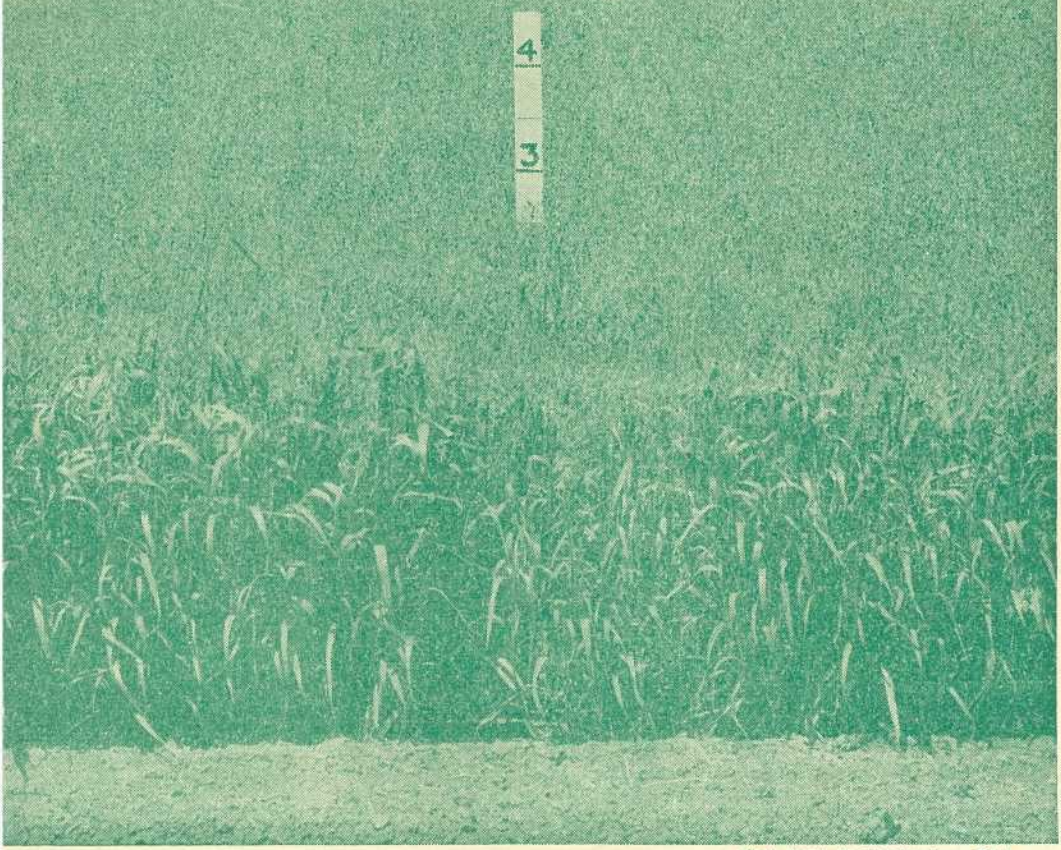
VOL. 69. PART 3 SEPTEMBER, 1949

DEPARTMENT OF AGRICULTURE

# QUEENSLAND AGRICULTURAL JOURNAL



*Oat Seed Multiplication Plot, Hermitage Regional Experiment Station.*

LEADING FEATURES



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

Volume 69 Part 3

# QUEENSLAND AGRICULTURAL JOURNAL

Edited by
C. W. WINDERS, B.Sc.Agr.

SEPTEMBER, 1949

Issued by Direction of
THE HONOURABLE H. H. COLLINS
MINISTER FOR AGRICULTURE AND STOCK

GOVERNMENT PRINTER, BRISBANE

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# Contents


# Scrub Falling by Bulldozer in Coastal Central Queensland.

E. WIDDUP, Adviser in Agriculture.

SHORTAGE of rural labour for scrub falling and land clearing operations has been a serious problem in recent years to many primary producers who desire to continue the improvement and development of their properties. The widespread use of mechanized equipment for many purposes during the war years attracted much attention from landholders who realized the possibilities of machines in overcoming shortage of rural labour in various ways. Consequently, it is not surprising that attempts have been made to adapt mechanized units in the form of bulldozers for the purpose of falling scrub.

Two bulldozer units have been operating in coastal Central Queensland almost continuously during the last two years and several thousands of acres of certain types of scrub have been cleared in a very satisfactory manner. Not all scrub types are amenable to clearing by this means; for example, in heavy scrub many trees of large diameter may be left standing and undergrowth may be insufficient to carry a good fire, which is very necessary for success in clearing land after scrub falling.

## Suitable Types of Scrub.

Scrub falling by bulldozers, to which this article refers, has been successfully carried out in the districts of Milman and Marmor and in the Dalma-Raglan-Bajool area. The scrub thus treated may best be described as light (trees 4-12 inches in diameter), dense softwood or vine scrub in which common timbers are plum,[1] sarsaparilla,[2] milkwood,[3] corkwood,[4] slatewood,[5] scrub yellow-wood[6] and scrub ironbark,[7] all of

[1] *Pleiogynium cerasiferum.*
[2] *Alphitonia excelsa.*
[3] *Excoecaria Dallachyana.*
[4] *Erythrina vespertilio.*
[5] *Geijera salicifolia.*
[6] *Terminalia sericocarpa.*
[7] *Bridelia exaltata.*

which are of little or no commercial value. Bottle trees[1] are found in this type of scrub, but such trees are usually left standing when scrub is fallen, to be utilized for supplementary feeding in times of severe drought. The undergrowth consists, in the main, of currant bush[2] and several other species.[3] Vines are common, including native grapes,[4] nightshade,[5] caustic vine,[6] wait-a-while[7] and several other species.[8]

In these small timbered scrubs few trees exceed a diameter of one foot, and bulldozers can flatten the vegetation rapidly, especially where the soil is soft and trees are easily pushed over. Larger trees can also be handled by the bulldozers, but if there are many of them costs automatically increase.

## Equipment.

Mechanized scrub falling in coastal Central Queensland is carried out by bulldozers of the 2 H.D. type, rated at 100 b.h.p. with a drawbar capacity of 85 b.h.p. and pushing hydraulic or cable operated blades 12 ft. 6 in. wide. The bulldozer weighs approximately 13 tons.

## Method of Falling.

The method adopted by bulldozer operators in falling scrub is quite simple, the scrub being fallen in lands similar to ploughing practice. The elevation of the blade is adjusted to suit the type of scrub being treated; it is raised for heavy timber and lowered for lighter trees. In the types of scrub referred to in this article, the blade was operated at a uniform height of three feet, as there were no trees requiring the blade to be adjusted to a higher elevation.

The bulldozer runs over the vegetation as it is pushed down, breaking up any dead timber present. Often trees may be dragged out by the roots. As might be expected, the trees and undergrowth are compacted in the process, thus favouring good burns. With the elevation of the blade as commonly used, there is no risk of piling earth over the vegetation and so spoiling the burn. Occasionally small "whipstick" suckers pass under the blade and are not broken, but they are of relatively little importance. Normally their eradication is not a problem and in any case the subsequent fire destroys a large percentage.

The bulldozer can be used satisfactorily for falling scrub on pronounced slopes, but in extreme cases, if the country is considered worthy of clearing, axe work is required.

The rapidity with which large areas of suitable scrub can be fallen compared with axe work is a major advantage of mechanized scrub falling. Another favourable factor is the absence of stumps. Thus, the treated scrub land after burning could be brought under the plough in much quicker time, with small expense for further stumping, if it was decided to cultivate for crops.

---

[1] *Brachychiton rupestre.*

[2] *Carissa ovata.*

[3] *Alyxia ruscifolia, Heterodendron diversifolium, Acalypha sp., Citriobatus spp., Macropteranthes fitzalanii, &c.*

[4] *Vitis spp.*

[5] *Solanum seaforthianum.*

[6] *Sarcostemma australe.*

[7] *Cudrania javanensis.*

[8] *Cynanchum boromanii, Parsonia lenticillata, &c.*

## Costs.

In the following table are shown the costs of falling scrub by bulldozer. These are actual figures obtained from property owners who have employed contractors on the work.

| District. | Acres Fallen. | Cost per Acre. | Success of Burn. |
|---|---|---|---|
| | | £ s. d. | |
| Marmor .. | 100 | 3 0 0 | Fairly good |
| Raglan .. | 200 | 3 0 0 | Fair |
| Raglan .. | 200 | 3 0 0 | Excellent |
| Milman .. | 100 | 2 10 0 | Good |
| Milman .. | 100 | 2 10 0 | Very fair |
| Bajool .. .. | 70 | 2 10 0 | Good |
| Bajool .. .. | 80 | 2 10 0 | Good |
| Marmor .. | 70 | 2 10 0 | Excellent |
| Dalma .. .. | 140 | 2 10 0 | Fair to good |

In the second last and last example shown in the table, some scrub fallen by contract axe work on each property cost £4 and £4 5s. per acre respectively. Thus not only did mechanized scrub falling do a better job but the cost per acre was less.

The price of scrub falling by bulldozer was about £5 per hour in June, 1949.

As a result of experience over the last two years it would appear that scrub falling by bulldozer may be carried out satisfactorily at any period of the year if weather conditions are suitable, as no material difference has been observed between scrub areas which were fallen during different seasons.

## Treatment of Scrub after Falling.

After falling, the scrub is burnt; as already indicated, the compaction of the fallen vegetation by the bulldozers favours good burns. The general opinion of landholders is that the interval between falling and burning is much shorter with scrub fallen by bulldozer than is the case with axe work. In one exceptional case during hot dry weather an excellent burn was reported after a lapse of only 10 days from the completion of falling. Should the burn be unsatisfactory, however, the landholder is faced with precisely the same problem as falling by any other method—that is, the unburnt timber has to be collected in heaps and fired.

The general rule is to sow the burnt areas to Rhodes grass pasture following the burn as soon as the ash is cold. This is a desirable course to adopt, particularly on hilly country, where erosion of bare ground can be serious. The grass cover after it has seeded may be fired at suitable intervals to eliminate any unburnt timber and suckers.

Few landholders try to grow a cash crop following the burn, but maize and cotton could be grown and the grass seed sown when these crops were ready to harvest.

Re-suckering in the scrub areas under consideration has been negligible to date, particularly where good stands of Rhodes grass have been obtained. It is, however, too early to generalise in this regard, but it would appear most unlikely that re-suckering would be any worse following scrub falling by bulldozer than would be the case following the orthodox axe method.

## Conclusion.

On results to date, the indications are that falling by bulldozer of the vine scrub type described is superior to ordinary axe work. The bulldozer method, therefore, should prove of great value to landholders in overcoming the problem of shortage of rural labour for this class of work.

Plates 49–55 illustrate various features of the operations.

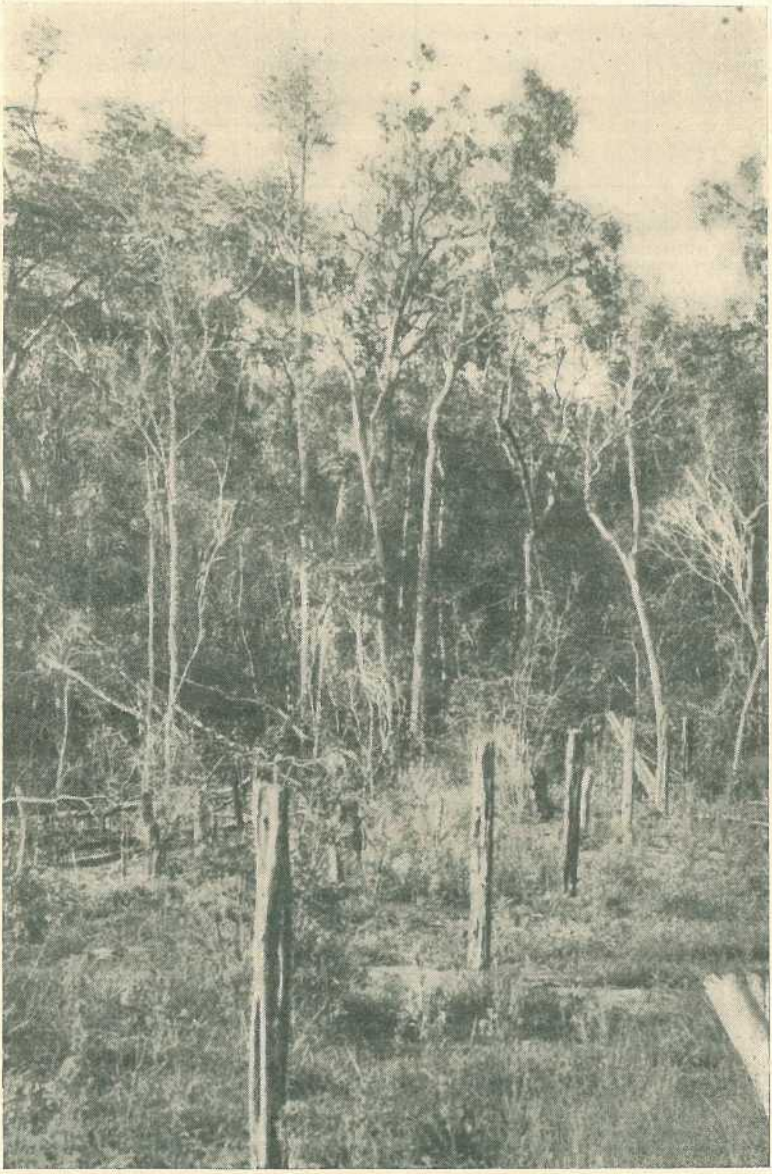


Plate 49.

TYPE OF SCRUB IN THE RAGLAN DISTRICT SUITABLE FOR FALLING BY BULLDOZER.

Plate 50.

TYPICAL SCENE AFTER FALLING BY BULLDOZER.—Note the bottle trees left standing.

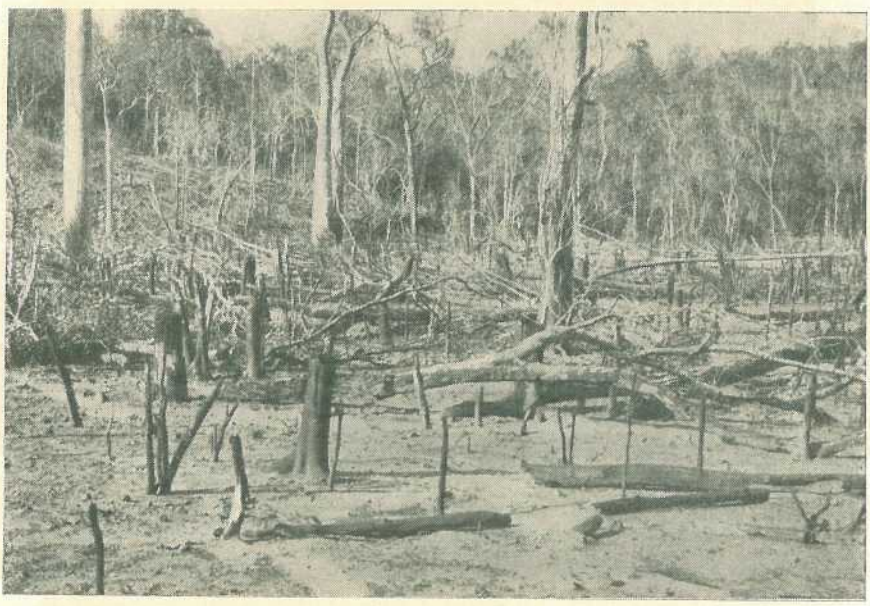


Plate 51.

APPEARANCE OF LAND AFTER SCRUB FALLEN BY AXE HAS BEEN BURNT (MARMOR DISTRICT).

Plate 52.

APPEARANCE OF SCRUB ADJACENT TO THAT SHOWN IN PLATE 51 AFTER BURNING.—In foreground, scrub fallen by bulldozer; in background, scrub fallen by axe.

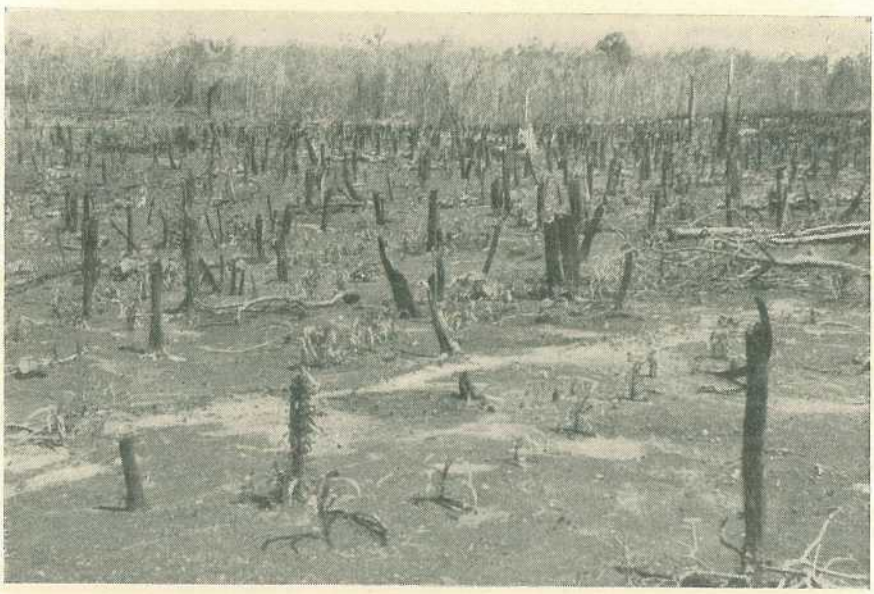


Plate 53.

SCRUB FALLEN BY AXE AND BURNT (DALMA DISTRICT).—Note young maize plants among the numerous unburnt stumps.

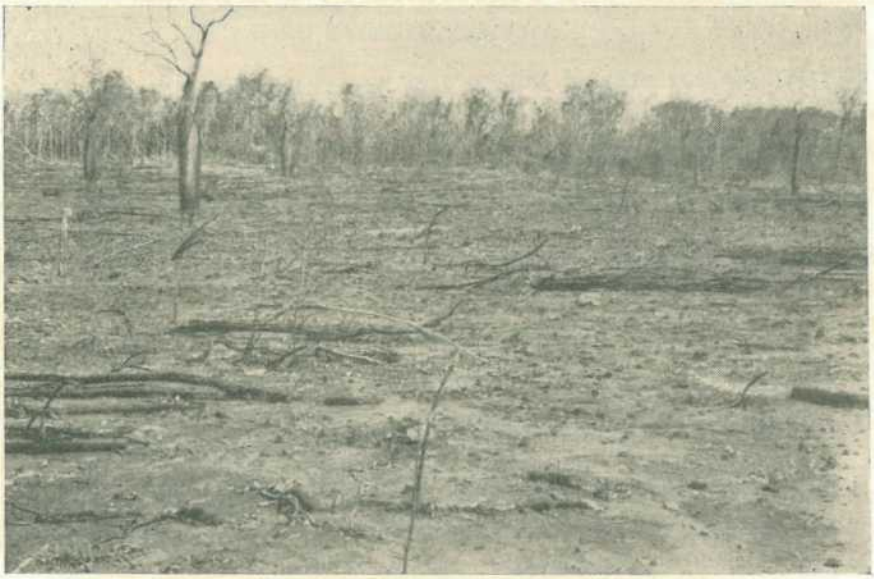


Plate 54.

