstrations given by field officers was 3,948.

Field Activities.—Seasonal conditions were good for the first half year but the summer rains were patchy and inadequate to assure a good winter. Some supplementary feeding commenced towards the end of the year and the outlook for the spring was not good. Blowfly was moderately active during the spring, when instances of poor fly control were reported, but were due to inadequate jetting techniques.

The incidence of internal parasites was widespread early in the year. In the highly endemic areas, fewer deaths, better weaner and wool growth have occurred since the widespread use of the newer anthelmintics has operated. Liver fluke (*Fasciola hepatica*) was more prevalent in its endemic area in the south-eastern corner of the sheep country than in recent years.

Bent leg syndrome in lambs and deaths of older sheep occurred in the south western sheep country during the spring when wild parsnip (*Trachymene ochracea*) was seasonally present but in unusual abundance.

The humpy back syndrome was again widespread.

Trace Elements.—Wool, showing loss of crimp frequency and steeliness, as grown on a copper deficient diet, appears not uncommonly but irregularly on widely separated properties in Queensland. Field trials to evaluate copper and cobalt supplementation were done on two properties in central Queensland. In the season which occurred, the incidence of steely wool was low in the control group and there was no apparent response in body weights to treatments. Shearing was completed in June and the data are being fully analysed. Preliminary indications are that no response to copper or cobalt supplementation occurred in this year.

TOORAK SHEEP FIELD RESEARCH STATION

Seasonal.—Rainfall in the first quarter was only 3 points; 76 points fell in the second quarter; between January and March, 1964, 1,238 points fell. Pastures responded well, but summer heat caused early drying of the feed.

In the final quarter, rainfall was negligible.

Sheep Purchases.—To increase stocking rates and provide replacements for research flocks, 940 mixed weaner sheep were purchased locally. There were over 7,000 sheep on the property at the end of the year, including 770 newly dropped lambs.

Development, Fencing and New Paddocks.—Much existing fence was hung with hinge-joint netting to make it ram-proof. Six new development paddocks, a set of welded-pipe sheep yards, and a small shed were erected during the year.

Water.—The catchment bank at Jackson's Tank was built up, and new fluming installed into the tank.

New bore drains were constructed to provide water for the newly fenced paddocks, and to extend the coverage provided by existing drains. In addition, water storage earth tanks from 1,000 to 3,000 cubic yards capacity were excavated at strategic points on bore drains.

Research and Trial Work

Nucleus.—The recording of observations and performance of this flock continued. This flock is based on ewes and rams purchased from a local stud in 1951. Further rams were purchased from the same stud in 1954.

The size of the ewe flock was increased in 1956 when some ewes bred on the property were added to it. No ewe progeny have been culled from the flock and with the exception of the rams purchased in 1951 and 1954, all rams used have been bred within the flock.

In 1958, breeding records of this flock indicated that ewes with low skin fold scores produced more lambs than those with higher skin fold scores. Since then, the ewe flock has been divided into a random, low skin fold score (plain) and high skin fold score (wrinkly) groups. Plain rams are joined to plain ewes, wrinkly rams to wrinkly ewes and both groups of rams are joined at random to the random group ewes. Excluding two-tooth maiden ewes from all calculation, the joining and lambing results, summarised for the years 1959, 1961, 1962 and 1963 are as follows:

Plain Group	1959	1961*	1962	1963
	Per cent.	Per cent.	Per cent.	Per cent.
Ewes showing oestrus at joining as a percentage of ewes present at joining ..	67	77	84	86
Ewes lambing as a percentage of ewes present at joining	45	47	63	69
Lamb marking percentage based on ewes joined	45	31	47	52
Lamb mortality before marking: to lambs born	20	40	31	30

* Near drought conditions precluded joining in 1960

Wrinkly Group	1959	1961	1962	1963
	Per cent.	Per cent.	Per cent.	Per cent.
Ewes showing oestrus at joining as a percentage of ewes present at joining ..	64	72	81	85
Ewes lambing as a percentage of ewes present at joining	31	33	55	58
Lamb marking percentage based on ewes joined	27	23	35	38
Lamb mortality before marking: lambs lost as a percentage of lambs born ..	20	35	42	38

Random	1959	1961	1962	1963
	Per cent.	Per cent.	Per cent.	Per cent.
Ewes showing oestrus at joining as a percentage of ewes present at joining..	70	70	79	86
Ewes lambing as a percentage of ewes present at joining	43	39	52	59
Lamb marking percentage based on ewes joined	35	27	31	48
Lamb mortality before marking: lambs lost as a percentage of lambs born ..	30	35	45	21

These results indicate the severity of the neonatal loss in all groups, and the better lamb marking of the plain sheep.

Oestrus Trial.—This long term trial, commenced July 18, 1961, continued under the same experimental procedure with groups of ewes running intermittently and a group running continuously with vasectomised rams. Accidental ingress by entire rams into the experimental group on two separate occasions interfered with evaluation of the year's results.

In the previous years, a high percentage of ewes demonstrated oestrus throughout the year and this situation was again apparent.

An unexpected result that occurred in the ewes which lambed as a result of the accidental service during May, 1963, by entire rams was the high percentage marked by the vasectomised rams during their pregnancy. About 50 per cent. were marked on at least one occasion and 43 per cent. more than once. This is in contrast to "teasing" results subsequent to the nucleus joining in March-April when the highest percentage of ewes marked in the 3 weeks after joining and which subsequently lambed, has been 2·7 per cent.

Ram Semen Observations for Seasonal Fertility.—The measurement of semen quality as indicated by density, volume pH, motility, morphology and live/dead ratio continued. Semen from the trial rams was collected by electrical stimulation at 14-day intervals. The quality of semen produced followed the same general pattern, a summer depression, but this occurred earlier than in previous years.

Greater variation occurred between sequential semen samples of individual rams and the group of rams than in previous years. The reason for this variation has not been found.

Spring, Autumn and Winter Joining Trials.—The two flocks, one for spring and the other for autumn joining, each of approximately 1,000 ewes, set up by dividing the main ewe flock at random in 1962, have now lambed twice. The spring joined flock is joined for 6 weeks from the middle of October, and the autumn joined flock for a similar period during March, April and May.

A third flock of approximately 80 ewes had previously been formed for joining in winter. This small flock is joined for 6 weeks immediately after shearing in July.

The lamb marking percentages for the joinings of these three flocks for years 1962 and 1963 are as follows:

Year	Percentage of Lambs marked to ewes joined		
	Autumn joined	Winter joined	Spring joined
1962	48	52	45*
1963	53	57	64

* Fly wave during lambing

Ram Joining Trial.—Current industry practices of mating rams with ewes employs two methods:

(*a*) Joining all rams with ewes at once.

(*b*) Joining groups of rams at intervals during the period of mating. This is commonly referred to as "staggered" joining.

A trial was carried out to determine which method obtained the higher lambmarking result. The group of ewes joined in the spring was divided, at random, into two flocks of over 550 ewes each; 2½ per cent. of rams were added on the first day of joining to one group of ewes; to the other 1 per cent. was joined on the first day, a further 1 per cent. on the 14th day and a final ½ per cent. on the 28th day. Each group was joined for 6 weeks.

Results were:

—	GROUP I Rams joined 1. At start 1% 2. At 14 days 1% 3. At 28 days ½%	GROUP II Rams joined at once, 2½%
	Per Cent.	Per Cent.
Ewes not served	15·5	11·3
Ewes mated first fortnight	33·8	36·8
Ewes mated second fortnight	56·6	58·5
Ewes mated third fortnight	11·8	10·5
Ewes mated second fortnight for first service	48·6	49·7
Ewes mated third fortnight for first service	1·9	1·8
Percentage lambs marked to ewes joined	65·31	64·09

In this year, neither method showed any advantage. This trial will be repeated next spring.

Seasonal Wool Growth Studies.—Continuation of this long-term project studying the variation of wool growth in the tropical environment showed the marked fluctuations which occur.

Samples were taken at varying intervals during the first year of the trial but have been clipped at monthly intervals since July, 1962. Results have been expressed in milligrammes per ten centimeters square per 28 days and have shown that clean wool production varies from just over 200 to about 400 milligrammes or greater in the seasons so far encountered. Maximum production coincides with the presence of nutritious green pasture which occurs in late summer and autumn whilst the dry period of late winter and spring causes a marked lowering of production.

In future observations the dye banding technique will replace the clipping at skin level method used during the first 3 years of this trial.

Protein Supplementation Trial.—The summer distribution of rainfall in tropical Queensland results in good quality green feed for a period during the summer and autumn followed by a period when grasses are mature, of lower quality and decreasing quantity. During the late winter, spring, and early summer, this low quality feed results in lower wool growth as shown by the seasonal wool growth trial.

A trial to find the response of weaner and two-tooth wethers to protein supplementation during spring and summer before rain falls was started in the spring of 1963.

The supplemented group comprised 94 weaners and 65 two-tooth wethers and the control group comparable numbers in age groups. To induce the sheep to eat the meat meal supplement, a small quantity of a proprietary line of molasses and blood meal was first given to the supplemented groups and when this was being eaten small quantities of meat meal were introduced and then gradually increased until unadulterated meat meal was being eaten. The groups were rotated fortnightly between two comparable paddocks. The season was better than average. Under these conditions a marked difference in body weights was not expected or obtained. The sheep will be shorn early in July, 1964, when wool weights, body weights and the wool classer's classification of each fleece will be obtained. Mid-side samples for the estimation of clean wool weight will also be obtained at shearing. The cost of supplements fed, and an estimate of labour and other expenses incurred, have been kept and the economic value of the supplement fed in that season will be obtained.

A trial of this type will be done again in 1964-65, and the seasonal outlook suggests that supplementation will be more likely to produce a response.

WOOL BIOLOGY REPORT

Altogether, 3835 wool samples were received by the wool laboratory for fleece measurement analysis. This represents a 25 per cent. increase on last year's figures. These samples were largely supplied by sheep studs and grazing properties participating in fleece measurement programmes; 937 samples were from field experimental trials.

Scouring for determination of percentage yield and clean scoured fleece weight was completed on 3,212 samples plus 204 clipping samples taken from the Toorak seasonal wool growth trial.

Fibre diameter, crimp and staple length measurements were made on 3,191 wool samples.

Two Indian Colombo Plan Fellows spent 3 weeks in October, 1963, in the Wool Biology Laboratory familiarising themselves with methods, procedures, and equipment.

CATTLE HUSBANDRY BRANCH

No significant changes in staff complement occurred during the year. A graduate officer was transferred to the Cattle Field Research Station, "Swan's Lagoon," to pursue with increased intensity the reproductive behaviour and performance studies that are being undertaken on the Station. The Branch actively participates in the programmes at the new Brigalow Research Station and an officer was transferred to that centre. A number of resignations occurred amongst junior staff members. Some resigned to pursue courses of tertiary education. The main changes in technical staff involved such junior officers and their replacements. No changes occurred in the complement of senior officers or graduates. One graduate officer remained overseas undertaking post-graduate studies at Cornell University, U.S.A.

District conferences were held during the year at Townsville, Rockhampton, Toowoomba and Kingaroy. These are the centres of senior district officers and each was attended by local district personnel supported by one or two from Brisbane. The need for such sessions of review and replanning on a district basis becomes readily apparent when the size and diversity of methods employed in the cattle industries of the State is considered. Such conferences must remain a feature of the administrative process of the Branch. They are a valuable medium for training and orientation of junior staff as well as providing a means of review of activity as a prelude to replanning.

In recent years, the Branch has had an increasing amount of counsel from, and discussion with, committees concerned with the planning and, in some cases, the execution, of extension and research programmes. The value of these committees is increased by the inclusion of producers in their membership.

The several Dairy Extension Advisory Committees, on which Branch officers serve, have been in existence for a number of years and their role in district dairying affairs is widely recognised by the community. Some are giving special attention to the organisation and promotion of artificial breeding services in their districts as well as to their more usual role in extension.

The Branch Director serves as Chairman of an Advisory Committee on A.I. on which are representatives of dairy breed societies and the Queensland Dairymen's Organisation. This group, although meeting irregularly, has been of considerable assistance to the Department in the definition of policy on A.I.

Reference and acknowledgement is also made to the Technical Committees in the organisation and planning of developmental and research programmes at "Swan's Lagoon" Cattle Field Research Station and "Brian Pastures" Pasture Research Station.

EXTENSION

A continuing feature of the dairying extension work is the development and expansion of A.I. New co-operative associations were formed in West Moreton, Downs, Upper Burnett and South Coast districts and several others are in an advanced stage of organisation leading to a commencement of field operations in the late winter and spring. In addition, several Associations made expansions in their field operations necessitating field staff additions. It is expected that 20 Co-operative Associations will be supplying field services in A.I. to member dairymen by the end of the current breeding season.

The Samford A.I. unit operated by the Branch continued to function for inseminator training purposes and for field research. A steady flow of trainees nominated by existing or forming Associations continues with seasonal surges that from time to time heavily tax Branch teaching resources. The quality of training and the proficiency of licensed inseminators is measured in the ultimate by the maintenance of acceptable first service conception rates. The overall State first service non-return rate is maintained at 63 per cent. for herds participating in A.I. programmes and is viewed overall as an acceptable and satisfying level by national and overseas standards.

The Branch role in extension in the beef industry continued in the pattern developed within recent years. The size of properties, distribution of the individuals comprising the industry and the communications available necessitate a different method of extension from that appropriate for more closely settled and mixed farming areas.

The field trial remains a central feature of beef extension. The nature of the particular trial is orientated towards the quantifying of data bearing on one or more of the basic local problems. A large number of producers in all districts actively participate in these programmes, supplying resources of land, labour and cattle in the co-operative work. Their role is considerable in the development and expansion of the industry. Their help is acknowledged with gratitude.

In the northern beef areas, emphasis in trials is placed on measurement of reproductive behaviour and performance, drought supplementation and young animal performance. The "Swan's Lagoon" Research Station, now in a reasonably advanced stage of development, has a primary role in research on reproductive performance, and programmes there will provide the additional precision that is ultimately essential in problem solution.

In central and southern beef areas, the nature of the industry and its methods require that aspects of intensive production be a prominent feature of field trials. Thus, crop and pasture fattening trials and studies in lot and pen become more important.

A successful school for graziers was organised in the Charters Towers area and was attended by about 100 graziers. The school agenda featured pasture and crop production and nutrition, and management of beef cattle in the northern environment. The Department had the assistance of several specialists from C.S.I.R.O. and the programme was jointly planned and organised with the Graziers' Association of Central and Northern Queensland. This medium for the passage of technology results and problems between research and practice has become an important feature of extension in the beef industry. The schools are well supported, discussion and debate is keen and their utility is widely acclaimed. Several other similar schools are in the planning stage.

Infertility in Dairy Cattle

Infertility in dairy cattle poses one of the several major problems facing dairymen irrespective of their production method. It has been under study for several years and is supported by finances from the Commonwealth Dairy Industry Extension Grant. Currently a detailed study of the extent and nature of the infertility complex in a sample dairying area is being made. Approximately 40 dairymen in the Dayboro-Samford area are co-operating. Some are serviced by a local A.I. Co-operative Association and some are undertaking natural service programmes.

A detailed clinical and pathological examination of all females in each herd was made as a necessary and central feature of the survey in 1963-4.

Brucellosis is a well-recognised factor in the infertility complex, and reactor cattle and their breeding performance are matters for detailed study. In the survey herds, brucellosis reactor cattle had a first service conception rate of 54 per cent. This is somewhat lower than the whole herd conception rate (58 per cent.) and lower also than the rate for brucellosis negative cattle (61 per cent.).

In addition, the 1962 performance of negative animals which reacted positively to the disease in 1963 indicated a conception rate of 58 per cent.—the same as the whole herd conception rate. However, new reactors in 1963 (having been negative in 1962) had a rate of the order of 37 per cent. in the later year.

The survey results further indicate that both *Leptospira hyos* and *L. pomona* are of importance and warrant consideration in the assessment of the role of causal agents in the incidence of infertility.

There is, for example, a trend towards an overall lower fertility in reactors to both diseases which coincides with a similar trend in brucellosis reactors. In respect of the brucellosis reactors, this trend is again evident in new reactors but no assessment has yet been possible for this type of reactor to leptospirosis.

Vibriosis remains an important agent in the complex and in the survey farming area, in 1962, 69 per cent. of the survey herds were positive to vibriosis to the extent of at least one reactor. By contrast, in 1963, 100 per cent. of the herds tested positive.

When the survey herds were partitioned into groups of high and low fertility on the basis of their performance it was found that 73·6 per cent. of all cows in the former grouping were negative to all tests. In contrast, 55·1 per cent. of all cows in low fertility herds were negative to all tests.

There would also appear to be a marked tendency for the conception rate of negative cattle to approximate the overall conception rate of the herd in which they are located.

Synchronisation of Oestrus

The methods of regulation of the oestral cycle of cattle and the advantages to management in such regulation are being studied by many workers in Australia and abroad. The Branch has for some time recognised the potential utility that would repose in the development of techniques of an acceptable standard.

Uses to which such regulatory techniques might be put include:

(1) Breed changes with minimum time lags—an application with dairy or beef industry usefulness.

(2) Provision of A.I. service in large herds remote from existing and functioning A.I. Centres—an application for the dairy industry.

(3) Effective control of certain reproductive diseases—an application for both cattle industries.

(4) Management aid in herds wherein a seasonal patterm of reproduction provides an optimal position.

The earlier Branch work in this field involved trials in synchronisation using hormones in combinations. At present, the method of daily progesterone injection has been selected for its utility and simplicity and on the grounds of economy. The results of some recent field trials give grounds for optimism and are encouraging. The method of daily injection for a specified period poses little problem in dairy herd management because of the daily yarding for milking. Such is not the case in beef herds.

Following the cessation of the daily treatment, the whole group is inseminated on a target date, usually the fourth day and then repeat inseminations are carried out on treated animlas showing oestrus on subsequent days to the seventh post treatment. The group is finally pregnancy diagnosed 50-60 days following insemination.

Some additional synchronisation trials are in progress and evaluation by pregnancy diagnosis is pending.

Because of the potential utility to the cattle industries in the method, providing an acceptable and predictable standard is attainable, it is the intention to pursue further studies in future seasons as resources permit.

Beef Breeding Herd Performance

Apart from the intensive studies of aspects of beef cattle reproduction, which are in progress at the "Brian Pastures" and "Swan's Lagoon" Research Stations, this important phase of beef herd management is being investigated in 10 commercial herds scattered throughout the State.

These field investigations range from relatively simple trials to assess the effect on calves of early weaning, to long-term year-round studies of conception, calving and branding rates, breeder and calf performance considered in relation to time of the year and seasonal conditions in a herd where mating is uncontrolled.

