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Event and Comment

Queensland's Outlook.

QUEENSLAND'S outlook for 1940, despite war conditions, is most favourable. That is the opinion expressed by the Premier, Hon. W. Forgan Smith, in a recent Press statement.

We commenced the financial year, he said, with a surplus in the State's funds. Industry generally had enjoyed the biggest returns for many years, and there was more full-time employment at award wages than at any other period in our history.

Queensland also had a greater rate of population growth than the other States, and succeeded in providing employment for the increasing numbers.

This progressive movement coincided with a policy which provided for higher wages, shorter hours, and a lower cost of living than in any of the other States.

Record production, record employment, record national income, and all that these things mean, fortified Queensland to face the future.

The Premier went on to say that the Government had not been carried along on the crest of that movement. It had every justification for claiming that, by a wise direction of major policy, it removed the impediments which had been placed in the way of progressive development, and gave necessary stimulus to industry.

Our great primary industries had a form of control that was the envy of producers in other States.

Our secondary industries had grown up around the needs of those primary industries, and the prosperity of the latter meant the prosperity of both.

Public works generally were brought under a form of control that made for the maximum of public benefit from the money expended.

It was this wide acceptance of organization and co-ordination in Queensland that gave stability to the State's industrial life, and should enable us to face, with comparative equanimity, the periodic economic disturbances over which we have no control.

The financial statement for the half-year ended 31st December, 1939, provided further evidence of the general stability, and Mr. Forgan Smith said he had every reason to believe that the Budget anticipations would be realized.

In view of all the circumstances, we in Queensland could look to the future with the greatest of confidence. There were dismal people who attempted to measure the State's progress with the yardstick of their own personal interests, and frequently their protestations had a volume out of all proportion to their importance. We could not tarry with them when the biggest issues affecting our national welfare called for attention.

The indications were that we should be able to proceed fairly normally with our work, and it was well that we should do so unfalteringly, refusing to be halted by fears of what the morrow may bring.

War Time Marketing.

WITH the impact of war on our economic system, it became necessary to alter our marketing arrangements materially.

Centralized selling became essential, and the central government had the responsibility of bringing it into operation, said the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, in the course of a recent statement to the Press.

Proceeding, he said that an elaborate system of centralized selling was necessary, because economic organisation during times of war was as important as military organization, and with innumerable sellers chaos would result if there were no centralization. Also, without controlled selling, it would be impossible to make shipping arrangements which would fully meet war demands. Fortunately, Queensland's peace-time marketing structure was such that there was little dislocation.

The sugar agreement, and the first sales contract to be effected under it, gave a clear indication of the Government's war-time marketing intentions.

The celerity with which the agreement was concluded, and its effectiveness, were possible only because the sugar industry was completely organized economically. The negotiations were conducted by the Premier (Hon. W. Forgan Smith).

Of considerable importance to Queensland were negotiations for the sale of beef and mutton to the Imperial Government.

Some apprehension existed among growers that the Argentine made a better beef deal, but figures to hand showed that this was not so. There was some variation in individual items, but it was clear that the Argentine average was comparable with that established in Australia under the terms of the agreement.

One regrettable, but unavoidable, feature of the meat agreement was the temporary suspension of the chilled beef trade. All beef had now to be shipped in frozen condition from the Argentine as well as from Australia. Frozen beef was more easily handled, required less loading space, and, unlike chilled beef, could be held for long periods.

Cheese and butter exports were not difficult to arrange because of the existing Commonwealth-wide organization. One satisfactory feature of this particular agreement was that Commonwealth dairy stabilization is preserved.

For eggs, producers had now a stabilized market and a uniform price.

Possibly the biggest war undertaking was in wool. Central appraisement, as an alternative to the auction system, was instituted. Apparently the difficulties associated with the new organization had been largely overcome.

A general review of the wool, beef and mutton, butter, cheese, sugar, and eggs agreements established certain interesting facts.

One was that the policy of those framing the agreements was to avoid profiteering. While price levels under the agreements were, on an average, better than those of the pre-war period, it was evident that there was a determination to prevent undue price inflation.

The producer must have all phases of the cost of production covered, and Mr. Bulcock said he was convinced that the outlook of the producer in Queensland was against taking any unfair price advantage at present.