THIS AREA, ADJACENT TO THAT SHOWN IN PLATE 53, WAS CLEARED BY BULLDOZER.—Note absence of residual stumps after burning.

Plate 55.

GRASSED AREA AFTER FALLING BY BULLDOZER AND BURNING.—The scrub was fallen in July, 1948, burnt off in November, 1948, and Rhodes grass sown in December, 1948. Note absence of stumps and the bottle trees left standing. Photograph taken March, 1949.

# Lime for Agricultural Purposes.

F. B. COLEMAN, Standards Officer.

LIME for agricultural purposes is classified under the *Fertilizers Act of* 1935 as follows:—

(1) Burnt lime, caustic lime, or quicklime—consisting chiefly of lime in the form of calcium oxide (CaO); or

(2) Slaked lime, air-slaked lime, mild lime, hydrated lime—consisting chiefly of lime in the form of hydrate of lime ($CaOH_2$) and/or carbonate of lime ($CaCO_3$), obtained by the slaking of burnt lime; or

(3) Processed lime—consisting of a by-product from a process—chiefly lime in the form of hydrate and/or carbonate of lime; or

(4) Pulverised limestone, marble, coral, or shells—consisting chiefly of lime in the form of carbonate of lime ($CaCO_3$) obtained by crushing or pulverising; or

(5) Earthy lime—consisting chiefly of lime in the form of carbonate of lime ($CaCO_3$) obtained by excavation of the natural substance; or

(6) Gypsum—consisting of lime in the form of hydrated sulphate of lime ($CaSO_4 2H_2O$).

Such classification of lime is based on terms in common use, which describe the process of preparation or manufacture to which the limes concerned have been subjected.

In order to fully understand the article, it is necessary to note that 56 per cent. calcium oxide—or lime (CaO) as it is commonly known—is equal to 100 per cent. calcium carbonate ($CaCO_3$); this may be explained by saying that 56 tons of pure burnt lime, containing 100 per cent lime (CaO), is equal to 100 tons of pure limestone, containing 100 per cent. calcium carbonate ($CaCO_3$).

As lime (CaO) is present, either free or combined with other elements, in all limes for agricultural purposes, it is used as a unit of measurement by analytical chemists in order to evaluate these materials.

Thus, pure limestone is not stated on analysis to contain 100 per cent. calcium carbonate ($CaCO_3$), but to contain 56 per cent. lime (CaO) as or in the form of calcium carbonate.

A description of limes for agricultural purposes and matters dealing with their origin, composition, and value are dealt with below.

## BURNT LIME.

Burnt lime is obtained in the following way:—Limestone is first quarried and broken into fairly small pieces. These pieces are placed in alternate layers in a kiln with fuel—in Queensland usually wood—which is ignited. The heat serves to liberate the carbon dioxide from the calcium carbonate, leaving calcium oxide and a quantity of impurities proportionate to the purity of the original limestone.

Pure limestone would contain 56 per cent. lime (CaO) and 44 per cent. carbon dioxide; pure burnt lime would contain 100 per cent. lime (CaO) actually in the form of calcium oxide. In actual fact the minimum purity of good burnt lime can be accepted as 90 per cent. lime (CaO). It should be emphasised that the impurities mentioned above, consisting of iron, alumina, magnesia, silica, &c., are naturally present in limestone, and cannot without great expense be removed; moreover, in normal proportions they do no harm and can be disregarded.

It is essential that the limestones should be completely burnt, otherwise the purchaser is buying some of the original limestone at the price of burnt lime.

In this connection it may be mentioned that limestone (or coral) can only be completely burnt in a properly constructed brick or brick lined kiln; "open-kiln" burning as practised in the past (consisting of logs built round the broken material) is not successful in giving a complete "burn."

An analysis of burnt lime indicates whether the limestone has been completely burnt; even if the burnt lime has been partially slaked it is still possible to determine this, providing the sample analysed is representative of the bulk.

In addition, a physical examination of badly burnt lime reveals in the resultant product "cores" of unchanged limestone which will not break down on slaking.

Burnt lime slakes under normal atmospheric conditions, taking in carbon dioxide and water from the air and "altering" from calcium oxide to a mixture of calcium hydroxide and calcium carbonate. This slaking may be considered in two steps:—

At first the calcium oxide alters to calcium hydroxide and calcium carbonate, with calcium hydroxide in much greater proportion than calcium carbonate.

An analysis would show, say—

50 per cent. lime (CaO) as calcium oxide.

30 per cent. lime (CaO) as calcium hydroxide.

4 per cent. lime (CaO) as calcium carbonate.

When the whole of the oxide has "altered," the proportions of the hydroxide and carbonate would be represented by, say—

0 per cent. lime (CaO) as calcium oxide.

60 per cent. lime (CaO) as calcium hydroxide.

10 per cent. lime (CaO) as calcium carbonate.

This slaked lime would then gradually "alter" until it becomes all carbonate, an analysis revealing, say—

55 per cent. lime (CaO) as calcium carbonate.

This is then a stable article, and undergoes no further change under atmospheric conditions.

Following on the above, it may be assumed that an analysis of—

50 per cent. lime (CaO) as calcium oxide,

30 per cent. lime (CaO) as calcium hydroxide,

4 per cent. lime (CaO) as calcium carbonate,

represents a well-burnt lime that has partially air-slaked.

An analysis such as the following, however, would indicate by the excess of calcium carbonate, compared with calcium hydroxide, the presence of unburnt calcium carbonate, and consequently could be assumed as being a partially-slaked, badly burnt lime:—

50 per cent. lime (CaO) as calcium oxide.
7 per cent. lime (CaO) as calcium hydroxide.
22 per cent. lime (CaO) as calcium carbonate.

Of course the following—

70 per cent. lime (CaO) as calcium oxide,
0 per cent. lime (CaO) as calcium hydroxide,
16 per cent. lime (CaO) as calcium carbonate,

is obviously a freshly-prepared, badly burnt lime.

It must be noted that the percentages given are *calcium oxide* (CaO)—not calcium hydroxide ($Ca(OH)_2$) or calcium carbonate ($CaCO_3$).

When a farmer realises that burnt lime slakes even under normal atmospheric conditions, and its percentage of calcium oxide (CaO) and its neutralising value become lower, it is easy to see that burnt lime should be packed and railed as *freshly burnt* material. If the material has started to slake before being packed and weighed, the purchaser is buying and paying freight on partially slaked lime, which, as above stated, has a lower percentage of lime (CaO) and lower neutralising value.

Thus, a person who pays for burnt lime and asks the manufacturer to slake it for him, unless he gets the *increased "weight equivalent"* of slaked lime, is losing badly on the proposition; in any case he is paying freight on carbon dioxide and water that could be added to the burnt lime on his own property.

*Burnt lime should be purchased on the basis of net weight at the place of burning*—which in North Queensland is usually some distance from the coast—as, during transit to the coast, an increase in weight could occur (due, as above stated, to taking up of carbon dioxide and moisture) before weighing; if weighed at the coast this increase would be included in the net weight charged for. In other words, 10 tons of burnt lime at the kilns could weigh 11 tons on the coast, with a consequent increased cost to the purchaser.

**Ground Burnt Lime,** as its name indicates, is burnt lime that has been pulverised by machine without first slaking. One such product is now being offered for sale in Queensland.

The farmer in this case must weigh the additional cost of the material against any advantage in fineness, taking into consideration the fact that although he can easily slake unground burnt lime on his own property, there is no additional freight cost (as with slaked lime) involved with ground burnt lime, providing it is bagged and railed immediately.

Of course the fine state of division would accelerate slaking considerably, and this would not be apparent from appearance—as the original material is already in a fine state.

Packing in water-proof paper bags (similar to cement bags), however, eliminates any disadvantages that may normally be associated with such an active substance in transit, storage, or handling.

## SLAKED LIME.

This may be of two main types:—Air-slaked lime and hydrated or water-slaked lime.

**Air-slaked Lime.**—This, as mentioned above, is obtained by exposing burnt lime to the slaking effects of the atmosphere. An explanation of the action has been set out previously.

The slaked lime made by farmers from burnt lime is usually air-slaked lime, that is, the burnt lime is dumped in heaps on the field, allowed to break down, and then spread and worked in.

The proportion of calcium oxide present and the forms in which it occurs at the time of application to the soil vary with the progress made in the process of slaking; this, of course, causes complications with respect to the amount of lime to be applied.

If burnt lime is purchased, the purchaser should apportion the lime actually applied to the soil into the same number of units as he planned for the original burnt lime.

For instance:—

A farmer buys 10 tons of burnt lime with a neutralising value of 160, planning to apply $\frac{1}{2}$ ton per acre to 20 acres.

When slaked ready for use the total weight may have increased to, say, 12 tons with a neutralising value of $133\frac{1}{3}$—which figure was, of course, reduced from 160 by the slaking. It should be noted that, by slaking, the neutralising value is reduced.

The lime should still be divided into twenty lots and applied as planned, but the actual weight per acre will now be $\frac{12}{160} \times \frac{1}{2} = \frac{12}{320}$ ton = 12 cwt. instead of 10 cwt.

The actual weight of lime (CaO) applied to the soil will be the same, however.

This is demonstrated thus:—

10 cwt. x neutralising value 160 = 1,600

12 cwt. x neutralising value $133\frac{1}{3}$ = 1,600

The neutralising value bears an approximate ratio to the lime (CaO) percentage.

If burnt lime is emptied direct from the bags into heaps on the ground to which it is to be applied, any increase in weight, &c., need not be considered.

**Hydrated or Water-slaked Lime.**—A more rapid and effective method of slaking can be obtained by adding measured amounts of water to burnt lime; this produces a rapid chemical change, with evolution of heat, and results in a fine, even, white powder, termed hydrated or water-slaked lime.

With a correctly made water-slaked lime the amount of water added is about one-third of the weight of the original burnt lime. The resultant product should be practically all calcium hydroxide ($Ca(OH_2)$), and should give a minimum analysis of 70 per cent. lime (CaO) as calcium hydroxide.

Possibly owing to lack of experience in this method of slaking, and the necessity for careful control with respect to proportions, &c., in order to obtain a consistent product, water-slaked lime for agricultural purposes is very scarce in Queensland.

To correctly manufacture commercially, an hydrating plant is necessary.

Of course, although hydrated lime is more active and more water soluble than air-slaked lime, it gradually alters to air-slaked lime on exposure, changing in time from practically pure calcium hydroxide to practically pure calcium carbonate.

There is not much of any slaked lime sold in Queensland.

## PROCESSED LIME.

In certain industries various forms or compounds of lime are used in chemical processes, and a resultant lime by-product is obtained. The common types of "processed" limes—as these are designated—are set out below.

**Gas Lime.**—In the ammonia-recovery process associated with the gas industry, burnt lime is used; the spent lime consists chiefly of calcium carbonate and hydrate together with certain impurities such as sulphides—when freshly run off. On exposure to sun and air, however, the material becomes practically all carbonate, while the impurities are oxidised to harmless compounds. A recognised lime for agricultural purposes is obtained after drying and grinding.

**Carbide Lime.**—In the manufacture of acetylene, calcium carbide and water are used, giving as a waste by-product—when fresh—lime chiefly in the form of hydrate.

This lime also needs to be exposed to the atmosphere, dried and ground. Obviously, after long exposure, carbonate would be formed.

This form of processed lime is, in Queensland, naturally limited in supply, and to date it has not been considered worth commercialising.

[TO BE CONTINUED.]


# Tomato Seed Certification.

A. A. ROSS, Horticulturist, and K. G. FISHER-WEBSTER, Manager,
Maroochy Experiment Station.

BOTH yield and market quality of the tomato varieties grown throughout the State have frequently been unsatisfactory and this may, in part, be responsible for the low market returns sometimes received by growers. Experimental work has, therefore, been carried out in the Stanthorpe district during the past four seasons to determine the varieties most suited to the Granite Belt and ultimately to produce pure strains of seed which could be planted with confidence by commercial growers in that district.

Many varieties obtained from a number of sources were grown in the initial tests and pure strains of the best of these were developed later by selection methods. Trials were then conducted to determine which of these varieties embodied desirable characteristics such as high yields, good plant type, desirable fruit shape and quality, carrying capacity and resistance to drought, sunscald and cracking. As a result of this work, the four best varieties were selected as a basis for the establishment of a seed certification scheme. These four varieties produce fruit of excellent quality and, as they mature at different periods, all can find a place in tomato production on one and the same farm.

## Production of Certified Seed.

The Tomato Seed Certification Scheme is administered under *The Seed Acts,* 1937 *to* 1941 by a Departmental Seed Certification Committee. It is designed to ensure that supplies of good quality tomato seed, free from disease and true to type, will be available to growers. A brief outline of the rules and regulations governing tomato seed certification will indicate the care taken in the production of certified seed.

The grower who is granted registration of an area for the production of certified seed is supplied with mother seed of an approved variety for sowing. This seed is usually obtained from a single plant selection in a certified crop grown during the previous year and harvested by the Seed Certification Officer. The registered area is inspected when the seed-bed is established and sown, between germination and transplanting, when seedlings are transplanted into the field, between flowering and the time at which the first-formed tomatoes reach the mature green state, just prior to harvesting, at harvesting, and during seed cleaning and packing.


[*Photograph by S. H. Mitchell.*

Plate 56.

A TYPICAL PLANT OF VARIETY Q1 (DERIVED FROM SIOUX).—Note the spreading habit of growth and the type of foliage.

A crop is rejected for certification if—

(1) at any time excessive weed growth prevents thorough inspection;

(2) bacterial canker appears in the registered area;

(3) the total number of plants showing symptoms of Fusarium wilt during the life of the crop exceeds 1 per cent. and they are not rogued out immediately;

(4) plants showing symptoms of virus diseases have not been rogued out promptly;

(5) the incidence of any disease may adversely affect the crop yield or quality of the seed extracted from the fruit;

(6) any plants showing undesirable varietal characteristics are not rogued out as directed;

(7) fruit is picked for market from the whole or part of the crop before the collection of fruit for the extraction of certified seed is completed;

(8) pests and diseases are not effectively controlled.

Only sound, full-ripe fruit, two inches or more in diameter, is harvested for seed. The fermentation method of cleaning, which entails extraction of the seed and juice from the fruit with a minimum of pulp, is practised. After the seed is washed and thoroughly dried, it is sampled and sealed with a temporary label by the Seed Certification Officer. The sample is tested for germination and if all requirements for certification are satisfied the bulk is weighed out and repacked under supervision.


[*Photograph by S. H. Mitchell.*

Plate 57.

A TYPICAL PLANT OF VARIETY Q2 (DERIVED FROM GROSSE LISSE).—Note the medium-sized plant of semi-erect habit.

## Certified Varieties.

Four varieties were approved for certification during the season 1948-49 in the Stanthorpe district, and the crops grown in all registered areas were very good. An outline of the origin of each certified variety and its growth behaviour under Stanthorpe conditions may assist intending growers when selecting the type best suited to their own district. Experimental work to determine the behaviour of the certified varieties in other parts of the State is already in progress.

**Q1.**

Derived from Sioux, an introduction from Nebraska, U.S.A., and evolved from a cross between All Red and Stokesdale. It has a medium-sized, very open, sprawling type of non-determinate bush with long, narrow, tomato-type leaves (Plate 56). The fruit (Plate 60) is large, circular in transverse section and slightly flattened in longitudinal section. The mature fruit is pale green in colour, with no darkening of the shoulders, and it ripens to a bright red.

Q1 is a first early tomato which is ready to harvest 10 weeks after transplanting and yields heavily until final picking. The variety stands up well to variable weather conditions, cracking and sunburn being very rare in the fruit. The quality of the fruit is excellent and it carries well to southern markets

**Q2.**

Derived from Grosse Lisse, which was introduced from northern Africa into Australia in 1939 by the New South Wales Department of Agriculture.

The bush is medium-sized, semi-erect, non-determinate, with foliage of moderate density (Plate 57). The leaves are long and broad and of the normal tomato type. The fruit (Plate 60) is large, circular in transverse section and slightly pointed in longitudinal section. The mature fruit is pale green in colour with darker shoulders, free from ribbing and ripens to a bright red.

Plate 58.

A SINGLE PLANT OF THE VARIETY VALIANT AT THE TIME OF SETTING OF THE FIRST FRUIT, SHOWING THE COMPACT HABIT OF GROWTH.

Q2 is a mid-season variety, which is ready for picking 11 weeks after transplanting and crops for a further seven weeks. It yields heavily even under relatively hard conditions and the fruit, though large, seldom cracks during growth and carries well to distant markets. Good crops have been grown in districts other than Stanthorpe.

**Q.3.**

Derived from Valiant, which was introduced from the United States of America in 1936; its pedigree is somewhat obscure.

The vine is vigorous, erect, compact, determinate and densely covered with long, broad leaves which are rather dark in colour and of the normal tomato type (Plate 58). The mature fruit (Plate 60) is deep green in colour, with dark green shoulders. It is deep-globe shaped, very smooth, with a shallow stem-end cavity. The fruit is very resistant to sunburn and cracking. It develops a bright red colour when ripe.

Q3 is a late variety, which is ready to harvest approximately 13 weeks after transplanting. It yields very well and produces good quality fruit which holds its condition well in transit to market.

**Q4.**

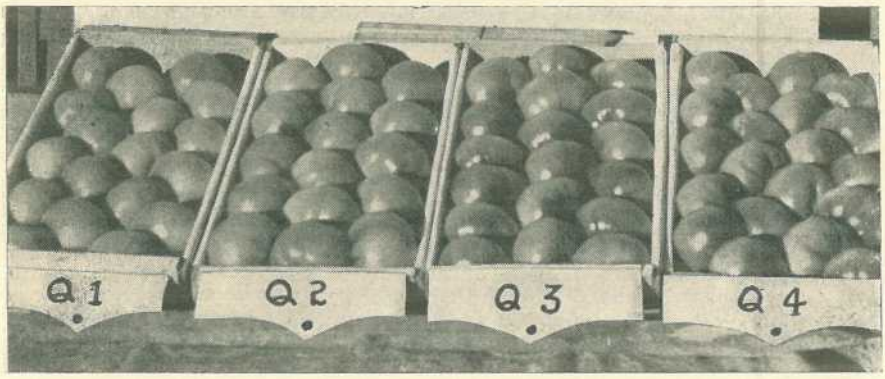
Derived from the variety Rutgers, which was introduced into Australia in 1934 from the New Jersey Agricultural Experiment Station, where it was selected from the progeny of a cross between Marglobe and J.T.D.


[*Photograph by S. H. Mitchell.*

Plate 59.

A TYPICAL PLANT OF VARIETY Q4 (DERIVED FROM RUTGERS).—Note the erect habit of growth and the dense foliage.