In those trials where calving performance is being studied, the technique of pregnancy diagnosis is used to distinguish the two factors involved in this aspect of reproduction —conception rate and prenatal mortality. Although the technique has been used by appropriately qualified staff only as a research tool, graziers have been quick to realise its potential as a practical method of improving breeding herd performance.

Following pregnancy testing of breeders in the autumn, non-pregnant cows can be culled so that only pregnant animals need be carried through the critical winter and autumn period of feed shortage. Several graziers have now adopted this technique and it can be expected that it will

result in an immediate, substantial improvement in calvings in herds on better developed properties during the next few years.

While studies on other aspects of breeding herd management have not yet reached the stage of providing firm conclusions, early weaning of calves in the autumn, at ages down to 6 months, has been shown to have no adverse effects on their subsequent performance. It is expected that removal of calves at this time will result in considerable improvement in cow performance in terms of survival, body condition and subsequent calving rate. Further trials are in progress to establish the effects of early weaning on subsequent breeder performance.

An article dealing with early weaning trials at "Fanning River" in the Charters Towers district, including the use of supplements for early weaned calves, has gone to press.

Research Station, Coolum

The Branch recently commenced to participate actively in the programmes of wallum research at the Coolum Station, with the concentration of research resources on the low heath phase of the coastal lowland complex. The aggregate area of such heath has been estimated at 300,000 acres, mainly situated between Caboolture and Bundaberg and adjacent to the coast.

Until recently, research programmes on the heath were mainly orientated towards plant nutrition studies including trace element trials and the establishment and maintenance of fertilizer levels appropriate to the infertile soils of the area. In addition, pasture studies to screen for survival and compatability the promising array of grass and legume species were undertaken.

More recently, programmes involving grazing management were commenced and are being expanded. Early measures of productivity for beef production from a sown pasture are promising. The main current trial involves a young pasture stocked for the first time in the spring of 1963 at a pressure of one animal to 1·6 acres. Summer gains have approached 2·5 lb. liveweight daily on two occasions and early winter performance has been of the order of 1·5 lb. daily.

The Australian Cattle and Beef Research Fund will contribute financial resources to the expansion of the Station programmes. In particular, a project that is currently being prepared will involve the interaction of grazing pressures and maintenance fertilizer levels. This project involving 72 acres of heath will be sown in the coming summer.

"Swan's Lagoon"

The 31-square mile Cattle Field Research Station, located on the Burdekin River at the foot of the Leichhardt Range, was acquired in 1960. Its main purpose is research in husbandry and management especially in relation to reproductive performance in the northern environment. Problems in the dry tropics, an area which carries about one-third of the State's beef cattle, warrant study in an environment representative of the region.

The Department has the advice of a Technical Committee with two grazier representatives of the Central and Northern Graziers Association in planning the development and research work of the property. The Station carried no useful improvements at the time of acquisition and this preliminary phase of development started in 1962.

Good progress has been made and by September of the year under review a total of 55 miles of internal and subdivisional fencing had been completed and the property divided into 12 paddocks. Water facilities have presented considerable difficulty and it has been necessary to supply the paddocks by pipeline and central storage from a pump site on "Swan's Lagoon".

The all-weather access road to the centre of the property —the main experimental site—was cleared, formed and drained during the financial year with some additional work yet remaining. In addition, quarters to accommodate four single men and a manager's residence in Millaroo township have been completed. Yards capable of handling 300 head of experimental cattle are also available now.

The experimental herd comprises 300 head of Shorthorn breeders, bought as heifers from northern properties.

The first principal research project in management at the Station has as objectives:

(*a*) to describe the seasonal incidence of mating under uncontrolled mating conditions as commonly practised in the northern areas;

(*b*) to determine the relative levels of fertility of cows mated at different times of the year;

(*c*) to determine the survival rates of cows and/or calves when calving occurs at different times of the year;

(*d*) to record the performance of calves born at these various times.

The experimental design consists of five groups of breeders mated for 63 days at different times of the year. A control breeder population is mated continuously. The first matings were made in February, 1963, and the programme has an expected duration of about 6 years.

Beginning at the February, 1964, mating period, detailed observations commenced on the oestrous behaviour of breeding cows.

There is an ultimate need to have accurate information on exact service dates, conception rate and returns to service. In addition, the effect of season on ovarian activity, gestation length, calf birth weights and interval between calving and first oestrus are all factors having heavy management repercussions for northern cattlemen and about which there is virtually a complete lack of precise data. These are the immediate research objectives of the Station.

The programmes of work at the Swan's Lagoon Research Station are assisted by grants from the Australian Cattle and Beef Research Fund and Cattle Research Committee.

"Brian Pastures"

(*a*) Conception rate is one of the most important determinants of breeding herd performance. A project to investigate factors which influence conception rate was commenced at "Brian Pastures" Pasture Research Station in October, 1961.

To study the effect of time of mating, groups mated at the following times are used at "Brian Pastures":

Early mated, October–December; normally mated, January–March; late mated, April–June.

Two bulls are used for each mating group and in order to nullify the effect of variation in bull fertility, the same two bulls are used for every mating group each year.

Bulls are fitted with marking crayons to enable detection of services. During the mating period females are inspected daily from service recording. Pregnancy diagnosis is performed as soon as possible after mating ceases and subsequently at monthly intervals to check on abortions. The trial is proceeding.

(*b*) Another major cattle project at "Brian Pastures" has as objective the determination of the optimum period of the year (in terms of the performance of cows and their progeny) for calving of beef cows in southern Queensland.

Three groups, each of 22 cows, are mated at the following times:

Early mated, October 8 to December 7; normally mated, January 8 to March 9; late mated, April 8 to June 7.

It appears that calves born at the normal time have better liveweight performance. The late calving has certainly produced slower growth rates than either of the other two periods. However, other important factors, such as greater liveweight of the early calves at initial times during the pasture production cycle and higher survival rates of cows during drought years, may more than offset the slight difference in growth rates between the early and normal calving times.

(*c*) The effect of method of fattening on carcass composition is also under study. The objective is to determine the influence of rate of growth on carcass composition and yield of the various cuts of beef. Progeny of the cow groups in the time of calving trial are selected and fattened from 18 months of age (*a*) in a feedlot and (*b*) on grass. Animals are slaughtered when they reach liveweight of 900 lb. for steers and 800 lb. for heifers. The main treatments are:

(i.) *Pretreatment*: Slaughtered off grass at 18 months of age, at the time the feed lot fattened groups enter the feed lot.

(ii) Feed lot fattened.

(iii) Grass fattened.

Within each of the feed lot fattened and grass fattened treatments, progeny of the early, normal and late mated treatments from the time of calving trial form separate groups. In each of these groups and the pre-treatment group heifers and steers are represented by two to four animals each and these six sub-groups are analysed separately.

The trial has now been in progress since 1961 and 2 years progeny, calves born in the 1959-60 and 1960-61 seasons, have been slaughtered.

Key features arising from the preliminary analysis of these data are, briefly as follows:

- Age at slaughter (that is, when target weights were reached) differed as might be expected between treatments, lot fattened animals being turned off at an average age of 26 months, while those off grass averaged 41 months. There was also a noticeable sex difference in the grass fattened groups, average age of heifers being 38·5 months and steers 44 months.

- Liveweight losses between final property weighing and pre-slaughter weighing at the abattoir—involving a fasting period of approximately 36 hours of which approximately 23 hours were spent on rail—varied considerably between grass and feed lot treatments. Average losses, expressed as a percentage of final property weights were: pre-treatment 12·4 per cent.; grass fattened 12·6 per cent. and lot fattened 6·9 per cent.

- Dressing percentages (hot carcass weight) differed continuously between treatments, average percentages, based on immediate pre-slaughter liveweight, being—pre-treatment 50·4 per cent., grass fattened 53·2 per cent. and lot fattened 55·8 per cent. When calculated on final property liveweight the hot dressing percentages are reduced to 44·6, 46·4 and 52·0 per cent. respectively.

- Meat and fat to bone ratios in the carcasses, obtained by breaking down into boneless commercial cuts, varied in the same way as dressing percentages, the ratios being—pre-treatment 2·89 : 1, grass fattened 3·84 : 1 and lot fattened 5·05 : 1.

- The continued effects of similar variations in dressing percentages and meat and fat to bone ratios between the treatments resulted in meat and fat yields (expressed as a percentage of pre-slaughter liveweight) of—pre-treatment 35·7; grass fattened 41·5 and lot fattened 46·8 per cent.

PIG SECTION

One Field Officer reached the retirement age during the year. Difficulty in obtaining new staff with the necessary qualifications has been experienced. One Field Assistant was offered appointment towards the end of the year, but two vacancies for cadets remained.

Additional suitably qualified recruits are needed within the next few years for in-service training, to allow for adequate staffing of existing and future extension districts and replacement of senior officers who are approaching the retirement age.

Extension.—A conference of all Branch members, and two regional meetings of staff, were held during the year to discuss new ideas, trends, and problems in the industry.

Nine extension officers worked in their country districts throughout the year, supported by visiting staff from head office.

Group extension methods were used whenever possible for conveying information to pig raisers. Regular use was made of country press and radio services. On a number of occasions there was co-operation with other branches to organise field days, slide and film evenings, discussion groups, and similar gatherings.

Most extension work was again of a type requiring individual contacts. The continued interest in provision of better housing for pigs required many personal visits, while steady requests for information from persons contemplating rearing pigs likewise required individual treatment.

Most country officers reported an increasing demand for their services. It is anticipated that this trend will continue, as pig raising is now being conducted more on business-like lines than as a casual sideline.

Further subdivisions of the present extension districts will be necessary as the industry develops.

RESEARCH

Pig Testing Station, Rocklea

During the year five boars completed tests. Progeny of a further 10 boars were undergoing testing, and applications for the testing of another five boars were received. A better understanding by pig raisers of the value of progeny testing has resulted in an increase in applications.

Over the years it has become increasingly difficult to obtain wheat and sorghum of the protein levels required; this year barley was added to the grain mixture in order to make it easier to keep the crude protein content of the grain portion of the ration stable at 11 per cent.

Of the 103 sow applications received, 54·37 per cent. had to be cancelled, leaving 45·63 per cent. of the sows whose litters were able to meet the Station standards for numbers in the litter and weight of pigs.

The existence of such conditions in purebred herds as indicated by these figures (which are not normally evident) is very disturbing. It is hoped their revelation will stimulate stud breeders to strive for improvement. The large number of teams nominated for testing, but cancelled, would indicate that breeders must pay greater attention to fertility of their herds.

Carcass quality of tested pigs has shown an improvement.

Boars of the Large White and Landrace breeds were the only nominations prior to this year. Nominations of Berkshire boars, whose progeny were being received for testing, widened the coverage on purebred herds in the State.

RESEARCH STATION PIGGERIES

The performance at all three piggeries has been good. A very satisfactory level of experimental work has been maintained at Biloela and Hermitage although at Kairi, owing to the lack of trained staff, no experiments have been conducted. Results have been publicised through the *Queensland Agricultural Journal,* bulletins, technical and service notes, the press and radio, as well as lectures and field days.

Kairi.—During the calendar year 1963, records of food and stock purchases and sales indicated a gross margin of £1,070 (excluding the value of skim-milk). No deferred pay will be received but a dividend of 5 per cent. on shares and a bonus share issue valued at about £110 will also be received.

Sow numbers increased from eight to 12 during the year. Twenty-nine farrowings produced an average of 11·4 pigs born live and 9·1 pigs weaned. Sales totalled 184 pigs. In view of the high cost of maize and other foods in the area, these figures are considered satisfactory.

The appointment of a field assistant to the Station is anticipated in the near future; this will enable experimental and demonstrational work, of value to the district and State, to be recommenced.

Biloela.—Bulk grain storage was made possible by the erection of a 2,000 bushel silo. Plans have been made to accommodate trial pigs under better conditions and to improve sow feeding facilities and accommodation. These are urgent requirements, as under present conditions, disease outbreaks, although they have involved little or no mortality, appear on the increase amongst pigs housed in dirt yards.

The average number of pigs born (11·2) and reared (8·9) is considered very good. Nearly all the pigs reared have been utilized in experimental work. A total of 14 trials and observations were completed.

Four of these investigated the problem of protein supplementation of rations, and particularly studied the value of local meat and bone meals. Results indicated their poor biological value when used as the only source of protein supplement, and emphasised the need to include other supplements, such as fish meal or milk powder, to improve growth rates.

The level of protein needed to balance high energy rations fed in restricted amounts was also studied.

Three grazing trials were completed using green panic or clover grazing to economise on meal consumption. They indicated that a good quality all-meal ration was more economical for bacon production.

Interesting results were obtained from a trial in which three types of housing, in hot summer conditions, were compared. These were the controlled conditions at the Test Station, a semi-insulated farrowing house and a "half tank" type of shelter in a bare paddock at Biloela. Temperature conditions affected performance but not to the expected extent. Performance of the "half tank" group was satisfactory under temperature conditions (up to 111 deg. F.) which, according to U.S.A. reports, should have caused actual loss in weight.

Early mating of sows and 5-week weaning of litters were both carried out. Results were not altogether satisfactory.

Other trials included replication of Hermitage work, feeding of zinc supplements, and observations on creep feeding and anaemia.

Hermitage.—Additional pens with individual feeding facilities for 24 pigs and manure disposal through slatted floors to a pond were constructed. Work began on the installation of bulk grain storage facilities.

The performance and health of the herd showed a distinct improvement. Numbers born (8·5) and weaned (7·5) per litter are considered quite satisfactory for the Berkshire breed. Selection for litter size is being practised.

Oedema was responsible for losses among newly weaned pigs while scouring and joint ills occurred.

Fourteen trials and observations were completed during the year. The majority were concerned with the influence of feeding on carcass quality and the economy of production.

A trial, in co-operation with the Animal Research Institute, investigated the influence of the variety of sorghum on the palatability of complete rations. It indicated that the variety preference, established under free choice feeding, had no influence on intake and performance when included with meat and bone meal in complete rations.

An interesting observation on the use of soybeans was conducted. The value of cooking was confirmed and further trials will be undertaken.

Fish meal, produced in Brisbane, was compared with the imported product and with Q.M.I.B. meat and bone meal as a protein supplement. Results indicated that the local fish meal compared favourably and both sources were superior to meat and bone meal.

A small observation on the performance of bacon pigs fed only once daily suggested, by the satisfactory results, that this practice should be further investigated.

GENERAL

For the second year in succession, pig population and total production for 1963-64 were below the previous figures. Grain harvests in a number of major pig-raising areas have been inadequate for intended pig production for a few seasons, and due to continued dry weather there were actual feed shortages by the autumn. Purchasing of large quantities of Queensland feed grains by New South Wales buyers at prices above local levels also reduced the grain stocks available to pig raisers, and increased prices.

In all areas but those most favoured by rainfall, feed shortages caused reductions in breeding stock numbers on many farms.

The steady increase in pig raising throughout the grain growing areas evident in the past few years was halted by the poor sorghum crop; this year production in such areas as central Queensland will probably be lower than for the previous year.

The favourable pig and feed prices early in the year again enabled many producers to continue the widespread trend to provide better housing and stock in piggeries. There has been a very strong demand for purebred breeding stock to replace poor types. New piggeries, both large and small, became common sights. Interest was concentrated chiefly on labour saving designs; manure disposal methods and slatted floors attracted most attention.

There was an increase in the amount purchased of ready mixed proprietary feeds and pre-mixes, but this in turn brought additional work for extension officers. A number of complaints regarding poor results following use of some of these feeds revealed nutritional problems, mainly parakeratosis, particularly when the major portion of the protein was derived from meat and bone meal in the mixtures.

The quality of most meat and bone meals again was below requirements for satisfactory growth when used as the sole source of animal protein in feed. In addition to slow growth and parakeratosis there were also many instances of scouring in pigs of all ages which ceased when meat and bone meal was replaced in their rations.

Imported fish meals proved far superior to meat and bone meals in feeding trials and on farms. Producers complained of shortages and irregular supplies. Branch enquiries revealed that importers would be able to meet demands if farmers and retailers placed firm orders in advance.

The staff blood sampled more than 150 purebred pig herds for the annual Brucellosis-free herd check. Almost all the registered studs in the State are certified Brucellosis-free herds.

A number of Local Government bodies altered their by-laws to permit greater control of pig raising in their areas.

The attitude of bankers towards the lending of monies for pig-raising ventures appears to be undergoing a change towards more favourable consideration of such propositions. Many producers in the past could not effect improvements from profits, and could not increase profits because loans for necessary improvements were not generally available.

POULTRY SECTION

EGG PRODUCTION

Egg production in south-eastern Queensland, as measured by intake at the Egg Marketing Board, rose by an estimated 8 per cent. as compared with production for 1962-63. Queensland is now third to N.S.W. and Victoria as a Commonwealth egg producer. Despite increased production, the economic situation for the commercial egg industry remained favourable with producers enjoying a higher than usual net return. This was due to available markets in N.S.W. and Victoria for Queensland's increased autumn and winter production. The establishment of a market for Queensland eggs in the Northern Territory and the guarantee of a continuous supply by refrigerated road transport from Brisbane to Darwin have meant another relatively good outlet for Queensland eggs. Now that production in N.S.W. and Victoria is once again rising, it is likely that producers in south-eastern Queensland will have to accept a lower net return in the coming year.

In central Queensland, production was 10 per cent. higher than in the previous year and the Central Queensland Egg Marketing Board at Rockhampton may be faced with a serious problem of over-production. It is possible that the present dry conditions in the Callide Valley area may result in a cut back in production due to shortage of home produced grain. At the same time, it is felt that any drop in production in the sorghum growing areas may be offset by more intensive development close to Rockhampton. In the past 18 months, laying cage plants have been established on the fringe of the city area.

Production in north Queensland was similar to that for the previous year. Further expansion in this area is unlikely as any further demand for eggs could be easily met from central and south Queensland.

TABLE POULTRY PRODUCTION

Only in the Brisbane metropolitan area was there any marked increase in broiler (table chicken) production, where the number processed was 43·8 per cent. higher than in 1962-63. Much of this expansion was due to one major broiler producing company in the Brisbane area which now produces almost half of the broilers grown in Queensland. It is of interest to record that Queensland is now a big supplier of broilers to other States including South Australia.

The system of growing broilers on contract to a processing firm is now well established with well over 70 per cent. of all broilers being produced in this way. During the year under review, the basic price paid to broiler growers was reduced and in some cases food prices were increased. This resulted in a lower average return to some broiler growers. Interest in duck and turkey production continued with significant increases being noted in the numbers being processed as compared with those in 1962-63. Details of poultry slaughtered in the Brisbane–Gold Coast area appear in the report of the Veterinary Services Branch.

