QUEENSLAND AGRICULTURAL JOURNAL

VOL. 86 DECEMBER, 1960 NO. 12

Registered at the General Post Office, Brisbane, for transmission by Post as a Newspaper

contents

COVER PICTURE: Department of Agriculture and Stock Botanist, Miss Danny Ellis, Inspects Massed Poinsettias at the Brisbane Botanic Gardens. The poinsettia (Euphorbia pulcherrima), which is a native of tropical Mexico and Central America, is Brisbane's floral emblem.

EDITOR: *E. T. Hockings*

PUBLISHED BY THE QUEENSLAND DEPARTMENT OF AGRICULTURE & STOCK.

SUBSCRIPTION RATES (PAYABLE TO DIRECTOR-GENERAL, DEPARTMENT OF AGRICULTURE AND STOCK, WILLIAM STREET, BRISBANE):

QUEENSLAND FARMERS, SCHOOLS AND STUDENTS—5S. A YEAR; OTHERS—£1 A YEAR.

Plate 1

Grazier's Transport Photographed at a Far Western Field Day.

Does It Pay To Use A Plane On A Grazing Property?

By H. I. TOFT, Agricultural Economist.

The privately owned aeroplane has become much more prominent in recent years in the wool industry. Many graziers now have their own planes. That an aircraft is a convenient means of transport between towns is obvious. In grazing areas this is more so, due to increased distances. The aircraft can also be a very useful piece of equipment in work on the property itself. In this article it is proposed to indicate the level of costs which might be expected in owning and operating a small aircraft, and also to discuss some of the possible benefits.

Through the co-operation of a grazier running a typical property, details of which are given, an example has been obtained of the use on a property of a private aircraft. The economic analysis carried out suggests that the cost of having an aeroplane would at least be largely offset by the economic advantage of using the plane on the property. This is in addition to non-economic benefits, such as convenience, which are to be derived.

Owning and Flying Costs

The type of aircraft used on the property is a DH82—Tiger Moth. An estimate of the costs of owning and operating a Tiger Moth is shown in Table 1, with a similar estimate for the Cessna 172 in Table 2. These estimates were obtained from information supplied by commercial users of these planes.

Costs have also been separated into annual or fixed costs, and variable costs. The annual costs shown consist of depreciation, insurance, and an annual appropriation towards Certificate of Airworthiness costs. This certificate must be renewed every three years and involves maintenance work on the plane prior to issue. Under the heading, variable costs, are shown costs which vary directly with the number of hours flown. These consist of costs of fuel and oil, 100 hour checks,

and engine and propeller overhauls, which are carried out about every 1,300 hours for the DH82 and every 1,000 hours for the Cessna 172.

In estimating the depreciation on an aeroplane, account has been taken of the effect of the repeated overhauls, in which parts are renewed, on the aircraft's market value. For this reason an estimate of depreciation was made by comparing the market value of the plane bought to-day in new or completely overhauled condition and its market value in 6 years' time in completely overhauled condition.

When a Tiger Moth is bought to-day for £800 it is assumed that its value in 6 years time will be between £500 and £600. A Cessna 172 bought to-day for £5,500 is assumed to be potentially worth £4,000 in 6 years' time.

The costs shown apply to that time span. This method of calculating depreciation aims at finding the actual annual loss in capital value as distinct from depreciation as allowed for taxation purposes.

The total costs each year of operating a Tiger Moth will vary according to the number of hours flown. Where the aircraft is flown 200 hours in the year the estimate is £700, for an aircraft flown 300 hours in the year the estimate is £1,000, and for a plane flown 400 hours, £1,200.

TABLE I

THE COSTS OF OWNING AND OPERATING A TIGER MOTH

Annual Fixed Costs—Tiger Moth	
Depreciation	£40 a year
Interest on Capital Invested—5% ..	£40 a year
*Insurance of Aircraft (Ground and taxying insurance at 32s. 6d. per cent., based on a value of £800)	£13 a year
Third Party Insurance (£10,000 cover)	£8 a year
Passenger Liability (£5,000 cover) ..	£10 a year
Allowance for Certificate of Airworthiness. (This cost could vary considerably. The cost of £92 is an estimated maximum.)	£92 a year
	£203 a year
Variable Costs—Tiger Moth	
Fuel and oil (5s. a gallon for fuel ; 2s. a pint for oil)	£1·90 a flying hour
Cost of 100 hour checks	£0·40 a flying hour
Cost of overhaul to engine and propeller (1,300 hour interval)	£0·25 a flying hour
	£2·55 a flying hour

* Comprehensive insurance including all flying and ground handling risks and third party insurance to £10,000 is available at 6 per cent.

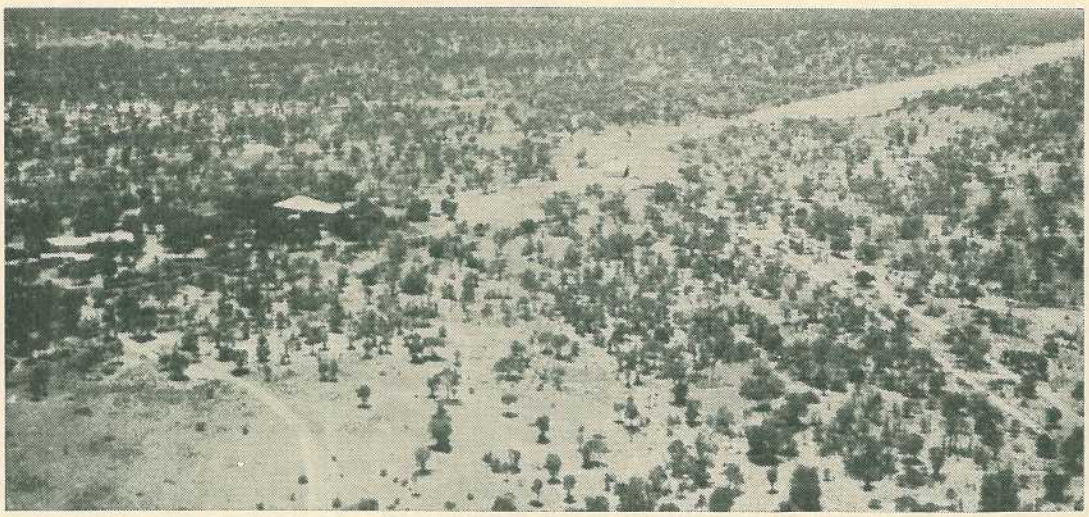


Plate 2

Stock Can be Mustered on This Property Largely by Air. Note the landing ground on the top right.

Plate 3

Supplies and Mail Can Be Dropped to this Flood-Bound Station by Air.

TABLE 2

THE COSTS OF OWNING AND OPERATING A CESSNA 172

Annual Fixed Costs—Cessna 172

Depreciation	£250 a year
Interest on Capital—5%	£275 a year
Insurance of Aircraft (Ground and taxying insurance at 32s. 6d. per cent., based on the initial value of £5,500.)	£89 a year
Third Party Insurance (£10,000 cover)	£8 a year
Passenger Liability (£5,000 cover)	£30 a year
Allowance for Certificate of Airworthiness. (This cost is stable for the Cessna 172.)	£23 a year
	£675 a year

Variable Costs—Cessna 172

Fuel and oil (5s. a gallon for fuel ; 2s. per pint for oil)	£1·50 a flying hour
Cost of 100 hour checks	£0·22 a flying hour
Cost of overhaul to engine and propeller (1,000 hour interval)	£0·31 a flying hour
	£2·03 a flying hour

The estimated total annual cost of a Cessna 172 operating 200 hours a year is £1,100, that of a Cessna operating 300 hours, £1,300, and 400 hours, £1,500.

Using Aircraft to Muster Sheep

Information was obtained of the use of an aircraft—in this case a Tiger Moth—to muster sheep on the property mentioned earlier. This is a property of 41,000 acres, with a stock of 8,000 sheep including 4,000 breeding ewes. The lamb marking varies from 40 to 75 per cent. in the year. As such, it is a fairly typical property. The plane is used on this property to locate the sheep, force them into mobs and start the mobs in the required direction. The number of mobs is counted. Then after the plane returns to the landing strip, the sheep are rounded up in a jeep. This is followed by another trip in the plane to ensure the paddocks are clear.

The mustering of a paddock by this method takes one man about 1 hour in the plane for both trips, and about 4 hours in a jeep.

Previously on this property the mustering was always done on horseback. This would take three men about 6 hours in each paddock to do the first mustering, and then four men 6 hours finding the strays.

Comparing the two methods it can be seen immediately that, as expected, there is a considerable time-saving in the use of the plane. Not

only has the plane an obvious edge on the horse in speed but it offers a vantage point from which the sheep are more easily seen.

The economics of the use of the plane instead of the horse depends on the value of the time saved compared with additional costs incurred in achieving the time-saving. Estimates of these extra costs and the amount of time saved follow:

(a) Extra costs of Mustering by Aeroplane

It is assumed here that the grazier already owns the aircraft and is deciding whether it is economical to use it to muster sheep. Here the annual fixed costs need not be considered.

Variable costs per flying hour of a Tiger Moth	= £2·55
Flying time for single mustering of a paddock	= 1 hour
Annual flying time mustering	= 32 hours
Annual flying costs of mustering (variable costs only)	= £82
Annual running costs of jeep in mustering	= £24
Total extra costs of mustering by plane (Tiger Moth)	= £106

(b) Saving in Labour time through Mustering by Aeroplane

An estimate has been made of the labour time which is needed on this property to muster by aeroplane. On the average a mustering of a paddock takes:

1 man 1 hour in the plane	= 1 man-hour
1 man 4 hours in the jeep	= 4 man-hours
Total number of man-hours for a single mustering of a paddock	= 5
Total number of man-hours for a year's mustering	= 160

The labour time involved in the alternative method has been estimated in a similar way. That is:

3 men 6 hours on horseback doing initial mustering	= 18 man hours
4 men 6 hours on horseback finding strays	= 24 man-hours
Total number of man-hours for a year's mustering	= 1344

The saving in labour time through mustering by aeroplane is 1,344 man-hours less 160 man-hours, that is 1,184 man-hours. The estimated

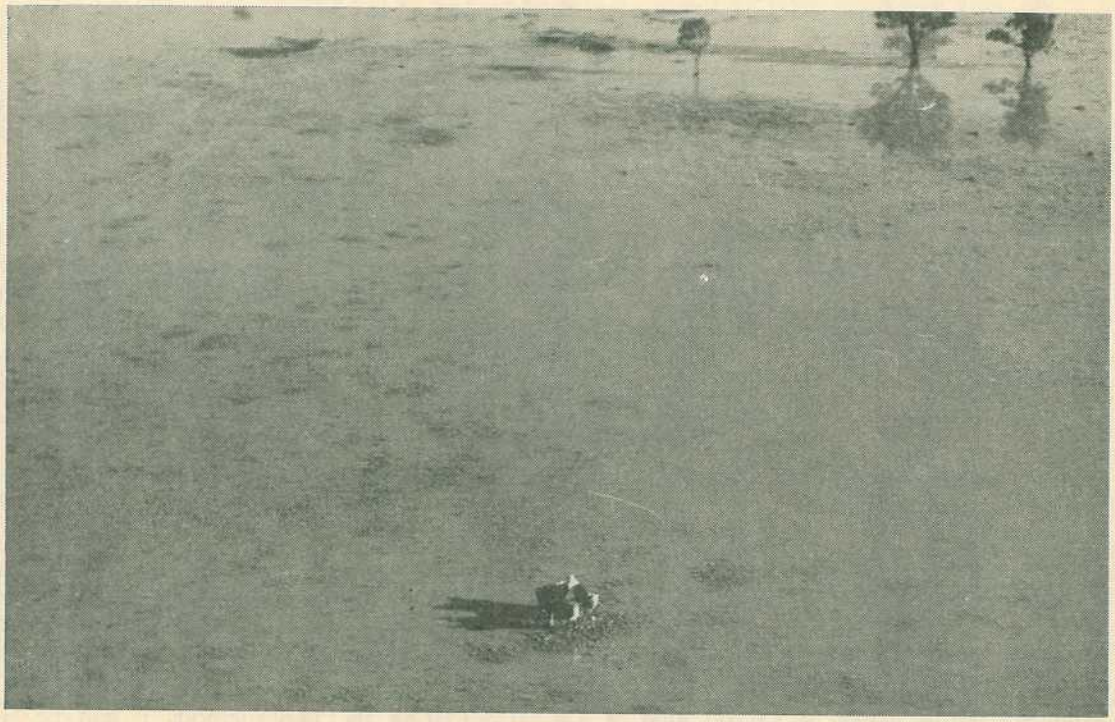


Plate 4

Stock Can Be Saved From Starvation by Dropping Food From the Air in Time of Flood.

cost of doing this work is approximately £110. Provided the 1,184 man-hours saved are worth more to the property than £110, the use of the plane in mustering is economical.

For the purpose of giving a value to this saving in labour time, suppose an employee's wage and keep are conservatively estimated at £15 a week for a 50-hour week. This amounts to a cost of 6s. an hour. On this basis 1,200 man-hours would cost approximately £360. Comparing this figure with the £110 cost, it seems quite definite that on this property, using the Tiger Moth in the mustering work is an economical proposition. In fact, the £360 saving in labour-time would not only pay for variable costs of £110 incurred in mustering by plane (and jeep), but also would cover the overhead on a Tiger Moth of about £200 a year.

Other Uses for the Aircraft

Mustering is an example of the uses to which an aircraft can be put on a grazing property.

Off-property travel is another example.

Distances from this property to business centres normally visited are only three-quarters as far by air as by road. The variable costs of a Tiger Moth are estimated at £2·55 a flying hour while the cruising speed is 84 m.p.h. This is a variable cost of 7d. a mile travelled, which, allowing for the fact that the distance travelled on a flight is only about three-quarters that travelled by car, would compare with a running cost of 5d. for a car.

Another big advantage of having the plane is in its use in locating drying or boggy earth tanks. This requires, on this property, a flight of a about 20 min. each day during which all earth tanks are examined. This is followed by a visit to those tanks where the water is low. Without the use of the aircraft every tank would have to be visited every day during dry weather. Here obviously is another considerable saving in labour time.

Again the plane is particularly suited to work in bushfire spotting, locating damage to fences from fire or flood, and is a definite aid in time of sickness.

Conclusion

It can be seen that the light aircraft is naturally suited to a variety of jobs on and around a sheep-station. On the property considered, which has open downs country, the aircraft can be used in mustering, and this looks as if it could be an attractive proposition economically, depending on the advantage taken of the labour time saved. Some properties in thickly timbered country may not be able to use the plane for this purpose.

There remain numerous other possible activities which could make an aircraft a useful "work-horse" on the property as well as offering convenience and pleasure.

Grateful acknowledgement is extended to Mr. E. J. Davis, Chief Flying Instructor, Air Academy of Queensland, and to Mr. J. Nation, Sheep and Wool Adviser, for assistance given in obtaining data on which this article is based.

Bacteria In Milk

The subject of numbers and types of bacteria occurring in milk is a matter of some importance to dairy farmers in Queensland, whether they are milk or cream suppliers. It is especially important during warm weather.

Milk producers are required to meet standards for quality which are laid down, such as the methylene blue test and the thermoduric count. Cream suppliers, of course, have their produce graded for flavour which is very largely determined by bacterial growth in cream.

Bacterial organisms, which are far too small to see, abound on the surfaces of all equipment, in water and particularly in dust. They will grow where moisture is available.

It is clear, therefore, that the utmost care must be taken to ensure that all equipment is kept thoroughly clean, is sterilized, preferably with boiling water, and above all is left to dry so that bacterial multiplication cannot take place. Very special attention should be given to the rubberware of milking machines because these parts become a harbourage for bacteria as and when the rubber surfaces become swollen, fat-soaked or cracked.

Finally, a word about sterilization. There appears to be no satisfactory substitute for copious quantities of boiling water, remembering, of course, that boiling means bubbling.—*V. R. SMYTH, Senior Bacteriologist (Dairy Research Branch).*

Double Forage Yield With Irrigated Lucerne

By Officers of Regional Experiment Stations Branch.

Where irrigation is available it is often a problem to decide what sort of crop to grow for stock fodder.

Is it best to grow a perennial crop such as lucerne or can more feed be obtained from a series of annual grazing crops?

Over the past seven years, an irrigated trial has been carried out at the Biloela Regional Experiment Station to determine the relative merits of lucerne and annual crops. Irrigation was available from a well capable of delivering 12,000 gal. an hour, and the experiment was located on a free-working clay loam soil, which is fairly typical of the Callide Valley alluvial plain.

Results of the trial show that lucerne is by far the better proposition. Here are the reasons why—

(1) The yield of air-dried fodder may be expected to be doubled by growing lucerne in preference to annual crops.

(2) A better quality grazing fodder can be obtained from lucerne. Its high protein content combined with fairly low moisture content would provide a fodder capable of obtaining maximum production from dairy stock. Although quite high in protein, annual crops would normally be too succulent to provide a ration for maximum production.

(3) Continuity of feed supply is assured, whereas annual cropping results in a loss of at least four months grazing.

(4) The soil is left in excellent condition at the end of the lucerne phase. Fertility is high and, because the structure has remained good, water from rain or irrigation penetrates more readily.

(5) More efficient use of irrigation water and rainfall can be expected from lucerne. If water is available at lower depths it is likely that lucerne will make good use of it.

(6) Once established, lucerne is much less costly to maintain.

(7) Supplies of lucerne surplus to grazing needs can be readily conserved as a high protein hay.

It should be borne in mind, however, that these findings are valid only for crops grown under irrigation in central Queensland. Under other circumstances, annual grazing crops still have an important part to play. But the trial does highlight the great value of lucerne.

The experiment was set out in two phases, each of $3\frac{1}{2}$ years.

In the first phase, 1952-55, an area was planted to lucerne, while an adjacent area was used for continuing summer and winter annual grazing crops. In the second phase, 1955-59, cropping was reversed; that is, lucerne was planted in the area previously annually cropped, and vice versa.

Supplementary irrigation was applied to all crops in both phases with the intention of producing maximum yields.

The annual grazing crops used were oats, oats and field peas or vetches during winter, and cowpeas or mung beans with giant setaria during the summer.

First Phase (1952-1955)

During the 3½ year period, lucerne produced 23½ tons of air-dry material to the acre and 31 grazings were possible. Best lucerne production obtained was 19 cwt. of air-dry material to the acre in 28 days, during the November-December period of 1953.

Overall, 10·9 tons to the acre of air-dry material were produced by annual crops and 21 grazings were possible. Best annual crop production was 10 cwt. an acre of air-dry material in 29 days in the January-February period of 1954. It is well to remember that the area under annual crops was out of production for at least a third of each year while land was being prepared for the following crop. In the graph (Plate 1) it is seen that the line showing lucerne production rises quickly above that for annual crop production after the first winter.

Irrigation Applied

Water usage for the first phase of the experiment is shown in Table 1. No account has been taken of water which lucerne roots may have taken from lower depths not touched by annual crops. Also, losses due to evaporation would be higher from soil worked for annual crops. It will be noted that in the case of lucerne the same amount of water produced twice the yield of dry material.

TABLE 1

WATER USAGE AND PRODUCTION, MARCH, 1952 TO OCTOBER, 1955

—	Lucerne	Annual Crops
Rainfall (in.)	109·25	109·25
Irrigation (in.)	87·75	65·25
Water in top 5 ft. of soils at original planting (in.)	4·00	6·00
Total water (in.)	201·00	180·50
Tons air-dry material produced per acre	23·53	10·86
In. water per 1 cwt. air-dry material	0·43	0·82

The protein content of all grazing crops was high, although that of lucerne was higher throughout.

Soil Structure

A marked deterioration occurred in soil structure and in the rate of penetration of water into the soil of the annually cropped area. Run-off was more severe in this area.

Fertility of the soil in the cropped area was not affected very much. It appeared, however, that it was essential to plant a legume with the winter crop to provide nitrogen in the later stages of growth.

Lucerne, oats, vetches and giant setaria continued to produce reasonably well with repeated grazings, but field peas and cowpeas could not stand repeated grazings satisfactorily.

After 3½ years the lucerne had thinned out slightly due to weed invasion with continued grazings, while the soil in the cropped area was becoming powdery and water penetration was poor. Both areas were ploughed in October, 1955.

Second Phase 1956-1959

The establishment of lucerne in the area previously cropped to annuals was a little difficult due to the poor soil structure. In the first season, run-off of irrigation water and rainfall was severe, but a good stand was obtained later. Early lucerne yields were therefore poor.

The first oat crop growing in the land previously cropped to lucerne was extremely vigorous. A total of 2·7 tons of air-dry material an acre was produced, and five grazings were possible. The oats were of very high protein content.

The winter of 1956 was the only one of the seven in which annual crops outyielded lucerne.

During this second phase, lucerne produced 22½ tons an acre of air-dry material and provided 28 grazings. Best production for the second phase lucerne crop was achieved when 27 cwt. to the acre of air-dry material were produced in 34 days during November-December, 1957.

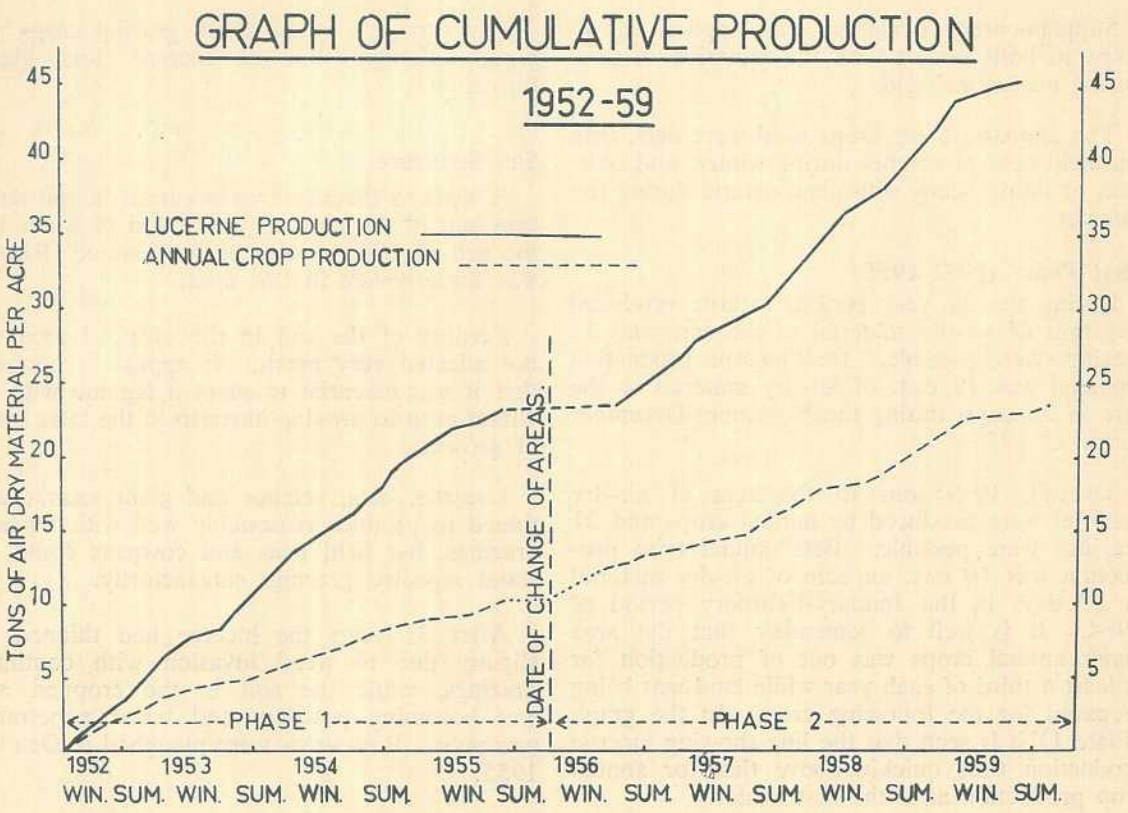


Plate 1

Production of Lucerne and Annual Fodder Crops.

Annual crops produced 13·1 tons an acre of air-dry material in 19 grazings over the 3½-year period. Maximum production from the areas cropped to annuals was obtained when 16 cwt. air-dry material to the acre were produced in 36 days during the period May-June, 1956.

The pattern of growth as shown in the cumulative graph (Plate 1) is similar to that of the first phase of 3½ years. Apart from the winter of 1956 when oats outyielded lucerne, the production line for lucerne once again quickly increased above that for annual crops.

Water usage in the second phase was similar to that of the first phase but annual crops needed more irrigation than lucerne. Lucerne again produced almost twice as much feed for the same quantity of water supplied to annual crops.

TABLE 2

WATER USAGE AND PRODUCTION APRIL, 1956 TO OCTOBER, 1959

	Lucerne	Annual Crops
Rainfall (in.)	77·25	77·25
Irrigation (in.)	120·05	127·75
Water in top 5 ft. of soil at original planting (in.)	3·50	4·00
Total water (in.)	200·80	209·00
Tons air-dry material produced per acre	22·50	13·10
In. water to produce 1 cwt. air-dry material	0·44	0·80

At the end of the second phase, run-off occurred in the cropped area. The lucerne stand had once again thinned out allowing the invasion of weeds.