This variety has a large, dense, erect, non-determinate vine with leaves which are long, broad and rather dark in colour (Plate 59). The fruit (Plate 60) is large and deep-globe shaped, with smooth shoulders and shallow stem-end cavity with a medium-sized corky ring. The stylar scar is very small and smooth; cracking and sunburn blemishes are rare. The mature fruit is bright green in colour, with darker shoulders, and ripens to a bright red.




[*Photograph by S. H. Mitchell.*

Plate 60.

FRUIT EXHIBITED BY GROWERS OF CERTIFIED TOMATO SEED AT THE 1949 STANTHORPE SHOW.

Q4 matures late and is ready to pick 13 weeks after transplanting. It yields good crops consistently even under unfavourable climatic conditions. The fruit carries reasonably well. The parent variety Rutgers has been popular throughout the State for many years and the improved strain now available is a great deal better than related commercial lines.

### Yields from Certified Seed.

The use of certified seed should pay dividends to growers by increasing yields and improving fruit quality. The four certified varieties (Q1, Q2, Q3, Q4) now available have consistently produced from 800 to 1,200 half-bushel cases per acre under Stanthorpe conditions. Recent reports show that similar high yields can be obtained in some other districts.

### Distribution of Certified Seed.

The certified seed produced from registered crops and packaged under supervision is the property of the grower, who makes his own arrangements for selling it. Supplies can be purchased direct from the grower himself or through distributors appointed by him. The amount of seed produced annually depends largely on seasonal conditions and the growers' estimate of the probable demand. The latter, of course, determines to some extent the amount of fruit reserved for seed extraction on the farm before the balance of the crop is picked for the fresh fruit market.

## CERTIFIED TOMATO SEED—1949.

Under "*The Seeds Acts, 1937 to 1941,*" four varieties of tomato were approved for certification during the 1948-49 season. Certified crops were produced by the following growers, to whom inquiries for seed may be addressed:—

| Grower. | Address. | Variety. |
|---|---|---|
| E. F. Wain .. .. .. .. | Bapaume .. .. .. .. | Q1 |
| Harslett Bros. .. .. .. | Amiens .. .. .. .. | Q2 |
| C. Couchman .. .. .. | Glen Aplin .. .. .. .. | Q3 |
| E. F. Wain .. .. .. .. | Bapaume .. .. .. .. | Q4 |

## AGRICULTURAL TALKS.

In the A.B.C. Country Hour session, heard from 4QG and regional stations on week days, talks are given by officers of the Department of Agriculture and Stock at 12.59 on Tuesdays.

Talks scheduled for September and October include the following:—

6th September.—Bees and their diseases: C. R. Roff (Apiaries Inspector).

13th September.—Pig carcass appraisal and its relationship to breeding and feeding: E. Melville (Senior Adviser in Pig Raising).

20th September.—Why milk is pasteurised: V. R. Smythe (Dairy Technologist).

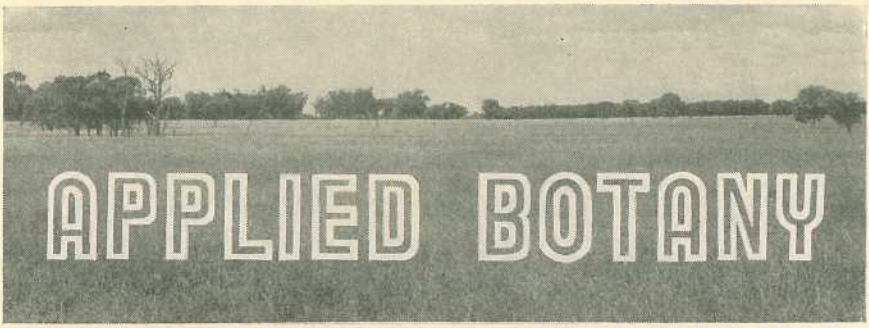
27th September.—Irrigation in the sugar industry: N. J. King (Director of Sugar Experiment Stations).

11th October.—Some aspects of milk and cream improvement: W. A. G. Haylett (Senior Adviser in Dairying).

18th October.—Sunflower growing for seed: J. Hart (Adviser in Agriculture).

## WILD FLOWERS PROTECTED.

For the purpose of preventing the indiscriminate picking of wild flowers, an Order in Council has been issued protecting boronia, Christmas bells, and vanilla lily for an unlimited period. It is an offence to pick these native plants on any Crown land, State Forest, or National Park; on any public park, reserve, or road; or on any private land without having first obtained the permission of the owner or lessee of such land.




# Wild Cottons—Declared Noxious Weeds.

C. T. WHITE, Government Botanist.

TWO kinds of wild cotton (*Asclepias fruticosa* and *Asclepias physocarpa*) have recently been declared noxious throughout the State, and the following notes and illustrations have been prepared to enable farmers, pastoralists, and local authority officers to recognise the plants should either or both make an appearance in their district.

The two kinds are very similar, but apart from minor floral characters can be distinguished as follows:—

*A. fruticosa:* Seed pods bladdery, 2-3 inches long, more or less egg-shaped and tapering into a beak at the apex.

*A. physocarpa:* Seed pods bladdery, more or less globe-shaped, about 2 inches in diameter, apex blunt.

## Description.

For all practical purposes the two plants are so much alike in general appearance that they may be described together as follows:—

Erect shrub-like weeds, all parts exuding a milky sap when cut; bark green, very fibrous. Leaves narrow, 2-6 inches long and tapering at both ends. Flowers white, in clusters (umbels) of 5-10 in the leaf-axils; the cluster itself on a stalk of about 1 inch and the individual flowers on more slender somewhat shorter stalks. Seed pods bladdery, about 2 inches in diameter, and with soft bristles. Seeds dark brown, numerous, and each with a tuft of hairs at the top which enable them to be distributed by the wind.

## Distribution.

These plants are natives of South Africa but are now widely spread as weeds in many warm countries. They were probably introduced as garden subjects and are still occasionally seen in gardens, mainly as a curiosity, though individual bushes are rather attractive.

## Common Names.

The plants are mostly simply known as wild cotton or cotton bushes, sometimes as white cotton to distinguish them from the allied red-flowered cotton (*Asclepias curassavica*), a moderately common though not very aggressive weed. The names Cape cotton and balloon cotton are also given to them.

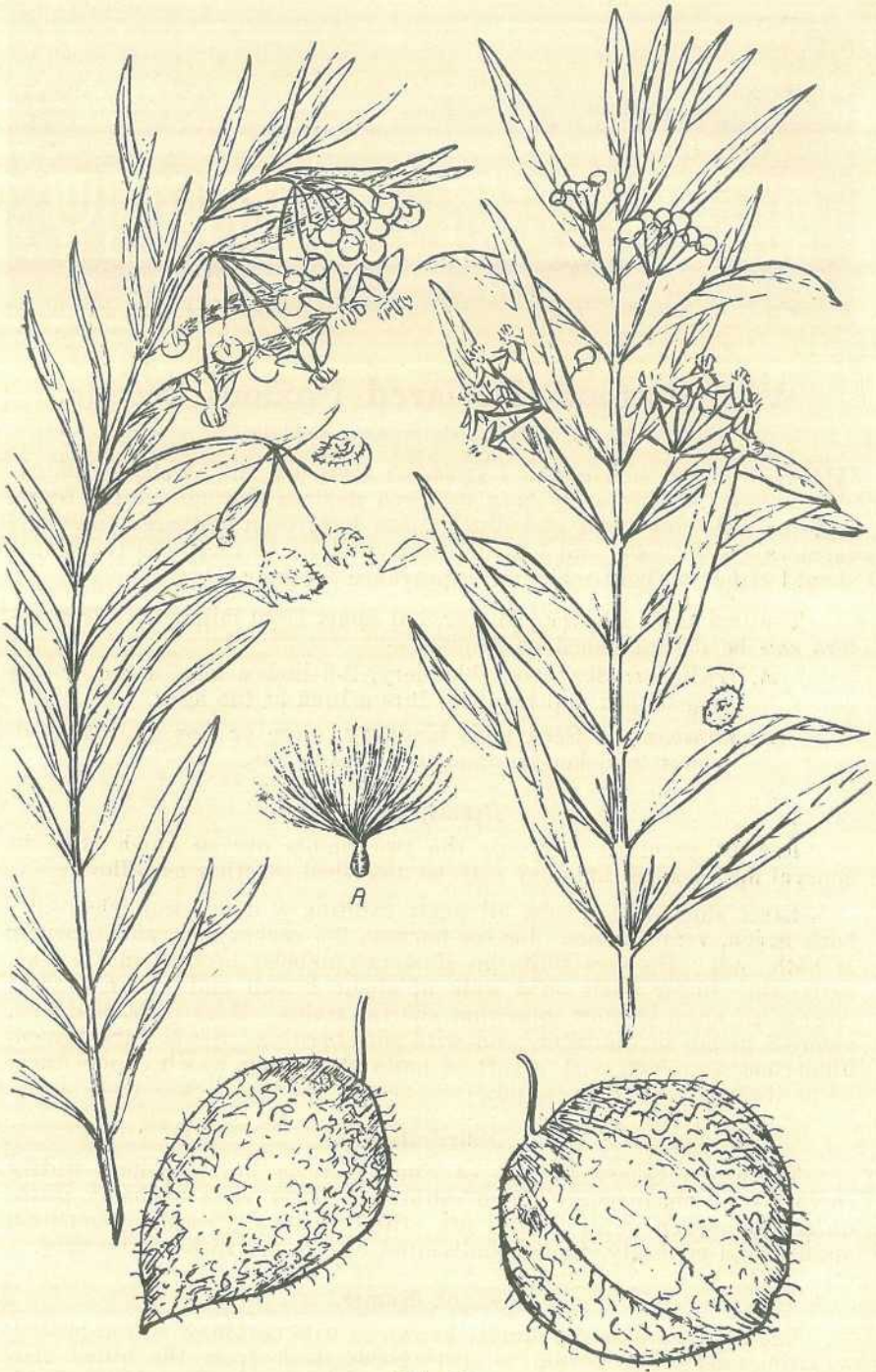



Plate 61.

WILD COTTONS—Left, *Asclepias fruticosa;* right, *Asclepias physocarpa.*

### Poisonous Properties.

They belong to a dangerous family—the Asclepiadaceae or milkwort family—many members of which are known to be poisonous. In most of them the poisonous principle is a cardiac glycoside—that is, a poison having a strong action on the heart. Feeding tests at the Animal Health Station, Yeerongpilly, have shown them to be poisonous to cattle. Fortunately, the plants are distasteful and are only eaten in sufficient quantities to cause trouble when animals are driven on to them in the absence of other fodders.

### Useful Properties.

The question is often asked if the down or silk-cotton surrounding the seeds has any commercial value. It is of no use for textile purposes, the fibre being too short and brittle, and could only be used in the same way as kapok. During the war a good deal of this "silk-cotton" was collected from allied species in the United States by school children and used as a kapok substitute for army goods. Its commercial collection for this purpose is hardly likely to be a payable propositoin. The bark contains a strong fibre which might have some use commercially, but at the present time there is no market for it. During the war the plant was tried for the extraction of rubber but was not a success.

### Eradication.

Where wild cotton occurs in pastures the only practical means of control is to dig the plants out or cut them off well below the surface of the ground. Hormone-type weedkillers so far tested against wild cotton have not given satisfactory results, and arsenicals, as well as being dangerous to grazing stock, are not entirely effective.

## FINDING DIRECTION IN THE DAYTIME.


Provided meticulous accuracy is not necessary and one merely desires to obtain a general idea as to direction, a simple but very effective way of ascertaining the north is to hold a watch horizontally in front of one and then turn it so that the numerals denoting 12 o'clock are pointing directly at the sun.

North will be found by the direction indicated if an imaginary line be drawn from the centre of the watch to midway between 12 o'clock and the hour hand whilst the watch is being held in the position given in the sketch.

*(Reprinted from "Handy Farm and Home Devices, and How to Make Them," on sale on behalf of the War Blinded Association.)*

# PLANT PROTECTION

## Tomato Diseases and Their Control.

J. E. C. ABERDEEN (formerly Pathologist, Science Branch).

(*Continued from page 91 of August issue.*)

### GENERAL NOTES ON CONTROL MEASURES.

CONTROL measures in general are discussed in the following paragraphs under the headings of selection and treatment of the seed, selection and management of the seed-bed, comparison of sprays and dusts, comparison of fungicidal materials available, crop sanitation, and spraying and dusting programme.

#### Selection and Treatment of the Seed.

The most important diseases which are frequently carried on or in the seed are bacterial canker and bacterial spot and certain of the virus diseases. Other important diseases which may be disseminated in this way but which are not so likely to contaminate the seed are Fusarium wilt, bacterial wilt, and target spot.

The selection of seed from disease-free plants is one of the means of combating virus diseases and is also the most efficient manner in which to eliminate the fungous and bacterial diseases of tomatoes. In view of this fact growers are strongly urged to select their own seed. This should be done while the fruit is still on the plants so as to ensure that only healthy plants will be chosen as a source of the seed supply. The fruit is left to ripen naturally on these selected plants before it is harvested for seed production. A further selection may then be made, special attention being given to the fruit type and to the health of the plant. A plant showing any symptoms of a virus disease—no matter how slight—should not be used for seed production even though the fruit may appear unblemished.

Should the grower purchase seed and there be any doubts as to its source it should be disinfected with corrosive sublimate in the following manner:—The tomato seed is placed in a piece of mosquito netting and suspended for five minutes in a solution of corrosive sublimate (mercuric chloride) used at a strength of one part of the chemical in 3,000 parts of water. The seed mass is stirred occasionally with a wooden stick during the period of suspension in order to remove any air bubbles which may be present. After immersion it is thoroughly washed in four or five changes of water, dried, and then sown immediately. Corrosive sublimate tablets, with directions for the preparation of the solution, may be obtained from a chemist.

Commercial products which may be used in the form of a dust for tomato seed treatments are those containing copper and mercury. Copper oxychloride may be used at the rate of 1 level teaspoonful to 1 lb. of seed and the mercurials at $\frac{1}{4}$ to $\frac{1}{2}$ level teaspoonful. The mercury seed dust that has found most favour overseas is the one containing ethyl mercury phosphate.

It should be realised, of course, that these treatments will not protect the seedlings from disease which may attack them after they have developed.

### Selection and Management of the Seed-bed.

The following diseases may occur in a tomato seed-bed sown with healthy seeds:—Irish blight, target spot, Septoria leaf spot, bacterial wilt, Fusarium wilt, bacterial spot, damping-off, and possibly the virus troubles. Care in the management of the seed-bed is accordingly essential, for in the seed-bed the whole crop is concentrated into a small area and the rapid spread of disease is facilitated. Loss of seedlings through such disease incidence often results in a delay of several weeks in planting out, with a consequential failure to gain the advantages of an early market.

Tomato seedling disease control may be exercised at four stages in the production of the young plants:—

(1) The selected seed-bed site should be well away from ornamental gardens as well as from tomato crops, and all weeds should be cleared from the site prior to sowing the seed.

(2) The seed-bed may need to be sterilized and the seed disinfected.

(3) At the time of sowing the seed should be sown in rows instead of being broadcast.

(4) After their emergence the seedlings should be sprayed or dusted with a suitable fungicide.

The placing of the seed-bed on new land is usually sufficient protection against soil-borne troubles other than nematodes, but if there is any doubt about this point the seed-bed should be sterilized by fire or by using formalin. If the heat method is employed brushwood or branches should be laid evenly over the seed-bed and the surrounding margin, the quantity of wood required being the equivalent of a solid layer about 3 inches thick. The soil should be moist but not excessively wet when the firing of the brushwood and branches takes place. When wood is readily available the heat treatment is the cheaper method of sterilizing the seed-bed soil.

If the formalin method is employed allowance should be made for the fact that the seed cannot be sown until some 12 to 14 days after the formalin has been applied. The seed-bed in this case is prepared ready for sowing, and the soil should preferably be moist but not wet when treated with the formalin. In the case of a dry soil a 1 per cent. solution of formalin (1 gallon of commercial formalin in 100 gallons of solution) is used, and it is applied with a watering can at the rate of 10 gallons to the square yard. If the soil is moist a 2 per cent. solution of formalin is watered on at the rate of not less than 5 gallons to the square yard. This amount of liquid per square yard is difficult to apply. It will be necessary to apply the liquid a portion at a time in just sufficient quantities to soak the soil, which should be loosened by a fork before each application. Alternatively, the borders of the seed-bed can be built up to form a miniature dam and all the liquid poured on in one application.

As soon as it is treated the seed-bed is covered with sacking for two or three days in order to keep in the fumes. It is then aired for a further 10 days or until the odour of formalin can no longer be detected, after which it is ready for use.

Growing conditions in the seed-bed include many factors, the more obvious of which—such as soil tilth and sufficiency of plant-foods—are well known to growers. One point which is worthy of consideration here, however, is whether the seed should be broadcast or sown in rows; the verdict in this case is that the latter method is definitely preferable in so far as disease control is concerned. A distance of about 6 inches between the rows allows easy penetration of the spray or dust to the stems and also prevents the formation of a still, humid atmosphere beneath the leaf canopy, such as is found when the seed is broadcast.

Regular spraying or dusting with a copper compound is necessary in the seed-bed, and, if spraying is preferred, Bordeaux mixture at the 2–2–40 strength, home-made cuprous oxide at the 1 to 19 strength, or commercial copper sprays at equivalent strengths, may be used. Care should be taken not to spray the seedlings too heavily, as an accumulation of spray liquid in the centre of the plants may result in burning of the young foliage. Should the grower's preference be for dusts, then any one of the proprietary copper dusts may be used. Heavy applications of these dusts should not be made on seedlings if much free moisture is present on the young plants, especially if warm weather is likely to follow dusting. Under such conditions burning may result with any of the dusts.

### Comparison of Sprays and Dusts.

In the recommendations for the control of certain of the tomato diseases copper sprays and dusts have been mentioned, but no details have been given with respect to their use and comparative efficiency. These details will be discussed now under several headings.

**Relative Efficiency.**

Assuming that the materials being used in the spray and dusts are equal in respect of fineness of division and chemical make-up, the efficiency of a treatment depends considerably on the durability of the protective cover. In this respect sprays have the advantage over dusts. Dusts have come into greatest prominence in vegetable treatments where applications are made regularly and frequently. Even under these conditions, when the poorer durability of the dust cover is counterbalanced by the frequency of application, the spray treatment is still the more efficient when conditions are very favourable to the disease. This difference in efficiency is more marked in the control of target spot than of Irish blight, as the latter disease appears to be very susceptible to the effect of copper fungicides.

**Relative Costs of Materials and Applications.**

Fungicidal materials are definitely more expensive to purchase as dusts than as spray materials. On the other hand, the dusts can be applied much more rapidly and require less time for refilling the machines. Thus the cost of the extra labour for the sprays counteracts the extra expense of the materials as dusts. This is illustrated by the following data, which compare a hand rotary type duster with a knapsack spray, these being the two commercial means of application for the small grower. Values are based on those current at the time of writing.