DAY-OLD CHICK PRODUCTION

The total number of chickens hatched in Queensland in 1963 was 11,416,989; the number sexed was 4,637,928 and was almost 8 per cent. higher than for 1962; 8,123,127 chickens were supplied to broiler growers by registered hatcheries and most of these were synthetic meat breeds. Sales of day-old chickens interstate (mainly N.S.W.) amounted to 222,263 and a further 156,691 were exported overseas mainly to New Guinea and Malaysia.

POULTRY ADVISORY BOARD

This Board met on four occasions. Items considered included the amount of precept to be levied on Egg Marketing Boards, proposed regulations for the grading and marking of eggs according to grade and the manufacture of egg pulp, the practicability of the application of quarantine restrictions to limit the spread of certain poultry diseases and suggestions for revision of certain sections of the Poultry Industry Acts to provide for a tighter control over poultry dealers. The Board also recommended to the Minister the formation of random sample test committees for both the layer and broiler tests to act as committees of review with regard to the rules and the conduct of the tests.

STOCK SUPPLIERS

During the year, 30 stock suppliers registered under the Poultry Industry Acts did not renew their registrations. These included 15 engaged in hatching chickens for sale, 9 supplying fowl eggs for hatching, and 6 poultry dealers. There were 11 new registrations for hatching chickens for sale, 10 for supplying fowl eggs for hatching, and 5 for poultry dealers. The number of registered stock suppliers now stands at 163.

EGG QUALITY INVESTIGATION

(a) Farm Survey of Husbandry Practices

In order to provide the Egg Quality Committee—a group representing the Department, the Egg Marketing Board, and the Egg Marketing Board Suppliers' Organisation—with factual information on the range in conditions met on farms which could have an important bearing on maintenance of quality, a survey was conducted by officers of the Branch. This covered approximately 10 per cent. of the farms in four of the five Egg Board districts. The results obtained indicate that there is no simple way to improve egg quality. Very few of the farms in the survey provided ideal conditions for promotion of quality. As a first step it is considered very necessary that proper egg holding facilities with cooling devices be installed on farms. The matter of road transport of eggs in uncovered vehicles particularly in summer time warrants further investigation.

(b) Long Term Storage of Washed Eggs

Two experiments on long-term storage of eggs washed at 120 deg. F. for 5 min. in a detergent-sanitizer solution were concluded. In both experiments, eggs from three commercial sources were used, the only difference being that the eggs used in the second trial were oiled "washed" eggs which were compared with "unwashed" eggs after 3 and 6 months of storage at approximately 32 deg. F. and 75 per cent. relative humidity respectively.

"Washed" eggs had significantly better internal quality (as measured in terms of Haugh units) than the "unwashed" after 6 months of storage. Oiling of eggs eliminated this difference which was not so noticeable at 3 months of storage.

It was noted also that "washed" eggs tended to lose more weight as compared with "unwashed" eggs over the storage period but that this loss could be eliminated by oiling both "washed" and "unwashed" eggs.

RANDOM SAMPLE TESTING

Egg Production

The Layer Random Sample Test No. 6 was completed in November, 1963. This was the first test in which breeders were allowed to enter commercially available stock. The control was a White Leghorn supplied from a random bred flock at the C.S.I.R.O. Poultry Research Centre, Werribee, Victoria. Twelve entries were first crosses between White Leghorns and Australorps, one was a White Leghorn strain cross, and the other an Australorp pure bred.

Certain husbandry changes were made for this test, namely reformulation of all rations to be more akin to modern "high energy feeds" and the use of early morning electric lighting from March onwards to assist in maintaining winter production. Included in this test were a number of Queensland hatcheries operating under a franchise arrangement with parent breeding organisations in New South Wales.

The results obtained were very gratifying and were considerably better than those obtained in previous years. At least seven entrants' samples produced more than 200 eggs per bird on a "hen day" basis during the 49-week period of the test. The only disturbing feature of the test was the higher than usual adult deaths which in previous years were about 11 per cent. In this test adult deaths were 17·13 per cent. Leucosis in its various forms was the biggest single "killer".

Layer Random Sample Test No. 7 is now in progress. However, it was marred during the early laying stages by a series of outbreaks of intestinal coccidiosis which caused heavy losses in some groups despite medication.

Broiler Random Sample Test

The results of the preliminary broiler test showed the marked superiority of meat-type chickens over the "crossbred" control derived from mating egg-type breeds. Statistical analyses of the results established significant differences between entrants for body weight, food conversion, profitability, and evisceration loss.

A broiler test commenced in January with the collection of hatching eggs. The average hatchability in this test was 61·5 per cent. as compared with 73·8 per cent. in the preliminary test. The lack of adequate egg holding facilities on some hatcheries during a period of high temperatures no doubt contributed to the poor hatchability. Another factor was the lowered fertility due to the age of the birds (a considerable number of hens were approaching the close of their first year laying cycle) and climatic conditions.

The results obtained were similar to those from the preliminary trial and suggest that an expected average weight of 3·2 lb. per broiler with a feed conversion ratio of 2·5 at 10 weeks of age can be expected using meat-type chickens aided by good management.

A further test was scheduled to begin in April, but an incubation failure at the nineteenth day of hatching forced the abandonment of this test.

RESEARCH

In order to evaluate the importance of date of hatch and age of bird on internal quality, a large-scale investigation involving some 791 Australorp layers was commenced. The stock for this investigation were obtained from six consecutive monthly hatches during March to August from pedigree mating pens in which 10 males were each mated to 12 females. This enabled comparisons to be made between full sisters in different hatches.

Internal quality was assessed by breaking out the first three eggs laid by each bird during a 4 weekly period. One egg was broken out within 24 hours of collection, a second egg was held at room temperature for 1 week to simulate the environmental conditions which generally occur during handling and retailing. A third egg was held in the air conditioned cool room for 1 week within a temperature range of 56 to 60 deg. F. and relative humidity of 75 to 80 per cent. In all, some 13,000 eggs were individually broken out for internal quality assessment.

This experiment was concluded at the end of May but because of the wealth of detail involved it has not been possible to present the data obtained at this stage. However, a comparison of the internal quality value of the earliest (March) and the last (July) hatches suggests that there is an adverse effect on internal quality due to age and that this effect appears to be accelerated during periods of high temperature. When a comparison is made between eggs broken out within 24 hours of laying and those held at room temperature for 1 week, it is obvious that there is a very significant difference in Haugh unit value irrespective of the season.

EXTENSION

The overall staff position was severely affected by the resignation of two officers, one of whom was a graduate. With increased blood-testing commitments for pullorum disease control and reduced staff, extension work suffered somewhat by comparison with previous years. Officers did, however, keep up with Departmental obligations for articles for the *Queensland Agricultural Journal* and for tape recordings. The second annual Poultry Industry Field Day to be held in May of this year was deferred until September to avoid clashing with the Australasian Poultry Convention which was held under the auspices of the Australian Branch of the World's Poultry Science Association towards the end of May at Surfers Paradise.

PULLORUM TESTING AND ACCREDITATION

The pullorum testing figures for the year are set out. An increase is noted in the number of birds tested. However, this is not all due to flock expansion. In three cases repeated retesting had to be carried out on large flocks where numbers of positive reactors occurred. There is a tendency as the State percentage of reactors falls for hatcheries to become rather complacent and even question the value of annual testing.

However, the experience of a few very large hatcheries during the year under review illustrates the serious nature of this disease and how ruinous it could be for a business. With the development of large supply flocks and all year round hatching, pullorum disease presents a serious eradication problem and adds to the work of poultry officers. In two of the three outbreaks involved, day-old chickens were derived from a well-known poultry breeding organisation in New South Wales.

—	1961–62	1962–63	1963–64
Total number of fowls tested	300,343	309,700	369,381
Number tested for registered stock suppliers	290,297	307,100	360,128
Number of registered Stock Suppliers' flocks tested	108	109	108
Number of flocks with no reaction at test ..	75	86	81
Percentage reaction for State	0·11	0·05	0·13

The number of Stock Suppliers accorded "Pullorum Free" accredited status for their flock or associated hatcheries for 1963 was 45, while a further 29 were granted a "Pullorum Clean" classification.

DIVISION OF DAIRYING

LOCAL AND OVERSEAS SALES

Perhaps the most noteworthy feature of the dairy industry was the dramatic change in the situation affecting the disposal of the exportable surplus of Australian butter and cheese. There was, early in the year, growing concern over the availability of adequate cold storage for stocks of butter and cheese for which markets were not in sight, and action was being considered to curtail cheese manufacture by 10 per cent. However, adverse seasonal conditions in Europe and other factors resulted in the complete clearing of stocks which had accumulated in recent years, and at the close of the year the industry was straining to fulfil its export obligation.

A distinctively Australian brand of butter was placed on the United Kingdom market for the first time. This action was taken by the Australian Dairy Produce Board with a view to building up a favourable image of Australian butter and to increasing sales. Only top quality butter is selected for this trade.

Further important developments took place in the efforts of the Australian dairying industry, spearheaded by the Australian Dairy Produce Board, to develop alternative markets and thus to minimise the problems connected with the former heavy dependence on the United Kingdom market. The success of these efforts is exemplified by the increase in sales of Australian cheese in Japan; the exports this year will be nearly 3,000 tons compared with 40 tons in 1957. In other south-east Asian countries, the establishment of recombined milk product factories is expanding due to joint business ventures of the Australian Dairy Produce Board and local enterprise.

SEASONAL CONDITIONS

Seasonal conditions for the dairy industry were patchy; in the south-east corner they were generally better than average. In most districts except the North Burnett and central Queensland, production was maintained at a satisfactory level during the first half of the year. In the latter half, however, below average rainfalls were mostly recorded and central Queensland was drought-affected. Despite these variable conditions, butter production fell by only 1,090 tons below that of the previous year and cheese production declined by 709 tons. The percentage of choice butter was slightly lower, while cheese quality was well maintained.

CHANGE IN PAYMENT FOR CREAM

A fundamental change in the system of payment for cream supplies at butter factories was decided on by the industry and will take effect from July 1, 1964. It will be to replace the commercial butter method by payment for butterfat. This will bring the Queensland industry into line with that in the southern States and overseas, and it will also mean that all milk or cream used for manufacturing purposes will be purchased on the same basis. The primary reason for the change was because the Commonwealth Government bounty is now being distributed solely for butterfat, a decision taken to meet new manufacturing processes within the industry. A considerable amount of preliminary work was done by Divisional officers in preparing the industry for the changeover.

DIVERSIFICATION

Diversification of the types of products made in Queensland dairy produce factories is continuing at a steady rate, and it is clear from Divisional research and the developmental programmes in factories under the supervision of officers that there are no insurmountable problems connected with the manufacture of many types of products not hitherto produced in Queensland.

OVERSEAS QUALITY REQUIREMENTS

In view of the exacting quality, hygienic and chemical standards which are being demanded by some new markets, the activities of the Division of Dairying have been strongly directed towards improvement of product quality both on farms and in the factories. The promising results which are being achieved by the export promotional activities of the Australian Dairy Produce Board can only continue to succeed if strongly supported by research and extension, and in this connection the Division's technical assistance can be expected to be increasingly sought. The recruitment of four graduates to the staff of the Field Services Branch during the year was thus most opportune in enabling the Division to fulfil the growing demand for specialist technical assistance.

RESEARCH

The research activities of the Division are receiving strong monetary support from the Australian Dairy Produce Board. A notable achievement was the development of a process to remove weed taint from butter oil, and this work is now being extended to the processing of cream with a view to eliminating or at least minimising weed taint in butter. Some progress has also been made on studies on farm aspects of weed control which will be the ultimate solution to the problem. A flavoured milk concentrate which was successfully developed is now being marketed throughout Australia by commercial interests, and many dairy associations are also producing similar type products which are competing for consumer preference against other beverages.

Similarly, several dairy companies are marketing new varieties of cheese as a result of research on their manufacture under Queensland conditions.

Another important phase of Divisional activities is the laboratory quality control scheme. Further extension of this work will be necessary to fulfil the demands for export products to be accompanied by official laboratory certificates.

MILKING MACHINE IMPROVEMENTS

Traces of base metals seriously impair the keeping quality of dairy products in cold storage. During recent years most factory equipment has been replaced by that fabricated from stainless steel and some progress has been made with the use of this metal for milking machines, particularly pipe lines. During the year, completely stainless steel components for most parts of milking machines became available at prices not appreciably higher than for tinned brass. However, the replacement of milking machines already on farms by the improved machines must be a long-term objective.

NEW FACTORIES

A large modern factory was constructed in Brisbane by Norco Co-operative Limited. Initially it will be mainly engaged in the manufacture of ice cream and similar products. A milk pasteurisation section was added by the Caboolture Co-operative Association for supplying milk to Redcliffe, Caboolture and environs.

The Director of Dairying contributed a chapter for the monograph "Milk Hygiene" published by the World Health Organisation. The object of the book, editions of which were printed in several languages, is to deal with the subject authoritatively for countries of very different climatic and technological conditions. He also attended as an Australian delegate the annual meeting of the International Dairying Federation in New Zealand.

FIELD SERVICES BRANCH

The Branch continued to give aid to the industry in the way of technological guidance both on farms and in factories, and at the same time carried out its work of implementing the legislation with which it is entrusted. In addition, the tempo of extension work was stepped up in an endeavour to narrow the gap between knowledge and application of practices leading to industry improvement.

FIELD SURVEYS AND INVESTIGATIONS

Abnormal Milk Survey.—An assessment of the importance of abnormal milk, including mastitis milk, is of great importance to the dairying industry, yet little information is available insofar as Queensland, or Australia, is concerned. For this reason, a major survey is being carried out to study and demonstrate the importance of the problem and its relationship to the large number of factors considered to be involved. The Rapid Mastitis Test (Californian Mastitis Test) which depends on abnormal cell content of milk is being used in this work.

A preliminary pilot survey to evaluate the Rapid Mastitis Test was completed. Each month, samples of milk were examined by this test, examined for cell count, and when abnormal, for the presence of mastitis organisms.

Analysis of the results with 5,245 samples showed a high level of correlation between the mastitis test reading and cell count ($r \doteq \cdot 82$, significant at the ·002 per cent. level). Furthermore, the results showed that 6·6 per cent. of samples with abnormally high cell counts were not picked up by the mastitis test and only 2·6 per cent. of samples showing abnormality by the mastitis test were not discerned by cell counts. Averages of cell counts for each rating under the mastitis test were also calculated.

Results were available for the completed lactations of more than 300 cows and were examined to study changes in the mastitis test rating brought about by physiological abnormality late in lactation as distinct from those due to mastitis.

The work thus far confirms the efficacy of the mastitis test as a criterion of milk abnormality to a degree sufficient to warrant its use on the much wider scale involved in the major work.

Copper Contamination of Dairy Products.—Much importance is now being placed on reducing the contamination of copper in dairy products and thus minimising the spoilage caused by traces of this metal.

While dairy factories have been most active in recent years in replacing copper and brass equipment with stainless steel, some factories still experience degradings of milk due to copper-induced oxidisation. A survey is now being undertaken in all butter factories to determine the amount of copper and copper alloy equipment still remaining.

Survey of Dairy Farm Incomes.—A survey of the income from dairy products received by dairy farmers throughout the State was made by obtaining the pay-out data in various income groupings from dairy factories for the years 1952-53 to 1962-63. This work was done in order to study trends within the industry which relate to various practices in the many dairying districts. Data were obtained in respect to nearly 15,000 farms, accounting for approximately 94 per cent. of the total number of commercial dairy farms. In some instances split incomes occurred where farmers supplied more than one factory, but these were ignored because they could not affect the overall result.

The data are summarised in the following tables.

TABLE 1

TOTAL FACTORY PAY AND AVERAGE GROSS INCOME PER FARMER

Factory Group	Total Pay 1962–63	Number of Suppliers	Gross Income in Excess of £1,500 p.a.		Average Income 1962–63
			Number	Percentage	
	£				£
29 butter factories ..	10,476,868	7,941	2,444	31	1,319
7 cheese factories also with milk quotas ..	2,152,651	896	589	66	2,403
8 cheese factories. No market milk ..	796,698	369	220	60	2,159
4 milk factories ..	3,041,894	999	735	74	3,045
1 milk products ..	692,366	479	161	34	1,445
10 butter and milk factories	4,831,338	3,051	1,142	37	1,584
Two Dairy Assns. handling butter, cheese and milk from which a break-up in income could not be obtained ..	1,528,260	1,152	310	27	1,327

TABLE 2

AVERAGE PERCENTAGE CHANGE FROM 1952-53 TO 1962-63

—	No. of Suppliers	Production	Final Average Price	Total Payout	Average Income
29 butter factories ..	−24	−22	−8	−28	−5
7 cheese factories with milk quotas	+30	+50	+2	+50	+21
8 cheese factories—no milk quotas	−2	+41	−6	+20	+10
4 milk factories	+6	+111	+9	+118	+122
1 milk products	+726	+3,143	−8	+556	−21
10 butter and milk factories	−25	+20	+3	+32	+51
Two other Associations ..	−22	−16	−4	+3	+34

In some respects, the accuracy of taking average of percentages as has been done in Table 2 is open to question, but it is felt that should some inaccuracy have been incurred the overall trend revealed is valid.

Whilst these incomes relate solely to payment received for dairy produce, the value and importance of subsidiary avenues of farm income cannot be ignored in assessing the relationship of the data to farmer prosperity. The data are being further examined to discern any changes of importance from district to district and from one factory to another.

Farm Bulk Milk.—Farm refrigerated milk storage and collection by tanker is now operating in five main dairying districts. During early 1964, a survey of bulk units on 68 of the 86 farms was undertaken by field officers. Electricity consumption studies were undertaken on 11 units. Results to date indicate electricity consumption rates ranging from 0·04 to 0·23 units per gal. The influence of location of the compressor unit, atmospheric conditions, final milk temperature and milk loading are being examined.

Operation of the tank units was satisfactory although some farm bulk refrigerated milks have possessed high counts of thermoduric organisms.

While interest in bulk farm milk has been expressed by a great number of individual producers in milk supply areas, only one factory has shown any intention of investigating the operation of this form of storage and collection.

Two farm-refrigerated tank units were tested for one manufacturing firm. These units were tested on the farm for structural details and cooling performance in accordance with the Standards Association of Australia Specification No. 46-1963.

Casein Whey Irrigation.—An investigation of pasture irrigation with hydrochloric acid casein whey in the Maleny district was commenced in 1963, and was continued in collaboration with the Agriculture and Agricultural Chemical Laboratory Branches. Significant increases were obtained in yield of green matter.

The casein whey was diluted 3–4:1 with wash water, and applied at the rate of approximately 12,000 gal. per acre at fortnightly intervals. At this level of dilution some evidence of chloride build-up in the soil was obtained. This, together with the pH of the soil, is being closely watched.

The initial 1 acre used for the trial has now been increased by the co-operating farmer to 14 acres to use the full output of factory whey.