TABLE 3

ANNUAL PRODUCTION OF LUCERNE AND ANNUAL CROPS

Phase and Season	Air-dry material in Tons per Acre	
	Lucerne	Annual Crops
Phase 1—		
1952–53	6·90	4·57
1953–54	7·07	1·94
1954–55	7·78	2·84
1955–56 (part year)	1·78	1·51
Phase 2—		
1956–57	4·92	3·78
1957–58	8·23	3·66
1958–59	8·30	4·84
1959–60 (part year)	1·05	0·82
Total for 7 years	46·03	23·96
Production per year	6·58	3·42

Summary of Results

The graph summarises the results of the two phases as a whole. It is seen that lucerne continued to produce at a higher rate than annual crops throughout the 7-year period. Yearly production figures are set out in Table 3.

Further dissection of these yields revealed that summer production of lucerne at 4·6 tons of air-dry material an acre was twice that of the winter production over the 7-year period. Corresponding summer and winter production figures for annual crops were respectively 1·9 and 1·6 tons of air-dry material to the acre.

During the seven years of trial, lucerne consistently yielded 20 to 25 per cent. (23 per cent. average) crude protein on a dry matter basis. Annual crops ranged in crude protein matter from 9 to 25 per cent., with an average of 17 per cent.

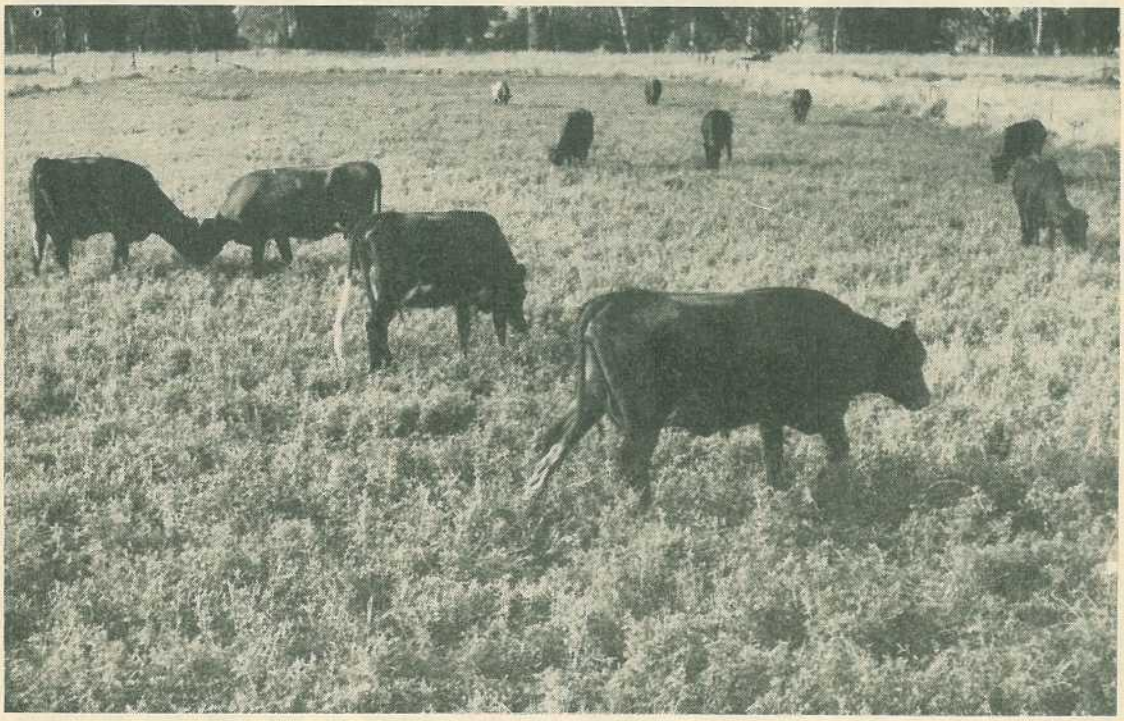


Plate 2

In the Second Phase of the Trial, This Lucerne Paddock is being Grazed in October, 1956.

Plate 3

This Picture shows the Outstanding Production from the Irrigated Annual Crop Immediately following Lucerne. The Crop is Vicland Oats, and it is being Grazed for the Fifth Time in October, 1956.

Conclusion

Where irrigation is available, lucerne production seems a better proposition than annual grazing crops on soils similar to those of the Callide Valley alluvials. A certain bloat risk is involved in grazing lucerne, but this can be largely overcome by spraying the crop with tallow before grazing. (See Q.A.J. Nov., 1959, pp. 707-710.)

Although the lucerne thinned out on each occasion after 3½ years, a good stand still remained and reasonable grazing would have been obtained for a longer period. Lucerne greatly improved soil structure and fertility and excellent growth was obtained in annual crops in the first season after lucerne.

Dairy Yield Firm In Dry Year

Queensland dairy herds production-recorded by the Agriculture Department came through the dry 1959-60 milking season with little loss in production.

The Minister for Agriculture and Forestry (Hon. O. O. Madsen, M.L.A.) said the average production per cow was 4,038 lb. of milk containing 169 lb. of butterfat. In the 1958-59 season, the average yield was 4,020 lb. of milk containing 170 lb. of butterfat.

In the 1959-60 herd recording season, the average length of lactation was 243 days, the same as in the previous year. The average butterfat content of the milk last season was 4·2 per cent.

Mr. Madsen said the number of cows production-recorded had increased to 47,607 last year compared with 43,412 the year before. When group herd recording was commenced in the 1948-49 season, the average yield of all cows tested was 144 lb. of butterfat.

Crossbred Steers Outweigh Purebreds

By R. A. BARNETT, Cattle Husbandry Branch.

During a trial period of 504 days following weaning, a group of Shorthorn-Aberdeen Angus crossbred steers gained an average of 125 lb. more than a similar group of purebred Aberdeen Angus steers grazing on improved dryland pasture in southern Queensland.

Previous field trials of this nature in Queensland have involved a comparison between British breed and Brahman cross animals.

The ability of first cross animals to grow faster than the purebreds of either parentage is generally recognised. This trial indicates the faster growth rate of first cross animals under good pastoral conditions.

This project was possible through the co-operation of Mr. Reg. Shannon, Manager of The Scottish Australian Company's Texas property, "Texas Station", whose assistance is gratefully acknowledged.

Selection of Cattle

The cattle selected at the commencement of the trial were weaners. Weighing commenced immediately after weaning in June, 1958. They were steers, bred on the property, with an age range of 6 to 9 months, and consisted of 15 purebred Aberdeen Angus and 15 first cross between Shorthorn and Aberdeen Angus. The crossbreds were the result of the mating of purebred white beef Shorthorn bulls with purebred Aberdeen Angus cows.

The dams of the weaners in each group of this trial were similarly bred, of the same age-group, and had been pastured under similar conditions.

One purebred died during the course of the trial and performances in this group are based throughout on 14 head.

Management

Both groups were run together as one mob and were subject to the same environment and management at all times. It was intended that these steers would remain in the one paddock for the duration of the trial. However, after a year's grazing in this paddock, consisting of 20 acres with a mixture of prairie, lucerne, clover, kangaroo grass and some couch, the steers had to be transferred to an alternative paddock of lucerne and native pasture.

After a month of grazing in this paddock the cattle were dipped in a DDT preparation to combat an infestation of lice. It is considered that the lice were primarily responsible for the weight loss which occurred in both May and June, 1959.

Identification and Weighing

The cattle were fire-branded, as well as being ear-tagged with numbered aluminium tags.

The normal weighing procedure was to yard all animals between the hours of 5 and 6 p.m. and commence weighing about 9 o'clock on the following morning. This meant a fasting period of approximately 16 hours before weighing.

Weighing was carried out normally at 28-day intervals.

The initial average liveweight of the 15 purebred Aberdeen Angus was 398 lb. with a range of 346 to 448 lb. The 15 Shorthorn-Aberdeen Angus crossbreds averaged 35 lb. lighter at 363 lb. with a range of 307 to 436 lb. This weighing was carried out on June 25, 1958.

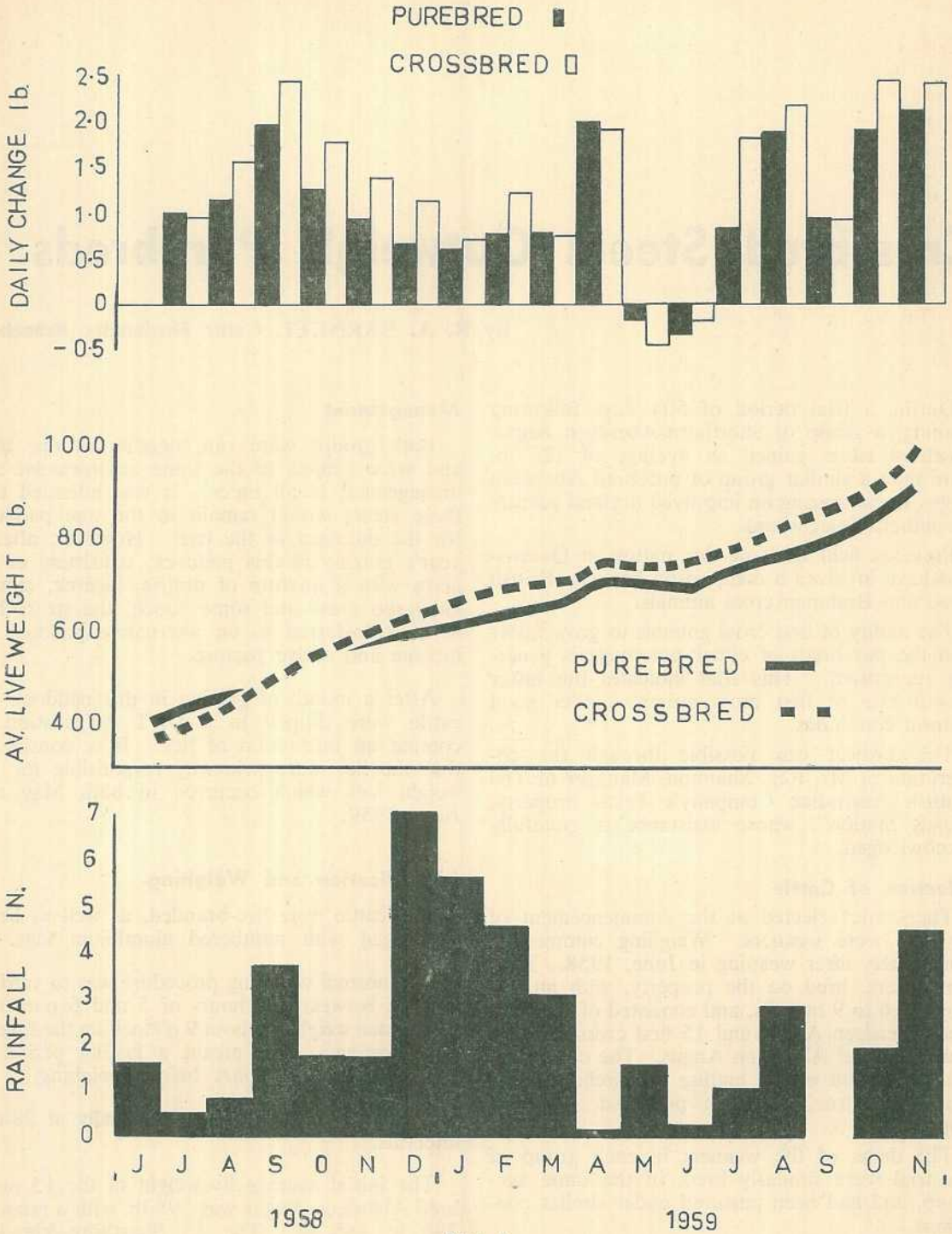


Plate 1

The Average Daily Change in Weight of each Group Calculated on a Monthly Basis is Shown in the Top Figure. The centre figure shows the growth curve for each group. Monthly rainfall recordings for Texas are shown in the bottom figure.

By October 15, the crossbred group had overcome the 35 lb. difference and averaged 1 lb. heavier than the purebred group. During this period of 112 days, the purebred group's average gain was 150 lb. as against the crossbreds' 186 lb.

During the following 200 days, the average daily rate of weight gain of both groups decreased. However, the ratio between the gains of the two groups was similar to that of the first 112 days. At this stage (April, 1959) the crossbreds were 43 lb. heavier than the purebreds.

During May the condition of the pasture deteriorated to such an extent that the steers had to be removed from the 20 acre paddock of improved pasture on which they had been grazing since the commencement of the project to another paddock of lucerne with access to matured native pasture.

Both groups of steers lost weight during May and June. This was attributed to the state of the pasture plus the added effect of a heavy infestation of lice. The purebred group lost an average of 14 lb. in comparison with a loss of 18 lb. recorded by the crossbred group.

From the end of June to the completion of the trial on November 30, when the steers were slaughtered, both groups improved remarkably in condition and liveweight. The final weighing was carried out on November 11. The average weights recorded at that time were:

Purebred group	903 lb.
Crossbred group	993 lb.

Slaughter Results

The steers were slaughtered on November 30, a period of 19 days after final weighing. In calculating the dressing percentage, use was made of the average daily liveweight gain for the 28 days preceding November 11, to estimate the final liveweight on the property.

The purebred's average chilled dressed weight was 536 lb., giving a dressing percentage of 57, whilst the crossbreds averaged 585 lb. with a dressing percentage of 56·4. The average difference in dressed weight was 49 lb.

At £10 per 100 lb. of beef, this difference is an advantage of £4 18s. a head in favour of the crossbred group. In addition, it should be noted that the crossbreds were initially 35 lb. lighter than the purebreds.

Judged on conformation, quality and finish, all carcasses were graded first but three were downgraded due to bruising.

SUMMARY OF RESULTS

Group	Initial Liveweight 25–6–58	Final Liveweight 11–11–59	Chilled Dressed weight 30–11–59	Dressing %	Liveweight gain 504 days	Gain per day
	lb.	lb.	lb.		lb.	lb.
Purebreds	398	903	536	57	505	1·0
Crossbreds	363	993	585	56·4	630	1·25

Statistical analysis indicates—

(*a*) That the calves with heavier initial weight within each group gained less weight over the trial period than the lighter calves; and

(*b*) The crossbreds gained significantly faster than the purebreds.

Botany For Farmers

Although compiled in the first place for beekeepers, "The Honey Flora of South-Eastern Queensland" has a use for farmers and others interested in botany. It contains illustrations and descriptions of the important ironbarks, gums, bloodwoods, boxes, stringybarks, wattles, tea-trees, and cultivated plants such as lucerne, pumpkins, oranges and clover.

"The Honey Flora of South-Eastern Queensland" contains 199 pages and 178 illustrations. Prices are: In Queensland 15s. a copy, with a 3s. discount to registered apiarists, University botany students and booksellers; elsewhere £1 a copy.

The Case Of The Coughing Pig

By E. R. JOHNSON, Veterinary Officer

If you admit to having coughing pigs in your piggery you have plenty of company. Coughing pigs are so common! And seldom is a coughing pig a thrifty pig.

Pneumonia is the most commonly encountered lesion in swine. In fact, in a survey done at Cannon Hill abattoir from March to August 1958, south Queensland swine turned in the startling figure of 76·25 per cent. with pneumonic lungs. What is the significance of this? Well, to the farmer it means poorer pigs, poor conversion rates, wider food/gain ratios, excessive retention of pigs until they attain market weight, and uneven litter size.

Numerous agents can cause pneumonia, and sadly enough, under many of the existing conditions they readily get their chance. In past years these agents formed a rather confusing and obscure picture, but today they have been largely sorted out and may be seen in truer perspective.

Let us look into those agents that cause pneumonia and also into some of those commonly *believed* to cause that affliction.

Virus Pneumonia of Pigs

Cause.—The disease virus pneumonia of pigs, commonly referred to in its abbreviated state of V.P.P., is due to a virus which has an Australia-wide distribution and is *by far* the major cause of pneumonia in pigs in this country.

Transmission.—It is transmitted by droplets of virus from a coughing pig to others in the immediate vicinity that inhale it. The disease is commonly introduced to a piggery via coughing stores but may be brought in by symptomless "carriers" in stores or breeding stock. From there it can smoulder on for years even if introductions are stopped. Piglets frequently become infected from their mothers. One pig was known to be infected for 66 weeks. From these last two facts you can see that once the disease is in, it is usually in for keeps if no action is taken.

V.P.P. is easily the most common cause of pneumonia in pigs, but, by itself it seldom causes a severe pneumonia. This is caused by the secondary bacteria which invade the lung after the virus.

Symptoms.—Ten to 16 days after exposure to infection, symptoms may be seen. Infected pigs can usually be divided into three groups:

(*a*) Symptomless and sub-clinical

(*b*) Acute

(*c*) Chronic

(*a*) Symptomless and sub-clinical. These are pigs of any age that harbour the virus without showing signs, or exhibit only fleeting signs when they are agitated or stirred up. The fleeting signs are usually a slight cough or irregular respiratory movements. Pigs in this category—a rather big category—are said to maintain condition and fatten moderately well, but they pose a big problem in that they maintain the virus in the herd and spread it to susceptible pigs.

(*b*) Acute or sudden onset. This type of disease occurs when a carrier or infected animal is introduced into a clean herd. Here all ages contract the disease, sickness can be 100 per cent. and deaths may be high. Younger pigs are more likely to die and death is due to effects of virus alone. Main signs are moderate fever (up to 106 deg. F.), poor appetite, lassitude,

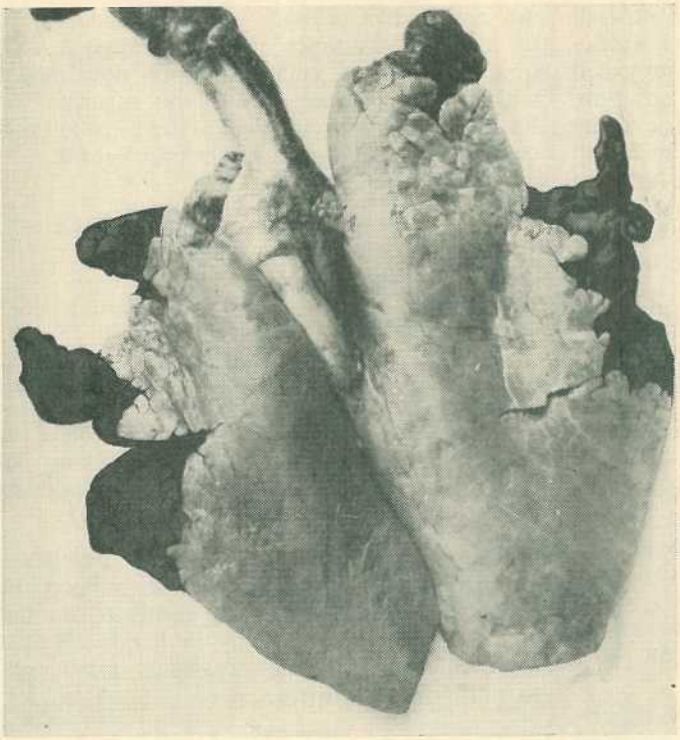


Plate 1

Note How the Darkened Hanging Parts of the Lung have been Destroyed by Virus First, then Bacterial Invasion. The destroyed tissues are plum-coloured, shrunken, feel hard and are clearly demarcated from healthy lung tissue.

slight cough and laboured respirations. Signs of infection disappear slowly, taking up to several weeks, and usually the affected pigs become very poor doers. The acute type is not the characteristic type.

(*c*) Chronic or long-standing. V.P.P. in the chronic form is found in 50 to 75 per cent. of affected piglets. It is the characteristic form of the disease. Pigs after an initial attack of the virus usually settle into this category. This is because many secondary bacteria invade the virus-damaged lung tissue and set up abscesses, inflammation and seats of infection. At this stage a delicate balance is set up between the pig on one side and infective agents on the other. Should adverse conditions prevail (poor housing and bedding, inadequate feed, excessive moisture and so on) the balance moves in favour of the infective agents. However, if pigs are housed well, kept dry and fed a good ration, the effects of the infective agents are mitigated considerably.

Signs seen in the chronic type of infection are—a very characteristic harsh, dry non-productive cough, appetite normal but food conversion poor; the coat lacks normal "bloom," and the skin may have a grey tinge. The cough is readily brought on by forced exercise.

Treatment.—There is no real treatment for the disease, but in the more severely affected pigs antibiotics may be used to control secondary bacteria.

Prevention and Control.—V.P.P. may be controlled by establishing a virus pneumonia-free piggery and employing a policy of no introductions or introductions only from V.P.P.-free herds.

There are three main ways of establishing a clean herd.

(1) Mate a clean boar to a clean sow.

(2) Remove piglets from the sow at farrowing and rear them artificially.

(3) Assure piglets are clean by removing them via Caesarian section at birth.

Whichever method is employed, remember that the virus droplets will not carry over 6 feet, so this makes it quite easy to start your free herd while disposing of your infected herd. Even an empty sty or pen between infected and free herds would be sufficient.

In (1) a piggery thought to be V.P.P.-free should be chosen. On this property a sow of at least three litters should be chosen (older sows are less likely to be infected) and subjected to vigorous exercise by means of agitation, chasing, and so on. Keep this up for some time and if the sow coughs at all—that harsh dry characteristic cough—she is out. In fact that piggery is out! Select a new piggery and repeat until a sow is obtained that can withstand vigorous exercise without coughing. In a similar fashion, select a boar. Remove these to clean quarters and mate. Half the resulting litter should be slaughtered after 4 weeks or so. If they are free of V.P.P. then the remaining half litter can be used as the nucleus of the new herd.

With (2) removal of piglets at farrowing and artificial rearing will undoubtedly result in many piglet deaths, but enough will be reared for a herd nucleus. This method appears to be the most practical method for the farmer as he can use his own stock and begin it at the next farrowing, without having to approach other properties, select, mate and wait. Once again, half the litter should be slaughtered for lung examinations.

The Caesarian method (3) is largely experimental and would have very limited practical application.

Swine Influenza

Swine influenza is a type of pneumonia which is caused by a virus not definitely known to be present in Australia. In 1944, an American veterinarian in Brisbane isolated what he said was this virus from a Beaudesert pig. Since it has never been detected subsequently and since the V.P.P. virus was not known until 1951, it seems likely that he may have been confusing these two viruses. However, some field outbreaks have been very reminiscent of this disease.

Swine Plague

The name of this disease, in Australia, is far more frightening than is the actual disease. Swine plague (pasteurellosis) is caused by a bacterium called *Pasteurella suiseptica* which in this country, for some reason or other, is not the severe blood-poisoning agent it can be overseas.

In our country the organism's role is almost solely that of a secondary invader. But make no mistake, it can kill and it can cause serious ill-thrift in pigs. About 70 out of every 100 pigs with a chronic pneumonia have Pasteurella in their lungs—a direct cause of ill-thrift.

This organism is an eager invader. Its prey are pigs with a primary virus pneumonia or pigs of lowered resistance in wet, draughty, muddy quarters or again, underfed poorly nourished pigs with little resistance. Make no mistake—when Pasteurella comes in under these conditions it can and does kill or severely affect thrift.

Infection	Age	Liveweight
	Days	Lb.
V.P.P. + Pasteurella infection ..	131	38
V.P.P. alone	120	66
Lungs, infection free	120	104

These figures were obtained under experimental conditions.

In practice V.P.P. never occurs alone. It is either V.P.P. plus secondary invaders or lungs free of infection. And what can be done about this?

The same simple management practices as outlined for V.P.P. hold here. Feed them properly, house them well, eliminate dampness and the problem is usually in hand. However, if already present, the organisms may respond to antibiotic treatment.

Swine paratyphoid (Salmonellosis)

The bacterial disease of Salmonellosis is the most common general infection of pigs in Australia. In addition to this, the organism usually concerned in Australia, *Salmonella cholerae-suis* variety *kunzendorf*, possesses marked invasive powers. So it is little wonder that the organism is so often found in pneumonic lungs of swine.

However, a Salmonella pneumonia is usually seen in survivors subsequent to a sudden and severe outbreak of paratyphoid. In an outbreak animals are often found dead or scour severely, show a purple discoloration of the skin, high temperature (105 to 108 deg. F.), muscular weakness and may have eye and nasal discharges. If the pigs linger a few days or survive the infection they usually develop respiratory signs including cough and difficulty in breathing, as by then the organisms have lodged in the lung. These pigs are likely to remain chronically affected and become poor doers.