If the fungicide is purchased as a ready mixed proprietary dust each pound of metallic copper costs approximately 5s. 2½d. Taking the cheapest spray—home-made Bordeaux mixture—the cost of each pound of metallic copper in the mixture of 4–2–40 strength is approximately 2s. 7½d. Assuming the rate of application of spray to be 240 gallons per acre, it takes 20 man-hours to treat the acre—that is, four knapsacks are applied per man-hour. This is equal to 6 lb. of copper per acre.

An equal quantity of copper in the form of a dust would be 60 lb. of a 10 per cent. copper dust, which could be applied in approximately 8 man-hours. On this basis, dusting is cheaper than spraying if labour is worth more than 10s. per man per 8-hour day.

In general, a dust is applied more frequently and at a lighter rate of application of copper per acre than a spray. For the purpose of a further comparison it is now assumed that the dust is applied four times for every three times the spray is used, but the same total amount of copper is applied per acre. It now becomes cheaper to dust if the labourer is to receive more than 16s. per 8-hour day. Many growers would calculate the results to be more in favour of dusting than the above because of the tendency towards rapid, relatively light applications of dusts. If a proprietary spray material is used instead of home-made Bordeaux mixture the comparison is more in favour of the dust treatment.

It is considered that a power spray, with its more economical use of the spray and more rapid application, is probably cheaper than hand-dusters.

Fruit harvested from dusted plants is always easier to clean than that from sprayed bushes. No definite comparisons are available here, but the saving in labour favouring dust treatment is quite appreciable.

**Influence of Special Circumstances.**

Dusting is favoured on the following occasions:—

(1) When there is an absence of suitable water supply for spraying.

(2) If the terrain is unsuitable for the relatively heavier gear required for spraying.

(3) Where rapid emergency treatments are required—for example, immediately before rain or between spells of rain when the ground is not sufficiently dry to take the heavier spray apparatus.

On the other hand, wind is definitely disadvantageous to dusts. Even in districts where dusts are widely used the ideal periods are usually only at dawn and dusk. In areas subject to prevailing high winds growers may be forced to use sprays.

**Comparison of Materials Available.**

Among the sprays commonly used for the control of tomato diseases are two home-made mixtures—Bordeaux and cuprous oxide—as well as several commercial products manufactured especially for spraying purposes and containing basic copper sulphate and copper oxychloride. All these materials exert some, often very slight, harmful effect on the plants to which they are applied, and the relative importance of this has to be considered when discussing their merits as a fungicide. While Bordeaux mixture is superior to the commercial products in respect of the actual control of the various diseases, it is inferior in that it reduces the yield of fruit to a greater extent than does any one of the others. The home-made cuprous oxide suffers from a slight disadvantage in that owing to its colour it is difficult to check the thoroughness with which the spray is being applied, although this is largely overcome if arsenate of lead is included in the mixture. The preparation of cuprous oxide mixture also requires the exercise of special care. The commercial copper sprays are easier to prepare than Bordeaux mixture, and usually reduce yields to a smaller extent.

Taking the various factors into consideration, the small grower will probably find it more convenient to use a commercial product, preferably a copper oxychloride. With a large quantity of spray being handled it is less trouble to prepare a home-made mixture, and such a spray may then be more economical and efficient to use and also more convenient generally.

Two types of copper dusts are available, one of which contains a neutral copper compound (either carbonate or oxychloride) with a kaolin filler and the other dehydrated copper sulphate with hydrated lime as a filler. They appear equally efficient in controlling Irish blight, but the copper sulphate dust may be slightly superior to the other in controlling target spot. The neutral copper compound, however, has a less detrimental effect on the total yield of fruit, which more than compensates for a slight reduction in efficiency in target spot control.

These proprietary sprays and dusts have increased considerably in popularity over the last 10 years. A number of factors have influenced this increased use, but the main one is undoubtedly the improved quality of these products; a second factor is the irregularity of supplies of materials for home-made mixtures during the war years and subsequently. As the commercial products vary in their composition, it is very difficult for any individual grower to readily judge the merits of a particular brand, and the position can be best summarised as follows. While the best products are sufficiently efficient for most circumstances, it is doubtful if any of them can control a disease such as target spot on tomatoes as well as Bordeaux mixture, and others of them are definitely inferior. The best course for the grower who wishes to use proprietary lines is to use only those which have been proved suitable, either by departmental experiments or by wide usage by other farmers.

Another point in the use of proprietary copper fungicides is that recommended rates of mixing with water are sometimes weaker in strength of copper than the Bordeaux mixtures recommended for the same purpose by the Department. Within certain limits this will not make a material difference on a rapidly growing crop like tomatoes, which is sprayed often, providing the application is thoroughly done.

TABLE 2.

TABLE OF COPPER EQUIVALENTS.

| Equivalent Strength of Home-made Bordeaux Mixture required. | Weight of Commercial Spray Material to add to 40 Gallons of Water. | | Weight of Dusts containing same Amount of Copper as 40 Gallons of Spray. | |
|---|---|---|---|---|
| | When Containing 50 Per Cent. Copper. | When Containing 12½ Per Cent. Copper. | When Containing 7 Per Cent. Copper. | When Containing 10 Per Cent. Copper. |
| | Lb. | Lb. | Lb. | Lb. |
| 6–4–40 | 3 | 12 | 21½ | 15 |
| 4–2–40 or 4–4–40 | 2 | 8 | 14¼ | 10 |
| 2–2–40 | 1 | 4 | 7⅛ | 5 |

Table 2 has been drawn up to show the amount of dilution of the various commercial products required to obtain a copper content equal to standard Bordeaux mixture. Copper dusts have also been included, as the general tendency is for growers to apply them at a much lighter rate of copper per acre than for sprays.

The following figures should be of some assistance to new growers in determining the quantities of sprays or dusts required to treat a crop. For 1,000 plants 2 or 3 feet across, 20 lb. of dust or 100 gallons of spray

should be sufficient for each application. As the plants increase in size the figures will rise to about 40 lb. of dust and about 150 gallons of spray. However, there is a considerable degree of variation in the quantities used by individual growers, and a knapsack normally uses more gallons of spray per acre than a power spray. As general practices stand at present, less copper is applied per acre per application when a crop is dusted than when it is sprayed, but the available evidence indicates that this reduced quantity is still sufficient to control average outbreaks of disease, although special care must be taken at critical periods. One important point in this connection, of course, is the fact that dusts are usually applied more frequently than sprays, and the total amount of copper applied throughout the growth of the crop may be approximately the same for the two methods of application.

### Crop Sanitation.

The destruction of the residue of a tomato crop after harvesting has been completed is a disease control precaution which is all too frequently ignored. This is unfortunate because the prompt destruction of the crop residue is a valuable control measure in the case of all diseases and is particularly important for the control of Fusarium wilt, Verticillium wilt, bacterial wilt, bacterial spot, and target spot.

### Spraying and Dusting Programme for Disease and Pest Control.

With every tomato crop grown there is usually an infestation of various insect pests the control of which generally entails the use of certain dusts and sprays, and for economy of labour and materials these may be combined with fungicides in the one application, both in the seed-bed and in the field. The remaining paragraphs in this article discuss suitable combinations of fungicides and insecticides.

In the seed-bed, light but frequent applications of a dust containing arsenate of lead 5 parts, sulphur 6 parts, copper carbonate or oxychloride 3 parts, and filler 6 parts by weight will ensure seedling growth free from most pests and diseases. A proprietary dust of this kind would carry the following analysis:—7.75 per cent. arsenic pentoxide ($As_2O_5$) as arsenate of lead, 30 per cent. sulphur as ground (or precipitated or sublimed) sulphur, 7.5 per cent. copper (Cu) as copper carbonate or oxychloride. A combination spray consisting of the 2–2–40 strength of Bordeaux mixture (or 1 in 20 home-made cuprous oxide mixture) with colloidal sulphur (1 lb. to 50 gallons) and arsenate of lead (1 lb. to 50 gallons) will achieve the same purpose. If aphids appear they should be treated with a 3 per cent. nicotine dust or nicotine sulphate spray (½ pint nicotine sulphate, 2 lb. soap, and 50 gallons of water). Insecticides containing hexaethyl tetraphosphate (HETP), such as Hexone, should not be used on tomatoes.

In the field an all-purpose dust mixture should contain arsenate of lead 10 parts, sulphur 6 parts, and copper carbonate or oxychloride 4 parts. Such a proprietary dust would carry the following analysis:—15.5 per cent. arsenic pentoxide ($As_2O_5$) as arsenate of lead, 30 per cent. sulphur as ground (or precipitated or sublimed) sulphur, 10 per cent. copper as copper carbonate or oxychloride. If desired, a combination spray of the 4–4–40 strength of Bordeaux mixture (or 1 in 10 home-made cuprous oxide mixture), to which 1½-3 lb. of arsenate of lead and 1 lb. of colloidal sulphur are added to each 50 gallons of the spray, may be used. A nicotine dust or nicotine sulphate spray mixture similar to that used in the seed-bed should be applied if aphids become numerous. As a general guide, treatment in the field should commence when flowering begins and continue at approximately 7–10 day intervals at least until picking tallies are at their maximum. Such a

schedule, in addition to dealing with other pests and diseases, should give a reasonable measure of control of the corn ear worm.

DDT has now been proved to be a very efficient substitute for lead arsenate and further departmental recommendations incorporating this insecticide may be summarised as follows:—

(1) For general use, apply fortnightly a treatment of a DDT-sulphur-copper oxychloride spray. It should contain 2 lb. of 50 per cent. water-dispersible DDT powder, 2 lb. wettable sulphur, and 2½ lb. copper oxychloride to 50 gallons of water. If weather conditions are such as require more frequent application of copper for fungus and bacterial diseases, the above treatment can be interspersed by a copper plus sulphur spray, as it is unnecessary to use DDT more frequently than once a fortnight.

(2) If a dust is required where corn ear worm and leaf-eating looper are the major pests, apply a standard combination lead arsenate-sulphur-copper carbonate dust at seven-day intervals. It should contain 5 parts of lead arsenate, 3 parts of sulphur, and 2 parts of copper carbonate. An occasional extra treatment will improve this schedule.

(3) If a dust is required in districts where jassids and mites are prevalent apply a DDT-sulphur dust (containing 2 per cent. DDT and 30 per cent. sulphur) at fortnightly intervals, with application of a copper dust (containing 7-10 per cent. copper) seven days after each DDT treatment.

Mixed dusts containing insecticides and fungicides in similar proportions to those stated in the recommended formulae are prepared by several firms. Although mixing on the farm cheapens the cost, it is preferable for the grower to purchase dust mixtures already prepared unless he has facilities for accurately weighing the ingredients and thoroughly mixing them.

Marketed tomatoes must not carry arsenical deposits in excess of 0.01 grains of arsenic trioxide per lb. of fruit. Ordinarily, the grower wipes his fruit to remove dirt and stains before marketing, but this procedure is not particularly efficient in removing spray and dust residues which tend to lodge in cracks and furrows on the surface of the fruit.

Chemical treatment is much more efficient and is therefore sometimes adopted. The method entails the use of first an acid solution and then an alkaline solution for neutralising any acid left on the fruit. The acid dip consists of 1 quart of commercial hydrochloric acid mixed with 25 gallons of water. The alkaline dip is made by adding ¾ lb. of hydrated lime to 25 gallons of water. The container used to hold the solutions should be large enough to allow easy manipulation of a suitable wooden case within them and should be equipped with inclined draining boards. The tomatoes are placed in the wooden case—which should have the boards spaced sufficiently far apart to allow rapid penetration of the solution and quick drainage—and are immersed in the acid dip for 1½ minutes, the case being moved up and down in order to wet all the fruit. The case is withdrawn at the end of the acid dipping period, is allowed to drain on the draining boards for a few minutes, and is then plunged into the lime dip for 1 minute. After removal from this dip the tomatoes are again drained, well sluiced with clean water, and set aside to dry thoroughly before packing.

Twenty-five gallons of the acid dip is sufficient quantity to treat at least 35 bushels of tomatoes carrying heavy spray residues. Sound and scarred tomatoes, whether coloured or green, are not injured by this treatment, nor is cracked fruit affected provided it is dried quickly after the dipping process.

# Yellow Crinkle Disease of Papaws.

## Provisional Control Measures.

T. McKNIGHT, Pathologist, Science Branch.

EVERY year the destructive virus disease "yellow crinkle" reduces the papaw yield of the State. In epidemic years it causes heavy losses in yield, but, what is more important, it produces ragged plantations with a marked reduction in the number of trees per acre, the effect of which persists over the whole of the bearing life of the plantation. Disease hazards in papaw culture are great, and the "yellow crinkle" virus must not be allowed to exact an early toll from the new planting.

Plantation owners are familiar with the fact that virus diseases are particularly hard to combat. The investigations on this disease are not complete, but the following notes will acquaint growers with some of the information available and will be of assistance in the establishment of bearing crinkle-free plantings with the required number of trees per acre at the end of the first 14 months.

Plate 62.

AFFECTED TERMINAL, SHOWING DWARFED CROWN LEAVES.

## Symptoms of the Disease.

Yellow crinkle appears in the early summer months, and by January of any year is of common occurrence in papaw plantations throughout the State. While the incidence of the disease varies appreciably in different localities of any one district, losses of the order of 10 per cent. commonly occur in young plantings in south-eastern Queensland, while in central and northern plantations losses up to 30 per cent. are recorded in years when the virus is particularly active.

The symptoms of the disease are accordingly well known to growers. The first signs of infection are the appearance in one or two of the mid-crown leaves near the leaf margins of translucent or "cleared" areas between the leaf veins and the yellowing of the older leaves, the stalks of which bend down slightly where they join the trunk. At this stage the youngest leaves are normal, but in a short time terminal growth ceases, the young crown leaves become yellow, the margins curl under, and the leaf blade is much reduced in size, being generally not much wider than the leaf stalk (Plate 62). By this time the cleared areas between the veins in the first infected leaves have dropped out to produce a very conspicuous, narrow, irregularly shaped leaf, with injury resembling grasshopper damage. The petals and other flower parts on diseased trees are replaced by coarse, frequently enlarged, leaflike structures (Plate 63), and in the final stage the tree is reduced to a trunk devoid of foliage and with a cluster of small leaves at the top.

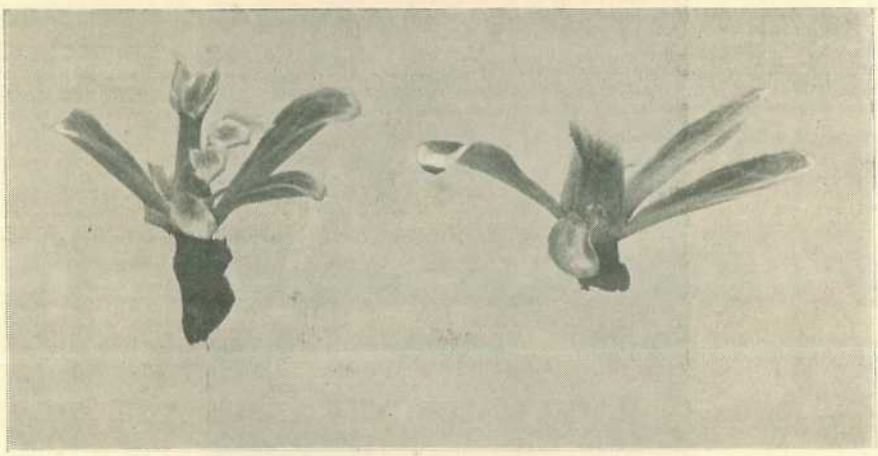


Plate 63.
LEAF-LIKE FLOWERS FROM A YELLOW CRINKLE-INFECTED PLANT.

## Some Features of the Disease.

A common misunderstanding among growers is that cutting back the trunk to remove the diseased terminal, or cutting off an affected side branch, depending on where the disease first appears, is a worthwhile measure which may prevent the subsequent spread of the disease throughout the plant. Field investigations, however, have shown that when one part of the plant becomes infected all other parts ultimately contract the disease. In the first instance the main trunk or one of the side shoots may exhibit symptoms (Plate 64) and, despite removal of the infected part, spread into the other parts occurs in most cases

by the following summer and no marketable fruit are obtained. In an established plantation the appearance of the disease in any part of the plant is the signal for cutting the plant at ground level to die.

Plate 64.

AFFECTED TERMINAL WITH A TEMPORARILY HEALTHY SIDE SHOOT.

Unlike a number of other viruses, yellow crinkle virus is not mechanically transmitted. There is, therefore, no likelihood of transferring the disease from plant to plant during picking or cultural operations.

The earliest infections occur in November. The incidence of the disease reaches a peak in midsummer, and the great majority of the season's infections are recorded by the end of March. New infections do not occur during the cooler months, and the period for further infections commences in the following November.

Generally a much higher percentage of infections occurs in young plantings than in older trees.

The diseased trees generally occur at random throughout a plantation, although occasionally irregular groups of diseased trees may appear. In the first summer, in multiple plantings more than one plant per position may become infected, but this is relatively uncommon.

It has been noted that over the period when yellow crinkle disease appears in papaws many common weeds and some cultivated plants growing in and adjacent to plantations in south-eastern, central, and northern districts are infected with tomato big-bud virus disease. It is probable that this virus is identical with the virus causing crinkle in papaw.

It is possible that most of the infection with yellow crinkle arises from other species of plants in and around the plantation and is carried to the papaw by an insect. The suggestion is made that the spread of the disease from papaw to papaw is not as important as the spread from outside sources into the papaw.

The virus is consistently appearing in plantations, but in some years it is epidemic—as in 1936, 1939, and 1948. There is no reason why this virus cannot become a still greater hazard to papaw culture.

## Control.

Work now in progress should lead to more definite recommendations for the control of this disease. In the meantime it is suggested that growers give some thought to the following suggestions.

To defeat this disease in young plantations, growers will have to maintain more plants per acre for the first 12 months—that is, until the first yellow crinkle season has passed, This must be achieved, naturally, in a manner that will not entail heavy competition between individual trees in the young plantation and in such a way that a reserve of trees will be maintained until the end of March or early April.

This can best be accomplished in conjunction with the desirable fairly late plantings, such as late February or early March in south-eastern Queensland, which will produce plants of relatively small stature flowering about November.

In plantations where the multiple planting system is adopted three plants are established in each position to permit the culling of unwanted males and to allow some individual selection for vigour and type. This culling, carried out in November, will coincide with the period for the appearance of the first yellow crinkle infections so that at this time the routine removal of yellow crinkle infected trees should commence also. Unwanted healthy companion trees in each position should be cut back and not cut out in order to provide a reserve of trees to compensate for further yellow crinkle infections developing during the period November-April.

In November, therefore:—

(1) All diseased trees will be cut out at ground level.

(2) The surplus companion tree, or two companion trees, as the case may be, in each position, will be cut back to either 1 or 2 feet above ground level. In order subsequently to differentiate between male and female trees, male trees could be cut back to a foot above ground level and female trees to 2 feet above ground level.

(3) One healthy, unpruned tree will remain in each position.

The cut-back companion trees in each position will subsequently produce side shoots which can be rubbed off as they appear or allowed to develop if the original tree should become diseased. On monthly inspections until early April, therefore, a routine should be adopted for cutting to the ground all virus infected plants and maintaining one healthy plant per position, either by (*a*) the continued growth of the original plant left in November, or by (*b*) cutting the original plant to the ground if infection occurs and permitting the side shoots from one of the cut-back companion trees to develop.