The second conclusion was that the agreements had a beneficial effect on the community. They had achieved stability.

In pre-war days prices varied from day to day. A producer had to be a prophet to estimate his return. Under the present arrangement he knew what he would receive. Such stability was necessary for agricultural development. One of the ironies of our agricultural endeavours was that in peace time the producer was largely at the mercy of the market, while in war time price stabilization became a constant feature of our agro-economic life.

With a certain and stabilized price production could be planned, regulated, made profitable, and made to serve the needs of our State and Empire. From this arose a question for our economists. How could we best carry through the principles for war-time economy to the days of peace? No doubt this question would be very fully examined.

While satisfactory agreements had been entered into for certain commodities, producers of other products were not so favourably placed. Into this class was placed wheat and canned fruits.

All sorts of difficulties were being experienced in the marketing of wheat, one of the major ones being shipping space.

Speaking generally, however, Mr. Bulcock remarked that Queensland would dispose of all her staple agricultural production satisfactorily. The result would be stabilization in essential industry and a general benefit from increased State income.

The war, he concluded, will open up new avenues of exploration in agricultural economy. Post-war planning, now essential, would envisage, as far as Australia was concerned, a removal of any impediments to increased production. The system of quotas, perhaps, would disappear. At least, it was reasonable that war experience would indicate the necessity for a broadened and expanded Empire market in Britain.

The Parasitic Worm Diseases of Cattle.

F. H. S. ROBERTS, D.Sc., Animal Health Station, Yeerongpilly.

COMPARATIVELY little is known of the parasitic worm diseases of cattle. This cannot be because cattle are not affected by worms, for even within the confines of our own State, these parasites are responsible for serious losses.

Calves and yearlings suffer most severely, particularly in the dairying districts. These, being practically confined to the coastal watershed, all receive high rainfalls and are associated with a comparatively heavy rate of stocking. Both of these factors are favourable to the infestation of cattle by worms. Furthermore, the methods of calf-rearing adopted by many dairy farmers, whereby the calves are weaned almost from birth and thereafter raised in a most haphazard manner, produces very susceptible animals. Heavy infestations are seen also among young beef cattle, particularly in the coastal areas.

Outbreaks occur chiefly during the winter and the early spring. Infestation, for the most part, takes place during the spring, summer, and early autumn, but so long as the pastures remain green and nutritious, the infested animals usually hold their condition fairly well. As soon as the pastures begin to dry off, however, the animals' resistance to the worms is lowered and ill-effects from the infestations become apparent.

The cattle owner and the dairy farmer in particular, should, therefore, be constantly on his guard against outbreaks of parasitic disease amongst his herds. These are not spectacular in their onset, like the diseases caused by bacteria, for example, and in many cases, the presence of worms is not suspected until the animals are noticeably ill. Mortalities can at times be serious, but even greater losses can follow from the less obvious effects of infestation, such as failure to make normal growth, loss of condition, general unthriftiness, and susceptibility to other diseases.

HOW CATTLE BECOME INFESTED WITH WORMS. (Plate 59.)

Worms do not breed inside an animal and so increase in numbers. The only way in which infestation can occur is through the animal picking up minute larval worms from the pastures as it grazes or drinks. These larval worms arise from eggs laid by female worms living in the animal and passed out in the animal's dung.

With some kinds of worms, flukes and tapeworms, for example, the larval worms after hatching from the eggs must undergo a necessary part of their development in a snail or some other such animal before they can infest cattle. The snail or other animal in which the larva develops is called an intermediate host.

HOW TO DETERMINE WHETHER AN ANIMAL IS SUFFERING FROM WORMS.

An animal whose health is affected by worms manifests certain symptoms, such as unthriftiness, loss of condition, diarrhœa, bleaching of the membranes of the eyes and mouth, the presence of a swelling under the jaws (see Plate 60), &c. Unfortunately, however, none of these symptoms is characteristic of worm infestation alone.