Treatment.—Long-standing cases are less likely to respond than are early cases. Antibiotics, sulphonamides and furazolidone have all been

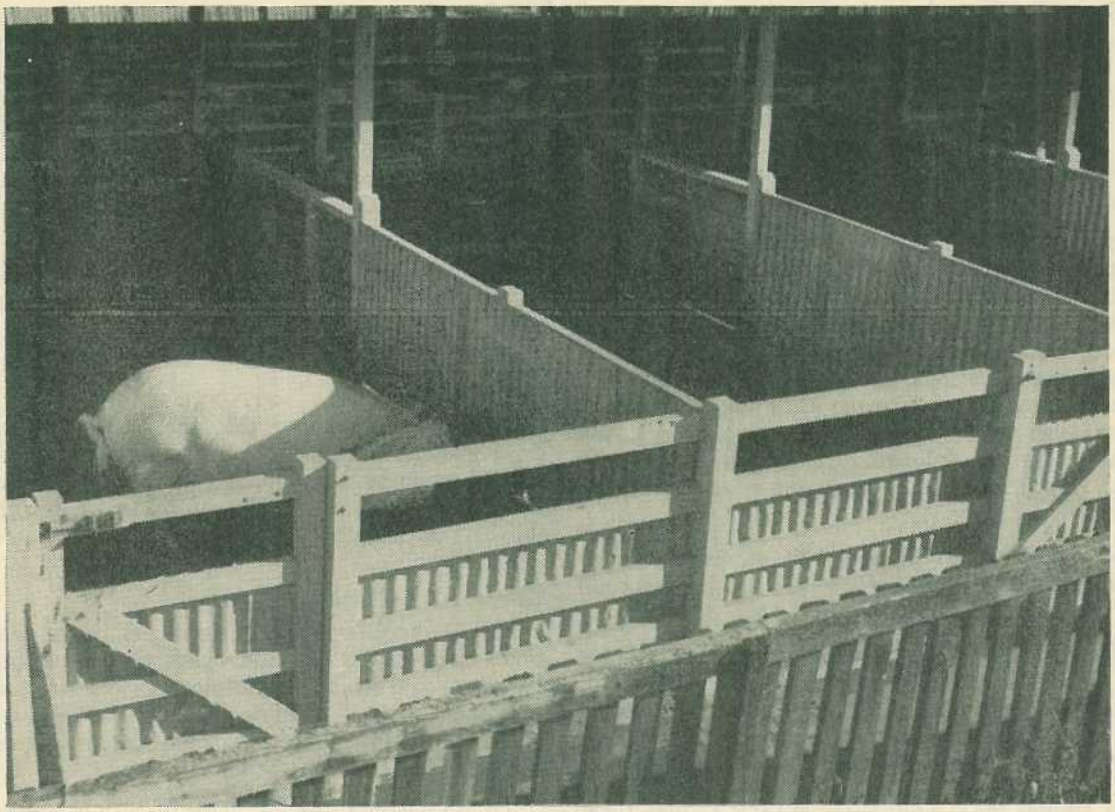


Plate 2

It has been Established that the V.P.P. Virus will not Transmit over 6 ft. (Open Space) or over 10 ft. (under a Common Roof). Therefore, one of these 10 ft. wide, roofed pens would be a sufficient buffer between infected and clean herds.

used with some success. However, sulphamezathine, the most readily available treatment, frequently gives good results. In an outbreak both sick pigs and in-contact pigs should be treated with the whole of the affected group being isolated. This treatment of paratyphoid should be carried out early in the disease before mass deaths and pneumonic "lingerers" occur.

Prevention.—Avoid buying in pigs—the main source of introduction. If this must be done, isolate the introductions for 2 to 3 weeks before adding to the home herd.

At times the disease comes into a self-contained piggery via rats. If this occurs isolate and treat early in the course of the disease.

Verminous pneumonia

There is a widely-held belief that the large roundworm, *Ascaris suum,* of pigs is responsible for the coughing-pneumonia symptoms frequently seen in pigs. To this state had been given the names "verminous pneumonia," "ascaris pneumonia" and "pulmonary ascariasis."

However, in the light of recent works it seems certain that worms are not the cause of the hronically coughing, poor doer pig. Why was the roundworm blamed in the first place? Well, the large roundworm, the commonest worm in pigs, is commonly found in the small intestine of the pig and its eggs pass out in the pig's faeces to be ingested accidentally later on. These eggs are ingested, hatch in the stomach and small intestine, and the larvae pass via the blood to the liver, heart and then the lungs. At the lungs the larvae burst into air sacs from the blood and *do cause a cough* whilst doing so. This cough causes them to be swallowed to the small intestine, where their life cycle is completed as they grow to adults.

So with those three facts—

(*a*) Roundworms are extremely common in pigs.

(*b*) Roundworms do cause a cough.

(*c*) Coughs are extremely common in pigs.

it was misinterpreted that worms are the common cause of the harsh dry cough in swine.

However, it has been shown that even in swine fed 250,000 to 500,000 infective larvae of the roundworm (an exceptionally heavy dose) though a temperature rise and cough were produced in half of the pigs, *the cough was soft and moist and persisted for only five days at the outside* (from the 7th to the 12th day). Furthermore, pigs were autopsied after receiving heavy doses, with the following result: larvae-injured lungs were healing by 10 days and were completely healed by 21 days.

So prior to this discovery it seems that once again confusion existed with the widespread V.P.P. disease.

Though roundworms are not responsible for the chronic cough and associated ill-thrift in pigs it is likely that they can "trigger" off pneumonia by carrying infection in or by injuring the lung so that infection can get in.

It should be remembered, however, that these worms can cause severe ill-thrift via their action alone from the pig's intestine and also by causing severe liver damage.

Treatment.—Both sodium fluoride and the piperazine compounds are highly efficient in removing roundworms.

Lungworm pneumonia

This pneumonia is due to the swine lungworm, *Metastrongylus sp.*, which is present in all States of Australia.

It is of little consequence. Seldom does it cause any major trouble. When present it is usually in young pigs under six months of age, lives in the terminal air passages and set up a bronchitis and pneumonia. However, pneumonia here is again due to bacterial or viral invaders.

The lobes of the lungs involved are mainly the vertebral (largest or hind-most) lobes and signs of worms are star or wedge-shaped sunken "scars" over these lobes.

There is a treatment for the swine lungworm but then the lungworm of the pig is not the problem that the lungworm of the ruminant can be. Do remember that the swine lungworm needs the ordinary earthworm to complete its life cycle. Larvae of the lungworm are eaten in by the earthworm and then the pig in turn must eat in the lungworm larvae from the earthworm.

If your pigs are coughing and doing poorly it is most unlikely that the lungworm is the cause.

Dry Feeding

It was once thought that the feeding of pigs on dry diets like crushed grain, meal or pollard, caused pneumonia. Since the recent discovery (1951) of the V.P.P. virus, it seems certain that this is not true.

Other Miscellaneous Causes

(i.) Tuberculous pneumonia. T.B. is sometimes responsible for odd cases of pneumonitis. It is rare and usually abdominal lesions are seen, not lung lesions. This is because the disease is mainly eaten in (infected milk, carcasses) and not breathed in as in cattle.

(ii.) Glässer's disease. This disease is common and widespread in Queensland and frequently associated with it is a pneumonia. Whether this pneumonia is truly a part of Glasser's disease or whether it is an incidental V.P.P. infection is, at present, uncertain.

Summary

To put it in a nutshell—if your pigs are coughing, poor doers and show signs of pneumonia, especially at or after weaning, the chances are 7 out of 10 that you have a virus pneumonia (V.P.P.) problem on your hands. If those pigs are poorly kept or underfed, Pasteurella and Salmonella will probably be present as a low-grade energy-sapping infection. Worms will not explain much. Swine influenza probably does not enter the question. "Dry feeding" coughs are in reality coughs due to V.P.P. T.B. will explain but one case in hundreds. Glasser's disease will be accompanied by other severe signs and you will quickly realise that it's not just a pneumonia problem.

The enormous role of V.P.P. is obvious!

Feeding Tray For Pet Lambs

. By C. R. SMITH, Senior Adviser in Sheep and Wool.

A device that lessens a good deal of the individual attention required in feeding several pet lambs was seen on a Dalby fat lamb farm recently.

It consisted of a lamb self-feeding tray constructed to carry a number of bottles with the teats securely fixed so that they could not be pulled off by the lambs during feeding.

The tray can be constructed easily from odd timber. A diagram of the device is given in the accompanying plate.

Main construction particulars are as follows:

The frame is built from light timber, and stands on short legs. The length of the frame is 3 ft. and the width 2 ft. An inverted V tray takes up the middle of the frame, sloping from the centre to each outside. Each side of the inverted V tray supports six leaning 26 oz. bottles.

Running the length of the frame on each side is a board in which holes have been cut, the result resembling a "bobs" board. The bottles are laid neck downwards on the tray so that the "bobs" holes support the necks of the bottles.

To prevent the teats being pulled off by feeding lambs, rubber rings are used. These are cut from a car's used inner tube. The rings are 2 in. wide and have a small slit cut at one end.

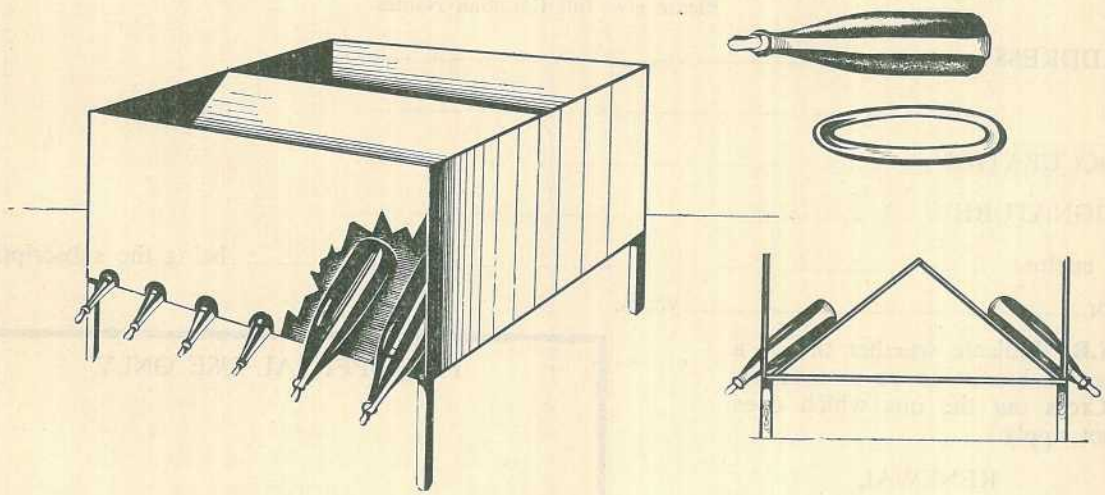


Plate 1

Left: The Feeding Tray Ready For Use. Right Top: Bottle with Teat and Rubber Ring. Right Bottom: Positions of Bottles on the Inverted V.

The teat is placed on the full bottle, slipped through the slit in the rubber, and the rubber ring pulled taut over the bottom of the bottle.

Early Lamb Care

If the orphan lamb has not suckled its mother, give a teaspoon of warm castor oil before feeding with cow's milk. The colostrum or first milk from the ewe's udder causes bowel movement and evacuation of bowel contents, as well as supplying antibodies which protect the lamb against infections. Castor oil does not contain antibodies as does the colostrum, but it does help to expel the meconium, or first faeces, of the young lamb, and starts off normal bowel movements.

Feed a lamb little and often in the first two weeks or so. The equivalent of half a small tomato sauce bottle of pure warm cow's milk five times a day is suitable. Thereafter half a 26 oz. bottle three times a day should suffice. All bottles, utensils, and teats should be well washed and scalded between feeds, and kept in a fly proof gauze safe when not in use.

After 4 weeks, provide supplementary feed for the lambs as well as milk. Equal parts by weight of lucerne chaff and cracked grain plus 1 per cent. of fine ground limestone can be fed from a self-feeder. Water also should be made available.

It's written for Queenslanders

QUEENSLAND AGRICULTURAL JOURNAL

Subscription for Queensland Producers, 5s. a year (10s. for two years, and so on)

To receive the Journal regularly, fill in below and send, with subscription, to:
The Director-General, Department of Agriculture and Stock, Brisbane.

NAME.....

Surname first in BLOCK LETTERS. State whether Mr., Mrs., or Miss and if Senior or Junior.
Please give full Christian Names.

ADDRESS.....

.....

OCCUPATION.....

SIGNATURE.....

I enclose.....being the subscription

for.....years.

N.B. Indicate whether this is a new subscription or a renewal. (Cross out the one which does not apply.)

RENEWAL
NEW SUBSCRIBER

FOR OFFICIAL USE ONLY

Pass this on to a friend.

Using Herd Recording Results

By C. H. CLARK, Technologist, Farm and Herd Surveys.

The use of the Annual Herd Summary in conjunction with the Sire Survey results enables members of the Herd Recording Scheme to cull their low-producing animals and select breeding stock for rearing of high-producing replacements. These production records also afford an important check on many farm and herd management practices.

Approximately one-quarter of the dairy farmers in Queensland have been members of the Herd Recording Scheme supervised by the Department of Agriculture and Stock. Some have recorded their herds for short periods only, but the majority have remained in groups for one year or more. This service by the Herd Recording Section provides information on the production of individual cows, and measures the capabilities of bulls according to the production of their daughters. Material is provided each month to members in the form of a Herd Recorder's Record Sheet, and in a Monthly Progressive Production Sheet. At the end of the year all records of the length of lactation, total milk and butterfat yield for individual cows are summarised in an Annual Herd Summary, and Sire Surveys are prepared.

TABLE 1

COMBINED RECORDS FROM ANNUAL HERD SUMMARIES

(*R. denotes replacement cows*)

1st Summary—1957–58						2nd Summary—1958–59					
No. of Cow	Age	Month Calved	Lactation (days)	Milk (lb.)	B/Fat (lb.)	No. of Cow	Age	Month Calved	Lactation (days)	Milk (lb.)	B/Fat (lb.)
9	5	7–56	300	4,755	231	9	5	8–57	300	4,600	200
10	5	8–56	270	3,900	191	10	6	8–57	270	4,010	186
17	5	8–56	270	4,140	189	17	5	8–57	150	1,680	77
21	8	7–56	270	3,930	170	21	9	9–57	210	1,965	83
14	4	9–56	240	3,780	164	14	5	9–57	300	3,690	165
22	4	9–56	210	3,045	150	22	..	8–57	270	3,255	162
24	3	7–56	240	3,885	144	24	CULLED				
18	3	7–56	210	3,885	112	18	CULLED				
6	2	11–56	210	4,500	173	6	5	11–57	210	3,885	152
27	2	9–56	240	3,810	167	27	3	9–57	210	3,010	120
25	2	10–56	210	3,000	135	25	3	10–57	240	3,210	141
15	2	11–56	180	2,745	121	15	3	10–57	270	3,715	160
23	2	10–56	210	2,500	114	23	3	10–57	240	2,620	120
26	2	12–56	180	1,935	87	26	3	11–57	150	1,700	72
						16R	5	9–57	240	4,215	200
						12R	..	10–57	240	3,870	170
						4R	..	10–57	300	4,945	201
						1R	3	8–57	240	3,090	123
						20R	3	11–57	240	4,000	165
						7R	2	10–57	210	3,685	162
						3R	2	10–57	270	3,115	146
						2R	2	10–57	210	2,665	129

Unfortunately some of the information contained in these result forms supplied to producers is overlooked or not fully appreciated when considering herd management practices in relation to culling and breeding. To enable recording members in particular and producers in general to make the best use of their herd records the following material has been prepared detailing the special features of the Annual Herd Summary and discussing a specific herd record:

Annual Herd Summary

During each cow's lactation a progressive total production of her milk and butterfat yield is supplied to the owner each month. At the end of the year the production records for all completed lactations are assembled in the Annual Herd Summary. It contains the records of all cows in the herd which have completed a normal lactation during the year. The records of cows which have died or been disposed of are included only if they have completed a lactation of 240 days or more. Records are tabulated according to age, and are entered in ascending order of butterfat production within each age group.

When a member has been recording for one year only, all the records of cows which have completed lactations will appear on one summary. However, when two or more years of recording have been completed it is useful to combine these results into one table for ease of comparison. One of the best ways to prepare these records for examination is to assemble them from the summaries on to a separate sheet. If this is done, the production of individual cows may be examined more easily. The sheet is prepared by writing down all the records from the first summary and then noting records from subsequent summaries against the appropriate number of each cow.

An example of a combined result sheet is shown in Table 1. It represents the records of a small herd which has been recorded for two years. The information from the first summary (1957-58) has been entered so that the records of the mature cows are listed at the top of the sheet and the 2-year-old records are entered last on the sheet. The records of replacement animals (denoted by R) from the second summary which entered the herd in the 1958-59 year are listed on the bottom of the sheet.

Records Depend on Accurate Reporting

The accuracy and detail of each summary prepared in the Herd Recording Section's main office will depend on the information which has been provided initially on the Herd Recorder's Record Sheets. Perusal of the herd results shows that information concerning the ages of cows numbered 22 and 6 has been incorrect, resulting in errors on the Herd Recorder's Record Sheet. Sometimes ages have not been given when cows commenced their lactations and records have been included in the "Unknown" age category, for example cows 12R and 4R. In other cases the age of mature cows has been denoted by "5" when the accurate age was not known, for example, cows numbered 9 and 17.

The physical condition of the cow during her lactation must be considered. The records would require amendment if attention had been drawn to ailments, for example three day sickness, by notings on the Herd Recorder's Record Sheet. If this information has not been supplied to the recorder it makes a comparison of results between cows and between seasons a difficult procedure.

Ranking the Cows

In Table 1 the productions entered from the first summary are recorded in descending order of butterfat production within each age group. This way it is an easy task to pick out the highest and lowest producers in each age group and divide the herd into three portions according to individual production figures. Records from the second sumary, however, are entered opposite the number of each cow. It is therefore a little more difficult to sort out the highest and lowest producing cows, but if the herd average is taken as a guide the highest producers will be above this figure.

A useful method of relating these results between seasons to obtain information on the ability of a cow to produce at a high level continuously is to prepare a second set of tables. Using the same records shown in Table 1, results can be arranged as shown in Table 2.

Examining the Ranking Orders

Firstly, let us examine the records of cows in the top third of the herd from the first summary, and see what happened to them in the following year. Cows numbered 9 and 10

TABLE 2

RANKING THE COWS

Position	1st Summary, 1957–58 Cow No. (lb. b/fat)	2nd Summary, 1958–59 Cow No. (lb. b/fat)
Top 1/3 rd	9 (231) 10 (191) 17 (189) 6 (173) 21 (170)	4R(201) 9 (200) 16R(200) 10 (186) 12R(170) 14 (165) 20R(165)
Mid 1/3 rd	27 (167) 14 (164) 22 (150) 24 (144)	22 (162) 7R(162) 15 (160) 6 (152) 3R(146) 25 (141)
Bottom 1/3 rd	25 (135) 15 (121) 23 (114) 18 (112) 26 (87)	2R(129) 1R(123) 27 (120) 23 (120) 21 (83) 17 (177) 26 (72)

remained in this portion on the second summary while cow numbered 6 moved to the mid third of the herd and cows numbered 17 and 21 to the bottom third. An addition to the top third of the herd on the second summary was cow No. 14 which was in the mid-portion on the first summary. The other additions to these top producing members were replacement animals. These results enable us to accept with confidence that cows numbered 9, 10, 14 and 6 may be used for breeding replacement stock as they had shown consistently high production for the two years. If required, other calves should be saved from cows numbered 4, 16, 12 and 20; but before they are accepted as breeding stock their records should be examined again in 1959-60. It should be noted that cow No. 22 in the mid third of the herd has demonstrated her consistency and her calf could be reared if it is required.

Cows numbered 17 and 21 are aged cows and old age probably accounted for their low records on the second summary. Although they were high producers in the 1957-58 year their monthly production should have been examined during the 1958-59 season. As soon as their records indicated that their production was decreasing rapidly and below the herd average, they could have been culled immediately.

A glance at the records of cows in the bottom third of the herd according to each summary shows that cows numbered 15 and 25 were the only cows which moved to the mid portion. Cow No. 18 was culled and cows numbered 23 and 26, in their second lactation, remained amongst the lowest producers. Moreover, they produced less than the 2-year-old replacement animals denoted by 1R and 2R. These two young cows which failed again on their second lactations should now be culled, while cows numbered 15 and 25 should be watched carefully.

This combination and examination of results emphasises the following points:

1. The consistently high producing animals have been pinpointed.

2. The replacement stock may be bred from animals which are in the top and mid portions of the herd.

3. Old cows are frequently retained in the herd too long. They should be culled as soon as low production is evident.

4. Young animals which are in the bottom third of the herd on their first lactation should be given a second chance and culled if they fail again without a good reason.

5. Cows which move from the bottom to the mid portion of the herd on their second lactations should be watched carefully, before being used for breeding replacement stock.

6. Attention is focussed on the manner in which basic information on each cow has been kept and recorded. Ages, calving dates, sires and so on, should be available for each cow and the poor health of cows should have been noted. Unless all information is made available to the recorder it is difficult to make an accurate decision on breeding and culling programmes.

Factors Influencing Records

Besides the influence of age and health on production records, surveys of State-wide herd recording information have shown that the month of calving, period between calving, length of lactation, length of dry period and treatment prior to calving may affect records considerably. In

TABLE 3

EFFECT OF LENGTH OF LACTATION

1st Summary—1957–58			2nd Summary—1958–59		
Length of Lactation (days)	Butterfat (lb.)	Average B/Fat (lb.)	Length of Lactation (days)	Butterfat (lb.)	Average B/Fat (lb.)
180	121	121	180		
210	150, 112, 173, 135, 114	137	210	152, 120, 162, 129	141
240	164, 144, 167	158	240	141, 120, 200, 170, 123, 165	153
270	191, 189, 170	183	270	186, 162, 160, 146	164
300	231	231	300	200, 165, 201	189

the case of the herd records described, the production level of cows numbered 6, 15 and 25 could have been influenced by one of these factors. It may be noted, for example, that cows 15 and 25 milked longer in 1958-59 than in 1957-58.

(*a*) *Length of Lactation.*—We may study the effect of length of lactation on production by tabulating individual butterfat records according to the number of days each cow has milked. The tabulation is shown in Table 3. The records of the aged cows numbered 17 and 21 have been deleted from the second summary, and the low records of cow numbered 26 have been deleted from both summaries.

From Table 3 it is evident that the cows which milked for 270 and 300 days produced considerably more butterfat than those which milked for 210 days.

(*b*) *According to Month of Calving.*—Another interesting analysis is to list the number of days in lactation according to the month of calving. This has been done in Table 4, and shows that in both years the cows which calved in August milked longer than those which calved in the other months.

While the number of cows in each section is small, there are sufficient records from this herd to indicate the influence these factors can have on milk production. Similar studies may be made on other factors which influence individual records. It is well to recall that these factors may be responsible for variation in production records from year to year.

Plan of Examination

Each month and at the end of the year, information is forwarded to producers who participate in the Herd Recording Scheme of the Department. To use these records effectively a plan of examination and a knowledge of their importance is necessary. This article has shown how to use the Annual Herd Summaries to check individual records and to rank cows for breeding and culling purposes. Points regarding the examination of records have been made and factors influencing records have been considered. It has been possible to illustrate the methods of using the summaries to check on these factors.

TABLE 4

EFFECT OF MONTH OF CALVING ON LENGTH OF LACTATION

1st Summary—1957–58			2nd Summary—1958–59		
Month of Calving	Length of Lactation (days)	Average Lactation Length (days)	Month of Calving	Length of Lactation (days)	Average Lactation Length (days)
July	300, 270, 240, 210	255	July		
August	270, 270	270	August	300, 270, 270, 240	270
Sept.	240, 210, 240	230	Sept.	300, 210, 240	250
Oct.	210, 210	210	Oct.	240, 270, 240, 240, 300, 210, 270, 210	247
Nov.	210, 180	195	Nov.	210, 240	225

Crops And Pastures For Beef Cattle In The Burnett

By N. F. FOX, Agrostologist.

The purpose of this article is to show how fodder crops and sown pastures can be grown and used on beef cattle properties in the Burnett district.

Crops and sown pastures can be combined with native patures in a system of agriculture which will lead to increased turn-off and higher carrying capacities.

This stage can be reached on most properties by the adoption of a simple land development programme. I have called it unit development. It envisages the provision of units or "islands" of intensively managed areas of crop and pasture, strategically located within the property.

The species or kind of plants you grow will depend on the location of the property, its topography, soils and climate.

The success with which you use these species will depend on adoption of sound management and land use techniques.

There are some questions you want answers for:

What to grow?

When and how to grow it?

How much to grow and how to use it?

To answer these questions you should have some knowledge of:

Soils and their suitability for crop and pasture production.

Suitable fodder crops and pasture mixtures.

Establishment methods

Management techniques and their influence on land use systems.

Soils and Their Suitability for Crop and Pasture Production

Soils supply moisture and plant nutrients. They vary in their ability to store moisture. Sandy soils are commonly droughty but loams and clay soils store large amounts of moisture.