In early April all surplus cut-back companion plants should be removed by cutting to ground level.

Alternatively, to have this reserve of trees to cope with losses from the virus, some growers may prefer to plant out an additional seedling between every tree position either at the same time or a few weeks after the original seedlings are established. At the time of thinning out of the trees in position the reserve trees will be cut back, and they will either be maintained or cut out later, depending on the disease incidence.

A similar plan may be adopted in plantations where the multiple planting method is not practised but where seedlings are planted a few feet apart in the row and a close density of plants per row is maintained until the thinning out of excess trees at flowering. In this case between 10 and 30 per cent. of trees at regular intervals between those left in position will be cut back instead of being cut out in November. On subsequent monthly inspections until early April all yellow crinkle infected plants will be cut to ground level and the previously cut-back trees will have the developing shoots rubbed off if the nearby trees are healthy, or allowed to develop if an adjacent tree in the row has been removed because of infection.

It is considered that this system of providing reserve cut-back trees over the period of yellow crinkle incidence should not produce a detrimental effect on the trees in position if the regular monthly routine is adopted. The cutting-back cutting-out routine could be speedily carried out with a cane knife and there would be no need to sterilize the knife during the operations. The affected trees can be left to die where they fall. The net result will be a bearing planting with the requisite density of trees per acre at the end of the first 14 months. On an average, as the trees become taller epidemic incidences of the disease become less probable. If infected trees appear the following summer they should be cut out.

Seed-beds should be isolated as far as possible from summer growing crops and from ornamentals, and as a precaution seedlings should be dusted or sprayed with DDT at intervals of a week or 10 days.

Many weed species are suspected of carrying the yellow crinkle virus, so that in plantations on level country good weed control in and around the plantation should be maintained over the period November-March. On hillside plantations it is neither practicable nor desirable to keep the plantation free from weeds over the period of the summer rains, and in both types of area the accent is placed on the cutting-back cutting-out procedure.


# Mastitis in Ewes.

G. R. MOULE (Officer in Charge, Sheep and Wool Branch), G. C. SIMMONS (Assistant Bacteriologist, Animal Health Station, Yeerongpilly), and H. POPE (Senior Adviser in Sheep and Wool).

MASTITIS, or mammitis, as it is sometimes called, is a condition in which there is inflammation of the udder. It is not commonly seen in ewes kept under pastoral conditions, but the recent occurrence of gangrenous mastitis in two flocks in the Maranoa focussed attention on the quite heavy losses which can occur when ewes with lambs at foot are affected.

## The Cause of Mastitis.

Mastitis is caused by bacterial infection establishing itself within the udder. This usually occurs after the invading organisms have ascended the teat canal, though they may gain entrance through a wound. Several types of organisms may cause mastitis, the one most commonly occurring being a staphylococcus.

Many conditions predispose the udder to infection. These include:—

(1) Any changes lowering the general resistance of the ewe.

(2) The milking capacity of the ewe.

(3) Mechanical injury to the udder.

(4) Frost bite, which is probably uncommon in Queensland.

(5) Sore teats, which southern observers consider are important forerunners of gangrenous mastitis.

Veterinarians investigating mastitis of ewes in Tasmania report that sore teats are relatively common in Merino ewes during their first lactation, irrespective of age. From 20 to 60 per cent. of Merino ewes lambing for the first time may be affected, and some of these subsequently develop gangrenous mastitis.

## Symptoms.

Two types of mastitis occur, namely—

(1) Simple mastitis, which is usually not very serious;

(2) Gangrenous mastitis, which is serious, and may be fatal.

In simple mastitis the milk becomes clotted and the udder may be hard, swollen, and inflamed. Recovery may be complete or the affected teat may go blind. Because of its comparatively mild nature, mastitis of this type commonly escapes notice, but it can be quite important amongst crossbred mothers of fat lambs as it leads to a decreased milk supply and a reduced fattening rate. Accordingly, ewes should be examined carefully each year before joining, and animals with blind teats rejected.

Gangrenous mastitis is more severe and can be fatal. The onset is sudden and one or both halves of the udder may be involved. Attention is often first drawn to the disease by lameness in one or both hind limbs. The affected udder is hot and swollen; the skin is discoloured and painful when touched, and it characteristically changes colour, from red in the early stages to dark blue, and finally black. Milk secretion is suppressed and that from the affected half may be blood-stained. Sometimes a dark swelling extends along the belly and the wool from this area may pluck easily. The animal is depressed and disinclined to eat. Temperature is raised and the respiratory rate increased. The whole of the hindquarters may become stiff, and sometimes the udder or affected half sloughs.

Some sheep recover, but quite heavy mortalities may occur. In one of the recent outbreaks, involving a flock of 2,400 ewes, 72 died and six recovered. The ewes were affected two and a-half to four months after lambing, but reports from other States indicate that ewes are commonly affected five to seven days after lambing. Some ewes collapse suddenly and die without showing typical symptoms.

### Post-mortem Findings.

The post-mortem findings are fairly typical in ewes which have died from gangrenous mastitis.

The subcutaneous tissues of the belly are usually infiltrated with sanguinous exudate, which may be black and as much as ¾-inch thick. Sometimes it extends down the inside of the back legs.

The udder is dark and contains blackish, blood-stained fluid, and the regional lymph glands are usually enlarged. Small scabs may be found around the teat orifice.

### Treatment.

The recommended treatment is administration of the drugs sulphamezathine or penicillin. Sulphamezathine is sold in 0.5 gm. tablets or as a solution of sodium sulphamezathine. The tablets may be given by mouth and the dose rate is two such tablets—that is, 1 gm. per day for every 15 lb. live weight. A 33⅓ per cent. solution of sodium sulphamezathine may be injected subcutaneously, and the dose rate is 3 c.c. for every 15 lb. live weight.

Alternatively, if the disease is detected early, penicillin in oil can be introduced into the udder through the teat canal after the affected half of the udder has been stripped of milk. There are several proprietary lines of penicillin in oil which are marketed for the treatment of mastitis in dairy cows, and one of these may be used.

If these drugs are not readily available, local treatment which may be used is frequent milking out of the udder and, perhaps, hot foments and gentle massage.

# ANIMAL HEALTH

## Cattle Tick Control: Results Achieved in the Field with DDT and BHC.

J. C. J. MAUNDER, Director of Veterinary Services.

OWING to the failure of standard arsenical dips to control ticks (*Boophilus microplus*) in many parts of Queensland, it became necessary to develop new methods. Extensive laboratory and field trials indicated that DDT and BHC (benzene hexachloride) were vastly superior to arsenic. This article gives a brief resumé of the information obtained in the field and will indicate which material is likely to give the better results under various conditions.

The name DDT is now familiar to most people; BHC stands for benzene hexachloride, the name of a substance which has a complex makeup, its active principle being called the gamma-isomer. This is the substance that is contained in those proprietary preparations with the prefix gamma.

For official dipping mixtures recognised in The Diseases in Stock Acts, dipping fluids must contain, when mixed according to the manufacturer's instructions, either—

(*a*) 8 lb. arsenic in 400 gallons of mixture; or

(*b*) 0.5 per cent. para-para-isomer of DDT; or

(*c*) 0.05 per cent. gamma-isomer of benzene hexachloride.

### REQUIREMENTS OF AN EFFICIENT DIP MIXTURE.

To enable one to determine the efficiency of any given mixture the following requirements are enumerated:—

(1) Ability to kill ticks, including the arsenic-resistant tick, in all stages with an economical concentration.

(2) Non-toxicity to stock and to humans.

(3) Residual effect—that is, continues to kill larval ticks picked up subsequent to dipping.

(4) Stability in a dipping vat over a period of months.

(5) Control of other external parasites—for example, buffalo fly, bush fly, and lice.

(6) Economy.

(7) Ease of mixing and management.

## DDT DIPPING MIXTURES.

At present there is only one preparation on the market that is considered to be suitable for use in a dipping vat, as it is the only one that will retain reasonable stability over a period of months. The concentrate is a thick, paste-like substance containing 50 per cent. of the para-para-isomer of DDT, and it requires heating before being added to the dip.

This preparation has been used extensively under official supervision during the past two years. The following is a brief resumé of the information obtained, grouped under the headings previously mentioned. It must be understood that the remarks apply only to this specific preparation, and not to any other DDT preparation.

### Toxicity for Ticks—Concentrations to Use.

Dips are usually charged at the rate of one 56 lb. drum of the concentrate to 500 gallons of water; the concentrate contains 50 per cent. of the p.p. isomer of DDT, so the dipping mixture used contains 0.56 per cent. DDT. Subsequent topping-up should be at the same rate. In some cases dips are charged at half this strength—that is, one 56 lb. drum of concentrate to 1,000 gallons of water. Dips charged at 0.56 per cent. give a very good kill of all stages of ticks, though it cannot be expected that one dipping will kill 100 per cent. of ticks in all stages on every beast. Those most likely to escape are the engorged nymphs and the engorged female adults, and some of these will drop off and lay viable eggs. It would appear that those which drop off within a few hours of dipping are less likely to lay viable eggs than those which drop off a few days after dipping. There is no doubt that DDT at this strength is considerably superior to arsenic in the kill obtained, whether the ticks be arsenic-resistant or otherwise.

The kill is fairly slow, and takes about 10 days to reach the maximum. The majority of ticks would be killed within 5-7 days, but a few that were alive at seven days would be killed within 10 days.

The kill obtained at half-strength (0.28 per cent.) is still very good, and superior to arsenic, but is much less than at 0.56 per cent.

### Non-toxicity to Stock and Humans.

There is no information available to suggest that men handling DDT dips suffer any ill-effects, and certainly DDT is much less dangerous to handle than is arsenic.

There is no doubt about the low toxicity of DDT for cattle; in fact, this is one of its greatest advantages. Travelling mobs can be treated in the heat of the day, or in humid, drizzly conditions, without suffering any ill-effects; drovers maintain that cattle seem refreshed by the dipping. Therefore, there is no danger of the scalding and mortalities that are often experienced with arsenical dippings under Queensland conditions.

### Residual Effect.

This is the property of DDT that makes it such an outstanding material for control of the cattle tick. When used at 0.56 per cent., the protective period is almost absolute up to five days, which means that practically all larval (seed) ticks that are picked up within that

period will be killed. The residual effect then fades gradually; it is still good up to 10 days, and from then fades fairly rapidly and would be very slight after 14 days.

At half-strength the residual effect is correspondingly shorter.

The residual effect of DDT dipping has been utilised to protect susceptible cattle which travel through tick-infested areas. It often happens that fats from marginal country are railed to works on the coast and rest en route at spelling places that are heavily infested with pathogenic and arsenic-resistant ticks. The dipping of these fats in DDT prior to trucking enables them to spell in dangerous areas without running the risk of picking up pathogenic ticks and subsequently developing tick fever before they are killed out. This particularly applies to fats railed from north-western Queensland and destined for works in New South Wales. The residual effect of the DDT is sufficiently strong to kill any larval ticks that are picked up at the spelling places before they can infect the cattle with the tick fever organisms.

The same applies to stores from marginal country walking through infested country with an ultimate destination in clean country.

### Stability in a Dipping Vat.

This is an aspect of DDT dipping mixtures which requires clarification; we do not yet know the full answer to the problem, but at least we know enough to enable the mixture to be used effectively and economically.

When a dipping vat is charged at the rate of 0.56 per cent. the concentration falls fairly rapidly and stabilises at about 0.38 per cent. Provided that cattle are going through in fair numbers and topping-up is carried out at the rate of one 56 lb. drum to 500 gallons, the dipping mixture will remain stable round the figure of 0.38 per cent. Where only a small number of cattle are dipped (say 100 head) and then the vat is allowed to remain idle for, say, three months, then the DDT concentration may be low, perhaps in the vicinity of 0.2 per cent., which still kills ticks but does not give the full residual effect.

Although dips under official supervision are analysed regularly to determine DDT content this would not be necessary for private dips used to control ticks. Simply get an analysis when the dip is first charged, continue to top-up at the rate of 1 drum to 500 gallons, and get another analysis done only if the vat has been flooded or if it has not been used for some months.

### Control of Buffalo Fly, &c.

Dipping in DDT dipping mixture gives excellent kill and control of buffalo fly, the residual effect persisting for nearly a month; it is also effective against lice and bush flies. Reports coming to hand from time to time suggest that the control of bush flies has a beneficial effect on the incidence of blight. No work has been done by us to confirm these reports on blight, and they are only mentioned as a matter of interest.

### Economy.

This is the point where DDT dipping loses some ground, particularly compared with arsenic. It costs approximately 10 times as much to charge a dipping vat at 0.56 per cent. DDT as it does to charge with arsenic. On the other hand it must be remembered that yarding and

mustering for dipping would cost in the vicinity of 3d. per head, the cost varying up or down according to the type of country. In many places cattle have been dipped 10 times during the year in arsenic, costing, say, 2s. 6d. per head per annum, without achieving control of cattle ticks. Those same places now dip in DDT. Not more than five, or sometimes four, dippings per year are required, costing, say, between 3s. and 3s. 6d. per head per annum, on the basis of 6d. per head for material and 3d. per head for mustering. When it is realised that buffalo fly, lice, and possibly bush flies are also controlled with no extra cost, and that there is no risk of scalding or mortalities, plus the fact that tick worry is absolutely eliminated, then the cost of DDT dipping is not so prohibitive after all. Moreover, some stock owners have obtained very good tick control with half strength mixtures—that is, one 56-lb. drum to 1,000 gallons of water.

Obviously, in areas where ticks can be controlled with arsenic by dipping, say, six times a year, and where buffalo fly is not prevalent, then it may not pay to dip in DDT.

### Ease of Mixing and Management.

The only satisfactory DDT concentrate on the market that can be used in a dipping vat requires heating before adding to the water in the vat. The manufacturers' instructions should be followed carefully, when little difficulty should be experienced. As the preparation is more effective when used in soft waters, special precautions must be taken. Before a dip is charged a sample of the water to be used should be sent to the Department of Agriculture and Stock or to the manufacturers for examination. It may be found necessary to add some softener to achieve best results.

It has always been stressed that over-heating will spoil the product, but it is seldom realised that insufficient heating must also be avoided. Provided that the contents are stirred slowly during the heating and are not allowed to boil it is quite safe to continue heating until the contents are of an even, dark-brown consistency.

The management of a DDT dipping vat requires more care than an arsenic vat. For instance, as the DDT settles down from suspension very rapidly it is necessary to use about 20 head of stirrers before a mob is dipped. Otherwise the first 20 would be going through a suspension that would not contain sufficient DDT to kill ticks.

For much the same reason large sumps should be avoided and the run-off from cattle in the draining pen should go back directly into the vat. If allowed to run back through a sump much DDT settles out in the sump and therefore a weaker suspension is returned to the vat.

Sandy particles seem to take DDT out of suspension, and care must be taken to prevent cattle carrying too much dirt into the vat. This can be done by concreting the floor of the entire length of the crush and placing some "stops" across the floor of the crush to prevent the dirt being carried in.

Hair, &c., that accumulates on the surface of the dipping mixture should not be skimmed off unless absolutely necessary, as it is rich in DDT and its regular removal would weaken the mixture.

### Cattle Travelling to Clean Country.

Outstanding success has been achieved with the policy of charging with DDT dips strategically placed along stock routes for the dual purpose of buffalo fly and cattle tick control. There have been quite a number of occasions on which spread of the fly has been averted by the fact that cattle had to pass through DDT dips for tick control before proceeding to clean country. In addition, the long hold-ups that often occurred through the failure of arsenic to kill ticks have now been eliminated, resulting in a large saving to the industry.

In those cases where cattle are grossly infested with ticks and have to be cleansed before proceeding to clean country, it has been found worth while to dip under supervision in DDT, dip again three days later, and then inspect seven days later—that is, 10 days after the first dipping. They are almost invariably found clean at this inspection, and they can then be dipped and proceed. This extra dipping at three days is only recommended where cattle are grossly infested.

## DDT PREPARATIONS FOR SPRAYING.

A number of emulsions are on the market which are very convenient where stock have to be hand-sprayed or treated with power-sprays. These are very satisfactory when used at the strength of 1 per cent. DDT, but at stronger concentrations tend to irritate cattle a little and horses quite a lot. For best results the actual spraying mixtures should be freshly prepared each time, since if made up in any bulk and allowed to stand there is always a possibility that the emulsion will "crack," with a separation of active ingredients and loss of efficiency.

Where hand atomisers are used the concentration of DDT can be increased to 2 per cent. or even up to 4 per cent. without causing irritation; these appliances have the advantage of economy as only a fraction of the volume is required that would be used with ordinary bucket sprays. Although their use is only new and experience therefore limited it is nevertheless interesting to refer to the use of these atomisers. On dairy farms that formerly carried heavy tick and buffalo fly infestations both pests are well under control as a result of the occasional use of hand atomisers. These have been used particularly in the Cairns district on the recommendation of Mr. N. C. Copeman, District Inspector of Stock, Cairns.

The dairyman keeps his atomiser of 1-pint capacity ready-charged with 2 per cent. DDT in the bails. The milking herd is not dipped or sprayed at intervals, but he simply sprays the legs, belly, brisket, udder, and escutcheon of any cow he notices to be ticky. Not only does this result in the majority of ticks being killed, but the residual effect of the spray on the brisket, belly, legs, udder, and escutcheon destroys thousands of larval ticks picked up from the paddocks. In other words, these cows act as walking poison baits and soon reduce the tick population of a paddock to negligible proportions.

Dispersible powders are also convenient for hand-spraying, again at strength of 1 per cent. DDT. The mixture is prepared simply by adding the powder to water and stirring it; it is non-irritant and should always be freshly made up just prior to use.

## BHC (BENZENE HEXACHLORIDE) DIPPING MIXTURES.

As previously explained, those preparations on the market with the prefix "gamma" have as their active principle the gamma-isomer of benzene hexachloride. At the moment there are only two preparations on the market that are used in dips for cattle tick, but there are a number of similar preparations not yet marketed here.

BHC will be dealt with under the same headings as DDT and comparisons drawn with that substance.

### Toxicity for Ticks—Concentrations to Use.

The concentrate on the market is obtainable in drums of 50 lb. which contain 50 per cent. by weight of benzene hexachloride, including 6 per cent. of the gamma-isomer. To give an effective concentration of 0.05 per cent. gamma-isomer one 50-lb. drum of the concentrate is added to 500 gallons of water. Subsequent topping-up should be at the same rate.

At this concentration the BHC dipping mixture gives an excellent kill of ticks in all stages, including the arsenic-resistant tick.

Once again, however, it is too much to expect that, in heavily infested cattle, every tick will be killed on every beast at a single dipping. As with DDT the engorged nymph and the engorged female are the most likely to escape, and a proportion of these will lay viable eggs. However, more of these ticks are killed by the BHC and a lower proportion of surviving females lay viable eggs.

The kill is considerably quicker than with DDT, the majority being killed within 24 hours and the maximum kill being achieved within three days.