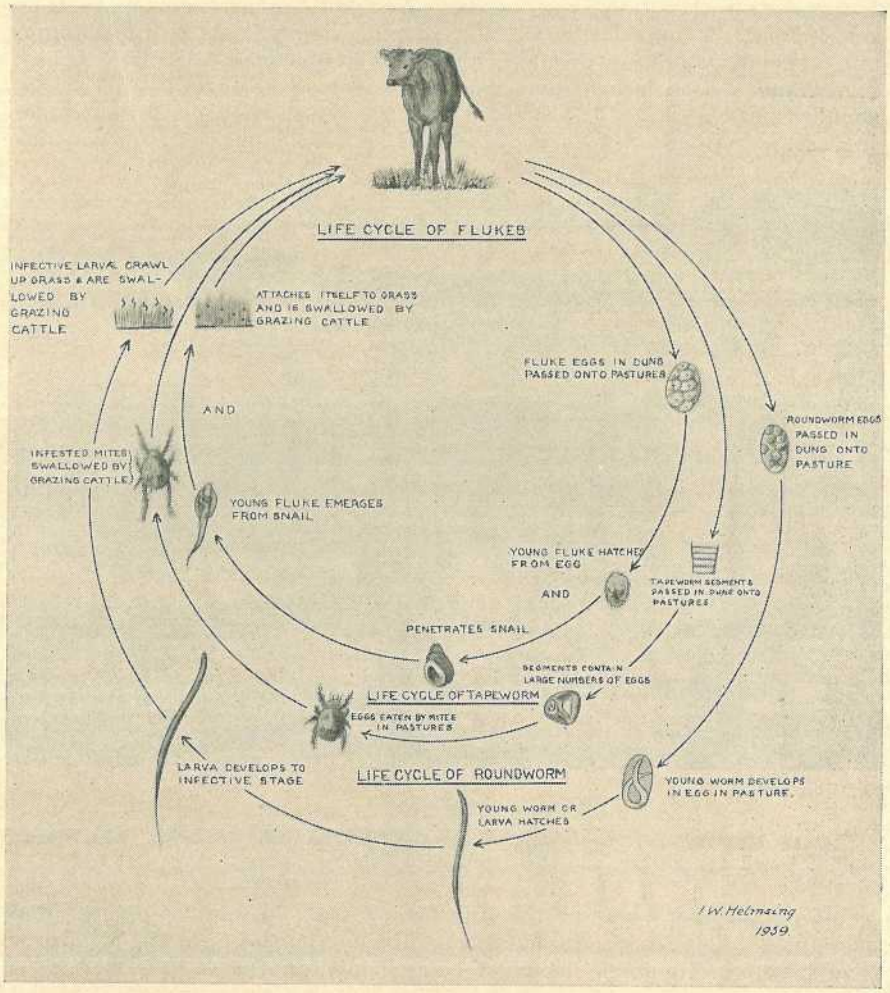

Plate 59.

How Cattle Become Infested with Worms.

1. Permanent pastures.
2. Damp, marshy pastures.
3. Overstocking.
4. Haphazard calf-rearing.
5. Poor nutritive conditions.
6. Unhygienic calf pens and yards.

Any suspicion of infestation in a herd should, then, be confirmed or otherwise by killing and examining an affected animal. There are occasions, however, when this may not be practicable, for instance when the herd is small or when the animals are valuable. It is the only way, however, by which one can make sure that worms are or are not responsible. Young cattle are, for example, susceptible to pneumonia, one type of which is brought about by lungworms. It is only by examining a dead animal that the farmer can make certain whether he should treat the rest of the affected herd for lungworms, or, for example, for calf pneumonia which is associated with bacteria. In making an