There are six major elements (Nitrogen, phosphorus, potassium, calcium, magnesium and sulphur) and seven minor elements (copper, manganese, zinc, iron, boron, molybdenum and chlorine) essential for plant growth.

Soils in the Burnett Valley and adjacent coastal districts may be designated under two main headings, coastal and subcoastal, each with a number of soil types.

Coastal Soils

Coastal soils are generally acid. The major elements, nitrogen, phosphorus and calcium are deficient over wide areas. Potassium is deficient on some soils.

No widespread evidence of deficiencies of minor elements exists though one or more may become limiting once the major deficiencies have been corrected.

Superphosphate will correct phosphorus deficiency and supply some calcium and sulphur.

Legumes, those plants which have the ability to extract nitrogen from soil air, will correct nitrogen deficiency. They make nitrogen available for following or associated grass crops.

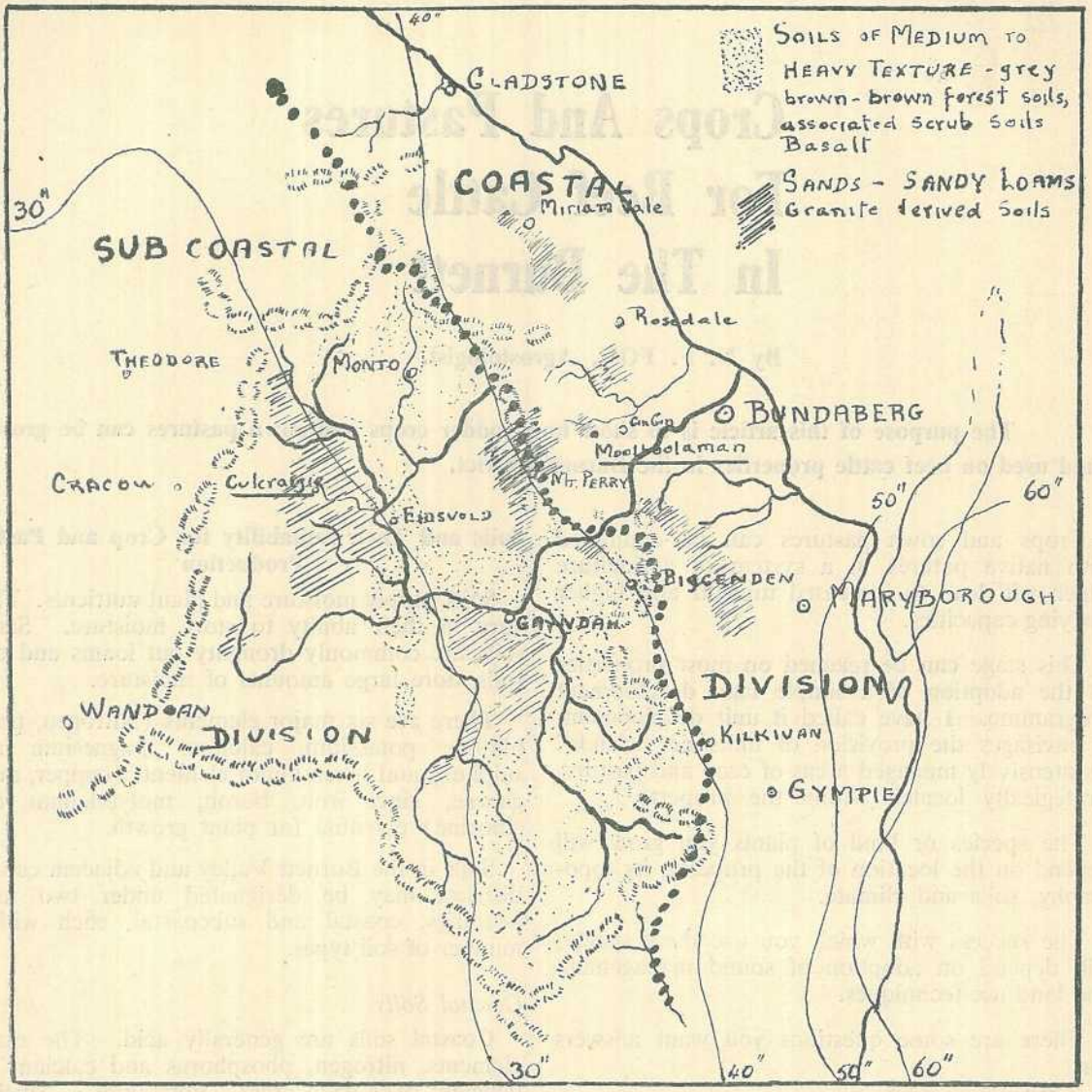


Plate 1

Burnett District of South-East Queensland.

Remember, legumes vary in their effectiveness in adding nitrogen to the soil. Centro, for instance, is more efficient than stylo.

Fertilizer trials showed that superphosphate at 5 cwt. to the acre increased the yield of phasey bean from 1¼ tons to 3½ tons per acre at "Moolboolaman".

Near Maryborough the following results were obtained with phasey bean:

	cwt.	cwt.	cwt.	cwt.
Superphosphate per acre	0	2½	5	10
Yield, cwt. to the acre	7.3	17.5	27.7	24.9

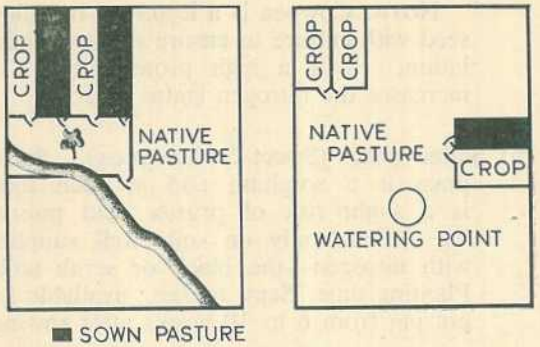


Plate 2

Diagram Showing Two Methods of Arranging Units in a Large Native Pasture Paddock.

There was progressive increase up to the most favourable application of 5 cwt. to the acre.

The effect of heavy dressings with superphosphate lasts some years. Where 10 cwt. to the acre was applied in 1953, the effects were still observed in 1960. The inference is that once a certain level of phosphorus in soil has been reached, periodic light applications only may be required.

Similar results have been obtained from trials at Rodd's Bay, Miriam Vale and Rosedale.

Evidence shows that provided superphosphate and leguminous plants are used in conjunction, fodder crops and sown pastures can be grown on a wide range of coastal soils.

Subcoastal Soils

Basalt derived soils include dark grey-brown or "black" forest soils, brown forest soils, and the associated "scrub" soils.

Scrub soils are well supplied with plant nutrients but there is evidence of a slow decline in nitrogen over the years following clearing.

Forest soils are deficient in nitrogen. Nitrogen can be accumulated by cultivation and fallowing to grow excellent grain or fodder crops. A response to sulphur by green panic has been observed at "Brian Pastures".

It is possible to grow a wide range of fodder crops and sown pastures provided legumes are included in pasture mixtures. Soil moisture conservation is important for fodder crops.

Granite derived soils are sandy soils that tend to be droughty. They are deficient in phosphorus and nitrogen. There is evidence of responses to potassium and molybdenum by lucerne at "Culcraigie".

Fodder crops, cowpeas for summer grazing followed by oats for winter grazing, can be grown if fertilizer is used.

Poor grey, forest soils (solodic) appear to be suitable only for timber and grazing at low stocking rates.

There are few soils which, given the required treatment will not produce fodder crops or sown pastures much superior in yield and quality to the native grasses they now support.

Suitable Fodder Crops and Pasture Mixtures

Climate and soils influence the selection of plants for a particular region. The 40 in. isohyet follows fairly closely the crest of the coast ranges. Crops and pasture mixtures which grow in the *subcoastal* division may not be suitable for use in the *coastal areas*. For example, lucerne will not persist under high rainfall conditions on acid and poorly drained soils. Paspalums grow on the coast but are not used in the dry areas. Townsville lucerne is better suited to coastal soils.

For further details of the crops and pasture mixtures listed contact your local agricultural adviser.

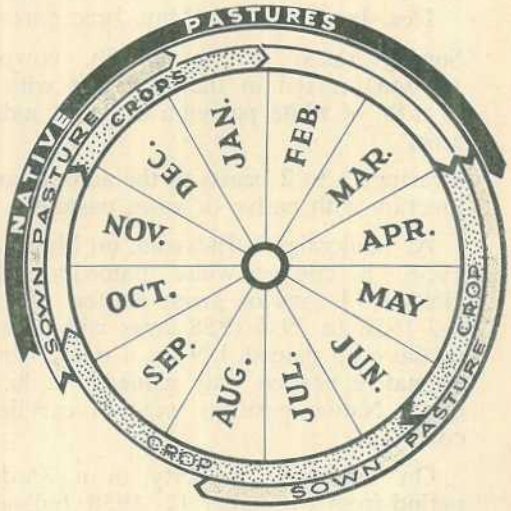


Plate 3

Grazing Seasons. Crops and Sown Pastures will Supplement Native Pastures.

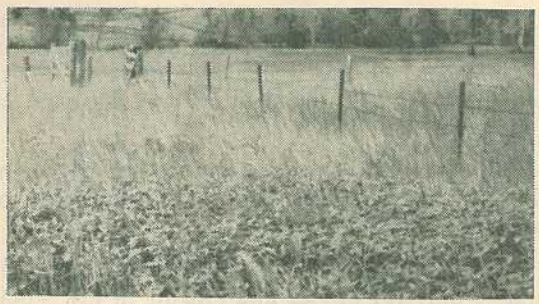


Plate 4

Five Hundredweight of Superphosphate Increased the Yield of Phasey Bean Three Times.

(*a*) *Summer-growing fodder crops*

(i) **Cowpea mixtures** are suitable in both coastal and subcoastal districts. Use superphosphate on coastal or sandy soils.

Cowpea may be grown alone but usually provides better grazing if planted with white panicum or sweet sudan grass, Mixtures may be grazed, or harvested for silage.

Varieties in use are Poona, Reeves, Cristaudo, and lately Malabar, a stem rot resistant variety.

Planting time:

Sept.-Oct. for Dec.-Jan. grazing.

Dec.-Jan. for April, May, June grazing.

Sowing rates: 10 to 15 lb. cowpea (Poona) mixed in the seed box with 6 to 8 lb. of white panicum or sweet sudan grass.

Grazing: 1 to 2 beasts to the acre in conjunction with native or sown pastures.

At "Culcraigie", Eidsvold, on March 6, 1958, a cowpea/white panicum crop yielded 14 tons of green matter. From 6-3-1958 to 29-4-1958 cows with access to the crop gained 1·9 lb. a day. Cows on native pasture only gained 1·2 lb. a day. Native pastures were in excellent condition.

On the same property in a 35-day period from December 12, 1958, bullocks with access to a cowpea/white panicum crop gained 2·7 lb. a day. On native pasture they gained only 1·9 lb. a day.

NOTE: Cowpea is a legume. Inoculate seed with culture to ensure efficient nodulation. It is a high protein crop. It increases the nitrogen status of soils.

(ii) **Sudan grass** (Sweet Sudan grass). Sudan grass is a sorghum and as such there is a slight risk of prussic acid poisoning. Plant only on soils well supplied with nitrogen—the black or scrub soils. Planting time: Sept. to Jan.; available for grazing from 6 to 10 weeks after sowing.

Sowing rate: 8 to 10 lb. to the acre through a seed box.

To obtain a better balanced fodder it is preferable to mix sudan grass with cowpea.

Sudan tends to regenerate in the spring and will provide some grazing in the second year. Yields of green feed at 8 to 10 tons to the acre are common. The crop is suitable for conservation as hay or silage.

(iii) **Sweet sorghum** (Varieties—Sugardrip, Honey, Italian, &c.) Some risk of prussic acid poisoning exists here. The normal precautions should be taken.

It is suitable for soils well supplied with nitrogen, for example, black forest or scrub soils.

Planting time: Sept. to February; available for grazing in 2 to 4 months.

Sowing rate: 8 to 10 lb. to the acre.

Sweet sorghum is not commonly used for grazing. Sudan grass is preferred, but yields of sweet sorghum often exceed 10 to 15 tons to the acre. Yields in excess of 20 tons have been recorded.

(iv) **Sorghum almum** or Columbus grass. It is another sorghum with a slight risk of prussic acid poisoning. Good yields are possible only on soils well supplied with nitrogen—black soils and scrub soils. It is perennial in habit, while sudan grass tends to be a biennial only.

Sorghum almum is not impressive on poor coastal or forest soils.

Plate 5

A Close-up of a Well-Grown Crop of Cowpea and White Panicum.
A crop such as this at "Culcraigie" was planted on December 20, 1957, and on March 6 yielded 14 tons of green material to the acre.

The crop has been grown with lucerne in the Taroom, Wandoan districts.

Planting time: January to early March.

Sowing rate: 5 lb. to the acre with 1 lb. lucerne to the acre.

At the time of writing, Columbus grass is still on the prohibited seed list in Queensland because of the difficulty in distinguishing its seed from Johnson grass which is one of our worst pests in farming districts. However, it has now been removed from the prohibited list in New South Wales.

(v) **Lucerne.** Lucerne is a perennial leguminous crop which can be grown on most soils west of the coast range. In coastal areas, it grows successfully on well-drained alluvial flats only. It is the most valuable hay crop but is also important for grazing, and as a legume in sown pasture mixtures.

For hay crops—see Departmental literature.

Time of Planting lucerne for grazing: March or April.

Sowing rate: 1 to 5 lb. to the acre; 1 to 2½ lb. gives excellent results in dry areas; 10 to 12 lb. to the acre under irrigation.

Grazing: Exercise care with bloat; ½ to 1 acre of lucerne for each beast grazed in conjunction with native pasture.

At Brian Pastures between 8-5-1958 and 25-8-1958, stock with lucerne available gained 86 lb. Stock on native pastures

lost 21 lb. in the same period. With supplementary lucerne, stock made steady gains of 1·3 lb. a day during the last 10 weeks of the period.

(*b*) *Winter growing Fodder Crops.*

Plant on well prepared land, in autumn or early winter rains.

(i) **Oats** is the most favoured crop. On the coast it is best planted on land previously cropped to cowpeas. On black or scrub soils, the crop is planted following a summer fallow to trap moisture and build up nitrogen.

Varieties: Use only rust resistant varieties. Bovah and Benton are popular. A new variety, Saia, is on the market. Bovah is satisfactory in the Burnett.

Planting rates:

30 to 40 lb. on droughty soils.

40 to 50 lb. on good agricultural soils.

Planting time: Late February to June.

Grazing: Commence to graze when plants are firmly established and before seed-heads show. The best results are obtained by grazing and then spelling to allow for regrowth. Crops may be available for grazing between May and October.

Results: Yields depend on soil nitrogen and moisture. On black soils at "Jubilee" in 1958, two groups of animals between 1-7-1958 and 13-10-1958 recorded gains of 2·4 lb. a day and 3·7 lb. a day respectively at 1 beast to the acre. Between June and October, 1959, (oats badly rusted) 47 head gained an average of 1·4 lb. a day at 1 beast to the acre.

On the "Culcraigie" sandy soils, weaners from 1-7-1959 to 8-9-1959 gained 1·5 lb. a day. On native pasture, the gain over the period was 0·2 lb. a day. Between 31-5-1960 and 12-7-1960, 40 weaners on 20 acres of oats *gained* 0·9 lb. a day. Those left with their mothers on native pastures *lost* 0·24 lb. a day.

(ii) **Wheat.**—Short grazing season only.

Varieties: Long growing season varieties, such as Lawrence.

Planting time: March to June.

Seeding rate: 45 to 50 lb. to the acre.

Plate 6.

Oats Growing on Poor Sandy Soil at "Culcraigie" in July, 1959.

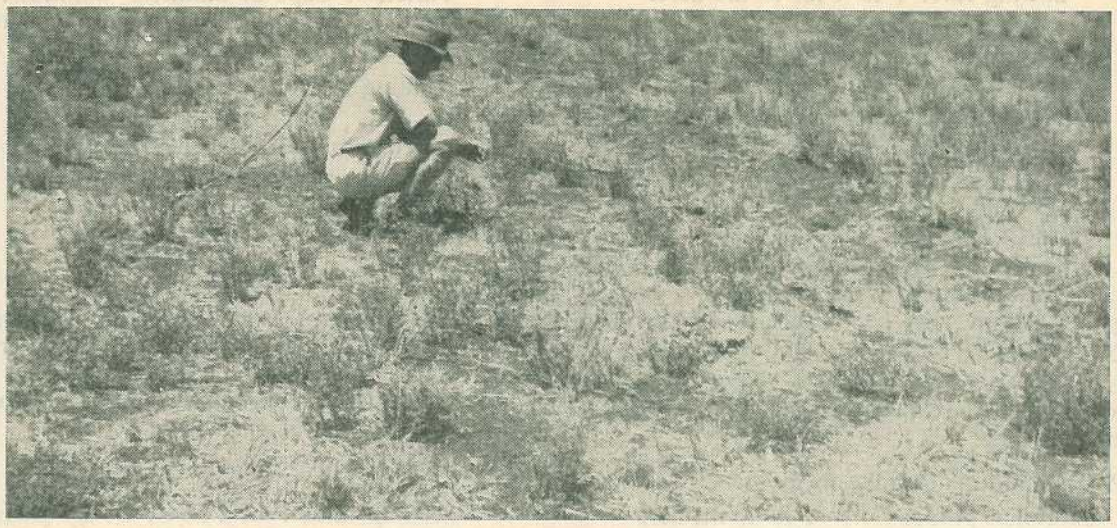


Plate 7

Lucerne Regrowth in a Rhodes Grass/Lucerne Mixture at "Brian Pastures" in December, 1957.

(iii) **Barley** provides little regrowth but may be planted late in the season to provide some spring grazing.

(iv) **Green panic—centro—phasey bean.** A suitable mixture for coastal soils with fertilizer applications.

Planting time: January to March.

Sowing rates: Green panic 3 to 5 lb. to the acre; Centro 4 lb. to the acre; Phasey bean ¼ lb. to the acre.

The pasture can be used for supplementary grazing between April and August and again in early summer. Under continuous grazing, it should carry 1 beast to 3 to 4 acres.

(v) **Scrobic—centro—phasey bean** is suitable for coastal soils, including soils subject to temporary waterlogging, with fertilizer.

Planting time: January to March.

Sowing rate: Scrobic, 2 to 3 lb. to the acre; Centro, 4 lb. to the acre; Phasey bean, ¼ lb. to the acre.

It is satisfactory pasture, extremely palatable at all stages of growth.

(vi) **Rhodes grass—centro—phasey bean.** This has been used with success at Rodd's Bay. It may have a wider application.

Planting time: January to March.

Sowing rate: Rhodes grass, 4 to 5 lb. to the acre; Centro, 4 lb. to the acre; Phasey bean, ¼ lb. to the acre.

(vii) **Green Panic—Molasses grass—centro—Townsville lucerne.**

Suitable for sandy coastal soils.

Planting time: January to March.

Sowing rate: Green panic 3 lb. to the acre; Molasses grass ½ lb. to 1 lb. to the acre; Centro 4 lb. to the acre; Townsville lucerne, 1 to 2 lb. to the acre.

(Phasey bean is subject to nematode attack on sandy soils.)

(viii) **Para grass** is used on wet or waterlogged soils in coastal districts. It is extremely palatable, and nutritious.

Plant by runners, roots or cuttings in September to October or January to February. Protect from stock.

(*d*) *Townsville lucerne* occupies the unique position of being the only introduced legume to establish successfully in native pasture. It is used with sown pastures in coastal districts.

Planting time: October to February.

Sowing rate: 1 to 4 lb. to the acre.

Note: Establishment is improved by renovation, using disc or tined implements. It is a heavy seeder. The density of the initial stand will increase. Townsville lucerne offers the one means of considerably improving the quality of native pastures in coastal districts.

(*e*) *Irrigated Pastures*

When conditions are suitable and high priced stock (for example, stud bulls) are grazed, irrigated pasture may be the means of providing very high quality fodder throughout the year.

Irrigated pastures are a separate study in establishment and management. Water requirements are high.

A suitable mixture may include:

Perennial prairie ..	5 lb. to the acre
H. I. rye-grass ..	4 lb. to the acre
Phalaris	4 lb. to the acre
Ladino white clover	2 lb. to the acre
Lucerne	1 lb. to the acre

Mixtures may be used at 2 beasts to the acre on a year-long basis. At "Eidsvold" Station, 20 acres fed 80 bulls from October to March in 1959-1960.

Establishment Methods

In the grazing districts the successful establishment of crops or sown pastures depends on the complete destruction of the native or weed species. There should be no competition for moisture or plant foods by unwanted plants.

Suitable seedbed conditions can be achieved by—

(*a*) A scrub burn

(*b*) Cultivation

Varieties: Cape or Skinless. Skinless has given better results towards the central districts.

Planting rate: 50 lb. to the acre.

(*c*) *Sown Pasture Mixtures*

(i.) Buffel grass and lucerne.

(ii.) Green panic and lucerne.

(iii.) Rhodes grass and lucerne.

The mixtures are suitable on the black (basalt derived) soils and on the scrub soils. They will persist for at least 5 years. Longer periods have been recorded, with careful management.

Planting time: January to March.

Seeding rates Forest soils: Buffel grass 3 to 5 lb. to the acre and lucerne 1 to 2 lb. to the acre; Green panic 3 to 5 lb. to the acre and lucerne 1 to 2 lb. to the acre; Rhodes grass 3 to 5 lb. to the acre and lucerne 1 to 2 lb. to the acre.

Seeding rate of grass depends on quality of seed. Good strikes have been recorded at 1 lb. to the acre on newly burnt scrub land.

Grazing management: The pasture mixture should be grazed lightly during the first year. Rotational grazing, 2 weeks on and 6 to 8 week off, ensures the persistence of lucerne. A suggested stocking rate is 1 to 4 acres on a year-long basis.

Some results:

TABLE 1

WEIGHT CHANGES FOR 5 GROUPS OF ANIMALS

"*Brian Pastures*" *Pasture Research Station*

lb./Liveweight per acre

Group	Period	Rhodes Grass + Lucerne	Green Panic + Lucerne	Buffel Grass + Lucerne	Native Grass
1	7–1–55— 20–1–56	112·0	116·2	122·9	36·0
2	20–1–56— 11–5–56	40·3	34·4	43·4	12·7
3	11–5–56— 14–9–56	20·8	33·4	34·3	—8·8
4	14–9–56—22–11–57	50·8	93·5	83·2	25·4
5	22–11–57— 15–8–58	50·2	56·5	68·0	43·5
	Totals	274·1	334·0	351·8	109·7

On sandy soils in the Burnett, trials suggest Biloela buffel grass and lucerne will be satisfactory.

Cultivation implies the use of machinery and certain costs are involved.

Minimum machinery required (1960 figures):

	£	£
Medium horsepower tractor	1,350	
Chisel plough (complete) ..	265	
Seed box	150	
Total	1,765	
Offset disc cultivators are desirable	185	
		1,950

The necessary equipment can be purchased for less than £2,000.

As a guide, a set of standard operating costs are presented. (Details will differ slightly with make of power unit, fuel costs and location).

Tractor Operating Costs can be summarised as follows, assuming that the tractor and equipment have a life of 8,000 hours or 10 years.

	Per hour s.	d.
Fuel—1 gal. dieselene per hour at 2s. 6½d.	2	6·5
Crankcase oil—2½ gal. every 200 hours at 10s. 3½d. gal. ..		1·54
Air cleaner oil—1 pt. every 50 hours at 1s. 6d.		0·36
Element for oil filter every 500 hours at 16s. 4d.		0·39
Elements for fuel filter every 100 hours at 28s. 4d.		0·34
Top up oil and grease every 10 hours at 1s. 6d.		1·80
New tyres and tubes every 3,000 hours at £180	1	2·40
Repairs and maintenance 5% ..	1	8·20
Depreciation at 10%	3	3·84
Interest on Capital 5% on first year on £1,348 to 5% on £135 in the 10th year ..	1	1·0
Total	10	2·37
Tractor driver's wages and keep at £16 a week	8	0
Total	18	2

Chisel Plough and Seed Box Costs: Capital costs are £413 and supposing they are used for the life of the tractor only—

	Per hour s.	d.
Depreciation at 10%	1	0·4
Interest on capital at 5% flat rate		6·0
Repairs and maintenance at 5% flat		6·0
Total	2	0·4

The cost of operating the tractor with attached chisel plough and seed box will be £1 0s. 2·4d. per hour.

The 7 ft. implement should work at the average rate of 2½ acres an hour.

Cost per acre = £1 0s. 2d. ÷ 2½
= 8s. 1d. or say 8s. an acre.

To prepare new land after native pasture has been burned, three workings may be necessary—

	£	s.	d.
Cost per acre	1	4	0
Cost of seeding	0	8	0
Cost of seed			
10 lb. cowpea at £2 5s. 6d. per bushel	0	7	7
6 lb. white panicum at 9d. per lb.	0	4	6
	2	4	1

The cost of land preparation and planting = £2 4s. 1d. an acre.