It can therefore be said that BHC at 0.05 per cent. gamma-isomer concentration gives a quicker kill than DDT at 0.5 per cent. para-para-isomer concentration, and probably accounts for more of the engorged females. BHC used at 0.025 per cent. gamma-isomer concentration gives a good kill of ticks and is comparable to 0.28 per cent. DDT (p.p.i.), but again gives a quicker kill.

### Non-toxicity to Stock and Humans.

There is no indication that humans suffer from handling BHC, but it is probably slightly more irritant to cattle than is DDT; in any case, it is much safer to use than is arsenic.

### Residual Effect.

Here, again, BHC is inferior to DDT but superior to arsenic. At the concentration of 0.05 per cent. the residual effect is quite good up to three days after dipping, but then falls rapidly and would be negligible at seven days. At 0.025 per cent. the residual effect is proportionately shorter.

### Stability in Dipping Vat.

As with DDT, the concentration falls fairly rapidly from 0.05 per cent. to something in the vicinity of 0.03 per cent., but it does not stabilise at that figure quite as well as DDT. However, it is still satisfactory, and it is found that the mixture will continue to kill ticks when topping-up is carried out at the rate of one 50-lb. drum to 500

gallons water and provided that the dip is used fairly frequently. It loses considerably when allowed to remain idle for a period of, say, three months. It would appear, then, that it is slightly inferior to the DDT dipping mixture on the score of stability in a vat.

### Control of Buffalo Fly, &c.

Comparatively little experimental work has been done on this aspect of BHC, but sufficient is known to state that it cannot compare with DDT in the control of buffalo fly. No information is available concerning bush flies.

### Economy.

BHC dipping is slightly cheaper than DDT, but still is much more expensive than arsenic. When the greater residual effect of DDT is taken into consideration, there would probably be no difference in the cost of dipping on the basis of per head per annum whether using DDT or BHC.

When comparing DDT and BHC with arsenic it is obvious that where ticks cannot be controlled with arsenic it pays to use BHC or DDT, but where arsenic is satisfactory it may not pay to use either DDT or BHC. The number of cattle likely to pass through a given dipping vat in a season would determine to a large extent whether or not it would pay to use DDT or BHC in preference to arsenic. On a run where some hundreds at least would pass through in mobs of 100 or more, the numbers would be sufficient to justify the dearer insecticides. However, it may not pay a small dairyman to charge a dip with BHC or DDT where he would only be dipping about 30 to 40 head say six times a year.

### Ease of Mixing and Management.

The BHC concentrate on the market does not require any heating before adding to the water in the vat. It is supplied as a dark paste which contains some lumps, and the contents should be stirred thoroughly until uniform in colour and until the lumps have broken down. Part of the contents is then transferred to another drum, to which cold water is added slowly, stirring thoroughly until completely mixed. This is then added to the vat and the process repeated until the whole of the contents have been mixed thoroughly and added to the vat.

Naturally, this is easier than the heating necessary with the DDT preparation, and saves a little time and trouble. It has not been found necessary to add softener to waters, and it is not necessary, though it may be advisable, to submit water samples for analysis before charging a vat with BHC.

In the management of BHC dipping vats the same precautions should be taken as described for DDT—namely, use stirrers, avoid sumps, prevent contamination of the vat with dirt taken in by cattle, do not skim the surface.

It is important with both DDT and BHC dipping mixtures to keep accurate records of the vats. Measure the depth of the mixture before and after each dipping and record the measurements so that concentrate can be added to compensate for any water that may leak into the vat between dippings. This is absolutely essential for the efficient working of the mixtures.

## SAMPLING OF DIPS.

With both preparations (BHC and DDT) special precautions must be taken when collecting samples for analysis. The DDT and BHC settle down rapidly after dipping and the actual sample should be taken while the last beast is swimming through. It is preferable that the sample be submitted in the actual container in which it is taken from the vat. A satisfactory procedure is to fasten a beer bottle on to a stick, push it down to a depth of about 2 feet from the surface and about 3 feet from the plunge end, allow to fill, withdraw, cork, and send to the analyst.

## THE MIXING OF ARSENIC WITH OTHER INSECTICIDES.

It is not wise to mix arsenic with other insecticides where dippings have to be repeated at short intervals (5-10 days). It is well known that different insecticides when mixed together seem to act as synergists—that is, they assist each other to have greater effects than either would have separately. However, just as their toxicity for cattle tick may be increased by the mixture, there is also the danger that the toxicity of arsenic for cattle may be increased, thereby increasing the possibility of arsenical poisoning occurring in dipped cattle. Therefore, until further work is done on this aspect of the problem, stock owners would be well advised to avoid mixing these insecticides with arsenical dipping mixtures.

## NEWER INSECTICIDES.

In addition to DDT and BHC there are new insecticides which may prove to be valuable for the control of cattle tick. Some experimental work has been carried out with chlordane and toxaphene. Preliminary results indicate that chlordane kills as well as BHC and has a residual effect at least equal to DDT. Toxaphene has also given good results. However, neither preparation is yet available in a form suitable for use in a dipping vat, and all trials carried out have been spraying trials. It is therefore too early to make any definite recommendation on the use of these substances.

## THE FUTURE OF DIPS AND SPRAYS.

The control of cattle tick in Queensland is essentially by dipping, but it must be remembered that in other countries where the cattle tick pest is a problem control is effected by the use of power sprays which deliver the spraying mixture under high pressure. In those countries dips are becoming a thing of the past, and it may well be that the future of tick control in Queensland will be bound up with the development of power sprays, which are so much cheaper to instal than dipping vats, are cheaper to operate, pass cattle through quickly, and are suitable for a greater variety of insecticides than is the case with dipping vats.


## Baconer Pig Carcass Competitions, 1949.

THE Australian Meat Board, in association with the Department of Agriculture and Stock and with the co-operation of all sections of the industry, this year again conducted a Baconer Pig Carcass Competition on a district basis.

The championship was awarded to Messrs. Hastie Bros., of the Mareeba district, for a pig sired by a Canadian type Berkshire boar and with a Large White x Berkshire cross dam, with a score of 82 per cent. The carcass was of very good type, scoring well in all points, thus presenting a nicely balanced and evenly proportioned carcass well fleshed and with an even covering of good quality fat.

Prize winners in their respective districts were as follow:—

| Prize. | Owner. | Breed. | Total Points. |
|---|---|---|---|
| | NORTH QUEENSLAND. | | |
| 1st .. | Hastie Bros. .. .. .. | Canadian Berkshire ex Large White Berkshire .. .. | 82 |
| 2nd .. | W. Hastie and Son .. .. | Canadian Berkshire .. .. | 79½ |
| 3rd .. | H. J. Williams .. .. | Canadian Berkshire ex Large White .. .. .. .. | 77 |
| | CENTRAL QUEENSLAND. | | |
| 1st .. | A. Lohmann .. .. .. | Wessex Saddleback .. .. | 81½ |
| 2nd .. | H. C. Iker .. .. .. | Berkshire .. .. .. | 78 |
| 3rd .. | E. G. Davey .. .. .. | Large White .. .. .. | 77½ |
| | DARLING DOWNS. | | |
| 1st .. | E. G. Traves .. .. .. | Berkshire .. .. .. | 75½ |
| 2nd .. | D. J. Doig .. .. .. | Large White .. .. .. | 74½ |
| 3rd .. | K. B. Jones .. .. .. | Large White .. .. .. | 74 |
| | SOUTH QUEENSLAND. | | |
| 1st .. | A. H. Ruge .. .. .. | Berkshire .. .. .. | 79½ |
| 2nd .. | Q.A.H.S. and College .. | Berkshire .. .. .. | 79 |
| 3rd .. | J. A. Heading .. .. | Large White .. .. .. | 75 |

Generally speaking, the competitions were a success. In all 103 carcasses were judged and showed a considerable improvement on last year's entries, indicating that farmers have benefited from experience and utilised the information and knowledge gained as a result of the 1948 competitions and field days.

Arrangements were made to announce the winners of each district competition immediately after judging and this met with approval, especially the completion of the score cards, which clearly set out the points awarded and also the standard measurements of carcasses within their respective weight ranges. It is considered that the display of these cards added greatly to the interest of the field days and was of excellent educational value.

### North Queensland.

At Mareeba, arrangements were made by the District Pig Adviser (Mr. T. Abell), in association with the manager of the North Queensland Bacon Association (Mr. Dunlop), for the holding of a field day at the factory, which approximately 35 farmers attended. Owing to wet weather conditions only 11 entries were available for judging. The carcasses were presented in good condition. Body length and eye muscle, the two points emphasised at the 1948 competition as needing attention, showed a marked improvement, several carcasses scoring full marks for these points and in one instance body length was exceeded by 10 mm. However, back fat was under standard in all cases except one and carcasses would have appeared better if carrying a little more fat. Ham development was fair, while the shoulders in many cases were a little heavy. These two points require the attention of breeders.

### Central Queensland.

At Rockhampton the arrangements for the field day, at which approximately 160 farmers attended, were made by Mr. O. H. Brooks (Veterinary Officer) in association with Mr. B. Dunbavand (Stock Inspector) and with the co-operation of the management of the C.Q.M.E. Co. Ltd., who also provided luncheon.

A record of 59 carcasses was presented for judging. All carcasses were well prepared. The chief points revealed by the judging were the marked improvement in eye muscle development and body length. However, while full points were scored in several instances, there is still room for improvement. Back fat was good, but in a number of cases carcasses were not finished and could have carried more fat, while on the other hand there were a few carcasses over-fat. Ham development should receive the attention of breeders and shoulders were inclined to be heavy.

### Darling Downs.

At Toowoomba arrangements were made by the District Pig Adviser (Mr. C. Porter) in co-operation with the management of the Darling Downs Co-operative Bacon Association, who made facilities available for judging and provided luncheon. A field day also was arranged, at which approximately 40 farmers attended.

Twenty-one entries were judged. Eye muscle development was not as good as in other districts and should receive the attention of farmers; again the back fat was good, but many carcasses could have carried a little more finish. Body length was good, a number of carcasses scoring full marks. However, there was a percentage of short length pigs and selection of type could receive attention. This is borne out by hams and shoulders, which could stand improvement in many cases.

### Southern Queensland.

At Brisbane, arrangements for a field day and judging were made by Mr. E. Melville (Senior Adviser), together with the management of the Queensland Meat Industry Board, who also provided afternoon tea.

Eye muscle development was disappointing except in one or two instances, and body length in relation to carcass weight could be considerably improved. Back fat thickness was good, all carcasses scoring well, while hams and shoulders showed improvement.

### Summary.

As in last year's competitions, the English method of appraisal was used in judging the carcasses and to qualify in this competition the dressed carcass had to weigh 120 pounds and not more than 180 pounds.

The 103 entries which complied with this year's conditions of entry had an average score of 67.97 per cent.

The average for each section of the judging is given in the following table:—

| — | Possible Points. | Average Points Obtained. | Percentage of Possible Points. |
|---|---|---|---|
| By Inspection— | | | |
| Hams .. .. .. .. | 8 | 6·27 | 78·4 |
| Shoulder .. .. .. .. | 7 | 5·92 | 84·57 |
| Streak .. .. .. .. | 12 | 5·57 | 46·4 |
| By Measurement— | | | |
| Eye Muscle of Loin .. .. | 28 | 18·04 | 64·42 |
| Thickness of Back Fat .. .. | 20 | 15·26 | 76·30 |
| Body Length .. .. .. | 20 | 13·06 | 65·30 |
| Leg Length .. .. .. | 5 | 3·02 | 60·40 |
| Total .. .. .. | 100 | .. | 67·97 |

*The accompanying photographs have been supplied by the Australian Meat Board.*

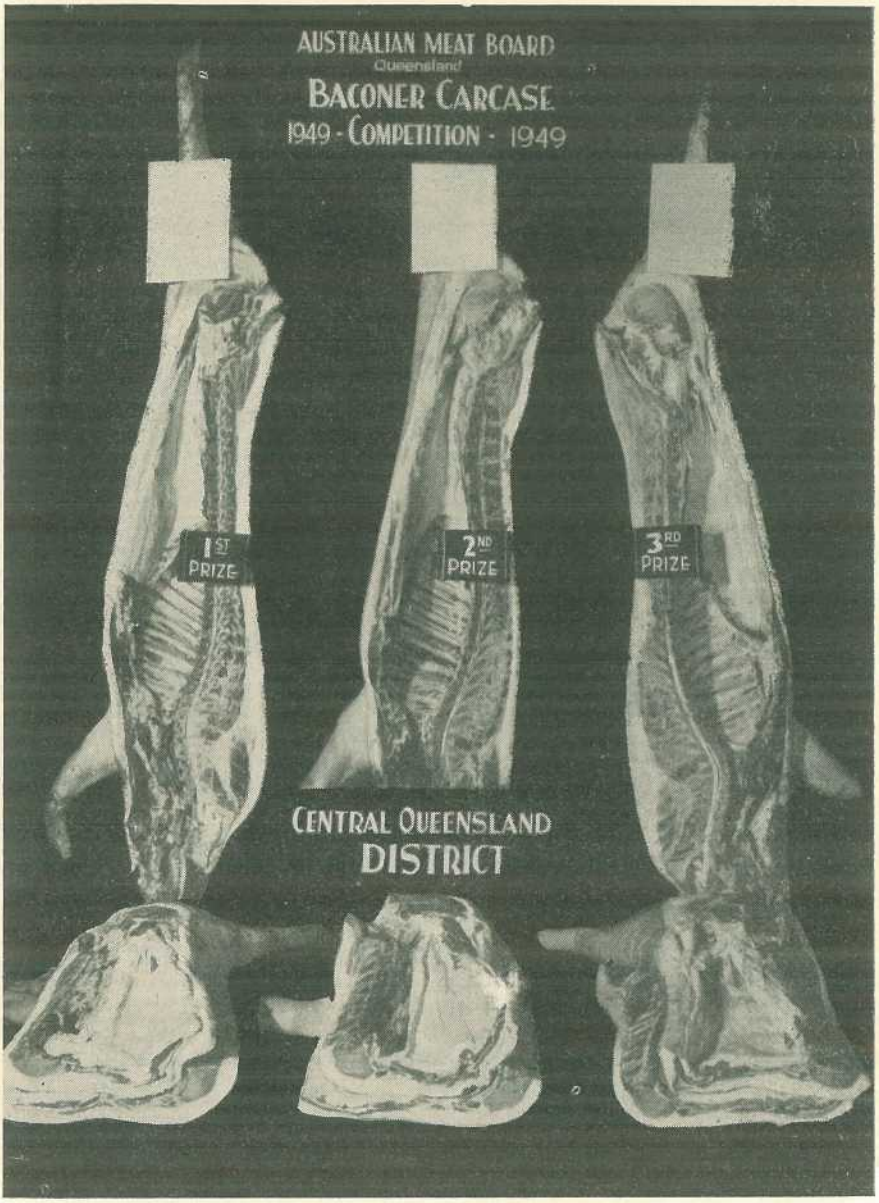



Plate 65.

CENTRAL QUEENSLAND DISTRICT PRIZEWINNERS.—First 81½ points, Second 78 points, Third 77½ points.


**Plate 66.**

DARLING DOWNS PRIZEWINNERS.—First 75½ points, Second 74½ points, Third 74 points.

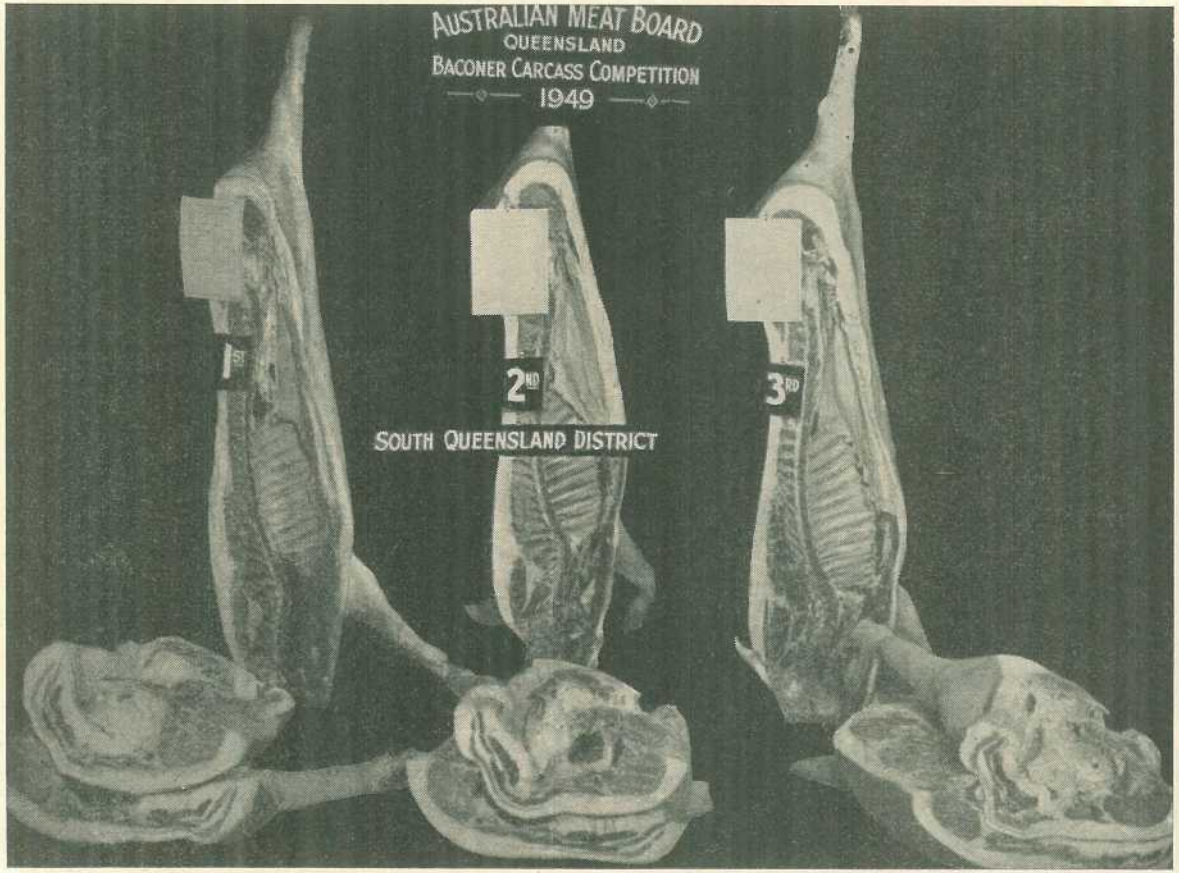



Plate 67.

SOUTH QUEENSLAND DISTRICT PRIZEWINNERS.—First 79½ points, Second 79 points, Third 75 points.