Transport of Dairy Produce.—Because atmospheric conditions markedly influence the temperature of cheese and butter during transport by rail and road, a series of temperature recordings was carried out during hot weather on dairy produce arriving at the Hamilton cold stores. Altogether, 266 consignments of butter and 214 consignments of cheese were examined. The results indicate that a high percentage (67·7) of butter consignments arrived above 54 deg. F. and a high percentage (27·8) of cheese consignment above 64 deg. F. This is regarded as unsatisfactory and not in the best interests of surface condition and quality. Consequently steps are now being taken to effect an improvement.

Gravimetric Testing of Cream Supplies.—Investigations commenced in June, 1962, concerning payment of Commonwealth Government subsidy on a butterfat basis, and the testing of cream supplies by the gravimetric Babcock method were continued during the year. Two full-scale fat balance surveys were conducted at the Toowoomba Branch of the Downs Co-operative Dairy Association. Results indicated that a satisfactory balance could be established with the gravimetric method, and have provided useful information on over-run levels which can be expected.

Sire Surveying.—Surveys to determine the breeding worth of dairy bulls is one of the most important aspects of dairy herd improvement work. This work was continued in three phases, that is, in respect to bulls used in stud herds, bulls used in commercial herds, and in proving bulls used in artificial breeding.

This year the results of surveys of 93 bulls were published and distributed to stud and commercial dairymen. In cases where the "final" surveys have already been published, no further details are given. Of the 93 bulls, 49 had plus ratings and 44 minus ratings. Two outstanding bulls, both A.I.S., were revealed. "Tabbagong Royal Standard" in the final stage of the survey had a rating of + 137 and "Vuegon Esteem" in the preparatory stage had a + 76 rating. It would be advantageous to the dairying industry, and to stud breeders in particular, if semen from animals such as these could be stored for future use.

In commercial herds, 551 bulls were surveyed during the year; an increase of 37 over the previous period. The results indicate that 40 per cent. of the bulls were raising, 36 per cent. were maintaining and 24 per cent. were lowering production.

The proving of both A.I.S. and Jersey bulls used for artificial breeding continued in concentrated areas. The progeny artificially bred is production recorded when they come into profit and bulls are rated on the records. A preliminary rating is taken on the production for the first 180 days and a final assessment is made on the results of the 300 days period.

Effect of Length of Lactation on Production.—This survey was completed and material prepared for publication in the *Queensland Journal of Agricultural Science, Technical and Service Notes* and *Recording Notes.*

Lactation Curve Studies.—Work continued in the preparation of production curves according to month of production. This work is useful to extension workers in advising farmers on calving patterns to yield the maximum return. The West Moreton and South Burnett areas received concentrated study during the year.

Testing of Milk Meters.—The search continued for a suitable meter to record the production of each cow and thus obviate the weighing of milk during production recording. Two such meters were tested during the year, one of which shows sufficient accuracy to warrant further investigation.

Maturity Equivalent Factors.—To assist in improving the accuracy of sire and other surveys, investigations are being made into the possibility of establishing reliable maturity equivalent factors according to the age in years and months of the cow at calving. Such factors were previously available only for the age in years which for various reasons was unsatisfactory. The work so far has established fairly satisfactory correlations with A.I.S. breed.

QUALITY OF DAIRY PRODUCE

Adverse seasonal conditions in many districts resulted in a drop in overall dairy production during the year.

Butter production for the year was 35,366 tons which represents a fall of approximately 1,090 tons below that of the previous year. Of this production, 73·6 per cent. was submitted for grading and yielded slightly more than 49·47 per cent. choice and 42·08 per cent. first grade. This represents a slight fall of 1·78 per cent. in the percentage of choice butter following a slight rise during the previous year. This more or less static position in respect to butter quality irrespective of the work expended to improve it is most disheartening. It would appear obvious that a radical change in industry structure is necessary to bring about a desired change. No doubt the very small price margin of ½d. per lb. commercial butter between choice and first grade is insufficient to provide any incentive towards quality improvement.

On the other hand, the quality of cheese has remained satisfactorily high, 91·66 per cent. grading choice and first grade. The marked increase in cheese consignments to Japan and the rigid standards being imposed will almost certainly have a beneficial effect in raising quality further. The production of cheese was 9,492 tons which represents a fall of 709 tons below that of the previous year.

The quality of liquid milk for market trade was maintained at a satisfactory level by regular testing and follow-up advisory work.

DAIRY FARM FACILITIES

The supervision of dairy farms is an important function of the Branch, not only to maintain quality but also to assist in raising production efficiency. The number of dairy farms supervised fell approximately by a further 500 to 15,086, which reduction in numbers is of the same order as in the previous year. A total of 228 new dairy buildings was constructed and 483 premises renovated. These numbers are slightly lower than in the previous year and reflect the adverse seasons which were experienced in many districts. The Departmental design for the combined dairy building continues to be the most popular but some modifications are being incorporated to suit local circumstances. Herringbone bails are becoming more popular for large herds and there was increased construction of circular holding yards. An increasing number of buildings was constructed of clay or concrete bricks. Metal (tubular steel) bails are also gaining in popularity.

Dairy Farm Machinery.—Officers continued to give advice to dairy farmers on milking machines. cream separators and other dairying machinery. On farms, 1,112 milking machines were tested for efficiency of operation using special equipment at each centre. Only 7 per cent. of machines tested had no serious faults and 29 per cent. were corrected on the farms, sometimes by simple adjustment. The correct operation of milking machines may have a profound effect on efficient milking and the prevention of udder damage.

The introduction of stainless steel milking equipment, particularly milking machine components, is a most important new development and is being fostered in the interests of quality of dairy produce and industry economy. This development has been assisted by advances in technology making it possible to manufacture from stainless steel certain components which hitherto had been excluded because of high cost. The cost of most stainless steel components is now not very much greater than tinned brass and gun metal.

Nevertheless, milking equipment showing large areas of bare base metal is common on dairy farms and farmers are being persuaded to either replace bare brass equipment with stainless steel or have this equipment effectively coated with an approved coating such as tin. Manufacturers and agents of milking machines have been instructed that the portions of all new milking machines and all replacement parts which come in contact with milk are to be of stainless steel or other approved material or shall be properly coated with tin or tin-nickel. At the request of machinery merchants, checks are being made of milking machine components held in store. Batches which comply with the requirements are stamped while unsatisfactory items are returned to the manufacturer.

DAIRY FACTORIES

One new dairy factory was registered and commenced operations during the year. In addition a milk pasteurisation and bottling plant was commenced at an existing butter factory and a further factory diverted portion of its milk intake to cheese manufacture. Dairy Associations spent approximately £800,000 in expansion and in equipment installation and replacement.

The time is not far distant when wooden churns will cease to exist.

A further desirable trend in butter factories is the installation of butter loading equipment to transport butter from the churns to the mechanical packers. Officers were instructed to press for the adoption of such equipment.

HERD PRODUCTION RECORDING

Herd recording is regarded as the basis for improvement in production whether it be obtained through feeding, breeding or management. The information supplied by herd production recording shows any weaknesses in the existing methods and provides a means of evaluating any changes which may be introduced. It is unfortunate that lack of finance has precluded any expansion in herd recording in this State during the last 2 years. The position now is that some 8 per cent. only of Queensland farmers production record their herds but there are many more who would enter the scheme if additional groups could be formed.

A greater awareness of the benefit to be derived from herd recording has resulted in stabilisation of recording groups in the last few years. This is shown in the following table:

PERCENTAGE OF HERDS RECORDED FOR VARIOUS NUMBER OF YEARS

—	Herds Recorded from 1948–1960	Herds Under Test 1964
Under 1 year ..	..	17·2
1–2 years	38·2	17·0
2–3 years	26·3	12·9
3–4 years	11·4	8·8
4–5 years	8·3	9·7
Over 5 years ..	15·8	34·4

Pure Bred Production Recording.—Recording under this section is limited to cows registered in the various herd books and owned by a member of the appropriate herd society. The role of the stud breeder is an important one as he must supply the bull requirements of the industry. However, with the increasing use of artificial breeding, the demands for bulls must decrease and it is expected that the small stud herds will cease to exist.

During the year, 159 herds were recorded of which 15 were withdrawn. The withdrawals were mainly from the Central Burnett area due to adverse seasonal conditions. The total number of herds recorded represents approximately 16 per cent. of the registered herds in the State compared with 8 per cent. of all herds recorded under the group scheme.

Some outstanding yields were recorded. "Allanview Envy," an A.I.S. cow which calved for her third lactation at the age of 3 years and 11 months, gave 20,280 lb. milk and 1,024 lb. fat in 270 days, while "Sunny View Little Princess 30th" another A.I.S. cow gave 25,300 lb. milk and 966 lb. fat. These yields compare more than favourably with records in other parts of the world and are a tribute to the skill of the respective stud masters.

In the recorded herds, 4,059 cows completed recorded lactations of 270 days or less. The average yield per cow was 6,508 lb. milk and 281 lb. fat. The average test was 4·3 per cent.

Merit Stud Register.—A total of 18 herds qualified for the honour of being classed as "Merit Studs," compared with 16 last year.

Register of Merit for Dairy Cows.—The number of cows entered in the Register of Merit was 289.

There is a greater acceptance by commercial dairymen of the advantages to be gained by selecting bulls from Merit Register Cows.

Total Solids in Milk.—There is increasing interest in the solids content of milk, and the field testing of milk for solids was continued in a number of pure-bred herds.

Group Herd Recording.—Seasonal conditions during the year varied greatly from district to district. Northern and southern Queensland recorded fairly good seasons while central Queensland and parts of the Burnett experienced drought. Despite these conditions most of the groups have been maintained at full strength.

During the complete herd recording year, a total of 49,576 cows from 1,168 herds completed recorded lactations. The average fat content was 4·2 per cent., the average length of lactation was 253 days and the average yield per cow was 4,201 lb. of milk and 175 lb. of fat. It is interesting to note that for 1952-53 the average length of lactation was 210 days and the average yield of fat 150 lb.

Goat Recording.—During the year, goats from 5 herds were production recorded. A total of 24 goats completed recorded lactations of 270 days or less for an average yield of 1,610 lb. milk and 59 lb. fat. The average fat content was 3·7 per cent.

Calf Identification.—The value of identification of heifer calves is now being more widely appreciated by dairy farmers. It provides a positive identification of animals which is necessary for proving sires and for the identification or selection of cow families for breeding purposes. During the year, 10,170 calves in 731 herds were ear tattooed by Herd Recorders.

EXTENSION WORK

One of the most important aspects of work of the Branch is concerned with dairying extension aimed at the wider application of improved practices within the industry. In addition the greater part of the work involved in enforcing the various provisions of the Dairy Produce Acts is achieved by an extension approach.

Dairy Production.—The average production per cow in Queensland has not materially increased and it is very doubtful whether there has been any change in the average production per acre. The downward trend in the numbers of dairy farmers has not been accompanied by a corresponding fall in production, apart from that due to drought. What has happened is that a similar number of dairy cows are being milked by fewer owners. It is felt that this in itself is not entirely an undesirable trend and represents a process of consolidation within the industry which has resulted in an upward trend in the average income per farmer.

The most promising avenue of approach lies in the wider use of herd production recording. The average production in recorded herds has risen by nearly 25 per cent. since the inception of the herd recording scheme, most of the increase occurring in the last few years. The increased production has been achieved as a result of extension advice given to recording farmers by dairy field officers who are guided by officers of the Herd Recording Section.

An expanded extension manual was prepared during the year and issued to all field staff. This manual sets out the whole programme of work covering appropriate timing of visits to farmers, what should be discussed at each visit and the advice to be given. Recording farmers are divided into categories according to their advancement in herd recording, each category requiring a different approach.

As production improvement embodies a wide variety of farm practices such as cropping, pasture establishment, feeding programmes, management and husbandry, field staff co-operate with local officers of specialist branches in order to ensure that the widest possible coverage is given to farmers. A compendium of information is being prepared to assist in this aspect.

Work is also continuing to apply the lessons learnt on production recorded farms to those farms nearby which do not record. In many respects this has proved to be most difficult largely due to the fact that many farmers who do not production record their herds, not only have no yardstick to evaluate their farm practices, but also lack appreciation of the basic principles involved in raising production per cow. Until the gap is narrowed between existing knowledge and its application, little overall advancement can take place.

The drive to obtain improved feeding of dairy cattle has been severely hampered in many districts by drought. While there has been a marked increase in the number of farmers who have set down improved pastures, the overall acreage has fallen sharply. For similar reasons there has been a slight reduction in conservation of roughage as hay and silage and also in stored grains.

Quality Improvement.—Officers made more than 25,000 visits to farms in dealing with advisory and quality improvement work. In general, the hygiene on milk producing farms is noticeably better than on those supplying cream, because of the more rigid quality standards imposed.

Under Queensland's warm climatic conditions, the problem of cream quality following storage on the farm between deliveries is difficult and even minor faults in hygiene can be magnified. The wider use of farm refrigeration is having a beneficial effect where practised. While the number of refrigerators installed increased by 300 to a total of 3,921, this total is far from satisfactory (representing only one farmer in every four).

Officers of the Branch arranged 568 extension functions of all kinds which gave an aggregate attendance of more than 12,700 farmers. In addition, a similar number of office contacts was made with farmers. Considerable use was made of extension avenues involving the *Queensland Agricultural Journal,* pamphlets, press radio and television.

Dairy Extension Advisory Committees.—Branch officers continued to act as secretaries of these committees situated in the major dairying districts. The committees comprise members of the Queensland Dairymen's Organisation together with Departmental officers and assist in promoting extension work in their areas. They plan and carry out their own extension programmes.

The West Moreton Committee was active in forming Dairying Development Committees at Laidley, Boonah, Grantham and Ipswich and has already achieved marked success in raising cream quality and fostering improved practices in these areas.

A senior officer of the Branch completed a post graduate course in Agricultural Extension at the Queensland University. This officer is now engaged part-time in initiating community group activity in one district.

COMMONWEALTH DAIRY INDUSTRY EXTENSION GRANT

Funds provided by the Commonwealth Dairy Industry Extension Grant were used for herd production recording and associated surveys. They were also applied to demonstration of improved practices aimed at achieving improvement in production and quality. The number of these demonstrations was increased during the year. Commencing with 102, 33 were terminated and 56 new projects were commenced giving a total of 125 currently being run. Demonstrations featured rain grown and irrigated pasture, water harvesting, silage, fodder and grazing crops, plaster water tanks and farm refrigeration.

There was increased interest in improved raingrown pasture demonstrations. This was due mainly to the promise shown by some of the newer tropical legume species, which are expected to increase greatly the productivity of dairy pastures in the better rainfall districts along the coast. The number of pasture demonstrations was increased from 29 to 44 during the year. The success of these demonstrations in stimulating interest is shown by the response obtained in the Cooroy district where more than 1,000 acres were sown to tropical legume species during the year. Faster progress in this regard is hampered by the high cost of seed of many of the species but the position is steadily improving.

Water harvesting projects proved successful in the higher rainfall areas along the coast but did not prove a success in the drier inland. The situation was made more difficult due to recurrent drought. On one project the dam has not been filled since its completion eight years ago. Demonstrations of reinforced concrete plaster water tanks attracted interest in many areas due to their durability and cheapness.

Grant funds were also used to provide various extension aids and to prepare exhibits at the Royal National Exhibition and country shows. The exhibits, one featuring a model of a herringbone milking shed with circular cow yard, and the other a display of weeds, attracted much attention. A further small portable exhibit depicting the latest recommendations for udder cleaning, stimulation and milking techniques was constructed and shown at country shows and displays.

PUBLICATIONS

Three papers were prepared for publication in the *Queensland Journal of Agricultural Science,* and officers have contributed 17 advisory articles for publication in the *Queensland Agricultural Journal.* In addition, the Branch circulates *Recording Notes* each month and publishes the annual reports for both pure bred recording and sire surveys. Technical and Service Notes are prepared each quarter for distribution in the Dairying Division.

STAFF

Four graduates in Agricultural Science were appointed to the staff of the Branch. The appointment of these officers will enable field surveys and investigations to be proceeded with, and will provide for closer liaison of field and research staff with corresponding increase in technical efficiency. Two scientific cadets, two junior cadets, three field cadets and one field assistant were also appointed, while four officers resigned.

DAIRY RESEARCH BRANCH

Shortage of laboratory space continued to be a major problem. However, the construction of the new Dairy Research Laboratories and Pilot Plant at Hamilton is under way and when completed will greatly improve the position. Some relief was afforded by the completion of extensions to the Murgon Laboratory.

The research drive for a greater variety of milk products has gained momentum and as a result several Queensland factories have now been equipped to produce a wider range of products and to more effectively utilize the by-products of milk.

The production of weed-free butteroil following research has helped to extend markets. A cheap simple method for the manufacture of butteroil direct from cream has been evolved This process has the advantage of making oil particularly suitable for recombination with skim-milk powder for the production of recombined milk products.

Experimental and investigational work carried out in association with various dairy companies has led to the commercial manufacture of some half dozen different varieties of cheese.

Good progress has been made in finding uses for butterfat and milk protein in dairy foods other than butter and cheddar cheese. These new foods offer a means of providing alternative uses for dairy products. Several have been developed in liquid form and dry recombined mixes have also been produced.

With high standards of chemical and bacteriological quality now being demanded by overseas purchasers, the laboratory quality control services have assumed greater importance. Regular testing for the presence of staphylococci, coliform bacteria, total bacterial content, yeast and mould count, antibiotics and pesticides in dairy products is now routine.

A survey of pesticide residues in dairy produce showed a significant reduction in the quantity of such residues contained in Queensland butters over the past 12 months.

Cheese studies were concerned with aspects of delayed acid production in manufacture, surface defects in cheese, the identification of lipase enzymes in cheese and their activity. The influence of residual milk sugar on cheddar cheese quality was examined.

Some degree of mechanised manufacture with stirred curd varieties of cheese was further developed.

In the field of butter manufacture, two broad avenues were investigated. Firstly, the improvement of butter quality through improved cream production and ripening; this investigation was of a bacteriological and chemical nature. In the other field of research, attention was directed towards the removal of weed taints from dairy products during processing. The purification of butteroil from weed taint by chemical means and supercentrifugation has now been replaced with an ultra-high temperature heating device which has enabled an oil with superior flavour and quality to be produced. The process was also applied for the removal of weed taint from cream for buttermaking.

The establishment of factory laboratories for thermoduric testing has aided greatly in the further improvement of market milk quality and one association has initiated payment for quality on this test. Seventeen such laboratories now operate and have been built, fitted and equipped under the guidance of this Branch. Extension of these units for other routine chemical and bacteriological tests on dairy produce and factory water supplies has also taken place, with benefit to quality. In this regard, plans were completed for a new laboratory at Booval for the Queensland Farmers' Co-operative Dairy Association, and building has commenced. These forward steps indicate the desire of the dairying industry to raise quality in order to meet the requirements of new markets, particularly Japan and South-East Asia.