The objects of cultivation or tillage are:

1. To prepare a suitable seedbed.
2. To protect the crop from competition.

Tillage

(*a*) Destroys and prevents the growth of weeds.

(*b*) Conserves soil moisture by means of a surface mulch of loose soil free of weeds.

(*c*) Incorporates stubble and other organic matter with the soil so that it is decomposed and plant foods are liberated for the next crop.

(*d*) Aerates the soil, which helps in decomposition.

(*e*) Reduces the soil to a structure suitable for the planting and germination of the crop seeds.

The beneficial effects are physical, chemical and biological.

Trials at "Brian Pastures" and elsewhere over a number of years have demonstrated that it would be a waste of time and money to sow on anything but a well-prepared seedbed.

Establishment of Summer-growing Crops

For September-October plantings, commence preparation in July. Burn native pasture. Plough to destroy the native plants. Chisel ploughing is satisfactory. Some prefer to use offset discs first and then the Chisel plough and sweeps.

Work on the contour so that the ground is left in a moderately rough condition with tine marks following the contour.

Three or more workings may be required depending on soil type.

Plant, using a combine, or chisel plough with a mounted seed box. Soil spill through the tines will provide a satisfactory cover on most soil types.

For December, January plantings continue working the soil to control weed growth.

Establishment of Winter-growing Crops

(*a*) Following cowpeas, till the soil sufficiently to prepare a seedbed. On sandy soils, one working only may be necessary. Provided soil moisture is adequate, oats can be seeded into cowpea stubble.

(*b*) On black or brown soils in dry areas, plough and leave land in a condition to absorb moisture during summer months. Control weeds and prepare seedbed by successive workings until a surface mulch of about 2 in. remains. Plant with a combine or mounted seed box on rains after the end of February.

Pasture Establishment

The two schools of thought are:

(*a*) Prepare as for a summer crop and plant in January to March;

(*b*) Plant only on land which has previously been cropped.

Pre-cropping is preferable. It ensures the destruction of native grasses which have germinated with the preceding crops. A seedbed more suited to costly small pasture seeds is the result. Competition from regenerating native species is reduced.

A summer crop-Winter crop-Summer crop-pasture sequence is generally satisfactory. The pasture mixture may be sown into the tilled cowpea stubble in the January to March season of the second year.

Pasture seed *should not be planted deeply*; ½ in. to 1 in. cover is satisfactory.

Mr. R. G. Wilson, Adviser in Agriculture at Toowoomba, has published an excellent article "Machine Sown Pastures on the Darling Downs", (Advisory leaflet No. 411) in which information on the preparation and use of a combine for planting is given.

Satisfactory results have been obtained by using a seed box mounted on a chisel plough.

Buffel grass will not plant through conventional machines. Special planters are on the market.

Pastures may be successfully established in two stages. Lucerne may be planted at 1 to 2 lb. to the acre with oats through every seventh run of the drill. Graze the oats crop, then cultivate between the rows of lucerne and drill in green panic or Rhodes grass in the following summer. Mr. E. Kirk near Gayndah successfully established a pasture in this way.

Farmers have planted Rhodes grass and lucerne or green panic and lucerne with crops of grain sorghum or maize. Success is achieved in seasons of high rainfall on fertile soils. The method is not recommended.

Land intended for irrigated pasture should be pre-cropped for at least one season. Every effort should be made by cultivation or grading to level the surface for most efficient watering. A fine firm seedbed is required.

Townsville lucerne may be broadcast directly onto native pasture in coastal districts. The seed is costly (about 10s. lb.) and the establishment and spread are slow if this method is used.

A trial showed that a light renovation of the native pasture at planting time increased establishment five times in the first year. The stand increased to 20 times the number of plants in the second year.

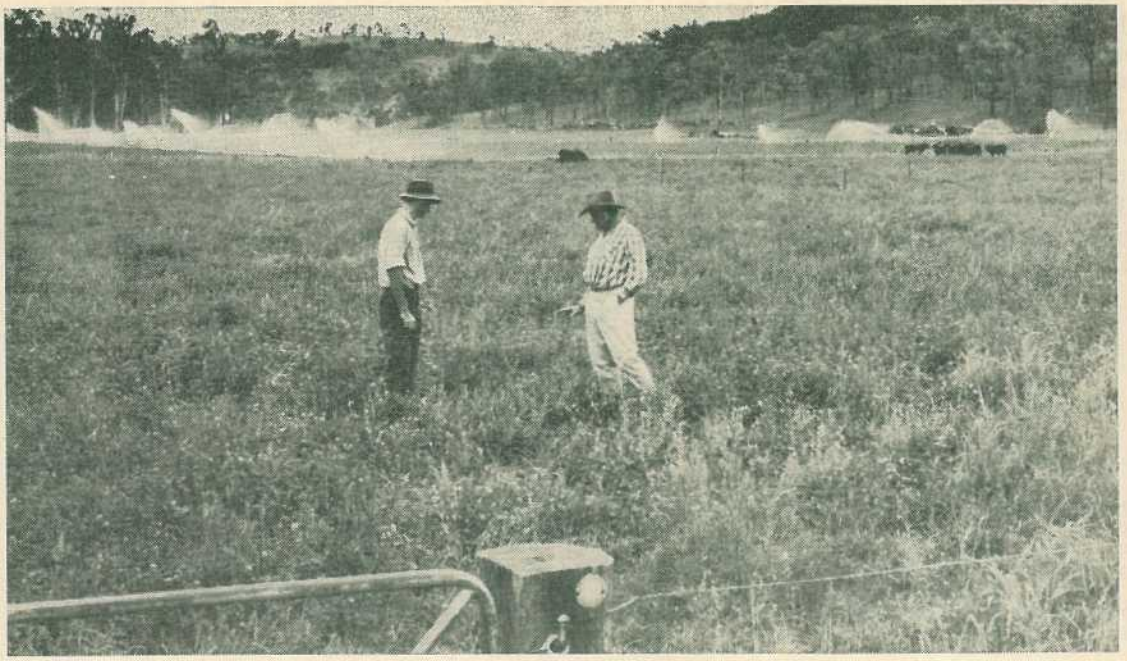


Plate 8

Irrigated Pasture at "Eidsvold" Station in January, 1960.

A recommended procedure is to burn native pastures in the spring and broadcast in front of a chisel plough. The treated paddock should be grazed during the summer months to control native grasses. Shading may retard the growth of young seedlings.

Successful establishment of crops and sown pastures depends on the application of good farming practice. There are no short cuts.

Management Techniques and Land Use Systems

Land utilization has been influenced by the type of country or the fodder it produces; breeding country, growing country, fattening country are common terms.

If crops or sown pastures are grown it may be possible to modify the composition of the beef herd and so adopt a different system of land use.

Sown Pastures

A number of experiments conducted over a wide range of conditions show no increase in production as a result of rotational grazing *except* when one component (lucerne) is susceptible to continuous grazing.

Mr. N. H. Shaw, of the Commonwealth Scientific and Industrial Research Organisation, has shown that it is necessary to observe some form of rotational or deferred grazing to maintain lucerne in a Rhodes grass-lucerne pasture. A system of rotational grazing in which paddocks are grazed for 2 weeks and spelled for 6 to 8 weeks is satisfactory.

When sown pastures are used as a supplement to the native pastures, the summer growth of January to March might be saved for April to July grazing. The pastures may be spelled until October and grazed lightly until December.

Some provision should be made to remove cattle from crops or sown pasture during periods of excessive wet. Avoid damage due to compaction and trampling.

Areas of sown pasture or crop should exceed 20 acres if possible. With tractor tillage, areas of 50 acres or more are economical; fencing, water and cultivation costs per acre are reduced. Land available and number of stock to be fed are considerations.

Rate of stocking is a most important factor in management. It is governed to some extent by seasons. In the Burnett (subcoastal), 1 adult to 4 acres is satisfactory in most years on forest country; 1 to 3 on scrub country.

On coastal areas 1 beast to 3 acres could be satisfactory. If deferred grazing is practised and summer growth is saved for April to July grazing, the pastures may be used at 1 beast to 1 acre for this period with a 1 to 3 stocking for the October to December period, again influenced by rainfall.

Understand that these figures are a guide only and actual stocking rates will depend on your experience and knowledge of the vigour of the pasture and on seasonal conditions.

Grazing Crops

At "Culcraigie", on sandy soils, summer cowpea mixtures have been grazed continuously for 60 days at a beast and a half to the acre, with a lighter second grazing. In the coastal areas. similar crops have been grazed at 2 beasts to the acre during the December to January period.

Oats crops will vary in yield with growing conditions. It is wise to commence grazing at 1 beast to 1 acre and increase the stocking rate as required to control growth. The grazing season on oats is probably lengthened if the crop can be grazed at intervals to allow for regrowth between grazings.

A Cropping System

Native pastures supply a satisfactory ration between October and April. Supplementary feed is required for the periods April to June and June to October.

A two-paddock system will provide the supplement in most years. An area of sown pasture used in conjunction with crops will improve the efficiency of the system.

December to February grazed crops and crops grazed between April and July can be used in conjunction with the sown pasture.

A cropping system is presented in diagrammatic form:

TABLE 2

A Fodder Crop Grazing System

for 50 head of adult cattle

50 acres

Early Paddock—25 acres	*Late Paddock—25 acres*
September–October—Plant cowpeas and white panicum	December–January—Plant to cowpeas and sweet sudan
December to February—Graze	April, May, June—Graze
March–April—Plant oats	June–July—If good rains fall, plant barley
June–September—Graze oats	If rains poor, graze sudan grass stubble in the spring
Repeat or	*Repeat*
September–October—Plant to cowpea and white panicum	
January—Plant to pasture	

The system allows for progressive property development. Each year the early paddock could be planted to sown pasture and a new area brought into cultivation. In this way the carrying capacity of the property might be gradually increased while maintaining production per animal unit.

"Unit Development"

The knowledge and experience accumulated to date suggests a practical land development system which could have immediate application and meet the needs of graziers.

The system involves the establishment of "units" or small paddocks within the larger grazing areas. It envisages islands of highly developed and intensively managed land within the property boundary.

Units will be more efficiently used if an area of native pasture with water and shade can be fenced in with the crop and sown pasture plots. If water is not available the unit will serve the large paddock by simply opening gates to give direct access to stock as required.

The minimum equipment required has already been detailed.

Plate 9

Suitable Equipment for Establishing Crops and Sown Pastures.

The development of each unit will follow a well-defined pattern and proceed in a logical sequence which must fit with stock work and normal property management.

The first plot in a unit is treated as follows:

(i.) Commence clearing in the winter–spring of the first year after the burn. It is preferable on most properties to delay a year between clearing and the initial ploughing.

(ii.) Fence during the winter of the second year.

(iii.) First crop: burn as early as possible in the winter and commence cultivating so that land is ready to plant in September.

(iv.) Second crop: Plant between the end of February and June for winter, spring grazing.

(v.) Third crop: Plant on the oats stubble after suitable cultivation in October.

(vi.) Sown Pasture: Plant in January, February of the fourth year. Stages (i.) to (iii.) could be attempted in the first year if sufficient labour is available.

The second or further plot in a unit may be brought into production by following the sequence, as capital and labour are available.

The size and composition of the unit will be governed by topography, soil and the number and *class* of stock to be supplemented.

Units in breeder paddocks may consist of three plots or paddocks of sown pasture. Breeders should maintain condition during the winter–spring months.

A unit in a bull paddock may consist of two plots of sown pasture and one for annual crops.

A unit in a weaner paddock may consist of one plot of sown pastures with two plots for annual crops, a higher quality fodder being required for this class of stock.

The actual crops or sown pasture mixtures in use will depend on property location.

A property well developed along these lines will have overcome to a large extent the usual seasonal variations in production. The grazier will then be in a position to strengthen his position further. He has available sown pasture and crops of high quality. In seasons of lush growth the surplus may be conserved as hay or silage.

The final picture is of a property well fenced and well watered, the native pastures improved by judicious timber treatment and the inclusion of Townsville lucerne where practicable. There are sufficient units of crop and sown pasture well distributed on the property. Surplus fodder from the units is conserved there for use in times of drought.

Tuberculosis-Free Cattle Herds

(As at 30th November, 1960)

Aberdeen Angus

Crothers, G. H. & H. J., "Moorenbah", Dirranbandi
Elliott, A. G., "Ooraine", Dirranbandi
Mayne, W. H. C., "Gibraltar", Texas

A.I.S.

Cox, T. L. & L. M. J., Seafield Farm, Wallumbilla
Crookey, J., Arolla A.I.S. Stud, Fairview, Allora
Davis, W. D., "Wamba", Chinchilla
Dennis, L. R., Diamondvale A.I.S. Stud, Mundubbera
Edwards Bros., "Spring Valley" A.I.S. Stud, Kingaroy
Evans, E. G., Lauraven A.I.S. Stud, Maleny
Green, D. B., Deloraine A.I.S. Stud, Fairdale
Heading, C. A., "Wilga Plains", Maleny
Henry, Mrs. K., & Sons, P.O. Box 4, Cambooya
Henschell, W., "Yarranvale", Yarranlea
H. M. State Farm. Numinbah
Littleton, H. V., "Wongalea", Bowenville
Marquardt, A. C. & C. R., "Cedar Valley", Wondai
McShane, A. H., Handford Road, Zillmere
Mears, G. S. & E., "Morden", M. S. 755 Toogoolawah
Moore, S. R., "Sunnyside", West Wooroolin
Neale, D. G., "Groveley", Greenmount
O'Sullivan, Con., "Navillus", Greenmount
Pinwill, A. A., Gaylands A.I.S. Stud, Gayndah
Power, M. F., "Barfield", Kapaldo
Messrs. Mitchell and Mulcahy, Rosenthal
Queensland Agricultural High School & College, Lawes
Radel, R. R. & Sons, "Happy Valley", Coalstoun Lakes
Roche, C. K., Freestone, Warwick
Sanderson, W. H., "Sunlit Farm," Mulgildie
Schloss, C. J., "Shady Glen", Rocky Ck., Yarraman
Scott, M. E. & E., "Wattlebrae" A.I.S. Stud, Kingaroy
Scott, W. & A. G., "Walena" A.I.S. Stud, Blackbutt
Shelton, R. A. & N. K., "Vuegon" A.I.S. Stud, Hivesville, Murgon
Estate Sokoll, A. H., "Sunny Crest", Wondai
Sperling, G., "Kooravale", Kooralgin, Cooyar
Sullivan Bros., "Valera", Pittsworth
Sullivan, D., "Bantry", Pittsworth
Sullivan, F. B., "Fermanagh", Pittsworth
Thompson, W. H., "Alfavale", Nanango
Webster, A. H., "Millievale", Sabine, via Oakey
Wieland, A. W., "Milhaven", A.I.S. Stud, Milford, via Boonah

Ayrshire

Dudgeon, C. E. R., Marionville Ayrshire Stud, Landsborough
Dunn, T. F., "Alanbank", Gleneagle
Goddard, B., Inverell, Mt. Tyson, via Oakey
Holmes, J. L., "Benbecula", Yarranlea
Mathie, E. & Son, "Ainslie", Maleny
Scott, J. N., "Auchen Eden", Camp Mountain
Zerner, G. F. H., "Pineville", Pie Creek, Box 5, Post Office, Gympie

Friesian

Behrendorff, E. C., Inavale Friesian Stud, M.S. 786, Boonah
Macdonald, S. E. G., "Freshfields", Marburg
Morrison, E. J., Cedar Creek, via Closeburn
Naumann, C. H., "Yarrabine", Yarraman
Pender, D. J., Lytton Road, Lindum
Stumer, A. O., Brigalow, Boonah

Guernsey

Doss, W. H., Degilbo, via Biggenden
Fletcher, A. B., "Cossart Vale", Boonah
Holmes, C. D. (owner Holmes L. L.), "Springview", Yarraman
Johnson, G. L., "Old Cannindah", Monto
Miller, G., "Armagh Guernsey Stud", Armagh, M.S. 428, Grantham
Ruge, A. & Sons, "Woowoonga", via Biggenden
Scott, C., "Coralgrae", Din Din Rd., Nanango
Swendson, A. C., Coolabunia, Box 26, Kingaroy
Wissemann, R. J., "Robnea", Headington Hill, Clifton

Jersey

Beckingham, C., Trout's Rd., Everton Park
Birt, W. C. M., Pine Hill Jersey Stud, Gundiah
Borchert, Mrs. I. L. M., "Willowbank" Jersey Stud, Kingaroy
Burrows, R. N., Box 23, Wondai
Bygrave, P. J. L., The Craigan Farm, Aspley
Carpenter, J. W., Flagstone Ck., Helidon
Conochie, W. S. & Sons, "Brookland", Sherwood Rd., Sherwood
Crawford, R. J., Inverlaw, Kingaroy
Farm Home For Boys, Westbrook
Fowler, P. & Sons, "Northlea", Coalstoun Lakes
Harley, G., "Hopewell", East Nanango
H.M. State Farm, Palen Creek
Hutton, D. R. & M. E., "Bellgrath", Cunningham, via Warwick
Johnson, H. G., Windsor Jersey Stud, Beaudesert
Lau, J. F., "Rosallen", Goombungee, Toowoomba
Matthews, E. A., "Yarradale", Yarraman
McCarthy, J. S., "Glen Erin", Greenmount, Toowoomba
Meier, L. E., "Ardath Stud", Boonah
Noone, A. M. & L. J., "Winbirra", Mt. Esk Pocket
Porter, F., Conondale
Q.A.H.S. & College, Lawes
Ralph, G. H., "Ryecome", Ravensbourne
Scott, Est. J. A., "Kiaora", Manumbar Rd., Nanango
Semgreen, A. L., "Tecoma", Coolabunia
Seymour, B. T., "Upwell" Jersey Stud, Mulgildie
Smith, J. A. & E. E., "Heatherlea" Jersey Stud, Chinchilla
Tatnell, W. T., Cedar Pocket, via Gympie
Toowoomba Mental Hospital, Willowburn
Verrall, F. W., "Coleburn", Walloon
Weldon Brothers, "Gleneden" Jersey Stud, Upper Yarraman

Poll Hereford

Anderson, J. H. & Sons, "Inverary", Yandilla
Hill, W. W., Mathalla
Hutton, D. R. & M. E., "Bellgrath", Cunningham, via Warwick
Maller, W., "Bore View", Pickanjinnie
Maller, W., "Bore View", Gowrie Junction
McCamley, E. W. G., "Eulogie Park", Dululu
Wilson & McDouall, Calliope Station, Calliope

Poll Shorthorn

Leonard, W. & Sons, Welltown, Goondiwindi

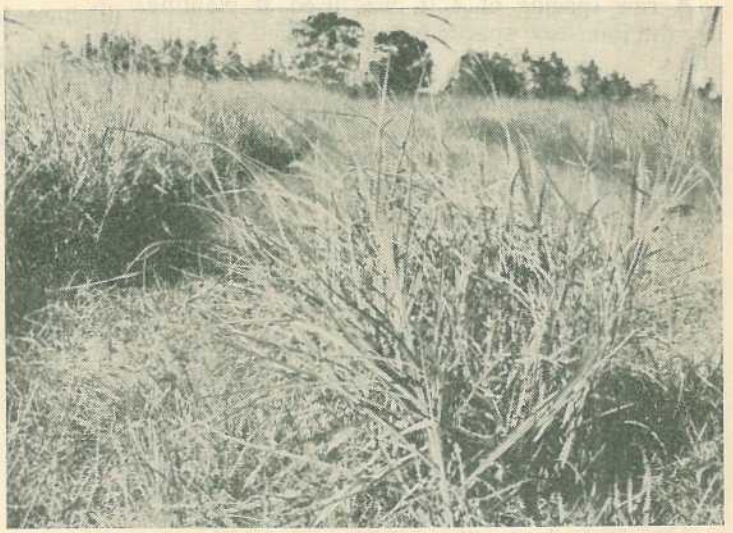


Plate 1: Elephant Grass.

Elephant Grass Fills a Fodder Gap

By T. K. KELLY and W. J. DRAPER, Agriculture Branch.

Fine stemmed elephant grass for grazing is filling a fodder gap for a dairy herd in the Millaa Millaa district on the Atherton Tableland.

Mr. L. Wallwork, a dairy farmer of Innisfail Road, Millaa Millaa, has, from a 1½ acre planting, provided supplementary grazing for a 48 cow herd all through the year.

The topography of this district is unfavourable for annual fodder crops and where limited areas can be cultivated it is desirable to revert to pastures after one year to prevent soil erosion.

The area of elephant grass at Mr. Wallwork's property was established as a Commonwealth Dairy Industry Extension Grant project to demonstrate the value of this species for supplementary grazing in a district where there is excessive dependence on pastures.

In the Millaa Millaa district the rainfall and soil type are very favourable for elephant grass but for high production attention must be given to soil fertility and management.

Average annual rainfall is 103 in. with fairly high intensity over the summer months and prolonged periods of misty rain during the autumn.

The soil, which is of basalt origin, is deep friable and permeable. It has a red-brown surface changing to bright red in the subsoil. Soil fertility was high following the clearing of rain forest about 50 years ago but as could be expected with a porous soil under high rainfall conditions there has been a decline in soil fertility, the main deficiency being nitrogen.

The present stocking capacity of the pastures is approximately one beast to 4 or 5 acres.

Management

At the time of planting the elephant grass in December, 1958, a fertilizer mixture of equal parts of sulphate of ammonia and superphosphate was applied at the rate of 2 cwt. to the acre This was followed by an application of 4 cwt.

to the acre in October, 1959. Since the grass was established, Mr. Wallwork has spread all the manure from his dairy premises on the area.

A row spacing of 4 ft. was used at planting but the inter-row spaces have now filled with the grass.

After establishment, the first grazing was delayed to permit the development of strong crown and root growth. Slashing was then required to reduce the top growth but no further cutting has been necessary.

The grass has not been frosted though the district is subject to a few light frosts in July or early August.

Grazing has been intermittent, using an average herd of 48 dairy cows. During the summer months, up to four grazings a month have been obtained with a reduction to two a month during the colder part of the year. On all occasions the area has been used as a night paddock mainly for convenience but over a period this should have an effect on soil fertility.

The grazing has been regulated to keep the elephant grass at a height of 18 to 24 in., which has induced the production of dense leafy growth from the stools. The young foliage has a relatively high crude protein content.

Following a night on the elephant grass, Mr. Wallwork's cows have shown a consistent increase in the morning's milk production to the extent of 2 to 3 gal. from the herd.

Altogether, Mr. Wallwork has found that:

(*a*) Elephant grass has a high carrying capacity when used as a supplementary grazing crop.

(*b*) Farmyard manure or chemical fertilizers or a combination of both are desirable for maximum growth.

(*c*) While elephant grass will grow under a wide range of conditions, it is particularly suitable for the Millaa Millaa district in which annual cropping practices are impracticable on most farms.

New Tobacco Curing Barn

A New Zealand-designed tobacco barn promises to help Queensland growers get more uniform and cheaper curing of their leaf.

The Director of the Division of Plant Industry in the Department of Agriculture and Stock (Mr. W. J. S. Sloan) said that the Central Tobacco Advisory Committee had formed a special sub-committee last year to examine tobacco curing methods. A decision to build and test the New Zealand type of tobacco barn in Australia followed the sub-committee's studies.

A barn of this type, now being built at Myrtleford in Victoria, will be tested this harvesting season. If successful, another will be built at the Parada Tobacco Experiment Station in time for the next harvest. It will be used as a demonstration for north Queensland growers.

Forced Draught

The New Zealand-type barn employs a forced draught method of curing. This involves forcing hot air into the barn at the top by means of a fan, so that it passes downwards through the leaf. This is the reverse of the present Queensland method in which hot air, not under pressure, is introduced at the bottom of the barn and is allowed to find its way to the top.

Tests have shown that the down-draught barn gives more uniform and generally better quality leaf than other barns. It also has more uniform conditions of temperature and air movement, and there are no cold corners. It has a greater capacity, holding about 75 per cent. more leaf. Curing time is reduced by up to 24 hours and the saving in fuel costs can be as high as 33 per cent. In properly-constructed down-draught barns the fire risk is lower than in the up-draught type.

He added that it is possible to modify the existing up-draught types of curing barns to down-draught types. This will mean a great saving to growers if the down-draught method is suitable under Australian conditions and growers want to change over to that system of curing leaf.

Mango Growing in Queensland

By S. E. STEPHENS, Horticulturist.

The mango (*Mangifera indica,* fam. *Anacardiaceae*) is related to the tar tree and the cashew nut and, in common with these, possesses a caustic sap. It is probably native to south-eastern Asia.

The tree is a densely foliaged evergreen which grows to 50 or 60 ft. Some races are tall, upright growing and narrow, others have a round or oval head, and several have a broad base and a tapering, conical or pyriform top. The leaves are simple and entire, often up to 15 in. long and seldom more than 2½ to 3 in. wide.