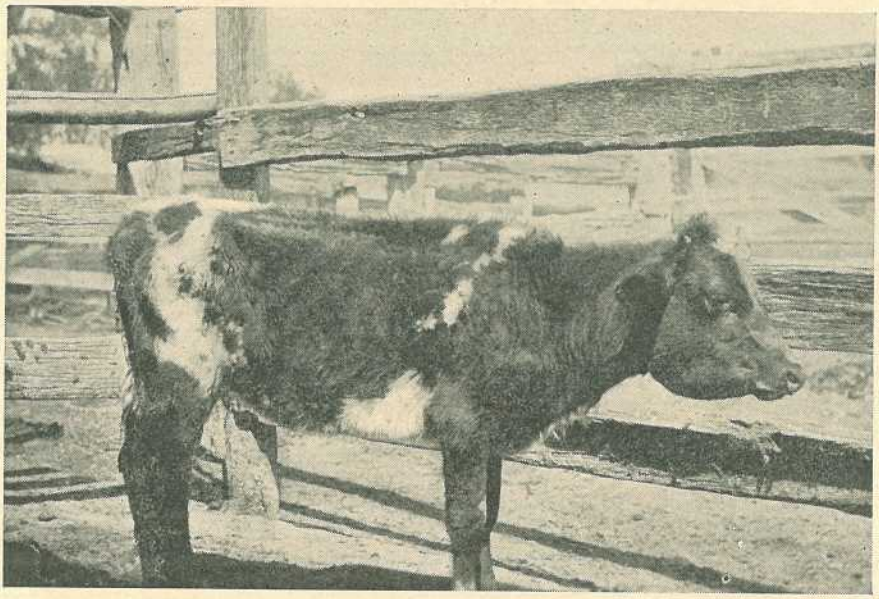

Plate 60.

CALF HEAVILY INFESTED WITH WORMS.—Note its poor condition, rough coat, dull, dejected appearance, and the pronounced swelling under the jaws.

examination the whole of the alimentary tract should be opened and examined. The lungs should also be given attention and the windpipe and airtubes slit open. It must be remembered that a few worms do little harm, and it is only when they are present in large numbers that they become serious.

THE CONTROL OF PARASITIC DISEASES.

Under the normal practical conditions of stock raising it is impossible to maintain animals completely free from worms. Much can be done, however, to prevent these parasites from becoming sufficiently numerous to endanger the animals' health. Even when medicinal treatment is efficient it should never be solely relied upon as a means of keeping the infestation at a low level. This applies particularly to cattle, for, unfortunately, very little is known of the efficiency of the drugs that are usually advised for the removal of their worm parasites. The cattle owner must, therefore, realize that in order to keep his stock healthy he should rely chiefly on preventive measures.

Preventive Measures.

Preventive measures are designed to reduce the chances of the animals' becoming infested. They are based upon a knowledge of the life histories of the worms and of the conditions in a pasture which favour the development and survival of worm eggs and larvæ. As calves and yearlings are most susceptible to infestation, these should be given primary consideration when putting the undermentioned principles into operation—

1. Avoid damp, low-lying pastures. Moisture is essential for the development of worm larvæ and also assists greatly in their survival. Such pastures, if it is impracticable to dry them out, should be used only for grown cattle.

2. Drinking water should be supplied in troughs. Shallow stagnant pools are a dangerous source of infestation, particularly when the pastures are dry, for at such times the animals concentrate on the green feed around them, thus heavily contaminating the ground.

3. Stock as lightly as possible. Overstocking is one of the most common factors predisposing to outbreaks. It stands to reason that the more animals there are in a pasture, the more contaminated does the pasture become and the greater the chances of the animals being infested.

4. Avoid permanent pastures for young stock. Calves and yearlings should if possible be run on pastures to which cattle have not had access for at least three months. Such pastures whilst being spelled from cattle could be grazed by horses, for the forms that occur in horses do not infest cattle and vice versa. If spelling is not possible, pastures for young stock may be cleansed of much of their infestation by firing. Firing of pastures, however, should not be given preference to spelling.

5. The state of nutrition of an animal greatly influences the degree to which it can withstand the effects of an infestation. A poorly-nourished beast is much more susceptible than one in good condition. Young animals, on being weaned should, then, be reared on an adequate and well balanced ration. During dry periods all young stock should receive supplementary foods. These can be supplied either by improved pastures, cultivation, or by hand feeding. The provision of a good lick will do much to keep the animals healthy. A useful lick may be made up as follows:—

Sterilized bone meal	70 parts
Coarse salt	25 parts
Limonite	5 parts

6. Dairy farmers should maintain the calf pens and yards in a sanitary and hygienic condition.

THE WORM PARASITES.

A large number of different kinds of worms are capable of infesting cattle and causing disease. These are either flukes, tapeworms, or roundworms.

FLUKES.

These are usually moderate sized worms either flat and leaf-like or conical in shape. They are usually hermaphrodite, that is, each fluke contains a complete set of male and female organs.