Work on the new Dairy Research Laboratories and Pilot Plant at Hamilton (to cost £219,000) is well-advanced and it is hoped to have the building completed before the end of 1965. Extensions to the dairy laboratory at Murgon were completed by the South Burnett Co-operative Dairy Association and the Department provided additional staff and equipment for chemical, bacteriological and technological investigations.

Plans were completed for the new laboratory at Malanda at an estimated cost of almost £30,000 and a suitable site located. In order to help in the expansion of technological services at the Murgon and Malanda laboratories, additional staff and equipment has been provided.

As a result of the chemical and bacteriological services provided the South Queensland Egg Marketing Board, the quality of pasteurised egg pulp for export has markedly improved. Compliance with proposed British standards for pasteurised egg pulp was also achieved. The use of the ∝ amylase test for pasteurised egg pulp was demonstrated.

Improved Butter Quality.—There is an urgent need for the further improvement of butter quality in Queensland and in this regard most of the work has been concerned with the investigation of the farm ripening of cream. This survey was designed to determine the reasons for degrading of cream from farms where conditions of hygiene appeared reasonably good.

Large numbers of spoilage organisms were isolated from ripened creams and associated with particular defects. A medium containing penicillin for the estimation of spoilage organisms was extensively investigated and the results of the work prepared for publication.

Creams stored at 40 deg. F. were frequently degraded or developed off odours. Many of these creams showed increased titratable acidity which was correlated with increased fatty acid values—some also showed high peroxide values. The nitrate reduction test was used to test cream samples for the presence of large numbers of spoilage organisms and results compared with counts of penicillin-resistant organisms and grade results suggested that a bacterial population of about 10 million was required before results of the bacterial growth became apparent.

Experiments were also commenced to investigate the chemical aspects of the oxidative deterioration of cream and to study the effect of the concentration of copper, ascorbic acid and bacterial growth on stability of the fat.

Weed Taint in Dairy Produce.—Each year, about 200,000 boxes (5,000 tons) or approximately 20 per cent. of Queensland butter submitted for grading are weed tainted. The taint is so objectionable in at least 100,000 boxes that degrading occurs.

Good progress has been made with research work on the removal of weed taint from butteroil and cream. Early research indicated that the weed-tainting substances could be removed with the addition of certain electrolytes, caustic soda, and sodium chloride or phosphoric acid followed by water-washing and supercentrifugation. In this regard, semi-commercial scale operations were initiated at the Butter Board with in-line dosing equipment. Whilst the process evolved for the Butter Board proved satisfactory in reducing weed taint it was considered that the process was too cumbersome for large-scale commercial operations. Accordingly, small-scale experiments were conducted without electrolytes using an ultra high temperature, low pressure, heating device. The success of these small-scale treatments has now been established. Trials on a commercial scale at 6,000 lb. per hour have been planned. The Australian Dairy Produce Board has provided £6,000 worth of equipment for use during the present weed season, to extend this research to the treatment of cream for buttermaking.

Research has continued into the alleviation of weed taint in milk and cream on the farm. In association with the Queensland University, the weed tainting principles have been investigated. The concentrations necessary for tainting, and the procedures for reducing such defects with well-fed cows, have been firmly established.

The effect of agronomic practices on weed population and density is also being examined in association with Agriculture Branch.

Influence of Preliminary Incubation on the Methylene Blue Results of Farm Refrigerated Milks.—The main bacteriological test for raw milk in Queensland is the methylene blue test—a standard of 4 hr. being prescribed for the decolourisation time. However, with advent of refrigeration on many farms, 99 per cent. of the raw milks pass the test regardless of the quality of milk and hygiene of production. It was therefore necessary to re-evaluate this test in order that the quality of refrigerated raw milk be more effectively revealed.

Samples of raw refrigerated milk were analysed bacteriologically for total bacterial, coliform, psychrophilic, casein digester, and thermoduric counts, both initially, and after storage overnight at 50, 60, and 70 deg. F. Methylene blue and nitrate reduction tests were performed. The relationship of the results of pre-incubation and post-incubation analyses were statistically examined.

A methylene blue reduction time of not less than 3 hr. when the milk sample had been incubated at 60 deg. F. for 24 hr. before testing provides a satisfactory standard for Queensland milk supplies.

New Dairy Foods.—Good progress has been made in finding uses for butterfat and non-fat milk solids in dairy foods other than butter and cheese. These new foods offer a means of reducing the dependence of the dairying industry on traditional products. In this regard, best use was made of the principles of recombination.

Following the successful development of recombined flavoured milk concentrates, cake frostings, toppings and fillings in liquid form last year, efforts were made to develop similar products as dry-mixes. Several promising batches of these products have been made in laboratory-scale trials, and all show improved keeping quality.

A consumer survey with the dry recombined cake topping indicated a better than 80 per cent. preference for this product. Keeping quality trials are continuing.

Already one commercial firm is distributing a dry recombined flavoured milk-mix to other States and consideration is now being given to its export.

Preliminary work was carried out to produce a suitably flavoured milk tablet which rapidly dissolves in water, and laboratory-scale equipment is now being designed for this purpose.

Work has continued on the development of a savoury spread using a neutral protein base such as cottage cheese.

A new conception of ice cream with miniature "flavour-buds" within the structure of the ice cream itself is also in the early stages of development. The structure of the product gives a smooth-textured ice cream but the flavour is experienced as an intermittent sensation.

Delayed Acid Development in Cheese Manufacture.—This problem is of the greatest importance in cheese manufacture and is directly related to abnormal cheese ripening and flavour defects. Survey work continued at various cheese factories concerning the problem. A significant advance was made in that it has been possible to link low grades, particularly those caused by the fermented flavour defect, with the presence of antibiotics and bacteriophage. It was shown that there was a dramatic disappearance of the starter early in ripening. Identification of the off-flavour substances and the bacteria responsible is continuing together with a study of the conditions favouring the development of this defect. Work is also proceeding in an attempt to relate the presence of different species of the various genera (*Lactobacillus, Pediococcus, Microbacterium, Micrococcus, Leuconostoc*) with good or bad flavoured cheese. Preliminary investigations were begun to evaluate the importance of starter cultures with inhibitory properties in determining subsequent cheese quality. The antibiotic produced by one starter culture D.R.C.I. has been extracted and partially purified. The possible effects of mutant starter populations as a result of bacteriophage or antibiotic action is also receiving attention.

The rate of lactose utilization in cheese is being examined in regard to the die-out of the starter and the effect on cheese quality.

New Cheese Varieties.—The continuing high volume of imports of non-cheddar cheese has increased the need for the development of methods whereby such cheeses can be produced locally. Guidance and control work to manufacturers in Queensland continued, particularly with such varieties as Gouda, Edam, Friesian, Leiden and Blue Vein which are being commercially manufactured. Cheshire, Feta, Danish Danbo type (Felbo), and a Romano type grating cheese are being studied to obtain information for commercial production.

Studies of the mechanisation and improvement of production of Stirred Curd cheese enabled smaller factories to gain the benefits of mechanisation of cheesemaking.

There was a continuance of commercial production of high quality Blue Vein cheese from heat-treated milk. An assessment is being made of the separate influences of changed milk composition (resulting in altered curd tension) and higher cheese holding temperatures, which may result from higher atmospheric temperatures.

Equipment was designed for the manufacture of Cheshire cheese and manufacturing trials commenced.

The lack of a genuine grating cheese among the varieties manufactured in Queensland has led to the commencement of experimental production of a Romano type cheese. Experiments aim at determining the most satisfactory acidity level having regard to rapid flavour development and also grating qualities. Trials of the effect of a bacterial lipase preparation on flavour development were carried out and results are encouraging. Other enzymes for accelerating ripening are also being tried.

Interest in Feta cheese particularly in north Queensland areas prompted an investigation of this type. As Feta cheese is commonly made from raw milk and consumed after a short holding period there are problems relating to flavour development when pasteurised milk is used. *Leuconostoc citrovorum* cultures and a lipase preparation were used to improve the flavour.

Cheese Flavour.—Lipase enzymes are thought to play an important part in flavour development in cheese. Work has been concerned with the development of a method for estimating low concentrations of such enzymes. The method involves the use of a substrate labelled with the radioactive isotope C^{14}.

A knowledge of the source, chemical action and specificity of the enzymes will give a reasonably complete picture of fat breakdown in cheese and its contribution to cheese flavour.

Surface Defects in Cheese.—These still present a serious problem on overseas markets. The use of sorbic acid, a fungicide, to prevent mould growth on the surface of waxed cheese was investigated, but the acid added to cheese curd during manufacture did not give sufficient protection against mould growth. Attempts were therefore made to control mould growth by dipping the cheese in aqueous solutions of potassium sorbate prior to waxing. However, this method created problems with respect to drying of the cheese surface for waxing. Use of alcoholic solutions of sorbic acid gave a considerable decrease in mould growth. The application of the solution was easily effected and the method could be introduced into any factory with little expense or inconvenience.

Survey of Pesticides in Dairy Produce.—Overseas purchasers of Australian butterfat have expressed concern at the possible incidence of chlorinated hydrocarbons it contains. Consequently the Australian Agricultural Council requested that the matter be investigated and the importance of the problems assessed. With the use of gas chromotography equipment, it was possible to check accuracies of the methods already in use. Investigations of analytical procedures employing paper chromotography increased both the degree of accuracy of the results and also made possible their definition within limits acceptable to the authorities concerned.

Results showed that whereas chlorinated hydrocarbon residues in butter manufactured in 1962 ranged from less than 0·5 p.p.m. to 6 p.p.m., they had fallen by December, 1963, to a range of less than 0·1 p.p.m. to 2·3 p.p.m. More significant, however, is the fact that in over 90 per cent. of the samples representing butter made in 1963, the content residues did not exceed 1·0 p.p.m. and 74 per cent. actually contained less than 0·5 p.p.m. Thus, overall, there is evidence of an appreciable reduction of such residues during the past 12 months.

Keeping Quality of Pasteurised Market Cream.—Market cream offers an important outlet for the disposal of surplus butter fat, providing keeping quality standards are good. Unfortunately, the quality of market cream has been extremely variable. Work continues, with a view to determining a suitable keeping quality test for such a product.

Reduction of resazurin to the white end point at 37 deg. C. after K.Q. storage for 24 hours at 20 deg. C. was used. A reduction time of not less than 1½ hr. would be a suitable standard.

The resazurin reduction time at 37 deg. showed a significant correlation with the total bacterial count after K.Q. incubation, and most creams with a resazurin reduction time of less than 1½ hr. after K.Q. incubation were classified as unsatisfactory on the results of initial bacteriological tests for total count, psychrophylic count, and presence of coliform organisms.

Effectiveness of Detergent-Sanitizers for Cleaning and Sanitizing Dairy Equipment.—Bacterial contamination from dairy equipment is still responsible for at least one third of all degradings of dairy produce. Consequently, field trials and laboratory tests were conducted to determine the suitability of a quatenary ammonium detergent-sanitizer in cleaning and sanitizing milking machines and other dairy equipment.

Unlike the detergent and sanitizing agents commonly employed, the detergent-sanitizer is applied by a technique which does not require the use of a final rinse with boiling water. Bacteriological examinations of the milking machines on the farms taking part in these trials and of the milk produced, showed that provided the milking machines are maintained in a state of good repair and are regularly dismantled and thoroughly cleaned, the detergent-sanitizer is quite effective in controlling contaminating bacteria on dairy equipment and thus allowing milk of excellent bacteriological quality to be produced. The only detergent-sanitizers recommended for registration are those non-corrosive to metal and rubber, non-tainting in milk, and having satisfactory general detergent properties.

Milk and Cream Quality Improvement.—Cheaper farm refrigeration can further improve the quality of cream and butter in Queensland. Of 15 experimental units now operating, 8 were assembled from superseded domestic refrigerators for use on dairy farms. The "immersion" system of refrigeration was employed, using farm constructed insulated concrete tanks to hold the chilled water and provide storage for the cans of milk or cream. Costs varied from £30 to £35 for each cooling unit, plus a farm built tank not exceeding £30, giving overall capital costs below £65.

The correct use of a cheap dairy detergent combining sodium metasilicate and a wetting agent was demonstrated on 30 farms throughout Queensland with highly successful results. Trials commenced on another 30 farms using non-corrosive detergent-sanitizers which are permitted to remain in situ between milkings. This new method proved particularly effective in controlling thermoduric bacteria.

Other investigations included:

(*a*) The influence of salting to hooping time on the properties and composition of cheddar cheese.

(*b*) The application of an agglutination test for starters for cottage cheesemaking.

(*c*) The effect of freezing and frozen storage on cheddar cheese.

(*d*) The effect of clarification on the keeping quality of milk.

(*e*) The development of a cheap thermistor for freezing point estimations.

LABORATORY QUALITY CONTROL

With increasing demands by overseas countries for high quality dairy produce all laboratory quality control services were stepped up. As well as carrying out routine examinations and analyses of dairy products and the materials of production, investigations were made of specific farm or factory problems.

Butter.—Examinations of butter samples under the Butter Improvement Service were continued during the year to provide information for both control and advisory services. A total of 22,898 tests was performed on 3,228 samples at the Hamilton laboratory.

Chemical.—Moisture and salt determinations were carried out on 1,971 samples of butter of which 56 or 2·8 per cent. were found to be overmoist. This is rather alarming and is even higher than the 2·2 per cent. for the previous year. These figures indicate the need for greater control in this aspect of buttermaking. The average chemical composition of these bulk samples was: moisture 15·69 per cent.; salt 1·39 per cent.; curd 0·88 per cent.; fat 82·04 per cent.

pH determinations were performed on 1,145 samples, and the mean serum pH reading was 7·59. This is slightly lower than 7·67 obtained in the previous year but 16 per cent. had readings higher than 7·9 and 2 per cent. were less than 6·8. Providing the copper level in butter is low, it was shown there is no need to neutralize to a low acidity level in order to achieve good keeping quality.

Bacteriological.—The average Bacteriological Quality Index from 1,966 samples was 257, which represents a good standard.

Extraneous Matter.—This year, 2,434 samples of butter were examined for extraneous matter and 96·6 per cent. were found to conform to the desired standard.

Hygiene Quality Index.—This index gives an indication of the standard of hygiene as shown by extraneous matter and bacteriological quality. The figure of 354 out of a possible 400 was an improvement on previous years and shows a good standard of factory hygiene.

Microscopic Examination.—The standard of butter working in manufacture as judged microscopically by the size and distribution of moisture droplets continued to be good. Examination of 2,192 samples showed 94·5 per cent. classified as "well worked" or "fairly well worked."

In recent years there has been a considerable improvement in this aspect of butter manufacture.

Competition Butter.—In addition to routine samples, 186 butters were examined for chemical and bacteriological quality relating to competitions conducted by the Royal National Association and Australian Institute of Dairy Factory Managers and Secretaries.

Local Pat Butter.—Samples of butter for local sale were examined from various parts of the State and 197 samples were examined.

The results indicated a good standard of pat butter for local consumption.

Coliform Free Butter for Export to Japan.—Of 45 butters examined, 73 per cent. were found to be free of coliform organisms in a 2 g. sample.

Copper and Butter Quality.—In spite of the introduction of stainless steel in factory cream lines, vats and churns, cream and butter quality has still been affected by copper contamination from such sources as brass pumps, metal parts and wooden churns and water supplies.

Techniques for the more rapid estimation of copper in dairy products were introduced and estimations are now being made regularly to assess the incidence of copper contamination in milk, cream and butter.

Cheese.—The cheese industry has benefited from the various investigational and advisory services available. Cheese starter cultures were distributed to factories, occurrences of bacteriophage or other forms of starter contamination were investigated and milk and cheese quality surveys were carried out. Whilst the popularity of commercial mixed cultures has declined they are still used. The use of individual single strains continued at the larger factories in the State with good results. Their use enables a longer rotation of strains to avoid bacteriophage, particularly under the two-shift system of cheese manufacture.

With increased bacteriological services available, the advisory and survey work is aimed at improving the standard of hygiene at cheese factories. There is need for attaining the highest possible standard of hygiene to comply with the requirements of the newer export markets.

Advisory work relating to the special requirements of cheese intended for packaging in film in a rindless form was maintained, and the majority of factories now produce cheese for export in rindless form. Packaged rindless cheese is also replacing waxed cheese on the local market.

Whilst Cryovac bagging is still the most common method, interest is also increasing in the laminated film, pouch-pak method. Proper cleaning and treatment methods for pressing cloths for the production of rindless cheese were developed.

Advisory compositional standards for the moisture, fat, salt and pH of cheddar cheese were, in general, satisfactory.

Studies are also being made in relation to pH standards for cheeses of different ages.

Much advice was given for the manufacture of the already established non-cheddar varieties of cheese including Edam, Gouda, Blue Vein, Friesian, Leiden and other spiced or flavoured types. The setting of advisory compositional standards has been achieved for the main varieties and this has facilitated control which is essential in establishing manufacture of any new cheeses. The demand for "block" Gouda cheese in Japan has also prompted investigations of this type.

To ensure control of coliform organisms and staphylococci in cheese for special markets it was shown that more effective pasteurisation and reduction of post-pasteurisation contamination were essential. It was also shown that practically all cheese factory water supplies were bacteriologically unsuitable for use with rennet or other materials used in cheese manufacture without treatment.

Market Milk.—The number of tests conducted at milk receiving depots and in the Departmental laboratories was considerably greater than in previous years. Samples examined regularly in the laboratories included bottled pasteurised milk and cream, flavoured milks, empty capped bottles, raw tanker milks, milk from producer-vendors, smears from low methylene blue tests, raw milks for thermoduric tests, and raw milks examined for mastitis.

Over 300,000 methylene blue tests were carried out at milk receiving depots and only 1·4 per cent. of raw milk samples failed to reach the advisory standard of 4 hr. Microscopic examinations were made regularly of milks failing the methylene blue tests, and producers were advised of the probable cause of the low quality. The use of farm refrigeration of milk intended for the market milk trade is now very widespread, so that most milk below the methylene blue advisory standard is of low quality because of mastitis infection in the herd. The methylene blue test as normally carried out is not suitable for detecting poor production methods when the milk is refrigerated. This fact places greater emphasis on the need for regular thermoduric testing, and also on the desirability of introducing some form of preliminary incubation before the methylene blue test.

There was a very marked increase in the number of thermoduric tests conducted on raw milk supplies. The regular testing has brought about a considerable improvement in raw milk quality at some depots.