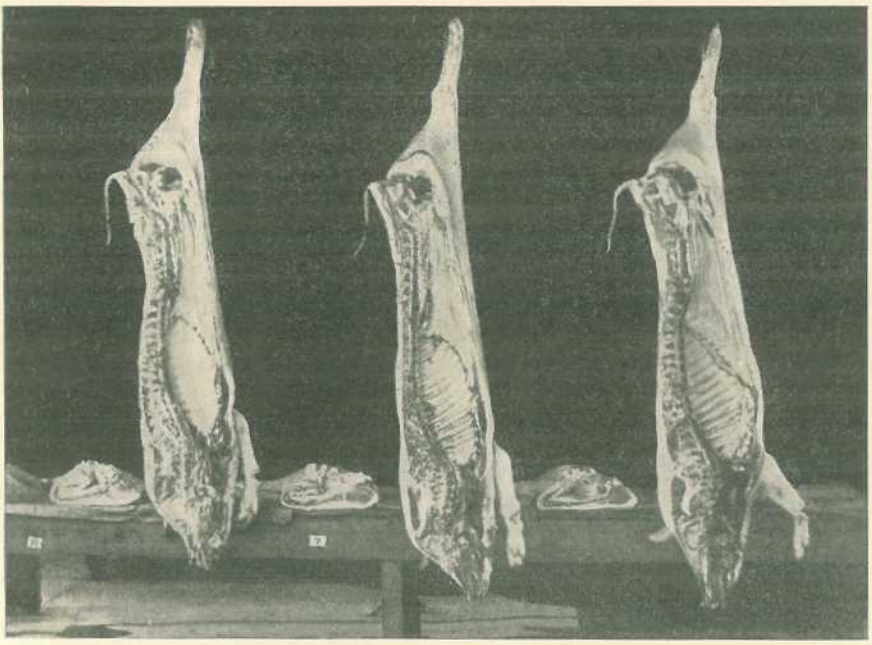


Plate 68.

NORTH QUEENSLAND DISTRICT PRIZEWINNERS.—First (No. 9) 82 points, Second (No. 7) 79½ points, Third 77 points.

## TUBERCULOSIS-FREE HERDS.

During the past few years a number of cattle owners have submitted their stud herds to annual tuberculin tests and have freed their herds of tuberculosis. These herds are maintained free of the disease by making sure that only tested animals are introduced to the herd or that the animals are tested as soon as practicable after introduction.

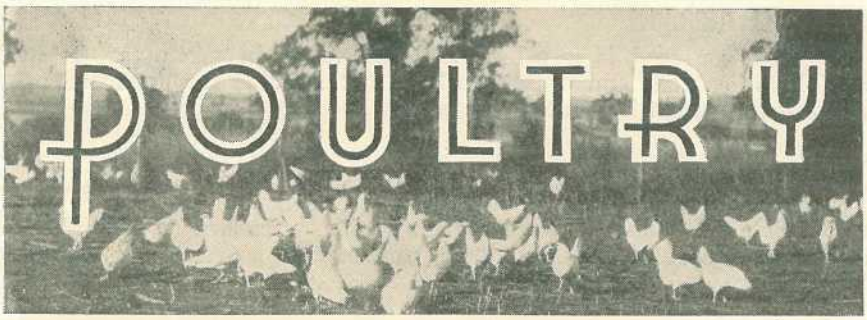
It is intended to publish each month a list setting out the names and addresses of owners of studs whose herds are certified as being free from tuberculosis in accordance with the terms of the Agreement Form which owners are asked to complete.

Those owners who have had previous tests will still be required to complete the Agreement Form before their herds can be listed. Two consecutive clean tests are necessary for tuberculosis-free status, and an official clean test carried out prior to the signing of the agreement will be accepted as the first of the two tests.

Blank Agreement Forms can be obtained on application to a Departmental Veterinary Officer or Inspector of Stock.

TUBERCULOSIS-FREE HERDS (AS AT AUGUST 1, 1949).

| Breed. | Owner's Name and Address of Stud. |
|---|---|
| Aberdeen Angus .. .. | The Scottish Australian Company Ltd., Texas Station, Texas |




# Poultry Nutrition : Principles and Practices.

P. RUMBALL, Officer in Charge, Poultry Branch, and F. N. J. MILNE, Assistant Husbandry Officer (Poultry).

(*Continued from page* 120 *of the August issue.*)

## FOODS AND THEIR USES.

### Grains and Grain By-products.

**Barley.**

Barley is not a popular food among poultry-keepers, and fowls do not consume it readily. It has a fair feeding value, but in order to increase its palatability it should be soaked or sprouted. When corn and wheat are high in price barley may be used to the extent of 50 per cent. of the grain mixture, but the change should be gradual. As a meal barley may be used freely in mashes.

**Beans and Peas.**

Fowls do not take kindly to whole beans or peas, but if they are crushed they will add to the protein content of the mash and may be used to the extent of 5 per cent.

**Grain Sorghum.**

Sorghums are slightly higher in protein content than maize. They may be used extensively as a grain or as a meal in mashes. Fowls appear to have a greater liking for the lighter coloured grain than for the darker varieties.

**Maize.**

Maize is one of Queensland's staple grain crops. Poultry eat it readily. Large grain should be cracked, but the smaller varieties can be fed whole. When purchasing maize for grain feeding, it is advisable to secure the small grain. The quality is then easily judged and there is no waste. Cracked grain should always be sieved before being used and the fine powder used in the mash. Yellow corn should be used in preference to the white because of its vitamin A content.

**Oats.**

In some places oats is one of the principal poultry foods, but as most of Queensland's supply is imported it cannot be used economically in large quantities. It is, however, desirable to add variety to the ration of breeding stock by using a proportion of oat grain. Only plump, full oats are suitable for extensive use.

**Sunflower Seed.**

Sunflower seed is a valued addition to grain mixtures. It has a high fat content and consequently is not suitable for extensive use. Its protein content is about 16 per cent.

**Whole Rice.**

Rice is a very starchy food of a fattening nature, but can be used to the extent of one-third of the grain ration. Crushed or ground rice should be used with care. It has a tendency to go rancid and is also high in fibre.

**Wheat.**

Wheat provides the bulk of our poultry food. It is readily consumed by poultry and can be fed as a part or whole of any grain ration, the market price of various grain foods available being the guide as to the quantities used. Plump wheats of a hard nature are of better feeding value than pinched grain or full soft grains.

**Bran.**

Bran is rich in protein and mineral matter but contains a considerable quantity of fibre. This fibre is useful in adding bulk to the ration. It also assists in making a wet mash of a desirable consistency. It may be used at the rate of up to 30 per cent. of the mash.

**Pollard.**

Pollard has a greater proportion of carbohydrates than bran, but not so much ash and fibre. It may form the principal constituent of mashes and be used to the extent of 60 per cent. of the total mash.

## Foodstuffs of Animal Origin.

**Blood Meal.**

Though blood meal has a high protein content, it is not a highly satisfactory food for poultry. Its use should be confined to finely-ground material that has not been burnt in processing. Its vitamin and mineral contents are low in comparison with those of other animal by-products and it should never be the only source of protein of animal origin used.

**Liver Meal.**

Liver meal is a very valuable adjunct to a poultry ration. It has a high protein content and has twice the riboflavin content of buttermilk powder and dried whey. In a chick starting mash 5 per cent. of liver meal will meet the riboflavin requirements and 3 per cent. or more of breeder's ration will ensure an adequate riboflavin level as well as enhance the protein value of the mash.

**Meatmeals.**

Meatmeals vary considerably in composition. They are essential for high egg production. When poultry are kept in closed runs where no other class of animal food is available meatmeals may be necessary to build up the protein content of rations to the necessary level.

**Milk Powders.**

Buttermilk powders and whey powders are very desirable additions to rations for both chickens and breeding hens. Like liver meal, they are a very good source of riboflavin. Buttermilk powder is frequently used to the extent of 10 per cent. of chicken starting mashes. Some whey powders appear to be very laxative and for this reason levels not exceeding 5 per cent. are suggested.

**Milk.**

There is no better animal protein-rich food for stock than milk. Skim milk, buttermilk, and whey—the most common milk products in Queensland—are foods of great value for poultry of all ages. Milk provides easily digested proteins, in addition to lactose, minerals, and vitamins, all of which are important for development, production, and health. Where skim milk is used to mix moist mashes, increased consumption and better development of young stock and increased production from layers follow. The lactose in the milk also helps to build up resistance to disease by keeping the intestines in a healthy state.

Fresh and soured milk are equal in food value. The feeding of milk as a drink is the only method by which quantities can be consumed by the fowl. Care must be exercised to see that the vessels from which milk is fed to poultry are kept clean and putrefaction avoided. Many adopt the practice of feeding the curds only, rejecting the whey. Whey, however, also has a definite food value, and should be used. When fowls are fed milk in open vessels considerable soiling of the feathers takes place. This gives adults an objectionable appearance and seems to affect the general health of young growing chickens. Therefore, chickens should be forced to drink milk through a grid.

It is generally accepted that 1 gallon of skim milk is equal in protein value to nearly 1 lb. of meatmeal. Poultry farmers generally appreciate the necessity of efficient feeding, and to give their fowls the necessary amount of protein they should use prepared mashes or prepare mashes including meatmeal. These mashes are usually fed with grain, the birds being given an equal quantity of each. In these circumstances a sufficient amount of protein is made available to the birds. The farmer who has a supply of skim milk available for his fowls must depart somewhat from his ordinary practice, for skim milk is a protein-rich food; but how far he may do so depends on the quantity of the skim milk available. When fowls are supplied with skim milk to the extent of 5 gallons per 100 birds per day, no other protein-rich food of animal origin is necessary. However, if the birds are given only, say, one-half of this quantity, half the quantity of mash that is usually fed should be supplied and the grain increased by about 50 per cent.

When milk, mash, and grain are being fed to the flock it is generally a sound policy to give the birds all the grain they will consume and not force them to eat given quantities of mash. This will enable the birds to balance their own ration.

**Dry Crushed Bone and Bone Meal.**

Dry crushed bone and bone meal are essential for the development of the bony structure of young growing stock and beneficial to laying birds. Poultry-keepers who are a distance from markets may build up

a supply of mineral matter suitable for young stock by burning any bones about their property. After burning, the bones are easily reduced to a size to feed. One per cent. is a very useful addition to the ration of growing birds. Many of the meat and bone meals contain appreciable quantities of bone meal.

## Vegetable Protein-rich Foods.

### Coconut Meal.

The need for a substitute for wheat bran is always in evidence, and as this shortage is likely to continue the poultry farmer may, at times, be forced to incorporate a substitute for bran in his rations.

Apart from its nutritive value, bran is used to give bulk to a ration and improve its physical condition, thus encouraging a healthy intestinal action. Coconut meal has a similar effect, and when available may be used extensively. Its protein content (19 per cent.) is higher than that of bran, whilst the oil content (5 per cent.) is almost double.

English experiments, in which coconut meal replaced bran on a weight basis, demonstrated that a ration containing coconut was slightly superior for egg production to one containnig the same quantity of bran. In these experiments coconut meal was used to the extent of 25 per cent. of the ration.

However, as birds cannot tolerate large amounts of oils and fats, it is not recommended that the whole of the bran portion of the ration be replaced by coconut meal unless most of the other ingredients of the ration are particularly low in fat or oil content.

### Cottonseed Meal.

Cottonseed meal, on analysis, would appear to be a splendid food for poultry, but in practice its extensive use has not given good results. A good grade may be used to the extent of 5 per cent., but this quantity should never be exceeded as it spoils the keeping quality and yolk colour of the egg.

### Linseed Meal.

Rich in oils and proteins, also fibre, linseed meal may be used to the extent of 2 per cent. in the laying mash and increased slightly during the moulting period.

### Peanut Meal.

Peanut meal is a protein-rich and easily digested food. Unless the fat content is low, the keeping quality is poor, as it is inclined to go rancid. It may be used to the extent of up to 5 per cent. in building up the protein content of a ration.

## Roots and Tubers as Poultry Food.

Because of their bulk, most roots and tubers have a limited value as poultry foods, but when market values are low they may be fed economically. Principally on account of their heavy yielding capacity, however, mangels, sweet potatoes, and pumpkins may be grown, especially as supplementary foods. The value of these crops must not be over-estimated, and care must be taken not to incorporate too great a quantity of any of these roots or tubers without giving due consideration to the

ration in conjunction with which they are fed. As previously mentioned, the total daily food intake of poultry is limited to approximately 4 oz. dry weight daily, and they cannot cope with an exceedingly bulky ration.

Root crops and tubers range in moisture content from about 70 per cent. in sweet potatoes to 90 per cent. in mangels, the total dry matter, therefore, being from as low as 10 per cent. to slightly under 30 per cent. The nutritive ratio of these crops is very wide when compared with the usual concentrated foods usually fed to poultry. At the same time, as most of the bulk of these crops is water and not fibre, it has been found practicable to include them in the ration to the extent of 50 per cent. of the total weight of food.

In an experiment conducted at the National Institute of Poultry Husbandry, England, potatoes were used to supplement the poultry rations. Four pens of birds were used and these were fed as follows:—

| — | Mash. | | | | | Grain. Oz. per Bird Daily. | Potatoes. Oz. per Bird Daily. |
|---|---|---|---|---|---|---|---|
| | Maize Meal. | Pollard. | Bran. | Meat Meal. | Clover Meal. | | |
| | Parts. | Parts. | Parts. | Parts. | Parts. | | |
| Pen 1 .. | 37½ | 27½ | 20 | 10 | 5 | 1 | 0 |
| Pen 2 .. | 25 | 27½ | 20 | 10 | 5 | 1 | 2 |
| Pen 3 .. | 12½ | 27½ | 20 | 10 | 5 | 1 | 3 |
| Pen 4 .. | .. | 27½ | 20 | 10 | 5 | 1 | 4 |

NOTE.—During the first two months fish meal was fed, but this was replaced by meat meal 9 parts, plus 1 part of salt. Oyster shell was provided *ad lib* to all pens.

Although the average daily intake of food per bird is approximately 4 oz., some birds in this experiment consumed as much as 4 oz. of dry food in addition to 4 oz. of potatoes.

Therefore, when attempting to induce birds to consume the maximum quantity of root and tuber crops, it is advisable to feed them on a good laying mash, working in about 30 to 40 per cent. of steamed roots or tubers, and feeding grain at night. With this method the amount of grain fed could be reduced considerably.

### Potatoes.

Of the roots and tubers dealt with in this section, potatoes are the highest in feeding value, but because of their market value it is only at odd times that they may be fed profitably to poultry. They contain 2.2 per cent. of protein and 17.4 per cent. of carbohydrates. By feeding them in a cooked state, mixed with the mash, there is practically no waste and the birds are encouraged to eat fairly large quantities.

### Sweet Potatoes.

Sweet potatoes contain only 1.6 per cent. of protein, but are as high as 26.4 per cent. in carbohydrates; therefore, though their nutritive value is lower, they may be used to approximately the same extent as potatoes. Because of their size and the fact that they are palatable to poultry, sweet potatoes may also be fed in the raw state. Before being fed raw they should be chopped or split

**Mangels.**

Mangels are useful as poultry food, and may be used largely as roughage and fed as a mid-day meal to poultry. Although not taking the part of green feed, mangels are useful as an adjunct to any ration, being ready for harvesting in the spring, when dry conditions usually prevail in south-eastern Queensland. Mangels contain only .8 per cent. of protein and 6.1 per cent. of carbohydrates, and are nearly 90 per cent. water, but as the average yield per acre is high they are suggested as a good supplementary feed. They are palatable and poultry have a natural liking for them. If split and hung up just within reach of the birds, poultry are provided with a profitable pastime in pecking at them. Overfeeding of mangels may induce scouring.

**Pumpkins.**

Pumpkins are fed in much the same manner as potatoes, but as the seeds are reputed to be poisonous these must be removed before cooking or before being fed in a raw state. Pumpkins contain 1.7 per cent. protein, 5.2 per cent. carbohydrate, and about 90 per cent. moisture. Therefore, as it is low in feed value, the quantity of pumpkin in a ration should be less than that of potatoes or sweet potatoes when it is being utilised in their stead.

**Swede Turnips.**

Swede turnips may be fed in much the same manner as mangels, but are usually pulped or cooked and mixed with a wet mash, or split open and fed as a supplement to green feed and mash. They have about the same feed value as mangels and pumpkins, containing 1.3 per cent. protein and 7.2 per cent. carbohydrates.

**Carrots.**

Carrots contain vitamin A and when available would make a valuable addition to the ration. They have about the same nutritive value as mangels, but should be fed in a minced state, mixed with mash.

## Grits.

**Lime Grit.**

Shell grit, limestone grit, and bone grit supply poultry with calcium. Plentiful supplies of oyster shell or ground lime should always be available, while bone may be supplied in the form of either meal or grit.

**Hard Flinty Grit.**

Hard pieces of rock, sand, &c., are necessary to enable poultry to grind their food, and should be in free supply, particularly with stock confined to pens. Without grit it is impossible for poultry to obtain all the nutriment from the food supplied, and any system of feeding without grit is wasteful.

**Salt.**

Salt needs to be well mixed with the mash; when wet mash is fed it may be dissolved in the water but when fed dry too much care cannot be exercised in thoroughly distributing it throughout the mash. Excessive quantities are poisonous.

## FEEDING OF DUCKS.

Ducklings should not be fed until 48 hours after hatching. Water and coarse sand may be supplied when the ducklings are placed in their brooding quarters. Coarse sand should always be supplied to ducks, as its consumption aids digestion. Ducklings should be fed mashes similar to those used for feeding chickens. The mash should be moistened to a crumbly consistency and several feeds given daily. This system of feeding should be adopted until they are four weeks of age, and the numbers of feeds then reduced to three, and later to two.

From four weeks, mashes similar to those used for laying hens may be employed, but each mash should have its bulk increased by the inclusion of 25 per cent. of good succulent green feed. Bran and pollard have formed the major part in duck rations, and when available a mixture of pollard 2 parts, bran 1 part, green feed 1 part, with the addition of meatmeal and salt, may be used. Meatmeal should be added to the mash at the rate of 1 lb. for every 10 lb. of bran and pollard, and salt at the rate of 2 oz.

When skim milk is available curds may be used to replace the meatmeal. The curd from 1½ gallons of milk would be almost equivalent to 1 lb. of meatmeal. Although milk is a most valued food, it is not desirable to supply it to ducks as a liquid because of their method of drinking.

Root crops and pumpkins, when available at reasonable prices, form a useful addition to the ration of ducks. They should be fed as recommended in the section dealing with such fodders.

The feeding of grain to ducks is not practised extensively. A little at mid-day may be fed. Some breeders prefer to soak grains for ducks.

Clean water should be kept continuously before the birds, and the water should be sufficiently deep to permit the birds totally immersing their heads. This enables the bills and eyes to be kept clean. A constant supply of water is equally essential for both young ducklings and adults, but with the former the vessel should not permit of ducklings gaining access for the purpose of swimming.

## FEEDING OF TURKEYS.

Feeding should be commenced 26 to 48 hours after hatching. Water and grit (coarse sand) may be given when they are placed in the brooder. The water should be given by means of a fountain to protect the young birds from drowning. The feeding practice may be either dry mash and grain, wet mash and grain, or an all-mash. If the all-mash method is employed, it should be changed when the young turkeys are about 10 weeks of age to mash and grain.