The flowers are borne in large terminal panicles, the individual flowers being small (about a quarter of an inch in diameter) and either staminate (male) or perfect (bisexual). Fruit setting is more frequent near the tip of the panicle than on the primary laterals near its base, and the fruits are therefore frequently borne on an elongated stem.

Plate 1

Kensington Mangoes at Bowen. In the Dry Tropics mangoes are a distinctive feature on many properties either in block plantings or as single or double row plantings separating adjoining farms.

Fruits vary considerably in size, shape, colour, flavour and fibre content. Colour is extremely variable. Some kinds are a uniform yellow-green colour when ripe; others may be deep orange, straw-coloured, red, or display a combination of two or more of these colours. Although colour is a varietal character, environment effects the intensity of the colour within a variety. Flavour varies from insipidly sweet and fragrant to strongly acid and odoriferous. Fibre content depends largely on the structure of the seed. The greater the number and length of the fibres on the seed, the poorer is the eating quality of the fruit. However, a fruit without fibre lacks carrying quality.

The seeds of the mango are relatively large and disc-shaped. They may be monoembryonic (with a single embryo) and produce only one seedling, or polyembryonic (with several embryos). In the latter case, a number of seedlings develop from the one seed; one of these is derived from the fertilized ovule and the remainder grow from vegetative buds in the ovary. Varieties such as Kensington, which are polyembryonic in habit, may be propagated by seed, as the majority of the seedlings will be identical with the parent tree. Monoembryonic varieties must, however, be propagated by budding or grafting.

Races and Varieties

In Queensland, where the mango is propagated almost entirely from seed, several races are recognised. Of these, the most widely grown is that known as the "Common" mango, which grows along the whole of the eastern coast and exhibits uniform characters. The tree usually has an oval head, the foliage is dense and the leaves are of medium size. The fruit is long, always yellow-green in colour and thin-skinned, with a very fibrous but sweet and well-flavoured flesh.

A race which is often called the "Apple" mango is represented by the variety Kensington. The tree is oval in shape and the leaves have a characteristic sweet scent when crushed. The

fruit weighs about 15 oz., and the fine-textured skin has a bright orange-yellow colour with a reddish-pink blush over the base and exposed faces of the fruit. It is grooved from the stem end to a projection on one side known as the nak. The flesh of the ripe fruit is thick, rich orange in colour, free of fibre and has a pleasant flavour. It is a mid-season variety.

Other races of minor importance exist in Queensland.

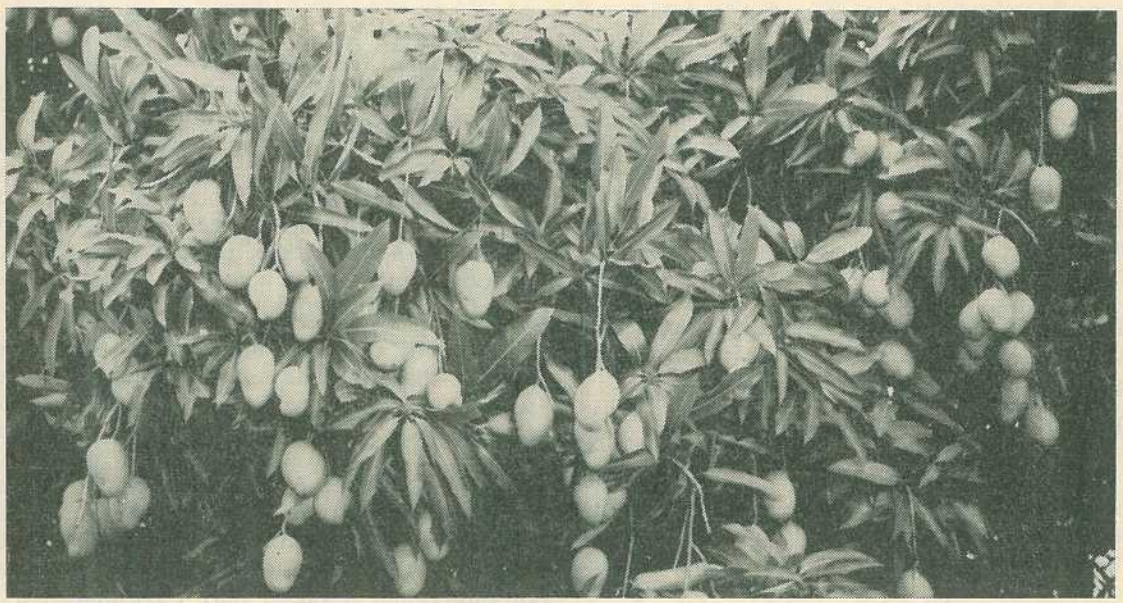


Plate 2

Portion of a Mango Tree in Crop. Given a season which is favourable for fruit set and normal development of the fruit, mango trees carry very heavy crops.

Climatic and Soil Requirements

The mango is a tropical plant and grows naturally in many parts of coastal Queensland. It is not frost-hardy, but in places where light frosts occur the tree usually can be established by giving it protection during the early years of its growth. When mature, it tolerates light ground frosts.

The tree thrives under the hottest conditions and the annual rainfall may vary between wide limits without adversely affecting the crop. Dry weather during flowering and the early stages of fruit development is, however, desirable.

The mango is grown on a wide range of soil types. In Queensland, it thrives on soils derived from decomposed granite, basalts and schists, and on alluvials and beach sands. Good drainage is essential and a stable water-table an advantage. The tree forages widely and deeply in a well-drained soil and this habit makes it very adaptable.

Propagation

Mango plants must be raised from seed and a special type of seedbed is used to restrict the development of the tap root. The seedbed is a frame about 8 in. deep with a floor of sheet iron or concrete. A medium to coarse sand may be used as the rooting medium. Plants raised in a seedbed of this type can be readily lifted without injury to the roots and have a fibrous root system which enables them to resume growth shortly after they are transplanted.

Mango seed must be fresh and is better not dried out before planting. Husking prior to planting is essential to prevent deformed root growth. As soon as possible after husking, the seeds should be planted in the seedbed with a 6 in. spacing each way between them. They must be set on edge with the convex edge on top and about three-quarters buried in the sand. A

mulch of straw or some similar material should then be placed on the surface of the bed. The seedbed is completed by erecting a hessian or light bush shade about 3 ft. above it.

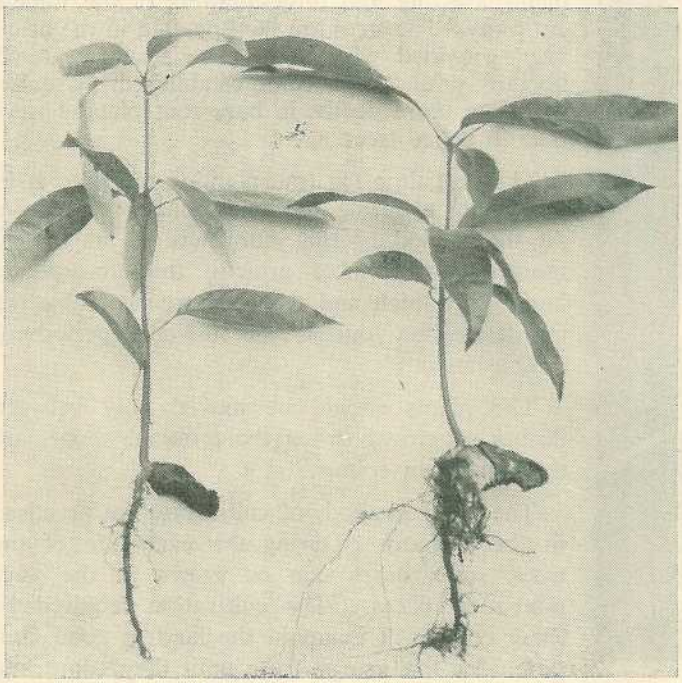
Sprouting of the seed commences in 8-14 days. About three weeks after germination, the shelter is gradually thinned to harden off the seedlings before they are transplanted to nursery rows or to their field positions. If they are to be grafted, it is customary to place them in nursery rows, but if the trees are to be grown as seedlings they should be planted directly into the orchard. If, however, they are too small for field planting, they may remain in the seedbed until they have matured their second flush of leaves, but no longer.

As stock plants for the production of grafted trees, polyembryonic races with a free habit of growth are preferred. The Common mango has been found quite suitable for the purpose.

Bud Grafting and Inarching

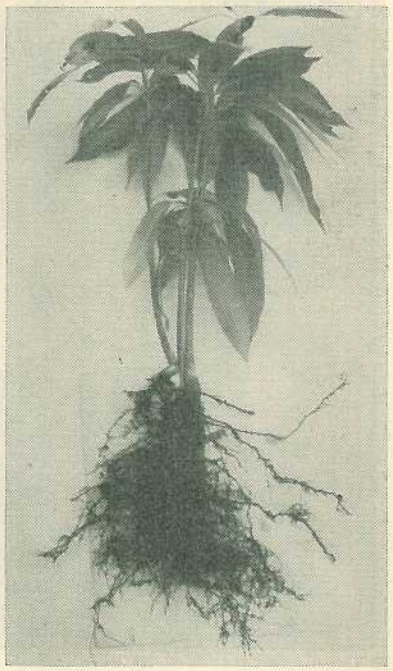
Budding is more difficult with mangoes than with many other fruit trees. Three methods have been used—the ordinary or inverted T bud, the Forkert bud, and the window bud. In window budding, the bud is held in close contact with the stock and there is little trouble from corky tissue under the bud, which sometimes causes an unsightly and weak union.

Under tropical conditions, budding may be carried out during a flush of growth after the buds have begun to swell but not later than a stage at which the new leaves are still only partly expended. A flush can be produced at any period of the year, except mid-winter, by applying a solution of 1 oz. of sulphate of ammonia in 1 gal. of water several days before commencing budding. Budwood appears to give the highest percentage of takes if it has been cut and stored in damp peat moss or wet sand for several days before use. Green wood of the second and third last flushes, and about three-eighths of an inch



(a)

Plate 3



(b)

Seedling Mangoes. (a) Monoembryonic type which produces a single plant from each seed; (b) Polyembryonic type which produces several plants from a single seed. Seedling trees of the polyembryonic variety Kensington mostly resemble the parent and are widely grown in Queensland.

in diameter, is the best type of budwood. The latest flush should be discarded as it is often insufficiently mature.

In India, it has been customary for many years to propagate outstanding varieties of mono-embryonic mangoes by inarching. Inarching is a laborious method of propagation and the graft union so made is not strong. The method is not favoured in Queensland.

Cultural Practices

As the mango grows to an immense size in the tropics on suitable soils, it is essential to allow plenty of room between the trees. A reasonable distance for planting is 40 x 40 ft., but on very good land the spacing may be increased to 50 x 50 ft. On poor soils and in areas with cold winter temperatures, tree growth is much less vigorous, and planting distances of 35 x 35 ft. may be safely employed.

If young seedlings are used for planting the orchard, the foliage should be reduced to about one-third by trimming each leaf, and the young tree is then set in a prepared hole. Shade from a small leafy branch pushed into the soil beside the young plant gives it some protection in hot weather.

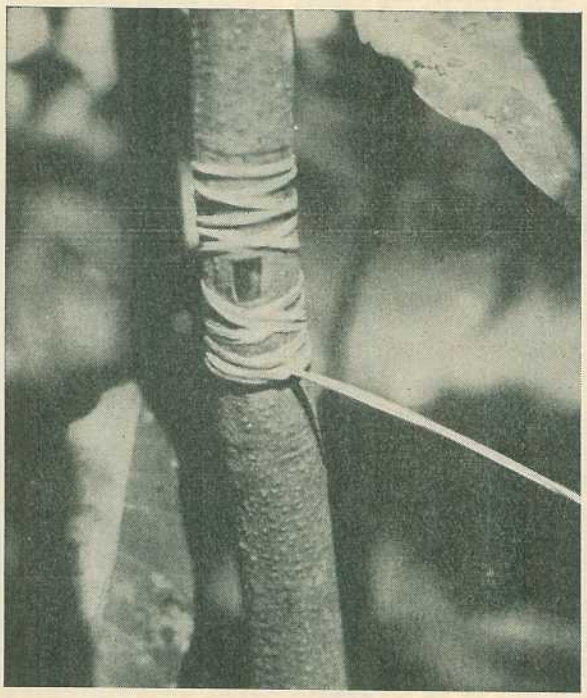


Plate 4

Window Graft in the Mango. This type of graft has proved suitable in Queensland for propagating mono-embryonic mangoes, seedling progenies of which vary considerably from the parental type.

If budded trees or large seedlings are used in establishing the orchard, preliminary conditioning of the young plants is necessary. This should be carried out about 6 weeks before the scheduled planting date and consists of digging down beside each tree to a depth of about 12 in. and severing the tap root with secateurs to ensure a clean cut. If the trees have a forked tap root, both branches of the root must be cut. The hole is then refilled and the trees given a good watering. After a period of six weeks, the young trees should be carefully dug with a ball of earth on the roots and planted in the orchard. Shortening back the foliage to about half helps the establishment of the tree.

If the young trees have to be transported some distance and bare-root planting is unavoidable, the roots should be well puddled immediately the plants are dug and three-quarters of the foliage cut away. The trees are then planted in the usual way, provided with ample shade and watered liberally until they become established. Usually, there are more deaths in bare root planted trees than in balled trees.

The best time for transplanting mangoes is in the summer during the monsoonal wet season. At this period of the year there is ample soil moisture to promote growth; the atmospheric humidity is high and the tops are not subjected to desiccation during the difficult period of establishment.

The plants should be moved only between flushes of growth when the terminal shoots are dark green in colour.

The usual methods of cultivation are practised in the orchard. During the early life of the trees, small crops can be grown in the wide inter-row spaces. The cultivation required by these crops will maintain the land in good condition for the mango trees until they come into bearing.

After the trees have reached an age and size at which further inter-cropping is inadvisable, the soil should be protected by a cover crop.

Pruning

The terminal bud of the whipstick seedling is pinched out when it reaches about 3 ft. This is done to start the main frame of the tree. Failure to do this often results in a single straight sapling 15 to 18 ft. high. If pinching back has not been done at the correct time, it will be necessary to cut back the top just above a growth ring at the appropriate height. The shoots which then grow from the head of the tree at the next flush should be reduced to two or three to form the main branches. These in turn are pinched back when they have made 18 to 24 in. of growth to induce further branching.

The only pruning needed subsequently is the removal of weak shoots that grow in the centre of the tree, the thinning out of overcrowded branches and the shortening back of limbs that droop too close to the ground.

Pruning is carried out immediately after the fruit is harvested.

Fertilizing

Mango trees apparently require fairly large amounts of nitrogen during the early years of growth and relatively large amounts of phosphate and potash after fruiting commences. Complete fertilizer mixtures with a formula such as 5:8:10 should prove satisfactory for bearing trees in Queensland. The condition of the individual trees should, however, also be taken into consideration when deciding on the amount of fertilizer needed. Rates of application comparable with those in citrus (1 lb. per year of age) could be followed in the first instance.

Fertilizer applications shortly before and immediately after the summer wet season appear to give the best results and the total annual dressing (about 30 lb. to each tree in full bearing) should, therefore, be split fairly evenly between the two dressings.

Fruiting

In coastal North Queensland, there are two main bursts of flowering. These vary in different areas but normally occur some time in the June-July and the August-September periods. In sub-tropical Queensland and on the northern Tablelands, the flowering period is restricted to the spring months of August to October.

The mango tree usually begins to bear fruit 5 to 7 years after planting. However, the variety Kensington is extremely precocious when grown under good conditions and its first fruits are borne at 3 years.

Plate 5

Mango Blossom. In spring, the mango tree is a mass of blossom with flowering stalks on almost all terminals.

Four to 5 months usually elapse between flowering and fruit maturity. During the early stages of development, the fruit is normally a dark-green colour, but as it approaches full size the skin acquires the blush characteristics of the particular variety on the exposed cheek. During the short period of about 10 days before full maturity is reached, the fruit fills out rapidly.

Harvesting

Harvesting is not easy in a large mango tree, for the fruit must be picked carefully and placed gently into the picking boxes. Fruit gathered from the ground after it has been dislodged by shaking the tree is quite unsuitable for the fresh market. Fruit on the lower branches is harvested easily

from a cart or truck and some of the higher fruit, which is often the best on the tree, can be picked from the inside by climbing into the branches. Part of the fruit is on the outermost tips of the branches, however, and special equipment is needed to reach it. A long, light rod fitted with a hoop and meshed bag at the end is useful. The hoop is narrowed to a V-shaped notch opposite its attachment to the rod and is set at an angle of about 45 deg. to the axis of the rod. The bag is slipped over the fruit from below and as it is withdrawn the fruit is caught in the notch and pulled free, dropping into the bag. The bag should be shallow and of small capacity as it is not possible to support the weight of more than four or five fruit on the end of the long rod and still operate it with ease.

The fruit must be handled with care both in the orchard and in the packing shed. Mango fruit bruises very readily and then breaks down rapidly.

Yields vary with the variety and the season. The Kensington variety, which is harvested in its entirety averages 4 bushels in trees 10 to 15 years of age. Trees over 25 years old yield up to 30 bushels.

Full-Scale Tests on Leucaena Glauca

Leucaena glauca, the potentially valuable fodder tree, will be tested extensively in northern and central coastal Queensland, announced the Director-General of Agriculture and Stock (Dr. W. A. T. Summerville). This summer, Agriculture Department officers will make trial plantings of high-yielding strains of Leucaena in frost-free districts with a rainfall of 30 in. and higher.

Dr. Summerville said this tree was planted in north Queensland in the early days, but never became a popular fodder plant. Interest was revived in 1953, when Mr. Hosaka of the University of Hawaii, visited Queensland. He told of the high value placed on Leucaena by Hawaiian ranchers who regarded it as a major cattle fodder plant.

Since then the C.S.I.R.O. has introduced and examined many varieties from various parts of the world. Their performance has supported the Hawaiians' confidence in this species. Seed of the better-yielding varieties has now been made available to the Agriculture Department for further testing.

Main criticism levelled against Leucaena glauca is that it contains an alkaloid that causes horses to lose the hair from their tails and manes, and sheep to shed their wool, if the plant provides a major portion of their diet. Cattle are not affected to any extent. Another problem is the strong tendency in favourable locations for the plant to grow into dense thickets impenetrable to stock. In fact, the early plantings on the far north coast have shown this tendency.

On the credit side, Leucaena glauca is a legume and provides fodder rich in protein. Cattle make remarkably fast weight gains and the plant will stand heavy grazing.

Mr. S. Marriott, Assistant Director of Agriculture in the Department, recently studied Leucaena and its management during a visit to Hawaii. He reported that ranchers using it have claimed liveweight gains up to 3 lb. a day and a stocking rate of two beasts to the acre.

In Hawaii, opinions on the management of work horses differed. Some ranchers kept their horses out of paddocks containing Leucaena, but others regarded the loss of tail and mane hair of little importance when matched against the valuable cattle feed the plant provided.

There were occasional reports that the calf drop was lighter if breeders were grazed heavily on Leucaena. Authorities of the Hawaiian Agriculture Department and the South Pacific Commission, however, advised that these reports were unconfirmed.

In old, thick stands, Mr. Marriott reported, management became a problem. Heavy rotary slashers were being used to cut back plants 8 to 10 ft. high and about 1 in. thick. Although this left dense stands of short stems in the paddocks which made stock work slow, the lush growth from the green panic and other grasses, together with regrowth from the cut-back Leucaena, provided extremely nutritious feed. Even when planted in rows, these free-seeding plants tended to thicken into small, scrubby patches unless properly managed.

Use These Formulations To Mix Your Own Poultry Rations

By B. W. MOFFATT, Adviser, Poultry Branch

Recommended formulations are given for rations for chickens, laying hens and breeding fowls. Their use by the poultry farmer will assist him in the mixing of his own poultry feeds.

Modern poultry farming has made the hen an egg-laying machine. She is no longer allowed to scratch in the fowlyard for her own natural food, for it has been found that making her eat a well-balanced concentrated diet will result in increased egg production. The same situation also applies to her chickens when destined to become table poultry. If they are not housed intensively and fed concentrated diets they take too long to reach a marketable weight.

Because of these trends towards intensive conditions, feeding has become one of the most important aspects of poultry husbandry. The rations used must contain all the nutrients necessary for growth, health and production. As fowls are particularly susceptible to vitamin deficiencies, the deletion of even one ingredient from the ration can lead to disastrous loss of production.

Many poultry farmers buy their poultry feed already prepared, but others prefer to mix it themselves. For those who formulate and mix their own mashes, a sound knowledge of certain basic principles in nutrition is necessary.

There are three main considerations in the formulation of a poultry ration:

The nutritive requirements of the bird.

The availability of the ingredients.

The cost of the ingredients.

Birds of different ages have different nutritive requirements. For instance, a laying bird does not need so much protein or vitamin B_2 (riboflavin) as a chicken, but can tolerate a more fibrous mash. Different rations, therefore, are made up for chickens, growers, layers and breeders.

Quite often special, more "forcing," rations are made up for broilers because of the faster growth required in this type of bird. Therefore, before formulating a ration, a table of the nutritive requirements of the bird should be consulted:

TABLE 1

RECOMMENDED NUTRITIVE ALLOWANCES FOR FOWLS

—	Chickens 1–8 Weeks	Growers 8–18 Weeks	Laying Hens over 18 Weeks	Breeding Hens
Minimum crude protein % ..	18·0	16·0	15·0	15·0
Maximum crude fibre %	7·0	7·0	7·0	7·0
Lime (CaO) % ..	1·4	1·4	3·15	3·15
Phosphoric acid (P_2O_5) % ..	1·4	1·4	1·75	1·75
Added salt % ..	0·5	0·5	0·5	0·5
Added manganese sulphate (oz. per ton)	6·0	6·0	6·0	6·0
Vitamins—				
A (*I.U. per lb. of feed)	2,000	2,000	3,300	3,300
D_3 (*I.U. per lb. of feed) ..	180	180	450	450
B_2 (†mg. per lb. of feed)	1·6	0·9	0·9	1·3

* I.U. = international units.
† mg. = milligrams (1 milligram = ·001 grams ; 28 grams = 1 oz. approx.)

If grain is being fed in conjunction with a mash, then the mash should contain extra protein, vitamins and minerals as the grain has a lower

content of these nutrients. For instance, if the ration being fed consisted of two-thirds mash and one-third grain, then the mash should contain half as much again of vitamins and minerals, and extra protein to make the whole ration balance at the minimum requirements for the type of bird.

The availability of ingredients can be a big problem to the farmer mixing his own mash. As fowls do not take kindly to a change in ration it is wise to choose ingredients that are not so likely to become unobtainable. The most serious problems of unavailability are usually found with meat-and-bone meal, liver meal, and buttermilk powder. Unfortunately, meat-and-bone meal cannot be done without, unless more vegetable proteins become available (for example soybean meal). If shortages are going to be a big problem, then it is perhaps better to buy a prepared mash.

The cost of the ingredients is of course important. Feed is the biggest single item of expense on an established farm, so economy here can mean pounds saved. However, it is foolish to economise if the quality of the ration will suffer. Economies can be made by using more of the cheaper grains such as sorghum and white French millet (when available) and less of the expensive grains. Buttermilk powder, or liver meal, however, cannot readily be replaced by similar cheaper products.

When choosing the ingredients, a table of analysis of the available foodstuffs should be consulted:

Simple analyses such as shown in Table 2 can be misleading to the inexperienced person. It does not indicate that foodstuffs such as buttermilk powder, lucerne meal or liver meal are important because of the vitamin or mineral content. It must also be remembered that these values are only average values and the particular ingredient available could vary from the figure shown.

For practical purposes, the ration is usually balanced with regard to protein and fibre content and then mineral and vitamin supplements are added. This ensures that vitamins and minerals

TABLE 2

ANALYSIS OF COMMON QUEENSLAND POULTRY FOODSTUFFS

	Minimum Crude Protein Per cent.	Minimum Crude Fat Per cent.	Maximum Crude Fibre Per cent.	Minimum Phosphoric Acid* (P_2O_5)	Minimum Lime* (CaO)
Wheat meal	12·0	1·5	5·0	..	..
Maize meal	10·0	5·0	5·0	..	..
Sorghum meal	10·0	2·5	2·5	..	..
Barley meal	11·0	1·0	6·0	..	..
Millet (Japanese)	10·0	4·5	8·5	..	..
Millet (white French)	12·0	1·5	6·0	..	..
Bran	14·0	2·0	11·0	..	..
Pollard	15·0	1·9	7·0	..	..
Lucerne meal (choice)	15·0	1·9	30·0	..	..
Lucerne meal (stemmy)	12·4	1·5	35·9	..	..
Wheat germ meal	27·0	10·0	2·0	..	..
Buttermilk powder	26·0	4·0	..	..	..
Dried whey powder	10·0	0·1	..	..	..
Coconut meal	20·0	5·0	12·0	..	..
Linseed oil meal	35·0	3·5	10·0	..	..
Meat-and-bone meal	55·0	8·0	..	6·0	7·0
Meat-and-bone meal	50·0	8·0	..	10·0	12·0
Meat-and-bone meal	40·0	10·0	..	15·0	18·0
Liver meal	65·0	12·0	..	2·27	0·65
Bone flour	20·0	..	..	25·0	30·0
Ground limestone	..	..	..	..	50·0

* Manufacturers are required by law to state on mash labels the minimum amounts of phosphoric acid (P_2O_5) and lime (CaO). This is the standard method of stating the phosphorus and calcium content of the product. To convert these figures to pure phosphorus and calcium, the phosphoric acid (P_2O_5) value should be multiplied by $^3/_7$ and the lime (CaO) value by $^5/_7$.

are present in definite amounts and does not introduce the inaccuracies that would occur by using average figures.