The number of samples of bulk tanker milk examined was much greater than in previous years. The amount of testing of tanker milk was increased as this milk now forms a large percentage of the Brisbane milk supply. Milk supplied by tankers from farm bulk refrigeration tanks in the Coomera area was tested regularly as well as tanker supplies from the receiving depots. Fortnightly testing of samples from raw milk vendors was continued.

The chemical composition of raw milk supplies was well maintained. Only 1·3 per cent. of samples did not comply with the 3·3 per cent. standard for fat. Of a total of 3,544 freezing point determinations made, 31 gave evidence of adulteration and were appropriately penalised.

Pasteurised Milk Quality.—During the year, 2,400 samples were tested for bacteriological quality and chemical composition. Less than 1 per cent. of samples failed the phosphatase test, showing that pasteurisation of milk was generally efficiently performed.

In spite of the increased amount of thermoduric testing of raw milk supplies, 69 per cent. of the samples of pasteurised milk had high bacterial counts. Several factories had consistently good results for total bacterial counts, but others were consistently high.

The results of coliform tests were considerably better than in the previous year. Only 18 per cent. of samples contained coliform organisms in 1 ml. compared with 27 per cent. last year. There was a slight increase in the percentage of samples failing the keeping quality test.

All samples of pasteurised milk were analysed for chemical composition. The average fat percentage was 3·9, slightly lower than in the previous year, and the average value for solids-not-fat was 8·7.

Several associations are now marketing flavoured milk drinks and samples were tested regularly for bacteriological quality and fat content. All samples were adequately heat-treated but a high percentage showed evidence of contamination in the carton or the bottle.

Pasteurised Cream Quality.—The regular testing of samples of whipping and dessert cream from Brisbane depots and of 35 per cent. cream from country factories continued during the year. There was a considerable improvement in the overall bacteriological quality of whipping and 35 per cent. cream, but many samples of dessert cream leave room for improvement.

Antibiotic Testing.—Disc assays for small amounts of penicillin are being performed regularly on raw milk supplies to milk receiving depots, and on all samples of pasteurised milk. Over 14,000 tests were carried out during the year. Positive results were given by 3 per cent. of samples.

The demand for fermented milks increased and cultures were supplied for such purposes.

In association with the Atomic Energy Weapons Test Safety Committee, the representative sampling of milk from a wide area of South-East Queensland continued so as to assess any variations in radioactive fall-out.

ANALYTICAL

Altogether, 10,737 samples were received in the chemical laboratories. They included milk, cream, butter, cheese, ice-cream, margarine, farm and factory waters, factory brines, detergents and chemical sterilants. The number of individual tests was about 18,500. There is a tendency by several associations to build, equip, and staff their own laboratories—an indication of the industry's increasing appreciation of the value of science in a more competitive world. Results of analyses for fat and solids-not-fat percentages in milk showed there is still room for improvement in the compositional quality of some milk supplies. With greater interest now being shown in these milk constitutents, producers will be compelled to comply with prescribed compositional standards. Maintaining a sound nutritional feeding level, particularly during the winter and early spring, is the main factor conducive to a satisfactory milk compositional standard.

The number of dairy thermometers tested was almost 10 times that for the previous year. Of 1,835 tested, 30 per cent. failed to qualify. However, during the final quarter of the year only 9·3 per cent. of thermometers proved unacceptable—an improved standard which it is hoped will be maintained.

With industry acceptance of butterfat testing in cream gravimetrically, dairying organisations requested investigations of this method and its suitability as compared with existing estimations volumetrically. Aspects of labour, time, equipment, accuracy and cost were examined in association with officers of the Field Services Branch. Suitable balances were considered and commencement and accurate sampling methods tried. Designs for testing laboratories were also prepared for factories.

PUBLICATIONS

Twenty-one research and advisory papers were prepared and 14 radio talks and 16 addresses given to various conferences, schools and dairy development committees. Press releases totalled 12.

DIVISION OF MARKETING

MARKETING

From the marketing point of view, 1963-64 was a satisfactory year. Production of most of the main commodities was high and export markets were maintained at a generally satisfactory level. The decision of the United Kingdom government not to join the European Common Market cleared away much of the uncertainty which overshadowed the previous year.

Deliveries to the State Wheat Board reached a record figure of over 20 million bus.

The export wheat market was again dominated by the large sales to Mainland China but there were also considerable sales to Russia. Exports were as follows—China 153,442 tons, Middle East 94,203 tons, Russia 79,827 tons, Rhodesia 9,500 tons and Japan 920 tons.

The barley crop was of a high quality but the Board was embarrassed by deliveries from growers being insufficient to fill the markets available.

Grain sorghum production suffered a setback from the severe drought conditions in central Queensland, and supplies were too small to allow of exports.

The sugar market continued to expand, and the favourable future prospects were reflected in the acceptance by the Government of the recommendations of the Sugar Committee of Inquiry, that an additional 150,000 acres assignment be granted to bring production up to a level of 2·13 m. tons of sugar by 1967-68.

Prices for fine wools reached their highest level for 6 years and the quantity of wool sold at Brisbane was also at a record level.

An agreement on meat import quotas was discussed with the Administration of the U.S.A. with a view to securing orderly marketing of Australian meat in that country.

Spot prices for choice butter in the U.K. were maintained at a level of 334s. stg. per cwt. There was an increase in the price for first grade Australian cheese from 226s. stg. per cwt. to 238s. stg. per cwt. These conditions were a direct result of the quota system introduced in the United Kingdom in the previous year.

The export trade in eggs was similar to the previous year and exports to the United Kingdom were again nearly all in the form of frozen liquid egg.

The production of vegetables for marketing in fresh form continued to increase, but markets were increasingly affected by the larger quantities and range of quick frozen vegetables available.

The introduction of bulk handling equipment at canneries contributed to the efficiency of the pineapple processing industry which absorbs some 80 per cent. of pineapple production.

Cold storage facilities were augmented to spread the marketing period for apples, but there is some doubt as to the ability of the industry to continue to recoup the increasing costs involved.

The Director of Marketing attended a conference concerning Industry Productivity convened by the Australian Institute of Management, and the Assistant Director was a member of the Queensland Government Trade Mission to Fiji. The Branch Senior Clerk acted as Assistant to the Secretary of the Sugar Committee of Inquiry, and accompanied the Committee on its investigations throughout the State.

The appointment of two graduates as Marketing Officers brought the professional staff complement back to its 1957 level.

Much more emphasis is now being placed on marketing research and investigation, and at the request of rural industry organisations several research projects were undertaken during the year.

AGRICULTURAL STANDARDS

Increasing general interest was shown by the seed trade and the agricultural and pastoral industries in improvements in seed quality, and the Seed Testing Laboratory carried out 16,301 tests, an increase of 908 tests over the previous year.

Investigations were continued towards developing accurate but speedier tests for grasses and legumes and this work was assisted by an increase in seed-testing staff and the allocation of glasshouse space for growing-on tests.

The Seed Testing Laboratory continued to play an important role in the Tropical and Subtropical Working Group established by the International Seed Testing Association.

There was a large increase in the export from Queensland of wheat and fruit and vegetables for which inspection services were provided by officers of Standards Branch on behalf of the Commonwealth Department of Primary Industry.

The quality of wheat exported was maintained, the outstanding features being the relatively high protein content, high bushel weight and low moisture content. The following table illustrates these points:

AVERAGE ANALYSIS OF QUEENSLAND WHEATS EXPORTED

Grade	Av. Protein	Av. Bus. Wt.	Av. Admixture	Av. Moisture	Tonnage
	Per cent.	lb.	lb.	Per cent.	
Qld. Q2A 1962–63 ..	10·3	66·25	0·16	11·8	13,573
Qld. Premium 1962–63	11·9	66·37	0·16	11·5	145,676
Qld. Q2A 1963–64 ..	10·3	66·95	0·17	11·9	75,963
Qld. Premium 1963–64	12·7	67·97	0·065	11·8	97,273

The sphere of influence of the Standards Branch was widened by the transfer to Toowoomba and Rockhampton of two inspectors responsible for the inspection of fruit and vegetables and agricultural requirements.

The staff situation in the Branch improved with the exception of the Agricultural Standards inspection section where vacancies exist as a result of staff resignations and transfers. Mr. R. L. Harty, an Agronomist, Agriculture Branch, was appointed Assistant Standards Officer following the appointment of Mr. A. Hegarty to Development Planning Branch.

ECONOMICS RESEARCH

The growing acceptance that primary producers are basically business men continued to make increasing demands on the Economics Research Branch and a great deal of this Branch's time was spent in fostering accounting and budgeting techniques through farm management training and liaison with public accountants. The Farm Management Accounting Groups operated by the Branch played an important role in developing this interest.

During the year, two major organisations, the Committee of Direction of Fruit Marketing and The Peanut Marketing Board, requested economic surveys of the deciduous fruit and peanut industries respectively.

The staff of the Branch was increased during the year by eight officers including four graduates. At the end of the year, 10 agricultural economists were stationed at Head Office and three at Toowoomba. Two of the new graduates received their university training under the scholarship scheme. One new scholarship in economics was awarded in 1964, and there are now three scholarship holders at the University of Queensland and two at the University of New England.

Two graduates were awarded postgraduate honours degrees during the year; eight other graduates are engaged in part-time postgraduate studies, and four other staff members are pursuing part-time undergraduate studies.

During the year, the Director of Economic Services was a member of the Atherton Tableland Investigation Committee and Chairman of the Joint Committee on Farm Management Accounting. He attended the Sheep and Wool Conference at Leura and a Conference of Practising Accountants in Agriculture at the University of New England, Armidale.

MARKETING BRANCH

MARKETING ORGANISATION

During the year, by Orders-in-Council issued under *"The Primary Producers' Organisation and Marketing Acts*, 1926 *to* 1962," alterations were made to the electoral districts of The Peanut and Tobacco Leaf Marketing Boards. There was an increase from three to five in the electoral districts of The Peanut Marketing Board, and the number of grower representatives was increased from four to six. In the case of The Tobacco Leaf Marketing Board, electorates were increased from three to four and representatives from six to eight. Subsequently, a by-election for The Peanut Marketing Board and the usual triennial election for The Tobacco Leaf Marketing Board were held.

By-elections were also held in the case of The Barley, Cotton, and Grain Sorghum Marketing Boards due to resignation of certain members.

The voting qualifications with respect to The Central Queensland Egg Marketing Board were amended to make them more appropriate to commercial egg producers. Further preliminary discussions took place on the question of amalgamation with The Egg Marketing Board and the possible reorganisation of egg marketing in Queensland which might become necessary upon the finalization of a Commonwealth-wide plan for stabilization of the egg industry.

Various amendments were made to the Hail Insurance Regulations of The Barley Marketing Board, and the annual sugar levies were prescribed by regulation.

The Fruit Marketing Organisation Acts were amended to transfer ownership and control of Northgate Cannery from the Committee of Direction of Fruit Marketing to The Cannery Board. A general revision was made of all regulations issued under these Acts.

Orders-in-Council were issued authorising the Brisbane Market Trust to raise finance from various sources, and the Trust was empowered to provide accommodation in the new markets for the Committee of Direction and the Queensland Chamber of Fruit and Vegetable Industries Co-operative Ltd.

MARKET RESEARCH

Numerous requests were received for research into marketing problems both from an industry point of view and on a regional basis. This aspect of the Branch's work is assuming an ever-increasing importance.

Market information was provided to the Atherton Tableland Investigation Committee, and also in connection with the Northern Australian Development Authority set up by the Commonwealth Government. A review was made of the general economic and marketing aspects of Queensland rural development, with particular reference to specific industries.

With the co-operation of field officers of production Branches, a survey was made of the availability of fodder supplies in the light of the severe drought prevailing in certain parts of the State.

Contact was made with navy bean growers and Departmental officers in the Burdekin, and a report made on the prospects of marketing navy beans grown in that area. A preliminary investigation was made of banana marketing, with particular attention to retail aspects and consumer preferences.

Information was compiled on conditions in primary industry in connection with discussions on the basic wage.

A most important aspect of all market surveys is that of population trends, and considerable progress was made in analysing population changes in Queensland since the war, as a basis for forecasting future trends.

MARKETING INTELLIGENCE SERVICES

Reports and forecasts published totalled 47, with a circulation of 31,000, an increase of 2,000 on the figure for 1962-63. "Grain Abstracts" and "Report on Production Trends" were published monthly. The latter report is forwarded to all Australian Trade Commissions, thus making it available in 36 oversea countries. "Report on Production Trends" is also circulated through all Australian States, and thus provides a wide distribution of information on the agricultural situation in Queensland. Following a request from the Department of Education, this report is now also supplied to those 17 State High Schools which conduct courses in agriculture.

Crop forecast reports were issued on winter grains (wheat, barley, oats, linseed and canary seed), summer grains (grain sorghum, maize, panicum and white French millet), peanuts, potatoes and onions. The quarterly report on the poultry industry in south-eastern Queensland was continued and provided statistical material adequate to meet the requests from local and interstate enquirers. The reports received wide newspaper and radio publicity during the year, particularly in relation to the record wheat crop harvested in November, 1963. The extent of the drought conditions in central Queensland was reflected in the fourth report on the 1964 grain sorghum crop.

The system of forecasting depends on the co-operation of honorary crop correspondents. These are farmers in the main growing areas so selected as to give an overall picture of crop progress at appropriate times. To maintain a continuous review of the situation and to ensure effective sampling through crop correspondents, officers of the Branch visited growers in the Dalby and North Downs districts, the Goondiwindi–Inglewood area, the Central Coast, and the Boyne Valley–Upper Burnett–Mary Valley areas.

An investigation was made of the summer grain situation in the Dawson–Callide district, and of the extent of the 1964 drought and its effect on associated primary production. The South Burnett district was visited to check the progress of the peanut harvest, and, at the same time, to assess the local feed grain position.

A research project was commenced to assess the effect of rainfall, at or before flowering, on yields per acre of grain crops. This effect, it is thought, may act as a guide to greater accuracy in crop forecasting.

MARKET REPORTING SERVICES

The Market Reporting Section continued to supply daily marketing information on prices realised for fruit, vegetables, other farm produce and fish, per medium of the radio and press. Comments were published, on a daily and weekly basis, on the supply position and quality of these commodities.

PRIMARY PRODUCERS' CO-OPERATIVE ASSOCIATIONS

Seven new co-operative associations were registered during the year under *"The Primary Producers' Co-operative Associations Acts,* 1923 *to* 1962." They comprised The Atherton Tableland Potatogrowers' Co-operative Association Limited and six co-operative artificial breeding associations formed by dairy farmers in the districts of Gympie, Gold Coast, Canungra, West Moreton, South Burnett and Laidley.

The formation of artificial breeding co-operatives has been the principal feature in the recent development of primary producer co-operation in Queensland. No less than 16 have been registered in the past 3 years, spread from the Atherton Tableland in the north to Warwick in the south.

Since the Acts were amended in 1962, six associations, by amending their rules, have taken advantage of the provisions which were designed to enable associations to protect themselves against the possibility of their business being disposed of without the express consent of their members by postal ballot.

ECONOMICS RESEARCH BRANCH

The year just completed was a significant one in this Branch's development. Good progress was made in training extension officers and farmers in management techniques, while improved liaison with the accountancy profession is achieving a wider adoption of farm accounting as a management tool.

An increasing proportion of the Branch's time is being devoted to State developmental projects. Economic data have been collected and analysed in connection with the planning of such projects as the Burnett River, Nogoa River and Gibber-Gunyah irrigation schemes, and the Cherbourg, Yarabah and Cape York Peninsula Settlements. Contributions were also made to Departmental reports on the development of Queensland, the development of Northern Australia and the dairy industry in Queensland.

Although these activities restricted, to some extent, the economic research programme, steady progress was also made in this direction. The major new project commenced during the year was an economic survey of the deciduous fruit growing industry in the Granite Belt.

Agricultural economics is a practical discipline, and for this Branch to make its maximum contribution to primary production in this State it is necessary that agricultural economists be appointed in all the major rural centres.

Shortage of staff makes this a long-term aim, but the first country branch opened at Toowoomba towards the end of last year was consolidated and expanded during the year. This centre has been established also as a training base for agricultural economists selected for posting to other centres.

RESEARCH

Wide Bay Dairy Study

The investigation into the economic implications of certain dairying practices in the Wide Bay Area continued throughout the year. Analysis of case-study data has been completed, and is now being processed into a series of reports on the various practices investigated. The second interim report in the series was published during the year. This dealt with the economic effects of adding irrigated pastures to those farms where it would be practicable.

Eastern Downs Dairy Study

A study somewhat similar to the Wide Bay work is being carried out on the Darling Downs.

A preliminary report was discussed with the Eastern Downs Dairy Extension Advisory Committee during the year, and the final report will be published next year.

The original aim of the study was to provide economic data to supplement extension advice. The establishment of a staff of Agricultural Economists in Toowoomba is to some extent a substitution for this aim, as these officers are available to conduct local investigations into specific problems which might be revealed in the report.

Atherton Tableland Fertilizer Study

This study into the economics of fertilizer application to pastures was based on the collection of mailed data from a sample of farmers for 12 months to be followed by a field survey.

Unfortunately only a small proportion of the farmers who had promised co-operation completed the year's records, and it was decided not to carry out the field survey, as the prospects of arriving at any conclusions would be too remote to warrant the time and expense involved.

Although it was not possible to come to any firm conclusions regarding the economics of fertilizer application to pastures, a report of limited value was compiled from the data provided.

Beef-Sheep Study

A joint study, in conjunction with Sheep and Wool, Agriculture and Cattle Husbandry Branches, was commenced into the economics of beef-sheep combinations in the Goondiwindi and Tara districts, and a pilot study of 11 properties was carried out. This will be followed by a more detailed investigation during the coming year.

Poultry Management Study

Since July, 1960, a continuous study in comparative farm analysis had been carried out with a small group of poultry farmers located in the vicinity of Brisbane, and a report analysing data collected for 1962-63 was published during the year.

This study has now been discontinued, and replaced by the formation of a Farm Management Accounting Group for poultry farmers.

Granite Belt Deciduous Fruit Growing Survey

With the financial support of the Deciduous Sectional Group Committee of the Committee of Direction of Fruit Marketing, an economic survey of the deciduous fruit growing industry in the Granite Belt was commenced. In general terms, the survey is designed to provide economic data which will assist growers and industry leaders in planning for the future.

Field work was carried out from September to November, when a random sample of 111 growers were interviewed. Information was collected in respect to income and expenses during the 3 years ended June 30, 1963, management and cultural practices on each farm, and growers' attitudes towards developments which are taking place in the industry.

These data are now being analysed and a report will be issued next year.

Peanut Industry Survey

During the latter part of the year, The Peanut Marketing Board requested that an economic survey be carried out of the Queensland peanut growing industry, and the Board undertook to make a contribution towards the expenses of conducting the survey.

Preliminary work was completed and it is expected that the survey will commence early next year.