In the feeding of wet mash, frequent feedings should be employed during the early life. Start with five feeds per day, gradually reducing to one feed of mash and one of grain when the turkey chicks are 10 weeks old. The mash should be placed in small receptacles that offer the maximum protection from fouling and that obviate wastage of dry mash.

Turkeys, like chickens, require different rations for different ages. The starting ration should contain approximately 20 per cent. of crude protein. This may be continued until 10 weeks of age, when the protein level may be reduced to 15 per cent.

The kinds of food that they should receive are largely dependent upon what foodstuffs are available in the locality in which the turkeys are reared. There is one point that turkey raisers should remember, and that is that no single food supplies all the requirements of the young birds; it is therefore more economical to purchase some additional foods to supplement home-grown grains than to limit the ration to the foodstuffs grown on the farm.

The following ration, used at the Oklahoma Agricultural Experiment Station, has been reported as giving good results, and is one that could be used in many districts in Queensland:—

25 lb. bran
25 lb. pollard
25 lb. yellow corn
7 lb. lucerne meal
5 lb. meat meal (63%)
3 lb. cottonseed meal
5 lb. dried buttermilk
¾ lb. salt
¾ lb. powdered limestone
1½ lb. bonemeal

The average weights of turkeys raised in this experiment are most interesting and are as follows:—

| Age. | Males. | Females. | Average. Weight. |
|---|---|---|---|
| | Lb. oz. | Lb. oz. | Lb. oz. |
| 4 weeks .. .. .. .. .. | .. | .. | 0 12 |
| 8 weeks .. .. .. .. .. | 2 6 | 1 14 | 2 2 |
| 12 weeks .. .. .. .. .. | 5 1 | 4 0 | 4 8 |
| 16 weeks .. .. .. .. .. | 8 9 | 6 0 | 7 4 |
| 20 weeks .. .. .. .. .. | 12 0 | 7 14 | 9 14 |
| 24 weeks .. .. .. .. .. | 15 8 | 9 9 | 12 8 |

In an experiment conducted in Great Britain at the Newton Rigg Farm the following rations were used:—

| —— | Starting. 1 to 10 Weeks. | Growing. 10 to 24 Weeks. | Fattening. 24 to 27 Weeks. |
|---|---|---|---|
| | Lb. | Lb. | Lb. |
| Pollard .. .. .. .. .. | 25 | 25 | .. |
| Bran .. .. .. .. .. .. | 22 | 26 | 20 |
| Maize Meal .. .. .. .. .. | 20 | 25 | .. |
| Sussex Ground Oats .. .. .. .. | 10 | 10 | 10 |
| Fish Meal .. .. .. .. .. | 6 | 3 | 10 |
| Soybean Meal .. .. .. .. | 8 | 5 | .. |
| Cod Liver Oil .. .. .. .. .. | 2 | 1 | .. |
| Salt .. .. .. .. .. .. | ½ | ½ | .. |
| Ground Limestone .. .. .. .. | .. | 2 | .. |
| Dried Skim Milk .. .. .. .. | 7 | .. | .. |
| Crude Protein content of the above ration was :— | | | |
| | 18% | 15% | 14% |

Grain Mixture:—2 parts of wheat and 1 part of cracked maize.

*Practice of Feeding.*—A very crumbly mash was fed five times daily during the first week and half grain and half mash for the last feed in the day. This was reduced to four of mash and one of half grain and

half mash for the second week, three of mash and one of half grain and half mash for the third and fourth weeks, after which they received two mash and one half grain and half mash to within three weeks of killing. For the first four weeks chopped clover leaves were mixed with the mash. At eight weeks marrow-stemmed kale was fed at the rate of 12 lb. daily. Growers' mash was fed from 10 weeks to within three weeks of killing, when fattening mash was given three times daily in a crumbly state.

In the feeding of turkeys, consideration must be given to the class of food they are likely to gather while on range. Insect life and grass seeds plus succulent grass are all possibilities. Insect life is of a high protein nature, and when plentiful it may be very desirable to reduce the animal protein that is used with any mash mixture. In general practice, however, farm poultry and turkeys generally suffer from a lack of protein.

### Feeding the Breeding Stock.

Turkey hens may lay as early as seven months when given a good start in life and fed a ration that is conducive to production, but production can usually be expected at about 11 months. For breeding purposes the turkey hen should not be too fat. A mash of bran 1 part, pollard 2 parts, plus 10 per cent. of meat and bone meal, with grain at night, will promote production and keep the birds in the best breeding condition. In addition to the above a plentiful supply of succulent green feed should be given, and shell grit should be available at all times. Where it is impossible to obtain green feed, lucerne chaff of good quality could be added to the mash to the extent of 10 per cent. When this is to be used it is better to soak it overnight. There may be localities where crushed grains would prove more economical than bran and pollard. When such is the case they may be used to advantage, but it is advisable to have some bran to give the mash a crumbly consistency, and where possible to use a mixture of crushed grains in order to add variety. When skim milk is available, it may be used to mix the mash or may be given to the birds to drink. The meat and bone meal may then be reduced to 1 lb. for every 1½ gallons of skim milk supplied.

American investigators of the United States Range Live Stock Experiment Station found that the following average quantities of food were consumed per bird per week over a period of 48 weeks:—Males, 5.88 lb.; females, 3.15 lb. A breeding pen of one male and 15 females would, therefore, consume, during a period of 12 months, 1,762 lb. of food.

## FEEDING OF GEESE.

On most farms sufficient food in the form of grazing will be available for the adult flock of geese. Geese are good foragers, but when vegetation is scarce green feed and grain should be provided. About 2 or 3 oz. of grain should always be given per bird as an evening meal.

With goslings which are being prepared for market a ration such as is recommended for the feeding of other table poultry is recommended.

Goslings require no food for upwards of 36 hours after hatching, although up to this period they may be supplied with water and grit or coarse sand. At 36 hours they may be given their first feed, which

may consist of equal parts of bran and pollard and the same quantity of some grain, such as sorghum, wheat, maize, or barley, moistened preferably with milk to a crumbly mash. Finely-chopped green feed may also be mixed with the mash and will prove beneficial to the goslings. Clean sand, which should always be available to the goslings, may be sprinkled over the mash. Three feeds per day of the above mixture should be given for about one month. After this period, provided there is plenty of good grazing available in the form of succulent greenstuff, the number of feeds may be reduced to one.

To obtain a good marketable carcase goslings need to be fed liberally up to four months of age.

Geese, both young and adult, should always be kept supplied with good, clean drinking water, but the drinking vessels for the goslings should be so constructed that they can only get their heads into them.

The sitting goose should always be given a supply of grain as she is usually unable to collect sufficient food during the short time she is off the eggs.

## SOIL AND WATER ANALYSES

★ ★

Attention of producers is drawn to the fact that the following analyses are carried out, free of charge, by the Department of Agriculture and Stock:—

1. Soil samples for fertility measurements;
2. Water samples to determine their suitability or otherwise for irrigation or stock use.

Unfortunately, in the past, many samples have been submitted which were valueless, either because they were incorrectly taken or were too small in quantity. **It is essential therefore that the information hereunder be strictly followed.**

**SOIL SAMPLE**

**When analysing soil it is essential that details of the history of the area of ground in question be known. In addition, samples should be taken according to a set pattern. Therefore, when an analysis is desired, a request for instructions as to the correct method of taking samples of soil should be forwarded to the Department of Agriculture and Stock, William Street, Brisbane.**

**WATER SAMPLE**

**Samples of water should be taken, in the case of established wells or bores, after the pump has been running for some time. The bottle (same capacity as a beer bottle) to be used for taking the sample should be well washed and then rinsed out several times with the water to be tested before being filled. About 1 inch air space only should be left between the cork and the water.**

In all cases, covering letters should accompany samples which should be marked clearly with the sender's name and address and forwarded to the Department of Agriculture and Stock, William Street, Brisbane.

# ASTRONOMICAL DATA FOR QUEENSLAND.

## OCTOBER, 1949.

By W. J. NEWELL, Hon. Secretary of The Astronomical Society of Queensland.

## TIMES OF SUNRISE AND SUNSET.

| At Brisbane. | | | MINUTES LATER THAN BRISBANE AT OTHER PLACES. | | | | | |
|---|---|---|---|---|---|---|---|---|
| Day. | Rise. | Set. | Place. | Rise. | Set. | Place. | Rise. | Set. |
| | a.m. | p.m. | | | | | | |
| 1 | 5.29 | 5.47 | Cairns | 36 | 22 | Longreach .. .. | 38 | 31 |
| 6 | 5.23 | 5.49 | Charleville .. | 28 | 26 | Quilpie .. .. | 34 | 36 |
| 11 | 5.18 | 5.52 | Cloncurry .. .. | 55 | 45 | Rockhampton .. | 13 | 7 |
| 16 | 5.13 | 5.55 | Cunnamulla .. | 29 | 30 | Roma .. .. | 18 | 16 |
| 21 | 5.07 | 5.58 | Dirranbandi .. | 18 | 20 | Townsville .. | 30 | 19 |
| 26 | 5.03 | 6.01 | Emerald .. .. | 22 | 16 | Winton .. .. | 44 | 36 |
| 31 | 5.00 | 6.04 | Hughenden .. | 40 | 30 | Warwick .. .. | 3 | 4 |

## TIMES OF MOONRISE AND MOONSET.

| At Brisbane. | | |
|---|---|---|
| Day. | Rise. | Set. |
| | p.m. | a.m. |
| 1 | 12.30 | 2.03 |
| 2 | 1.29 | 2.46 |
| 3 | 2.27 | 3.22 |
| 4 | 3.22 | 3.54 |
| 5 | 4.15 | 4.24 |
| 6 | 5.06 | 4.51 |
| 7 | 5.58 | 5.17 |
| 8 | 6.50 | 5.44 |
| 9 | 7.44 | 6.13 |
| 10 | 8.40 | 6.44 |
| 11 | 9.37 | 7.20 |
| 12 | 10.34 | 8.00 |
| 13 | 11.31 | 8.47 |
| 14 | .. | 9.41 |
| | a.m. | |
| 15 | 12.25 | 10.40 |
| 16 | 1.15 | 11.44 |
| | | p.m. |
| 17 | 1.59 | 12.49 |
| 18 | 2.39 | 1·55 |
| 19 | 3.16 | 3.02 |
| 20 | 3.52 | 4.08 |
| 21 | 4.27 | 5.16 |
| 22 | 5.04 | 6.27 |
| 23 | 5.44 | 7.39 |
| 24 | 6.29 | 8.50 |
| 25 | 7.20 | 9.59 |
| 26 | 8.17 | 11.02 |
| 27 | 9.18 | 11.57 |
| 28 | 10.21 | .. |
| | | a.m. |
| 29 | 11.22 | 12.44 |
| | p.m. | |
| 30 | 12.21 | 1·23 |
| 31 | 1.17 | 1.57 |

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27; Cunnamulla 29; Dirranbandi 19;
Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

| Day. | Emerald. | | Longreach. | | Rockhampton. | | Winton. | |
|---|---|---|---|---|---|---|---|---|
| | Rise. | Set. | Rise. | Set. | Rise. | Set. | Rise. | Set. |
| 1 | 29 | 10 | 45 | 24 | 20 | 0 | 52 | 27 |
| 6 | 19 | 19 | 35 | 34 | 10 | 10 | 40 | 39 |
| 11 | 10 | 28 | 26 | 43 | 0 | 19 | 28 | 52 |
| 16 | 10 | 29 | 25 | 44 | 0 | 19 | 27 | 52 |
| 21 | 20 | 16 | 37 | 31 | 11 | 7 | 42 | 36 |
| 26 | 30 | 9 | 46 | 23 | 21 | 0 | 54 | 26 |
| 31 | 24 | 14 | 40 | 29 | 15 | 4 | 46 | 33 |

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

| Day. | Cairns. | | Cloncurry. | | Hughenden. | | Townsville. | |
|---|---|---|---|---|---|---|---|---|
| | Rise. | Set. | Rise. | Set. | Rise. | Set. | Rise. | Set. |
| 1 | 53 | 4 | 67 | 33 | 50 | 19 | 44 | 5 |
| 3 | 44 | 11 | 61 | 38 | 45 | 23 | 37 | 11 |
| 5 | 34 | 22 | 53 | 45 | 38 | 30 | 28 | 19 |
| 7 | 24 | 31 | 46 | 52 | 31 | 37 | 21 | 27 |
| 9 | 14 | 41 | 39 | 58 | 24 | 44 | 13 | 35 |
| 11 | 6 | 50 | 35 | 63 | 20 | 49 | 6 | 42 |
| 13 | 1 | 56 | 32 | 67 | 16 | 53 | 2 | 46 |
| 15 | 2 | 55 | 33 | 67 | 17 | 52 | 3 | 45 |
| 17 | 9 | 47 | 37 | 62 | 21 | 47 | 8 | 39 |
| 19 | 20 | 35 | 43 | 55 | 28 | 40 | 17 | 30 |
| 21 | 33 | 22 | 52 | 45 | 37 | 30 | 27 | 19 |
| 23 | 45 | 9 | 61 | 36 | 46 | 22 | 37 | 9 |
| 25 | 55 | 2 | 68 | 32 | 51 | 17 | 45 | 3 |
| 27 | 56 | 3 | 68 | 32 | 52 | 18 | 46 | 4 |
| 29 | 51 | 6 | 65 | 34 | 49 | 20 | 42 | 7 |
| 31 | 41 | 15 | 57 | 41 | 42 | 26 | 34 | 14 |

*Phases of the Moon.*—Full Moon, 7th October, 12.52 p.m.; Last Quarter, 15th 2.06 p.m.; New Moon, 22nd October, 7.23 a.m.; First Quarter, 29th October, 3.04 a.m.

*Eclipses.*—There will be two eclipses this month—a total eclipse of the Moon on 7th October, and a partial eclipse of the Sun on 22nd October. The eclipse of the Moon will not be visible in Australia but on the 22nd, over the greater part of Queensland the Sun will rise with the disk of the Moon partly across it; and generally throughout the State the eclipse will end between 6.30 a.m. and 7.15 a.m. at the greatest phase less than half the Sun's disk will be covered by the Moon.

On 15th October the Sun will rise and set 10 degrees south of true east and true west respectively and on 6th and 20th the Moon will rise and set approximately at true east and true west respectively.

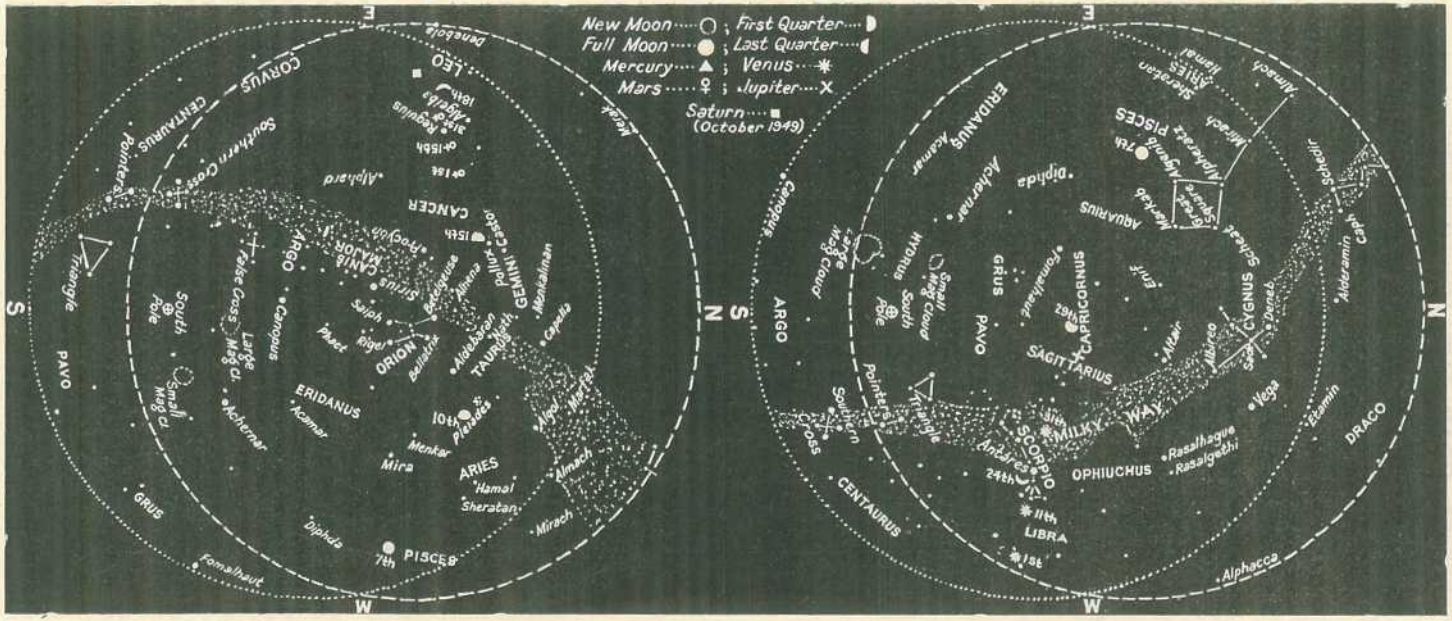
*Mercury.*—At the beginning of October, in the constellation of Virgo, will set half an hour after the Sun and will be in line with the Sun on 3rd October, after which it will pass into the morning sky and by the 19th will reach its greatest angle west of the Sun when it will rise 1 hour 30 minutes before sunrise. By the end of the month it will rise 35 minutes before the Sun.

*Venus.*—In the constellation of Libra, will set about 3¼ hours after the Sun at the beginning of the month and after passing through the constellation of Scorpio at the end of the month, in the constellation of Ophiuchus will set about 3¾ hours after the Sun.

*Mars.*—At the beginning of the month, in the constellation of Leo, will rise about 2½ hours before the Sun. On the 24th it will pass about 1 degree to the north of Regulus and at the end of the month will rise between 1.45 a.m. and 3 a.m.

*Jupiter.*—Setting just after midnight at the beginning of the month, at the end of the month will set about midnight.

*Saturn.*—May now be seen in the Eastern morning sky when on the 1st it will rise about 1 hour before the Sun and on the 31st about 2¼ hours before the Sun.




*Star Charts.*—The chart on the right is for 7.15 p.m. in the south-east corner of Queensland to 8.15 p.m. along the Northern Territory Border on the 15th October. (For every degree of longitude we go west, the time increases by 4 minutes.) The chart on the left is for 9 hours later. On each chart the dashed circle represents the horizon as viewed from Cape York and the dotted circle is the horizon for places along the New South Wales Border. When facing north hold "N" at the bottom; when facing South hold "S" at the bottom and similarly for the other directions. Only the brightest stars are included and the more conspicuous constellations named. The stars which do not change their relation to one another, moving east to west, arrive at any selected position about 4 minutes earlier each night. Thus, at the beginning of the month the stars will be in the positions shown about 1 hour later than the time stated for the 15th and at the end of the month about 1 hour earlier than that time. The positions of the Moon and planets which are continually changing in relation to the stars, are shown for certain marked days; when no date is marked the position is for the middle of the month.