The proportion of the feedstuffs to be used in balancing the ration can be found only by trial and error. However, certain basic principles apply. Usually 70 to 80 per cent. of the ration will consist of crushed grains or a combination of crushed grains and mill offals. The remainder of the mash will consist of ingredients such as meat-and-bone meal and lucerne meal in laying rations, with the addition of liver meal and/or buttermilk powder when designed for breeding birds and chickens.

Foods such as bran and lucerne meal should be restricted if a low fibre content is desired. Lucerne is seldom used at a higher rate than 5 per cent. It is important, however, to feed at least 3 per cent. lucerne because of its mineral and vitamin content, and in a laying ration, because it improves yolk colour.

Yolk colour should be given some consideration in every laying mash. Consumers object to pale-coloured yolks. For this reason both maize and lucerne are very desirable in a laying ration. When maize becomes expensive it can be reduced to 10 per cent. of the ration.

The rations shown in Table 3 have been formulated on the principle described. These rations show how different ingredients can be incorporated. If choosing one of these rations, then availability of ingredients and cost would be the major considerations. It should be noted that all these rations contain a 55 per cent. protein "meat-and-bone meal." If only lower protein content "meat-and-bone" meals are available, then more of these have to be added to balance the protein. This will add more calcium in the form of bone to the ration. The ration should therefore be balanced with respect to calcium by deleting some of the ground limestone. Overloading of the ration with calcium is likely to be detrimental, especially in chicken rations.

The calculations involved in balancing these rations are very simple. An example is shown in Table 4, where the protein content of this chicken mash has been balanced at 18·5 per

TABLE 3

CHICKEN RATIONS

	Ration 1	Ration 2	Ration 3*	Ration 4*	Ration 5	Ration 6
Maize meal	30·0	25·0	25·0	30·0	20·0	..
Sorghum meal	45·0	28·0	25·0	43·0	20·0	16·0
Wheat meal	..	25·0	20·0	..	18·0	16·0
Bran	..	..	..	..	10·0	20·0
Pollard	..	..	..	..	10·0	30·0
Lucerne meal	3·0	3·0	3·0	3·0	3·0	3·0
Meat-and-bone meal (55%)	11·0	13·0	15·0	17·0	9·0	9·0
Liver meal	5·0	4·0	5·0	5·0	4·0	4·0
Buttermilk powder	4·0	..	5·0	..	4·0	..
Ground limestone	1·5	1·5	15·	1·5	1·5	1·5
Salt	0·5	0·5	0·5	0·5	0·5	0·5
†Added vitamin A	200,000 I.U.	200,000 I.U.	200,000 I.U.	200,000 I.U.	200,000 I.U.	200,000 I.U.
†Added vitamin D_3	18,000 I.U.	18,000 I.U.	18,000 I.U.	18,000 I.U.	18,000 I.U.	18,000 I.U.
†Added vitamin B_2	100 mg.	100 mg.	100 mg.	100 mg.	100 mg.	100 mg.
†Manganese sulphate	0·3 oz.	0·3 oz.	0·3 oz.	0·3 oz.	0·3 oz.	0·3 oz.
Total	100 lb.	100 lb.	100 lb.	100 lb.	100 lb.	100 lb.
Crude protein %	18·2	18·5	20·6	20·3	18·1	18·8
Crude fibre %	3·5	4·1	3·7	3·4	5·1	6·4

* Rations 3 and 4 are " broiler type " mashes.

† Per 100 lb. of mash.

TABLE 3a

ALL-MASH LAYING RATIONS AND BREEDING RATIONS

	All-Mash Laying Rations				Breeding Rations	
	Ration 1	Ratiin 2	Ration 3	Ration 4	Ration 5	Ration 6
Maize meal	30·0	40·0	25·0	30·0	35·0	28·0
Sorghum meal	30·0	42·0	..	24·0	35·0	28·0
Wheat meal	25·0	..	22·0	..	12·0	..
Bran	..	..	15·0	10·0	..	10·0
Pollard	..	..	25·0	20·0	..	20·0
Lucerne meal	3·0	3·0	3·0	3·5	3·0	3·0
Meat-and-bone meal (55%)	5·0	12·0	4·0	10·0	5·0	5·0
Liver meal	4·5	..	3·5	..	4·0	3·5
Buttermilk powder	..	..	..	..	3·5	..
Ground limestone	2·0	2·0	2·0	2·0	2·0	2·0
Salt	0·5	0·5	0·5	0·5	0·5	0·5
*Added vitamin A	330,000 I.U.	330,000 I.U.	330,000 I.U.	330,000 I.U.	330,000 I.U.	330,000 I.U.
*Added vitamin D_3	45,000 I.U.	45,000 I.U.	45,000 I.U.	45,000 I.U.	45,000 I.U.	45,000 I.U.
*Added vitamin B_2	..	..	..	..	100 mg.	100 mg.
*Manganese sulphate	0·3 oz.	0·3 oz.	0·3 oz.	0·3 oz.	0·3 oz.	0·3 oz.
Total	100 lb.	100 lb.	100 lb.	100 lb.	100 lb.	100 lb.
Crude protein per cent.	15·1	15·2	15·9	15·8	15·1	15·4
Crdue fibre per cent.	4·4	3·9	6·6	5·6	4·1	5·5

* Per 100 lb. mash.

cent. The protein content of the ingredients has been taken from Table 2. The calculation involves finding the amount of protein each ingredient contributed to the 100 lb. of mash and the addition of these amounts gives the per cent. protein of the mash (that is, the amount of protein in 100 lb. of mash).

Just because the mash balances on paper it does not mean that it is a good mash. Some further points must be considered. The palatability of the ration is very important. This can be improved by making the feed of coarse texture rather than fine to the point of becoming a powder. If a ration contains a large percentage of pollard, then it is often found that the fowls will not eat the fine dust left in the trough.

Staleness of ingredients can also affect the efficiency of the ration. Staleness usually implies that the fats in the meal will have gone rancid, and in doing so may have destroyed the fat-soluble vitamins, such as vitamins A, D_3, E and K. It is for this reason that the added vitamins A and D_3 have been stabilised by the manufacturer. If some of the ingredients used have been stored for a long time, it may be advisable in chicken starting, broiler and breeding rations to add vitamins E and K to counteract the oxidising effect of rancidity in fat-soluble vitamins.

Over the past few years, much enthusiasm has been shown by farmers for the so-called "high energy" rations. These rations are compounded by reducing the amount of mill offals and more fibrous foods and using more crushed grains, particularly maize and sorghum, in their stead. Such rations have a high energy content derived from the carbohydrates, starches and sugars in the grains, and a low fibre content. They are very efficient rations, for birds eat less feed to produce a dozen eggs or a pound of flesh than with rations containing higher amounts of fibre.

Even though shell grit is fed without restriction, ground limestone should be incorporated in the mash to supply calcium for bone growth and shell formation. This is very important where large amounts of liver meal replace meat meal, because liver meal contains very little calcium.

Seasonal Greetings are extended to all our readers and to those who have helped and co-operated with the work of the Department during 1960

TABLE 4

METHOD OF DETERMINING THE PROTEIN PERCENTAGE OF THE MASH

Ingredients	Crude Protein Analysis Per cent.	Lb. per 100 lb. Mash	Calculations	Amount Crude Protein
Maize meal	10·0	25	$\frac{25 \times 10}{100}$	2·5
Sorghum meal	10·0	25	$\frac{25 \times 10}{100}$	2·5
Wheat meal	12·0	25	$\frac{25 \times 12}{100}$	3·0
Lucerne meal	15·0	3	$\frac{3 \times 15}{100}$	0·45
Meat-and-bone meal	55·0	10	$\frac{10 \times 55}{100}$	5·5
Liver meal	65·0	5	$\frac{5 \times 65}{100}$	3·25
Buttermilk powder	26·0	5	$\frac{5 \times 26}{100}$	1·3
Ground limestone	..	$1\frac{1}{2}$	..	..
Salt	..	$\frac{1}{2}$	..	..
Vitamins	..	..	..	..
Total	..	100 lb.	Per cent. Protein ..	= 18·5%

Care should be taken when incorporating small amounts of ingredients such as vitamin supplements in the mash. These small amounts should be incorporated into a premix or mixed with 4 to 5 lb. of mash before being incorporated in the whole mix.

Salt, manganese sulphate and vitamin B_2 (riboflavin) are often incorporated into a premix consisting of 10 lb. salt, 6 oz. of manganese sulphate and 2 grams of synthetic riboflavin. A half pound of this premix is then added to every 100 lb. of mash. This ensures that the small amounts of manganese sulphate and vitamin B_2 become properly spread throughout the mash.

If desired, coccidiostats (drugs to prevent coccidiosis) and growth stimulants (antibiotics) can be incorporated in chicken feeds. These can be regarded purely as additives and do not interfere with the balancing of the ration.

Irrigated Pastures For Tableland Dairy Farms

By T. K. KELLY, and W. J. DRAPER, Agriculture Branch.

Irrigated pastures can be profitable on dairy farms on the Atherton Tableland. This has been demonstrated on Mr. J. Bravery's farm at Maunds Road near Atherton.

To justify the capital outlay and operating costs of an irrigation project there must be a profitable outlet for the produce and a need to increase output and efficiency. In this district as a result of an expansion of the northern milk market, an incentive payment is given by the Atherton Tableland Butter Association for milk produced between July 1 and November 30. The current incentive payment is 5d. a gal. which gives a total payment of 3s. 7d.

Need for Irrigation

Atherton has an average annual rainfall of 54 in., but about 60 per cent. of the rainfall is received in the first three months of the year. During the next quarter the rainfall usually consists of a succession of dull days with light misty rain. After this period, cool dry weather with occasional frosts is the normal pattern until temperatures rise in the spring. Rainfall is light from June until the storm rains of November and December.

Another factor which limits pasture growth during the winter, spring and early summer is the inability of the soil to store a satisfactory reserve of moisture from the abundant summer rainfall.

The Department of Agriculture and Stock arranged with Mr. Bravery to demonstrate the practicability of pasture irrigation on the Tableland. Consideration was given to the water supply, soil type, pasture species, fertilizer requirements and management. The demonstration was established in early 1958.

Irrigation water has been drawn from Mazlin Creek adjacent to the demonstration area. The quality of the water is good and the supply ample even in periods of drought.

The soil is typical of the maize growing belt of the Tableland. Such soils are red in colour and have been derived from basalt. They are deep, well-structured clays, friable and permeable, and with a red-brown surface horizon changing to bright red in the deep subsoil. The permeability and good drainage has much to recommend it for irrigation but a defect lies in the limited water holding capacity within the root zone of the pastures. The main effect is that water application needs to be frequent to avoid any setback of pasture growth.

Pasture Species

It was accepted that feed requirements could best be met by using both tropical and temperate pasture species.

In February, 1958, two acres were sown to guinea grass and *Glycine javanica* and in April of the same year 3½ acres were sown to a mixture of H1 ryegrass *Phalaris tuberosa,* cocksfoot and irrigation white clover. A further

2½ acres of temperate species consisting of H1 rye-grass, cocksfoot, *Phalaris tuberosa, Phalaris arundinacea* and irrigation white clover were sown in May, 1959.

The mixture of guinea grass and glycine was a proven combination under summer rainfall conditions in the district. With irrigation, growth has been prolonged through the autumn until frosts occur, usually in July. Following water application, growth again commenced in the spring.

The temperate species had not the same proven capacity in the district.

Since the project commenced, clover has given very good results. Of the grasses H1 rye grass has made excellent growth but is susceptible to rust. *Phalaris tuberosa* and *P. arundinacea,* while satisfactory, have lacked the vigour associated with these grasses in southern districts.

To test the performance of additional temperate species the original block was renovated in April, 1960, and oversown with Priebe's prairie, Clare subclover, and ladino white clover.

Both the tropical and temperate species have given a carrying capacity in excess of two dairy cows to the acre.

Fertilizer Requirements

The demonstration area had been continuously cropped with maize for about 40 years. As a result, fertility was low, and a green manure crop of cowpeas was ploughed in before the establishment of the pastures. Weeds are a major problem on the Tableland and a cropping programme designed to reduce weeds before the establishment of pastures would have been an advantage. A fertilizer mixture of equal parts of nitrogen and phosphoric acid (10:10:0) has been applied annually at the rate of 3 cwt. to the acre, with half the dressing in the spring and the remainder after the wet season.

Management

Mr. Bravery has paid careful attention to grazing practices which involve quick uniform grazing at intervals adjusted to the growth of the pasture and feed requirements. Strip grazing with an electric fence has been employed.

With the tropical species, cows have not been permitted to graze the pasture below a level of 12 in. This has permitted rapid regrowth and during the winter has reduced frost damage. Weeds have not been troublesome, as glycine has adequately filled the spaces between the clumps of guinea grass and tended to suppress young weed growth.

Careful management of the temperate species has been very necessary to maintain a balance between clover and grasses and to control weeds.

As hot dry periods can occur during the early summer months, grazing has been regulated during such periods to maintain a minimum of 3 in. of ground cover.

This is necessary to keep soil temperatures at a sufficiently low level for the survival of the temperate species. To prevent wilting during hot weather, a watering of 1 to 1½ in. was required every 10 days. With the guinea grass and glycine, watering has been less frequent but applications heavier.

Costs

The following costs *per acre* have been based on an application of 20 in. of water a year.

	Tropical Species	Temperature Species
	£ s. d.	£ s. d.
Pumping (electric motor) ..	4 0 0	4 0 0
Fertilizer	3 15 0	3 15 0
Depreciation	6 13 0	6 13 0
Interest	3 5 0	3 5 0
Labour (Moving pipes) ..	2 16 3	5 12 6
Labour (Electric fence and spreading fertilizer) ..	3 0 0	3 0 0
Mowing or slashing	..	0 10 0
Total	£23 9 3	£26 15 6

In terms of milk production the costs are not high. For the temperate species the production of 178 gal. an acre a year would cover costs with a net return of 3s. a gal. for milk. This is equivalent to about ½ gal. daily per acre. In the case of guinea grass and glycine it would be slightly less. For the total irrigated area of 8 acres it would be necessary to produce 4 gal. extra a day to cover costs.

As 5 acres of lucerne have recently been established adjacent to the demonstration, some costs in future could be charged against the lucerne.

Milk Production and Composition

Mr. Bravery did not supply milk before 1958, but is firmly convinced that irrigated pastures are profitable on his farm and preferable to the alternative of conserving silage and buying concentrates.

Apart from an increase in production, the maintenance of milk composition has been an advantage associated with the irrigated pastures.

On many dairy farms on the Tableland there is a seasonal decline in milk composition associated with a fall in the nutritive value of pastures. As a result many dairy farmers have difficulty supplying milk late in the year above the legal minimum of 3·3 per cent. fat.

To Sum Up:

(*a*) Irrigated pastures can overcome both a seasonal decline in milk production and composition on the Atherton Tableland and be profitable to the dairyfarmer.

(*b*) All dairy farms in this district are not suitable for irrigation but a number have the necessary facilities.

(*c*) A spray irrigation system is best suited to a 2-man dairy farm.

(*d*) A cropping programme to increase fertility and reduce weeds is a desirable prerequisite before establishing pastures on the Atherton Tableland.

(*e*) Good management is of vital importance, particularly with reference to the maintenance of temperate pasture species.

Germinating Lettuce in Summer

Faulty germination of lettuce in hot weather is a major summer problem for growers.

Germination failures are due to the peculiar effect of temperature on lettuce seed. In cool weather, at 60 to 70 deg. F., the seed germinates freely, provided it is matured and has been held under dry and cool conditions.

Higher temperatures reduce germination ability. At and above 86 deg. the seed tends to go into dormancy and germination may be almost completely stopped. No wonder, then, that growers often record poor strikes in summer when the surface soil may be as hot as 100 deg. and more.

Seed for summer crops should preferably be packed in air-tight jars and held between 50 and 60 deg. If the seed has experienced long exposure to excessive heat, it should be soaked in water for 2 hours, then strained and held in storage at 40 deg. for 4 to 6 days. This treatment will break any dormancy, but the seed must be sown at once—it cannot be stored.

As an alternative, soaking the seed for 10 hours in a 0·5 per cent. solution of thiourea at 65 to 70 deg. is worth a trial. Thiourea is a chemical dormancy breaker, and treated seed may either be sown immediately or held for later plantings.—*D. DOWDLES, Adviser in Horticulture.*

pasture and crop

Barley Quality.—The highest quality malting barley is produced when the growing period is long and uniform, such as in the temperate regions. Climates which are warmer and drier shorten the growing period, resulting in the formation of a harder, higher protein grain. These shortened conditions apply to this State, but fortunately our soil fertility is high enough to produce good high protein grain, suitable for the milling industry. On the less fertile soils, reasonably good malting barley is produced.

At the Hermitage Regional Exepriment Station this year a Time of Planting trial is being conducted using the variety Prior. The first sowing commenced in March and from then onwards, monthly plantings, concluding in July. From this trial, protein, malting quality, yield, bushel weight, and the weight of 1,000 kernels will be determined.

In conjunction with the Barley Board, a grower survey for malting barley has just concluded. About 180 growers participated in this survey, which was carried out in a similar manner to that of last season and reported in this Journal. The information is proving to be of considerable value to the Board in disposing of the crop in the most favourable manner. Any grower desiring a report on the quality of the barley he is producing should contract the Agricultural Chemist.

—W. J. T. KELSO, Senior Cereal Chemist.

Experimental Work on the Downs.—In commenting on some of our Agriculture branch's activities on the Darling Downs, I must leave no doubt on two points, firstly, that this work is not associated with the research programme of our Science Branch (in fact it is quite minor when compared with the work of these specialists). And secondly, in dealing with experimental programme, though able to mention interesting trends, I am of course, quite unable to arrive at conclusions or to forecast results at this stage.

Nevertheless, it is interesting to know what is going on. Take wheat for example; we are doing all sorts of things, but one of our main lines is sorting out the potential new varieties in the material supplied to us by our plant breeders. In this territory we have four varietal trials, one at Jondaryan, one at Meandarra and two (an early and a late trial) at Wandoan. Apart from some completely new material supplied by David Rosser, the main interest in this series of trials lies in the comparative performance of Gala—that's the Lawrence x Gabo hybrid—and Mengavi, the much publicised N.S.W. variety, with that of our standard varieties. Gala, of course, has performed particularly well in past trials and Mengavi which has never previously been subjected to comparative tests in Queensland has a big reputation to live up to. By the end of the season we should be able to give you a fairly reliable assessment of the capabilities of both varieties.

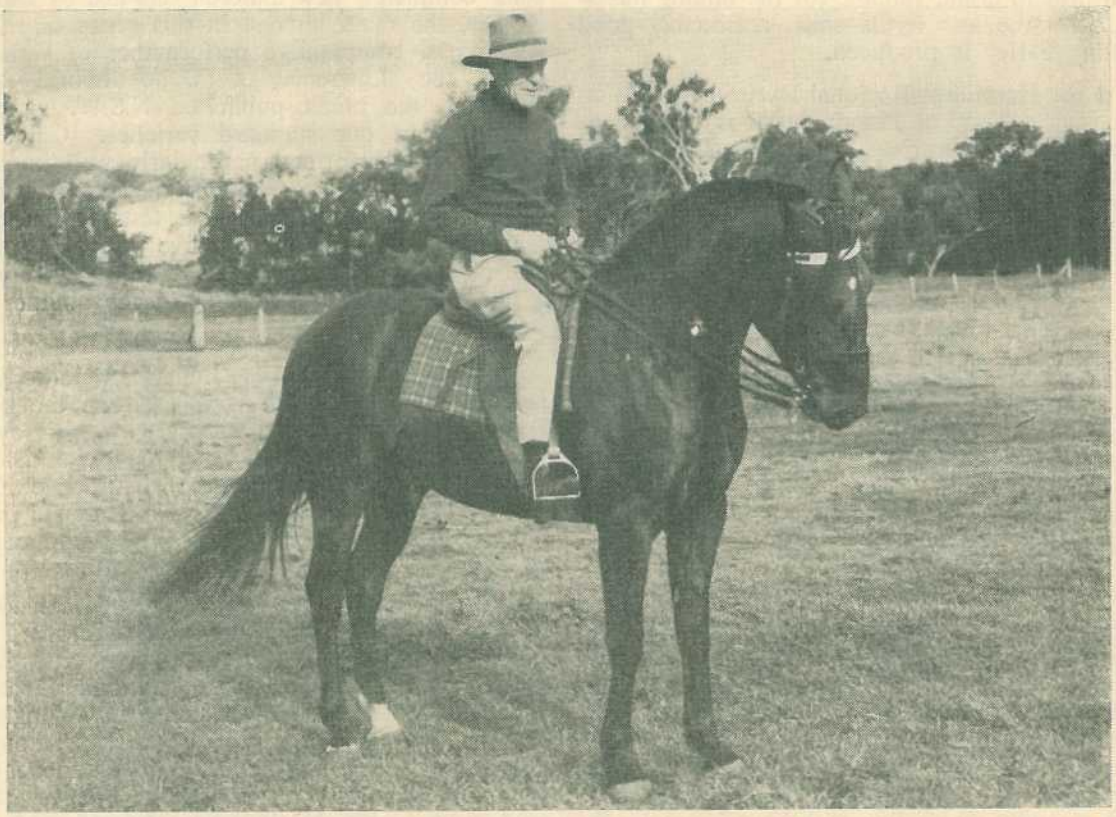
With barley we are doing similar varietal testing and here prime interest is focused on the new South Australian barley release Noyep—Noyep by the way is the abbreviation for Noyes Early Prior—Noyep looks particularly attractive and along with Maltworthy and Research should provide our standard Prior with some good competition.

Our oat grazing trials have now been extended to include comparison with grazing crops like Cape Barley, black barley, canary seed, crops like ryecorn as it is popularly called and dual purpose wheats, and winter wheats such as Winglen. Benton, that fast, beautiful oat looks as though it may take some tossing but it is yet too early to pass judgment especially as during the cold weather rye, black barley and Winglen all came into their own. But here again are trials which should add to our information on the grazing productivity of our various winter crops.

The glamour work of the season of course is our wild oat control work. For years now we have been saying—without much conviction or hope I must confess—"some day we'll get something to control wild oats" and it looks as though we really might have it now. Now, on no account do I want to raise any false hopes—there is a long way to go yet—but in a series of trials in which we have actually sown wild oats with other winter crops we are indeed getting promising results. We are testing two types of weedicides, a post-emergence and a pre-emergence and you can take it for granted that you will soon hear plenty about our results.

With linseed, too, we are doing quite a lot of work, especially in relation to the nutritional disorder so prevalent on our open downs country. Though I think that on this season's results we can say that we can largely correct this disorder by the application of certain mineral elements there is a considerable amount of work yet to be done in relating results to commercial applications. We rate this work highly for we feel that crops other than linseed may also respond to the corrective treatment.

—J. HART, Senior Adviser in Agriculture.



This Half-Bred Quarter Horse, Seen at "Risdon," near Warwick, is 2½ years old "Bomber," Bred from a Thoroughbred Quarter Horse Stallion and an Australian Mare. These horses are specially bred for arduous cattle drafting, outstanding speed, show performance and temperament.

Wheat Grain Composition And Soil Fertility

By W. T. KELSO, Senior Cereal Chemist.

A very wide range exists in the available phosphate content of the wheat-producing soils in this State. Expressed in terms of the amount present in 1 acre of soil, 1 ft. deep, this would range from 6,000 lb. to 150 lb. In the case of total soil nitrogen, the range is much narrower, that is, from 3,000 lb. to 1,800 lb.

Wheat grown in these soils can vary from 1.2 per cent. phosphate to 0.4 per cent. phosphate and so the content is much less variable than the soils.

Wheat protein (which is nitrogen multiplied by 5.7) varies from 17 to 8.5 per cent. and this range closely follows the nitrogen content range in the soil. Associated with protein content is the number of bushels harvested. As a general rule, it can be stated that for any one untreated soil growing the same variety, an increase in yield reduces the protein content and vice versa. This assumes that the crop has not suffered from disease, hail or frost. Variations in yield result from changing climatic conditions.