Small Crops–Poultry Study

A study is being carried out on a farm in the Brisbane area which combines the growing of small crops and poultry raising. The object is to determine the combination of enterprises which will maximize the farmer's net income at given costs and prices.

From this study it is hoped to provide a preliminary guide to optimum small crop and poultry combinations for any given area of cultivation.

ECONOMIC SERVICES

Farm Management Accounting

Farm management accounting groups comprise a system of comparative accounting analysis, aimed at helping farmers in their business management, and also providing a continuous source of economic data for research. Co-operating farmers are assisted in keeping records, and are provided at the end of the financial year with a detailed analysis of their business operations, and a comparison with the averages of their group.

The service was started on July 1, 1962, with the co-operation of the South Burnett Dairy Extension Advisory Committee, and an analysis of the first year's operations was carried out during the year. The University of Queensland computer was used in this analysis.

Three new groups commenced recording in 1963-64, and at the end of the year there were over 100 farmers keeping records under this scheme. Interest in this work is high, but limited resources have made it necessary to reject requests to extend the scope of this activity in 1964-65.

Accounting Project—Grain Growers

The Branch is represented on the Queensland Grain Growers' Association Farm Economics Subcommittee, which has been working out a practicable scheme to assist grain growers in their farm management. The Darling Downs has been divided into 25 districts, and a sample of grain growers is being selected in each district. These growers will be required to keep certain records, and public accountants have agreed to co-operate by preparing annual management accounts in a standard form. Final processing is to be done by the Economics Research Branch, which will calculate average results for each district. The scheme will be in operation in five districts during next year.

The project will provide standards against which an individual grower will be able to compare his performance, and will furnish continuous economic data for those concerned with industry policy.

Accounting Standards

Negotiations with the accountancy profession culminated during the year in the formation of a joint committee on farm management accounting. The committee includes representatives of the Economics Research Branch, the professional accountancy and cost accountancy institutes and the University. The committee has been established to recommend uniform methods of management accounting for primary producers.

There is a rapidly growing interest in this subject and encouraging support is being received from other workers in the fields of accountancy and farm management throughout Australia.

Farm Management Training

Training of extension officers and farmers in business management techniques was stepped up during the year.

The Branch combined with Information Branch in a second Extension Supervision and Farm Management School for senior advisers in November. In addition, two district schools each of 4-5 days duration, and three shorter schools were conducted for extension officers in Warwick and Toowoomba, and there were three farmers' schools. In all, some school instruction in management techniques was imparted during the year to approximately 70 departmental extension officers, and 60 farmers.

Apart from schools conducted by the branch, addresses on farm management were delivered to schools organised by outside organisations and other branches of the Department.

At the request of the Education Department, a syllabus was prepared for the Farm Management Section of the Agricultural Junior course in State High Schools.

Extension

During the year, two A.B.C. Country Hour talks were delivered, nine 1-minute radio talks were recorded for country broadcasts, and there were three radio interviews with staff members. Two full-length and 13 short articles were contributed to the *Queensland Agricultural Journal*, and a number of articles were prepared for the country press. In co-operation with other branches, agricultural economists addressed farmers at five field days, and approximately 40 talks were given to farmers' groups.

The branch combined with other branches of the Division of Marketing in staging an exhibit at the 1963 Royal National Show. Branch contribution towards the theme of "Our Developing Eastern Markets" was to show that improved farm management was essential in obtaining a share of this market.

Budgeting is an important tool in farm management extension. During the year, a handbook containing farm management data was published. This met a heavy demand, and it is proposed to issue a revised second edition next year.

Officers both at Head Office and in Toowoomba dealt with an increased volume of office calls and correspondence seeking assistance in budgeting and farm accounting, which indicates that primary producers are becoming more conscious of the importance of farm management.

STANDARDS BRANCH

One of the important developments during the year was the transfer of inspectors to Toowoomba and Rockhampton. There has been persistent pressure for many years for the establishment of a seed testing laboratory on the Darling Downs but it has been contended that the expenditure on such a project would not be warranted by the small proportion of samples of seed emanating from that source.

Although the inspector did not take up duty in Toowoomba until October, it is clear that the dual functions in relation to inspection of seeds, fertilizers, etc., and fruit and vegetables severely tax the officer concerned and it is envisaged that in this important area of the State from both the producer and consumer points of view, assistance in the form of an additional inspector will be necessary at an early date.

The appointment of an inspector to Rockhampton took place at the end of the year.

Mr. A. J. Crocker, Senior Inspector (Markets) completed a period of service in London as Assistant Australian Fruit Officer.

SEED TESTING

Reference to Table 1 shows an interesting comparison between tests carried out over the last 2 years. The most obvious changes which took place in the year under review were the increased number of tests requested for seed being certified and the increase in samples forwarded by individual growers. There is thus a progressive trend operating in the field of seed production by way of individual endeavours by farmers to produce a quality article and increased efforts by Government authorities to aid crop seed improvement. Nor can it be said that progress made with improved seed quality is restricted to the domestic market. During the year no less than 706 tests were carried out on samples submitted by private firms exporting top quality bird seed overseas. Many of these samples represented considerable bulks of seed.

TABLE 1

SUMMARY OF SEED SAMPLES EXAMINED

Source of Samples	1962–63	1963–64
Inspectors of the Branch	3,229	1,658
Seed certification	684	1,238
Experimental projects	2,055	3,686
Submitted samples—		
(i) Merchants	4,993	3,584
(ii) Farmers	349	916
(iii) Government Departments ..	1,357	527
Export	..	706
Totals	12,667	12,315
Total Germination Tests Carried Out ..	15,393	16,301

Experimentation with dry conditioned vegetable seed has been extended to include storage investigations on seed stored in the wet tropics.

Collaboration in seed testing work between Queensland and other member countries of the International Seed Testing Association tended to a greater unification during the year. Referee samples of legumes and grasses were despatched from Queensland for testing with a view to developing uniform seed testing methods for inclusion in the International Rules for Seed Testing.

SEED CERTIFICATION

Statistics of certified seed produced during the last three seasons are shown in Table 2.

TABLE 2

PRODUCTION OF CERTIFIED SEED

Crop	1961		1962		1963	
	Certified	Refused	Certified	Refused	Certified	Refused
Hybrid maize (bus.) ..	16,333	114	13,923	..	14,220	..
Grain sorghum (bus.) ..	19,767	184	28,635	5,914	14,817	912
Sweet sorghum (bus.) ..	3	..	901	..	216	..
Sudan grass (lb.)	94,585	..	57,418	5,100	104,260	..
French beans (bus.) ..	637½	36	446	..	305	..
Tomatoes (lb.)	218	3	687	..	376	17
Buffel grass (lb.)	789	..	..	..	..	..
Cowpea (bus.)	..	..	20	..	619	332

Adverse conditions and a shortage of foundation seed were responsible for the production of a reduced quantity of certified grain sorghum seed in 1963. Of the amount certified, 2,470 bus. was seed of open pollinated varieties and 12,347 bus. hybrid seed. In 1962, comparable figures were 12,094 and 16,541 bus. respectively.

Supplies of foundation seed were built up during the year so that adequate seed will be available for the production of certifiable hybrids for next year's and the subsequent year's requirements.

Another grain sorghum hybrid, Texas 621—a dwarf hybrid—was included in the scheme during the year.

Certified hybrid maize seed produced in 1963 was sufficient to meet the demands. Of the seed certified, 94·7 per cent. germinated in the range of 90-99 per cent. Growers producing certified hybrid maize seed have graded their seed in accordance with the sizes decided upon by their Association and only a small percentage of the seed required regrading.

Altogether, 619 bus. of Caloona cowpea seed were certified in 1963. This was an increase from 20 bus. in the previous season. A further 332 bus. of seed were not certified due to the seed containing other kinds of seeds, or the germination being below the standard. A considerably increased acreage of this seed has already been planted for the current crop. However, although the variety Caloona was included in the scheme because of its resistance to stem rot,

the disease was found in the current season in one certified seed grower's crops, which were rejected for certification purposes.

Four other cowpea varieties carrying stem rot resistance, Souvana, Eureka, Burnett and Aurora, were included in the scheme during the year.

One area of Q3 tomatoes was rejected for certification purposes due to the presence of bacterial canker in trace proportions. This disease has been causing concern to tomato growers in the Stanthorpe district.

Considerable concern was caused by the apparent build up of a species of rice weevil resistant to benzene hexachloride. At present it appears that an insecticide to replace the previously very effective benzene hexachloride is not available. Growers of certified seed, in particular grain sorghum seed, will be directed to assist in combating this insect by paying very close attention to farm hygiene, by destroying crop and seed residues in the field and barns. Investigations were continued to determine a desirable maximum moisture content of seed as a further means to relieve the weevil problem.

REGISTRATION

During the year, applications for registration, re-registration or extension of registration of 3,823 agricultural requirements were received compared with 4,152 in the previous year. The decrease is a direct result of consolidation by some firms who have deleted duplicated products from their sales range.

The Agricultural Requirements Board has been expanded by the inclusion of a botanist following the proclamation of *"The Agricultural Standards Act Amendment Act of* 1963." The Board is now supplied with direct information relating to weed and tree killing preparations which previously needed to be referred to Departmental officers for advice.

The Agricultural Requirements Board, at 24 meetings, reported on the efficacy of 1,323 products, of which 517 were pest destroyers and 806 were veterinary medicines. On the recommendation of the Board, 12 pest destroyers and 5 veterinary medicines were refused registration.

The products refused registration included 4 chemical sterilants advocated for use in dairies. Laboratory tests revealed that these products did not compare favourably with standard chemical sterilants commercially used in the dairy industry for bacterial kills.

All pest destroyer preparations became subject to review this year, as, at the beginning of February, a 3-year registration period for such preparations commenced. Alterations are required to the labels for a number of these preparations, particularly insecticides, as a result of knowledge gained from Departmental trials with the newer chemicals.

Two new fungicidal products were introduced to Queensland farmers during the year. One, dichloran (2,6-dichloro-4-nitroaniline), is advocated for the control of nesting of beans while the other, mancozeb, controls a wide range of plant fungus diseases. Two insecticides, vamidothion and menazon, have been introduced for the control of woolly aphid on apples.

A list of registered fertilizers was published.

INSPECTION (AGRICULTURAL STANDARDS)

Loss of staff and increased duties in relation to export wheat inspections contributed to reduced country inspections in relation to agricultural requirements.

In all, 131 towns were visited and inspections carried out on 964 premises as against 139 towns and 1,546 premises in the preceding year.

Details of action taken with respect to unsatisfactory seeds are contained in Table 3 while a summary of action taken by inspectors with respect to agricultural requirements other than seeds is set out in Table 4.

TABLE 3

ACTION TAKEN ON UNSATISFACTORY SEEDS

——	1962–63	1963–64
Cleaned under supervision or by instruction—		
(i) Agricultural crop seeds	2,964 bags	4,367 bags
(ii) Vegetable seeds	994 lb.	..
Destroyed or otherwise rendered unsuitable as seed—		
(i) Agricultural crop seeds ..	633 bags	834 bags
(ii) Vegetable seeds	3,401 lb.	1,249 lb. 10 oz.
(iii) Packeted seeds	57 pkt.	..
Processed for stock foods—		
(i) Agricultural crop seeds ..	1,419 bags	588½ bags
(ii) Vegetable seeds	60 lb.	..

TABLE 4

SUMMARY OF ACTION ON AGRICULTURAL REQUIREMENTS EXCLUDING SEEDS

——	1963–64					
	Fertilizers	Lime	Pest Destroyers	Veterinary Medicines	Stock Foods	Total
Samples received from—						
Inspectors	82	17	108	14	646	867
Buyers	..	..	5	..	5	10
Seized	81 (*b*)	..	160 (*b*)	40 (*b*)	89 (*a*) 729 (*c*) 765 (*d*) 167 (*e*)	..
Reconditioned, relabelled or deficiency rectified ..	..	..	40 (*b*)	..	89 (*a*) 765 (*d*)	..
Destroyed	81 (*b*)	..	120 (*b*)	3 (*b*)	..	..
Diverted to Abattoir	..	..	..	..	729 (*c*) 167 (*e*)	..
Withdrawn from sale	..	..	..	37 (*b*)	..	..

(*a*) Bags of prepared stock foods ; (*b*) Packages, tins or bottles ; (*c*) Trusses of hay ; (*d*) Bags of grain ; (*e*) Bags of chaff.

Inspections were carried out at railway yards on 6,551 consignments of farm produce, an increase on the previous year, and these comprised 182,377 bags of chaff, 334,326 trusses of hay, 104,567 bags of grain and 46,402 packages of sundry materials.

Only 15 consignments were detained—fewer than last year—comprising 1,711 packages of various produce. Of these, 815 packages were reconditioned and released and 896 packages were diverted to the holding yards at the Brisbane Abattoirs and fed to stock awaiting slaughter.

Supervision was maintained at the Customs Sections of the Parcel Post Office and Eagle Farm Air Port where 55 packages of imported seed were inspected while 268 packages were returned to the seed laboratory for further analysis; 607 packages of imported seed were detained and cleaned under supervision for the removal of prohibited material which consisted of soil in all but one instance.

A total of 3,767 lb. of bird seed was exported to the Territory of Papua and New Guinea and a similar amount was rejected on inspection due to the presence of soil.

The inspection of export wheat involved 337,892 tons in bulk and bags during the period under review compared with 152,683 tons in the previous year. Only one bulk ship was found to have part of its cargo insect-infested on arrival at destination.

Ship inspections were maintained to ascertain cleanliness and suitability to carry wheat, and continuous sampling and inspection of wheat being loaded aboard were carried out at both the ports of Brisbane and Gladstone.

IMPORTS AND EXPORTS

Imports and exports of seeds and grain subjected to inspection and testing are set out in Tables 5 and 6.

TABLE 5

IMPORTS—SEED FOR SOWING

Agricultural Seeds—

	Bags
Centrosema	159
Pueraria javanica	4
Stylosanthes gracilis	2
Mangel	7
Clover	264
Rape	135
	571

Grass Seeds—

	Bags
Molasses grass	45
Coloniao grass	139
Rhodes grass	4
	188

Velvet Beans .. .. 3,754 bags

Vegetable Seeds—

	Lb.
Beet	375
Cabbage	38
Carrot	102
Cauliflower	11
Celery	2
Cucumber	235
Lettuce	59
Marrow	31
Melon	286
Onion	14
Pumpkin	5
Radish	16
Turnip—kohl rabi	10
Miscellaneous vegetables	101
Herbs	6
	1,291

Peas .. .. 502 bags

Miscellaneous parcels .. .. .. 247 bags

TABLE 6

EXPORTS—SEEDS AND GRAINS

	Lb.	Bags	Tons
SEED FOR SOWING			
Agricultural Crop Seeds—			
Barley	210	..	..
Beans	277	..	..
Japanese Millet	..	1,324	..
Oats	60	..	..
Peas	102	..	..
Safflower	784	..	..
Sorghum	3,250	..	..
Miscellaneous	172	..	..
	4,855	1,324	..
Legume Seed—			
Centrosema	1,435	..	..
Clover	58	..	..
Cowpea	..	..	687
Lucerne	16	..	..
Mung Bean	21,600	..	..
Phasey Bean	16	..	..
Pueraria	120	..	..
Soybean	371	..	..
Stylosanthes	662	..	..
	24,278	..	687
Pasture Grass Seed—			
Buffel Grass	602	..	..
Carpet Grass	170,730	..	..
Green Panic Grass	126	..	..
Guinea Grass	1,924	..	..
Molasses Grass	821	..	..
Paspalum	384,675	..	..
Rhodes Grass	10,612	..	..
Rye Grass	3	..	..
	569,493	..	..
GRAINS			
Bird Seed—			
Canary Seed	..	46,175	..
Japanese Millet	..	3,517	..
Setaria	..	72,845	..
Sunflower	..	4,085	..
White French Millet	..	102,236	..
Mixed Seed	..	38	..
	..	228,896	..
Other Grain—			
Maize	..	3,959	..
Wheat	..	..	337,892
	..	3,959	337,892

INSPECTION (FRUIT AND VEGETABLES)

Statistics on the regrading of fruit and vegetables other than potatoes, pumpkins and onions directed by inspectors during the year are shown in Table 7.

TABLE 7

FRUIT AND VEGETABLES DIRECTED FOR REGRADING AND RECONDITIONING

	Pkg.	Lb.	Doz.	Bun.		Pkg.	Lb.	Doz.	Bun.
Fruit—					*Vegetables—*				
Tropical fruits	205	..	3	..	Beans	6,933	..	..	..
Citrus fruits	2,153	..	..	..	Carrots	377	..	..	..
Apples and Pears	11,649	..	..	..	Cucumbers, salad vegetables	753	..	..	..
Stone fruits	1,319	..	..	..	Root vegetables	93	..	..	..
Tomatoes	3,100	..	..	..	Other vegetables	208	..	48	..
Rockmelons	1,285	..	7	..					
Other fruits	266	..	..	..					
Totals	19,977	..	10	..	Totals	8,364	..	48	..

The quantities of fruit and vegetables other than potatoes, pumpkins and onions condemned during the year are shown in Table 8. Particularly in the case of vegetables, certain of the produce shown in Table 8 would not have been unsound when it first arrived at the market, deterioration taking place while the fruit and vegetables remained on agents' sections awaiting sale.

TABLE 8

MARKET CONDEMNATIONS—FRUIT AND VEGETABLES

	Pkg.	Lb.	Doz.	Bun.		Pkg.	Lb.	Doz.	Bun.
Fruit—					*Vegetables—*				
Tropical fruits	955	..	514	189	Beans	1,321	..	..	..
Citrus fruits	2,208	..	..	..	Cabbages, cauliflowers	936	..	1,381	..
Apples, Pears	9,986	..	..	..	Carrots	863	..	..	..
Stone fruits	6,386	..	..	..	Cucumbers, other salad vegetables	7,020	..	29	727
Tomatoes	5,552	..	..	..	Root vegetables	848	..	..	640
Rockmelons	2,313	..	..	..	Other vegetables	2,947	..	..	155
Other fruits	1,162	..	180	..					
Totals	28,562	..	694	189	Totals	13,935	..	1,410	1,522

Althogether, 8,119 consignments of potatoes comprising 558,495 bags, 2,122 consignments of pumpkins consisting of 121,956 bags and 264,611 bags of onions included in 2,146 consignments were inspected. Of these, 15,828 bags of potatoes (2·8 per cent.), 1,731 bags pumpkins (1·4 per cent.) and 35,556 bags of onions (13·4 per cent.) were found to require reconditioning. Approximately three-quarters of the onions requiring reconditioning were from interstate or overseas sources; 3,220 bags potatoes, 252 bags of pumpkins and 9,574 bags of onions were ultimately destroyed as waste after reconditioning. The percentages of the number originally inspected are comparatively small (0·57 per cent. in the case of potatoes, 0·2 per cent. pumpkins, and 3·6 per cent. onions).

There has been a continuation of retail shop inspections during the year in the Brisbane, Ipswich and Redcliffe areas. Private and small shopkeepers generally maintained a very good standard of quality; however, the chain stores do not appear to have sufficient supervisors, and the faulty produce left on the fixtures in this type of shop calls for special attention.

There has been a continued increase in the quantities of fruit and vegetables exported (1962-63 approximately 249,511 packages and 38 bins, 1963-64 291,855 packages). Additional staff were engaged in export inspections at Stanthorpe and Brisbane. This was mainly due to the length of the 1964 export season—mid February to the end of May. One feature of the 1964 inspections was the change to inspecting only at appointed places at Stanthorpe and Brisbane. This allowed more time for inspection as most of the fruit was assembled at the three major packing sheds at Stanthorpe and at the Brisbane Cool Store. There was an increase in the number of inspections of fruit being consigned to the Continent and requiring a phytosanitary certificate.

Details of fruit and vegetables inspected for export purposes are set out in Table 9.

TABLE 9

QUEENSLAND EXPORTS—FRUIT AND VEGETABLES

Fruit—	
Apples	189,809 cases
Apricots	104 cases
Avocadoes	49 cases
Bananas	362 cases
Cherries	161 cases
Custard Apples	14 cases
Grapes	635 cases
Grapefruit	436 cases
Lemons	243 cases
Mandarins	4,373 cases
Mangoes	1 case
Oranges	46,278 cases
Pears	8,862 cases
Passionfruit	17 cases
Peaches	319 cases
Plums	405 cases
Pineapples	6 cases
Rockmelons	3 cases
Strawberries	66 cartons
	236 punnets
Tomatoes	7,498 cases

TABLE 9—*continued*

Vegetables—	
Beans	31 cases
Beetroot	4 bags
	45 crates
Brussel Sprouts	3 cases
Cabbages	128 bags
	1,429 crates
Carrots	420 bags
	1,505 crates
Capsicums	462 cases
Cauliflowers	105 crates
Celery	794 cases
Cucumbers	764 cases
Egg Fruit	1 case
Eschallots	3 cases
Garlic	91 cases
Leeks	6 cases
Lettuce	2,933 cases
Marrows	5 cases
Onions	7,257 bags
	2,992 crates
Parsley	7 cases
Parsnips	470 bags
Peas	16 cases
Potatoes	2,804 bags
	8,376 crates
Pumpkins	901 bags
Radish	3 cases
Rhubarb	115 cases
Swede Turnips	308 bags

Total number of packages = 291,855.

The total includes 41,729 cases of Queensland apples exported ex Sydney.

FARM PRODUCE AGENTS ACTS

"The Farm Produce Agents Act of 1964," to amend and repeal the previous legislation received Royal Assent on April 14. It is anticipated that this Act will come into operation on January 1, 1965.

The new Act will strengthen the position of the producer in his dealings with a farm produce agent and will enable a greater measure of control to be exercised over agent-producer transactions.

It also places new responsibilities on a farm produce agent in regard to eligibility qualifications for a license or renewal of a license, increased amounts of fidelity bond, method of operation of the trust account, amount of the trust account, and the manner of keeping books of account and other documents.

An agent who also buys from a producer for resale on his own behalf will be required to issue to the producer at the time of purchase, a Purchase Memorandum note furnishing full particulars of the transaction.

There were 115 licensed farm produce agents registered in Queensland, comprising 73 in the Brisbane area and 42 in country districts. Country agents were situated in 21 different centres throughout the State.

During the year, routine inspections of agents' books were carried out in Brisbane and country areas. Inspections revealed that most agents were correctly accounting to their principals for the sale of farm produce.

One firm, Bundaberg Markets, of Bundaberg, defaulted in payment to its producer principals. The partners in the firm were convicted and fined for two breaches of *"The Farm Produce Agents Acts,* 1917 *to* 1952," and at present action is in train to make payment from the security held by the Department to the unpaid producers. It is expected that payment will not exceed 3s. 4d. in £1.

CLERICAL AND GENERAL DIVISION

There was an increase of 120 officers in the staff of the Department during the year, the total at June 30 being 1,772. This figure, however, does not include 81 young people who have been allotted scholarships for study in various sciences and who will enter the Departmental service at the conclusion of their courses. The clerical staff increased by 23 to 366 as shown and there are still some vacancies to be filled:

	Brisbane	Country	Total
Clerks	121	12	133
Clerk-Typists	99	86	185
Male Assistants	11	1	12
Female Assistants	5	1	6
	236	100	336

The appointment of male clerks and clerk typists to country branches of the Department in order to relieve technical officers of routine clerical duties is proceeding. During the year a senior clerk and a junior clerk were appointed to Toowoomba. Appointments of male clerks were also made to Rockhampton, Nambour and the Toorak Field Station, whilst two are in training for Maryborough and Rockhampton. As they become available, it is intended to locate personnel at Mareeba, Cairns, Millaroo, Bundaberg and Stanthorpe. There are comparatively large staffs of technical officers at all of these centres.

The number of clerk typists in country offices declined by five, principally due to resignations on account of approaching marriage, and the positions have yet to be filled.

OFFICE ACCOMMODATION

All Divisions of the Department are expanding and as a consequence there is a continuing demand for more accommodation. It appeared that a measure of relief would be forthcoming early in the year when advice was received that the space vacated by the Department of Native Affairs would be made available to us when that Department transferred to new quarters. However, later advice was to the effect that funds would not be available to recondition the building until 1964-65. The position will become even more acute when the Victoria Bridge bypass road is constructed along the river bank as this will involve the demolition of the building now occupied by the Sheep and Wool Branch as offices and for laboratory work. The structure used as a Departmental vehicle servicing and parking station is also to be removed and facilities will be required elsewhere.

However, in the country the accommodation position is showing rapid improvement. New Court Houses completed at Gatton, Laidley and Mitchell have provided excellent conditions. Extensions or additions to Government buildings at Bundaberg, Kamerunga, Quilpie, Brian Pastures, Mundubbera, Warwick, Toowoomba, Mackay and Wandoan have provided additional work space, or will do so when completed. At Ayr, premises have been leased for the horticultural field and research staff and plans have been approved for the construction of new offices at Roma.

HOUSING

Under the Government's housing programme, residences have either been completed or are in the process of construction at Atherton (2), Biloela, Boonah, Charters Towers, Jandowae, Killarney, Malanda, Millmerran, Monto, Mt. Isa, Pittsworth, Richmond, Wowan and Charleville. A further 11 have been approved for 1964-65.

TRANSPORT

Three hundred and ninety-nine official vehicles are now operated by the Department. A number of uneconomic units were replaced during the year and on account of the increase in field staff 23 new vehicles had to be purchased. Seventeen of the new purchases were made from Commonwealth, Trust and Special Funds. In addition, 364 privately-owned vehicles are being run for official purposes on a mileage basis.

LIAISON DUTIES

The Department Liaison Officer made 107 official calls at country offices and research centres during the year. The main purposes of these visits are to discuss any local administrative problems and procedures with officers, and ensure that offices, records and equipment are being maintained in a clean and proper condition. It has been found that this personal contact by an officer from Brisbane with a good knowledge of Head Office procedures can succeed in smoothing out apparent difficulties in country offices.

RECORDS

The volume of correspondence handled in the Records Branch continues to grow rapidly each year as shown in the following table:

MAIL REGISTERED

Year	Inward	Intramural	Outward	Total
1961–62	104,537	12,268	61,496	178,301
1962–63	119,339	12,781	66,614	198,734
1963–64	127,281	15,499	70,470	213,250

This table does not include many thousands of application forms, returns, diaries and other forms which are received and distributed to appropriate Branches. The increase in the amount of correspondence to be recorded has made it necessary to increase the staff in Records and provide for five registration boxes.

The photo-copying machine was again used extensively to reproduce exact copies of articles, drawings and documents.

ACCOUNTS

The total expenditure and receipts of the Department for the year 1963-64 compared with 1962-63 are as follows:

	Expenditure		Receipts	
	1962–63	1963–64	1962–63	1963–64
	£	£	£	£
Consolidated Revenue	1,918,903	2,061,301	299,652	273,653
Trust and Special Funds (Includes Sugar Bulk Handling Facilities Expenditure £415,880 and £318,303—Receipts £329,909 and £341,799)	2,023,424	2,082,738	1,968,837	2,127,550
Schedule B—				
Salary of Minister	3,852	4,000	..	..
Schedule C—				
Stock Fund	315,133	322,682	..	..
Banana Industry Fund	6,694	8,232	..	..
Loan Fund	23,138	..	..	..
£	4,291,144	4,478,953	2,268,489	2,401,203

Further statistical figures are detailed:

	1962-63	1963-64
Receipts Issued	29,638	29,519
Vouchers Paid	46,262	48,119
Cheques Issued	67,496	71,637
Income Earning Certificates Issued	2,399	2,565

INFORMATION BRANCH

EXTENSION SERVICES

Two extension schools with an aggregate enrolment of 64 were held during the year. One was the conventional extension methods school and the other a joint Extension Supervision and Farm Management School for more senior officers.

The offset duplicating machine was used extensively for the preparation of printed material such as circulars, brochures, field day handbooks, newsletters and training manual sections. Broadcasting tapes were sent each week to all radio stations in Queensland and a special series was prepared to give topical advice to farmers and graziers in drought-stricken areas.

Surveys of particular extension problems and methods were conducted on behalf of various Branches. The most comprehensive of these was a farm to farm check of some 50 dairy farmers in the Cooroy area, with a like check in the Kingston Butter Factory supply area, to ascertain the effectiveness of the special extension methods used in the Cooroy area. The survey indicated that the adoption of recommended practices had proceeded at a faster rate in the Cooroy area since the special project was initiated than in the Kingston area, where conventional extension methods had been employed.

The group extension project on the Darling Downs continued under the guidance of an extension research officer until January, 1964, when it was left to operate on its own strength. An interim survey revealed that the farmers acting as a group had gained a good appreciation of their problems and that group activity had been productive also in bulk buying and other ways. The progress of the group work will be examined further from time to time.

LIBRARY AND ABSTRACTING SERVICE

The increasing demand for library services from a constantly growing number of scientific and technical officers has created problems for the Department's Central Library which is staffed by officers of the Public Library of Queensland. Both the number of periodicals handled by the Library and the number of inter-library loans are mounting steeply. Some servicing of branch libraries was done during the year, but shortage of library staff hampered this work.

The abstracting of scientific literature, for the purpose of providing officers with a ready and up-to-date guide to literature within their various fields, was continued and expanded.

PHOTOGRAPHY SECTION

Despite restrictions on the use of some facilities for part of the year due to structural work in progress, the Photography Section had a large output of original photographic work as well as processing for numerous branches. New facilities and improved equipment enable the section to handle many types of high-quality photographic work expeditiously.

Considerable use of the central film library was made by field officers conducting film evenings for extension purposes. A film on the new Tally-hi shearing method was made for the purpose of instructing shearers in the technique. Material was obtained also for films on lot feeding of beef cattle and the construction of a plaster water tank.

PUBLICATIONS

Activity in the publications field was extended to embrace co-operation with Branches in the production of research station brochures. These brochures are used in the first place for distribution at station field days, and are held for subsequent supply to visitors, thereby forming a suitable medium for the publication of results obtained at the stations they represent. Brochures were produced for the Hermitage, Maroochy, "Brian Pastures" and Redlands Research Stations.

A 92-page illustrated booklet, *"Ecology and Control of Brigalow in Queensland"* was prepared for publication and is about to be printed.

Further improvements in format were made to the monthly *Queensland Agricultural Journal* and various new features were incorporated in its contents. The Journal's circulation was maintained around 15,000, and efforts are being continued to improve the percentage of renewals.

Extracts from the *Queensland Agricultural Journal* have been reprinted for use in the form of advisory leaflets. The total number of leaflets issued was 72, made up as follows: Division of Plant Industry 38, Division of Animal Industry 22, Division of Dairying 8, and Division of Marketing 4.

The quarterly *Queensland Journal of Agricultural Science* continued to be a valuable vehicle for the dissemination of scientific papers giving the results of research projects.

The year's sales of Vol. I (Farm Crops and Pastures) and Vol. II (Fruit and Vegetables) of the *Queensland Agricultural and Pastoral Handbook* were 735 and 512 respectively. This compares with the previous year's figures of 1,000 and 1,200.

The Department's advisory press release was circulated to more than 100 newspapers and radio stations each week. In addition, a 150-word precis of each item was forwarded to Australian Broadcasting Commission radio stations and selected newspapers. The precis was also recorded on tape and forwarded for broadcasting to commercial radio stations in Queensland. The circulation of this press release is still growing as more publications are asking for the service.

News reports of current activities of the Department were prepared regularly and released to newspapers, news-agencies and radio and television stations.

RESEARCH STATIONS SECTION

Research Stations section provides facilities for investigations by many Branches of the Department at nine regional centres in Queensland. On these Stations, research projects are directed primarily to the district problems associated with agriculture, horticulture, dairying, pig raising and cattle husbandry, while in certain areas specific work is undertaken in specialised fields such as irrigation, plant breeding, soil physics, nutrition and plant chemistry.

Some progress has been made in obtaining the facilities and equipment for the technical investigations desirable, but finances have been insufficient to bring any centre up to the required standard.

At each station, representatives of the Divisions associated with the work form a committee which advises on the priority of projects and prepares details of the annual research programme.

The submissions are reviewed by the Research Stations Board which includes the Deputy Director-General, Directors of the Plant Industry, Animal Industry and Dairying Divisions, and a Research Stations Section Officer as Secretary.

The Stations maintain 23 supervisory and clerical staff and 47 farm employees. Approximately 46 technical officers are located at these field centres and they include agronomists, agrostologists, plant breeders, husbandry officers and chemists.

The technical achievements are reported by the Branches responsible for the investigations. The Station administration is responsible for pure seed production of many crop and pasture species, and for the integration of crop and animal production for the purpose of evolving a balanced farm system. In providing the essential prerequisites for sound field experimentation it is necessary that a research station should operate on a systematic basis, while at the same time providing conditions comparable with those of a well-managed commercial property.

Developments of particular significance during the financial year were:

A high priority maize breeding programme was undertaken at the Kairi Research Station in an attempt to stabilize the local industry. In addition to work designed to overcome losses due to maize diseases, especially tropical rust, much of the trial programme is directed to the study of alternative avenues for economic use of the Atherton Tableland areas. The successes achieved by the introduction of glycine based pastures were consolidated by stimulation of commercial seed production and rapid expansion in acreage of sown pasture.

Following the collapse of the tobacco industry in the Burdekin Valley, and the granting of cane assignments on the levee soil areas, the technical work is now centred on detailed study of the extensive flood plain soils. Combined investigations into soil physics and plant nutrition clarified the problems, and some treatments including deep tillage and soil amelioration with gypsum offer promise for developing these difficult soils.

Pasture investigations were expanded to develop methods and species for improving the native grass lands used for cattle raising in the Burdekin region.

In central Queensland at the Biloela Research Station, animal husbandry projects were commenced to determine the significance of climatic conditions on dairy production when nutrition is maintained as a constant by stall feeding.

An additional 150 acres of land adjacent to the station were purchased to allow for expansion of trials in irrigated crops and livestock nutrition.

To meet the demand for expanding agriculture in central Queensland, plant breeding work with cotton, grain and forage sorghums was established at the Biloela Station.

Construction of a new administrative and laboratory building was commenced and this facility will provide services for the research station and adjacent districts.

In conjunction with the Mareeba-Dimbulah irrigation project, studies were undertaken at Walkamin Research Station to determine the most suitable economic use of non-tobacco lands. Notable success was achieved in the production of irrigated beans, soybeans, and maize and high yields of cotton were obtained. On the poorer soils, irrigated pastures were stocked at a beast per 1½ acres and livestock gains approximated 1½ lb. per day. A wide range of agricultural and horticulture crops, and many pasture species, were tested at this centre.

An appraisal of the potato industry resulted in expansion of the potato crop investigations at Gatton Research Station. Although progress has been made in determining varieties and cultural requirements for quality production there is a lack of consumer selectivity. Marketing of potatoes in variety branded bags may assist in stabilizing the industry.

Following preliminary trial production of processing peas at this station, commercial enterprises are now sponsoring 200 acres of crop.

Investigations showed that irrigated maize, cotton and soybeans form useful alternative avenues of agricultural production in the Lockyer Valley, and the commerical interest in dehydrated lucerne meal will provide a regular demand for lucerne grown with irrigation.

Further emphasis was placed on plant breeding projects at the Hermitage Research Station and material results were achieved in producing improved varieties of wheat and hybrid sorghums. The programme which also includes improvement of linseed, barley and oats will be assisted by facilities recently provided, which include a glasshouse, seed store, seed laboratory and specialised equipment. Hybrid grain sorghum yields of over 150 bus. to the acre were obtained this year.

The piggery at Hermitage is being equipped with modern experimental pens and bulk grain facilities to allow a more precise evaluation of pig rations and quality carcass production.

Agronomic investigations indicate that some new crops to the areas, such as soybeans and cotton, can be succesfully grown with irrigation in the nearby Condamine irrigation district.

Fairly extensive areas were established at the Coolum Research Station to evaluate on a commercial scale the procedures developed in experimental work for restoration of poor wet-heath wallum lands. The soil correctives and fertilizers applied resulted in excellent production of pangola grass and lotononis pasture, and beef cattle grazed at 1 per 1·6 acres averaged 353 lb. liveweight gain in the 32 weeks since the trial commenced.

At the small Theodore station, irrigated pastures retained high productivity. Sheep are used as grazing animals and the area of 35 acres carried over 400 ewes and 300 lambs. The station has inadequate area for extensive irrigated crop research.

The new Brigalow Research Station, 30 miles north-west of Theodore, comprises 9,000 acres and is situated within Area I in which the first blocks of land were released to settlers under the Fitzroy Basin Brigalow Development Scheme.

The Station was established to conduct research work into brigalow ecology, land usage for pastures and crops, soil conservation run-off studies and cattle husbandry problems on brigalow country.

Initial developmental work included the pulling and burning of approximately 1,500 acres of brigalow and associated scrub, and seeding to mixtures of Rhodes, green panic and buffel grasses, as well as to pure stands of these species. This partly developed area will allow research workers to begin early studies on sucker control, pasture management, and general development of brigalow lands. It will also enable the property to carry some stock so that investigations into animal performance can be commenced without delay.

A 13 million gallon earth dam was completed to Irrigation and Water Supply Commission specifications, and with the completion of three houses, and single men's quarters, occupation of the Station by technical staff is expected by the end of July.

By Authority: S. G. Reid, Government Printer, Brisbane