TABLE 1

Soil Nitrogen (Total)	Soil Phosphate (Available)	Grain Protein	Grain Phosphate	Yield
low ..	high	low	high	low
high ..	low	medium high to high	low	high
low ..	low	low	low	low
high ..	high	high	high	high

TABLE 2

District	% Phosphate 1958 with range	% Phosphate 1959 with range	Protein % 1958	Protein % 1959
Peak Downs	·58 (·71 to ·39)	·57 (·71 to ·48)	12·1	12·5
Callide	·83 (1·03 to ·44)	·85 (·98 to ·64)	14·2	13·6
Far Western 1	·69 (·97 to ·51)	·67 (1·01 to ·50)	13·7	13·8
Far Western 2	·77 (·93 to ·53)	*	14·2	*
Far Western 3	·53 (·66 to ·41)	·46 (·50 to ·43)	12·4	11·4
Warwick	·91 (1·19 to ·59)	·81 (·90 to ·64)	11·9	12·4
Burnett	·60 (·85 to ·33)	·66 (·86 to ·44)	11·1	11·3
Pittsworth	·77 (·97 to ·48)	·69 (1·03 to ·41)	12·0	12·2
Jondaryan	·84 (1·06 to ·57)	·78 (·99 to ·43)	12·5	12·9
Millmerran	·85 (1·19 to ·61)	·73 (·95 to ·48)	13·3	13·0
Meandarra	·61 (·70 to ·49)	·71 (·94 to ·66)	12·3	14·7
Jandowae	·78 (1·02 to ·61)	·76 (1·10 to ·49)	12·0	12·6
Cecil Plains	·76 (·87 to ·55)	·78 (1·02 to ·51)	12·0	12·5
Dalby	·81 (·97 to ·54)	·56 (·73 to ·41)	12·5	12·7
Clifton	*	·85 (1·03 to ·58)	*	12·5

*Number of samples was too small.

Far Western 1 is Warra, Brigalow, Chinchilla.

Far Western 2 is Miles, Dulacca, Jackson.

Far Western 3 is Roma, Wallumbilla.

Protein and grain phosphate are inter-related and there is a limit to the highest and lowest amounts which the grain can contain. Therefore if you have soils varying in nitrogen and phosphate, various combinations of grain composition can be expected to follow the pattern in Table 1.

For the 1958 and 1959 seasons, grain phosphate studies were commenced, in association with the normal protein surveys.

Table 2 sets out the average values, obtained on a district classification. The results are reported on a 13.5 per cent. moisture basis. It will be noted that in any one district the range of values is quite marked, and in many instances would be due to the district classification used. The phosphate level in general is high with the exception of Peak Downs, Far Western 3, Burnett, Meandarra and possibly Far Western 1.

Commencing this season, work on this survey will be continued for a further 5 years when samples will be analysed on a parish classification. It is anticipated that a useful map can be drawn showing soil fertility in relation to grain composition.

Mossman Burr And Sand Burr

For a long time Mossman burr* or Mossman River grass has been a troublesome weed in coastal districts and in some other tropical areas. More recently sand burr†, a similar grass, has appeared in several places in southern Queensland.

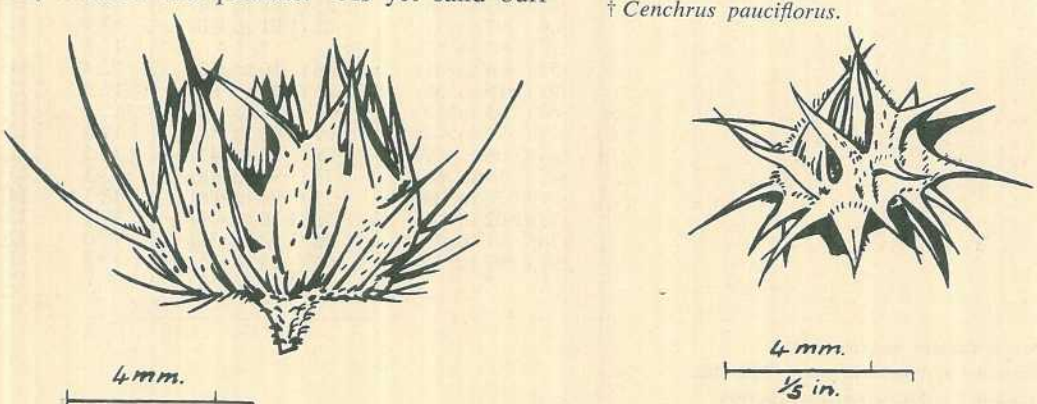
Both Mossman burr and sand burr are tufted grasses with fairly broad green leaves and an attractive appearance when young. Both have compact spikes of prickly, burry "seeds". Mossman burr grows in dense clumps with bunches of upright stems and the seed head is 2 to 4 in. long; sand burr is usually in rather flattened clumps with the stems spread and the seed heads short and with few burrs. Differences in the "seeds" themselves are shown in the drawings.

Mossman burr is very abundant near the coast from the southern border northwards. It is a troublesome pest along the coastline, particularly on bathing beaches and in recreational areas, where the sharp burrs stick to clothing and get in the feet of bathers. It is also a common weed of maize, tobacco and peanuts. As yet sand burr is not widespread in Queensland. It has been found in the south-eastern part of the State, particularly on the southern Darling Downs, but it could spread into sheep raising areas and would be a serious pest in wool. It grows on sandy soils, mainly along roadsides and in silty gullies.

Ordinary hormone weedkillers are not effective against either of these plants but both can be killed with grass-killers such as TCA, sodium chlorate and dalapon. Spraying with diesel distillate or power kerosene will also kill them if they are young. For recreational areas such as seaside resorts and picnic areas, regular close mowing is the best method of control. In crops, thorough preparation of the land helps to reduce the numbers of burr plants. Several chemicals show promise for pre-emergence weeding of maize but these need further testing before definite recommendations can be made. The important things are to recognise the plants and to attack them while they are still young and fresh and before the burrs are fully developed.

—S. L. EVERIST, Government Botanist.

* *Cenchrus echinatus.*
† *Cenchrus pauciflorus.*



Mossman Burr (left) and Sand Burr (right).

Dairy Yields Up In Dry Year

By W. R. SIGLEY, Dairy Officer, Allora.

The results of herd recording in the Allora and Ascot districts show how farmers are going a long way towards offsetting dry conditions by better farm management.

In the 1956-57 herd recording year, 21 herds were recorded. The herd average for the year was 4,619 lb. of milk and 194 lb. of butterfat. The length of lactation for the 19 herds was 234 days; 1956-57 was classed as an average season.

In the herd recording year 1958-59, which was a very dry year, 33 herds were recorded. The herd average was 5,159 lb. of milk, 210 lb. of butterfat and the average lactation period was 249 days.

The year 1958-59 was one of the driest on record. Yet the herds bettered their 1956-57 average by 540 lb. of milk and 16 lb. of butterfat. In addition, the cows milked for 15 days more than they did in the year recording was commemnced.

The increased production and length of lactation can be attributed to better farm management.

In the first place, there has been a marked increase in the amount of silage conserved. One farm in the Clifton district has 300 tons of silage underground, while several others have 50 tons or over. Much of this was fed out during the drought of 1958-59.

Grain Feeding

There has also been an increase in the amount of hay conserved on the farms. But the most spectacular feature has been the advance in grain feeding. Most farmers conserve sufficient grain on the farm to enable them to feed the cows a daily ration. If the season is dry, as it was in 1958-59, the grain is fed in conjunction with hay or silage.

Several dairy farmers have installed silos as a means of preventing rodent damage to grain. Others have built mouse-proof barns.

A ration of grain and hay or silage, all grown on the farm, has been mainly responsible for the higher production figures, despite the severe season.

Longer Lactation

Herd recording has also been responsible for directing attention to culling and the use of pure bred bulls. The information which herd recording gives the farmer enables him to cull on a sound basis without recourse to guesswork. The main reasons for culling so far have been low production and short lactation. The number of cows culled for disease or bad temperament has been far fewer by comparison. The effects of culling, combined with a better feeding programme, are reflected not only in the higher production, but in the extra number of days in the lactation period.

There has been an increased demand for pure bred bulls from high-producing cows as a result of the interest created by herd recording in this district. Farmers are turning more and more to bulls of tried blood to build up their herds.

There is also an increased interest in better calf management. More and more calves are now being fed grain and hay, to give them a sound start after weaning. These calves are growing into sturdier animals than their predecessors, who had to fend for themselves in the paddock once they were turned off the bucket.

Although 1959-60 has not been a favourable year for the dairy farmer, it is expected that the herd recording results when completed will show averages for this area as good as if not better than those of 1958-59.

Brucellosis-Tested Swine Herds (As at 30th November, 1960)

Berkshire

Bernoth, B., Wyreema
Clarke, E. J., "Kaloon", Mt. Alford, via Boonah
Cochrane, S., "Stanroy", Felton
Cook, F. R. J., "Astonvilla", Middle Creek, Pomona
Crawley, R. A., Rockthorpe, Linthorpe
Edwards, C. E., "Spring Valley" Stud, Kingaroy
Farm Home For Boys, Westbrook
Fletcher, A. C., "Myola" Stud, Jimbour
French, A., "Wilson Park", Pittsworth
H. M. State Farm, Numinbah
H. M. State Farm, "Palen" Stud, Palen Creek
Handley, J. L., "Meadow Vale", Lockyer
Handley, G. R., "Locklyn" Stud, Lockyer
James, I. M. (Mrs.), "Kenmore" Stud, Cambooya
Kath, E. E., "Topcamp", via Toowoomba
Kimber, E. R., Block 11, Mundubbera
Law, D. T., "Rossvill" Stud, Aspley
Lees, J. C., "Bridge View" Stud, Yandina
Ludwig & Sons, A. R., "Beau View" Stud, Beaudesert
O'Brien & Hickey, J., "Kildurham" Stud, Jandowae East
Orange, L. P., "Eula", Flagstone Creek
Pfrunder, P. L., Pozieres
Potter, A. J., Ascot, via Greenmount
Q.A.H.S. & College, Lawes
Regional Experimental Station, Hermitage
Rosenberger, N., "Nevrose", Wyreema
Rosenblatt, G., Rosevilla, Biloela
Schellback, B. A., "Redvilla" Stud, Kingaroy
Smyth, E. F., "Grandmere" Stud, Manyung, Murgon
Stark, H. L., "Florida" Stud, Kalbar
Traves, G., "Wynwood" Stud, Oakey
Weier, V. F., "La Crescent", Clifton
Young (Jnr.), W., Kybong, via Gympie

Large White

Assenbruck, C., Mundubbera
Barron Bros., "Chiltern Hill", Cooyar
Bell & Son, E. J., "Dorne", Chinchilla
Behm, A. M., "Aleun", Wondai
Butcher, Dr. B. J. & Parnwell, A. J. Plunkett Rd., via Tamborine
Clark, L. D., Greens Creek, Gympie
Coller, R. H., "Relloc", Tallegalla, via Rosewood
Cook, F. R. J., "Astonvilla", Middle Creek, Pomona
Dower, R. J. & E, A., "Dowlea", Tingoora
Duncan, C. P., "Colley", Flagstone Creek
Fowler, S., "Kenstan", Pittsworth
Franke, H. J. and Son, "Delvue" Stud, Cawdor
Garrawin Stud Farm Pty. Ltd., Samford
Gibbons, A. E. H., Mt. Glorious
Gibson, H., "Thistleton" Stud, Maleny
H. M. State Farm, Numinbah
Hall, M., "Milena" Stud, D'Aguilar
Heading, J. A., "Highfields", Murgon
Hickson, K. L., "Warra", Calliope
Hoey, T. W. & S. J., Mirridong Farm, Upper Forest Springs, MS74 Clifton
Horton, C. J., "Mannuem Brae" Stud, Mannuem, Kingaroy
Hutton, G., "Grajea" Stud, Toowoomba
Jones, K. B., "Cefn" Stud, Clifton
Kahler, J. & S., "Karajoy", East Nanango
Kanowski, A., "Exton", Pechey
Kennard, R. B., "Collar" Stud, Warwick
Larsen, H. L., "Oakway" Stud, Kingaroy
Law, D. T., "Rossvill" Stud, Aspley
Lees, J. C., "Bridge View", Yandina
Lobegeiger, L. C., "Bremer Valley" Stud, Moorang, via Rosewood
Mack, A. J., Mundubbera
"Marcliff" Stud, Wecker Rd., Mt. Gravatt
Neilsen, L. R., "Sunny Hill," Ascot, via Greenmount
Neilsen, A. R., Ascot, via Greenmount
Palmer, V. P. & Son, "Remlap", Greenmount
Port Curtis Co-operative Dairy Association Ltd., Stud Piggery, Biloela
Postle, R., "Yaralla" Stud, Pittsworth
Potter, N. R., "Actonvale", Wellcamp
Powell, R. S., "Kybong", Gympie
Q.A.H.S. & College, Lawes
Radel, V. V., Coalstoun Lakes
Radel, R. M., "Turua", Coalstoun Lakes
Regional Experiment Station, Biloela
Regional Experiment Station, Kairi
Robinson, O. R. & O. J., "Linvale", Argoon, Biloela
Rosenblatt, G., Rosevilla, Biloela
Skyring, G. I., "Bellwood" Stud, via Goomeri
Stanton, H. R., "Lanherne" Stud, Tansey, via Pomona
Stehn, L. W., "Hodgson Vale", via Toowoomba
Stewart, L., "Ban-Nookoo", Mulgowie, via Laidley
Stumer, K. F., French's Creek, Boonah
Thomas & Sons, "Rosevale", Laravale
Wharton, C. A., "Central Burnett" Stud, Gayndah
Wieland, L. C. & E., Lower Cressbrook, Toogoolawah
Zahnow, W., Rosevale, via Rosewood

Tamworth

Armstrong, H. J., "Alhambra", Crownthorpe, Murgon
Booth, J. D., Swan Creek, Warwick
Campbell, P. V., "Lawnhill" Stud, Lamington
Fletcher, A. C., "Myola" Stud, Jimbour
Herbst, L., "Hillbanside", Bahr Scrub, Beenleigh
Kanowski, S. E., "Miecho", Pinelands
Potter, N. R., "Actonvale" Stud, Wellcamp
Regional Experimental Station, Kairi
Salvation Army Training Home For Boys, "Canaan" Stud, Riverview
Stephen, T., "Withcott" Stud, Helidon
Wieland, L. C. & E., Lower Cressbrook, Toogoolawah

Wessex Saddleback

Ashwell, J., "Green Hill", Felton South
Cooper, G. J., Neumgua
Douglas, W., "Greylight" Stud, Goombungee
Dunlop, J. B., "Kunawyn", Acacia Rd., Kuraby
Kingsford, D., "San Antone", Toowoomba
Kruger & Sons, "Greyhurst" Stud, Goombungee
Lau, D. E., "Homevale", Goombungee
Law, D. T., "Rossvill" Stud, Aspley
Mack, A. J., Mundubbera
Scott, A., "Wanstead", Grantham
Smith, C. R., "Belton Park", Nara

Landrace

Ashwell, J., "Greenhill", Felton South
Behm, A. M., "Aleun", Wondai
Crawford, G. L., "Glenvillan", Manneum
Crothers, B. M., "Booligar", Clifton
Dower, R. J. & E. A., "Dowlea", Tingoora
Duncan, C. P., "Colley", Flagstone Creek
Fowler, K. P., "Northlea", Coalstoun Lakes
Franke, H. J. & Son, "Delvue", Cawdor
Garrawin Stud Farm Pty. Ltd., Samford
Grayson, D. G., Killarney
Itzstein, R. A., "Hyde Park", Gooroolba, Gayndah Line
Jensen, A. P., & Grace, V. S., Theodore
Jones, K. B., "Cefn", Clifton
Kajewski, W. & Son, "Glenroy", Glencoe
Kath, E. E., "Topcamp", via Toowoomba
Kingsford, D., "San Antone", Toowoomba
Law, D. J., Rossville Stud, Aspley
Lusk, P. B. and I., Westbrook
"Marcliff" Stud, Wecker Rd., Mt. Gravatt
Neilsen, A. R., Ascot, via Greenmount
Neilsen, L. R., "Sunny Hill", Ascot, via Greenmount
Orange, L. P., "Eula", Flagstone Creek
Palmer, V. P. & Son, "Remlap", Greenmount
Powell, R. S., "Kybong", Gympie
Radel, R. M. "Turua", Coalstoun Lakes
Semgreen, A. L. & D. J., "Tecoma", Kingaroy
Stehn, L. W., "Hodgson Vale", via Toowoomba
Stummer, K. F., French's Creek, Boonah

Large Black

Pointon, E., Goomburra

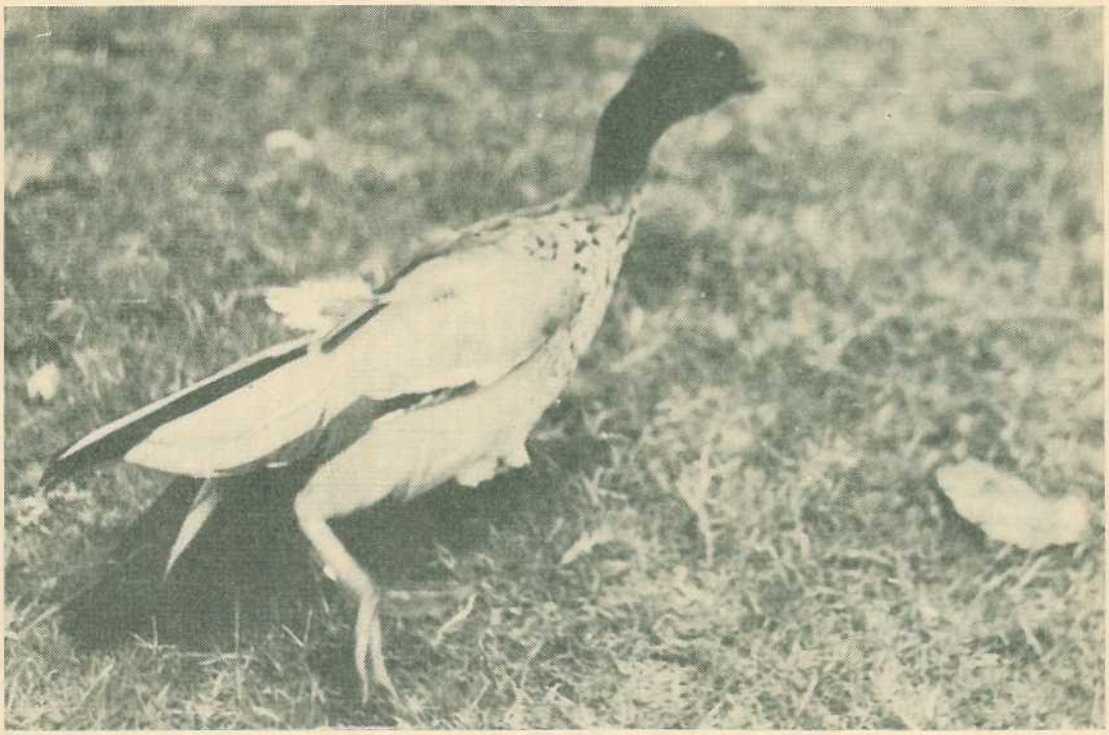


Plate 13

Maned Goose, *Chenonetta jubata* Latham, **Near Dyer's Swamp, Laidley.**

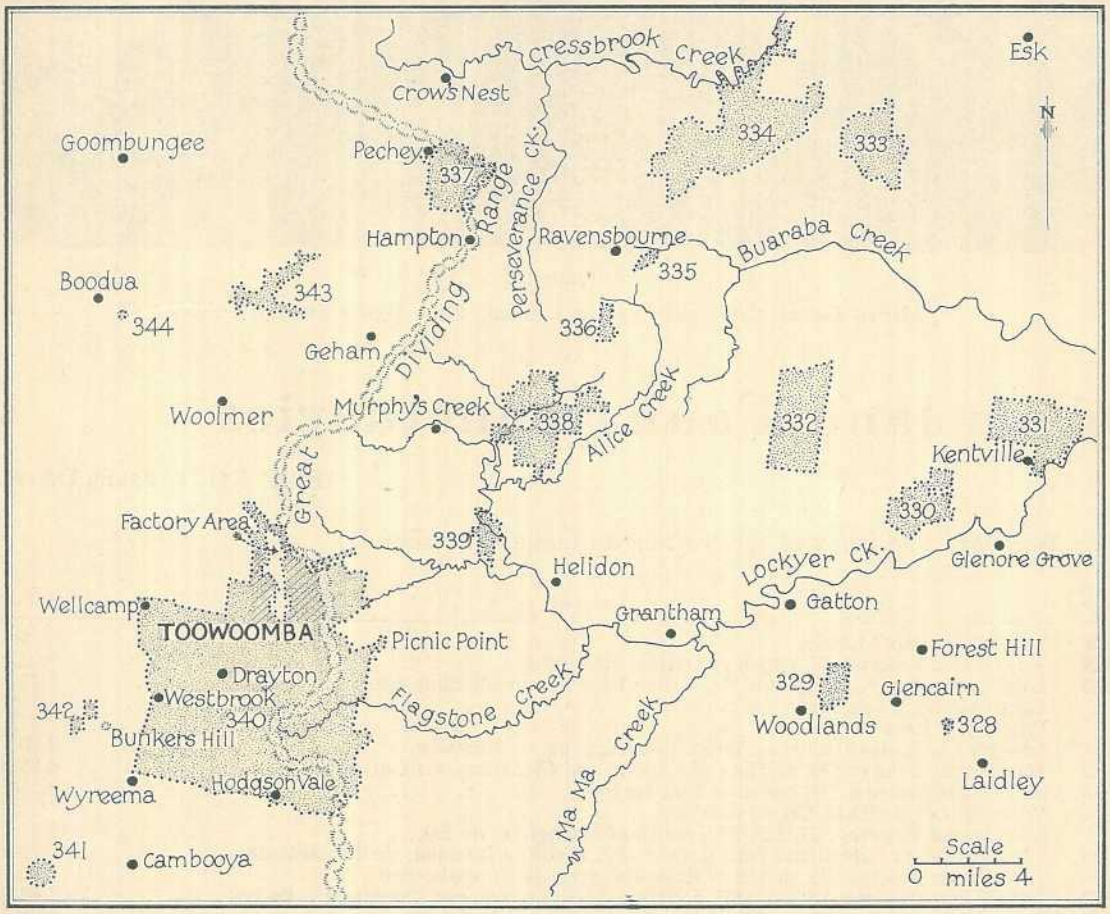
Queensland Fauna Sanctuaries

By C. ROFF, Fauna Officer.

The following is an index of the Sanctuaries outlined in Map 25:

Index No.	Sanctuary	Area in Acres
328	" Dyer's Swamp," Laidley	96
329	State Forest Reserve 667, parish of Gatton, via Gatton	1,023
330	Lake Clarendon, Pasturage and Recreation Reserve and adjoining area	1,292
	Lake Clarendon Sanctuary	735
	Property at Lake Clarendon	472
331	Lockyer Creek area (Including Seven Mile Lagoon), via Kentville	4,800
332	State Forest Reserve 573, parishes of Lockyer and Clarendon, via Gatton	6,854
333	State Forest Reserve 531, parish of Esk, via Esk	3,234
334	Property near Redbank Creek, via Esk	374
	State Forest Reserves 527, 528, 529, parish of Deongwar, via Esk	10,279
335	" Ravensbourne ", National Park Reserve 492, Parish of Buaraba, via Ravensbourne	224
336	State Forest Reserve 575, parish of Ravensbourne, via Ravensbourne	604
337	State Forest Reserves 509 and 909, parishes of Crow's Nest and Douglas, via Pechey	2,878
338	State Forest Reserve 564, parish of Murphy, via Murphy's Creek	5,060
339	" Springbrook ", Lockyer, via Helidon	766
340	Residential District of City of Toowoomba	
	Drayton Shire	
	Wetalla Sewerage Treatment Works, Toowoomba	

	Willowburn Hospital, Toowoomba	
	Horn Park, Toowoomba	
	Rifle Range, Toowoomba	
	One Tree Hill Reserve, Toowoomba	
	Property near Withcott	
	Jubilee Park, Toowoomba	46,670
	Picnic Point, Toowoomba	
	Weetwood, Toowoomba	
	Clifford Park Racecourse, Toowoomba	
	Hartman's Gardens, Toowoomba	
	Middle Ridge Golf Links, Toowoomba	
	" Smithfield," Drayton	
	" Southdown," Drayton	
	Property near Drayton	
	Redwood Park, Toowoomba	
341	Portion of Harrow Station, Cambooya	1,690
342	Experimental Farm Reserve, Westbrook	428
343	Cooby Creek Dam, Toowoomba	1,393
344	Cooby Creek Reserve, via Boodua	16



Map 25: **Map showing Sanctuaries in Part of Fauna District No. 1.** The sanctuary boundaries, as at December 31, 1957, are delineated by dotted lines enclosing the stippled areas.

VOL. 86 JANUARY-DECEMBER, 1960 PARTS 1 TO 12

Queensland Agricultural Journal

INDEX