The egg when laid by the fluke passes out of the animal in the manure. Should conditions be favourable, the egg develops and eventually hatches to give rise to a tiny larval fluke. The larval fluke before it can develop any further must then find a certain species of snail into which it burrows. After spending a period of growth in the snail, the young fluke makes its way into the open again and attaches itself to the grass. When swallowed by a suitable animal it makes its way to some favoured organ, settles down and grows to maturity (Plate 59).

Two kinds of flukes are found in cattle in Queensland, namely, the conical fluke and the liver fluke.

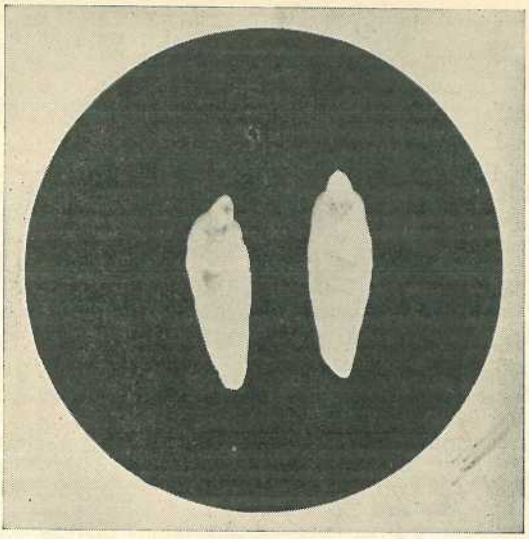

Plate 61.
LIVER FLUKE (natural size).

THE LIVER FLUKE (*Fasciola hepatica*). (Plate 61.)

The adult liver fluke is a flat, leaf-like worm, pinkish to pale brownish in colour, and measuring up to 1½ inches in length. It is found in the bile ducts of the liver.

Its life cycle is similar to that outlined above. The snail intermediate host in Australia is known as *Limnaea brazieri*.

FLUKE DISEASE IN CATTLE.

In Queensland, fluke disease in cattle is known to occur only in the south-eastern areas. Mature cattle appear to be little affected, for despite the presence of the flukes, they usually hold their condition fairly well. The parasites, can, however, be serious in young cattle, causing unthriftiness, loss of condition, diarrhœa, and death. In advanced cases the tissues of the mouth and eyes are pale and a swelling is present under the jaws, "bottle jaw." Aged animals are sometimes seen suffering from a chronic type of fluke disease which is denoted by wasting and scouring.

A "fluky" liver has an enlarged mottled appearance. The bile ducts are thickened and impregnated with lime and stand out as whitish tubes above the liver surface. This appearance gives the infested liver the popular name of "pipey liver."

Treatment and Control.

Carbontetrachloride is used very successfully for treating fluke disease in sheep, but unfortunately is a rather risky drug to give to cattle. It may, however, be administered with a fair degree of safety to calves and yearlings, but should never be used for milking cows. The dose for young animals is 2 cubic centimetres to 5 cubic centimetres according to weight, given in a small quantity of liquid paraffin. Liquid extract of male fern is safer but not as effective as carbontetrachloride, the dose being 10 c.c. to 30 c.c. according to weight and condition.

Another drug which is widely used in other parts of the world is hexachlorethane, the dose being 20 grams to 25 grams for every 100 lb. of weight.

As a certain species of snail is necessary for the liver fluke to complete its life cycle, it follows that by destroying the snail, infestation of cattle by the fluke can be prevented. With this object in view the following recommendations are given:—

1. Marsh land, bogs, backwaters from creeks, &c., should be drained and kept as dry as possible. The banks of creeks, &c., should be kept free of all weeds and other debris to facilitate the flow of water.

2. Bluestone in very minute amounts is very poisonous to snails. It may be applied to bog lands, creeks, and other places where the snails live, in the following ways:—

(*a*) In the case of pools and other still waters, tie a bag of bluestone to the end of a pole and drag it backwards and forwards through the water until the water has a faint blue tinge. In the case of running streams suspend bags of bluestone at intervals along the length of the stream.

(*b*) For boggy, marshy areas, broadcast a mixture of finely-ground bluestone and sand (1 to 4) at the rate of 20 lb. bluestone per acre.

To be most effective bluestone should be used especially during the early part of the months of June and December.

THE CONICAL FLUKE (*Paramphistomum* spp.) (Plate 62.)

These are pinkish, pear shaped worms which in the adult stage are found attached to the walls of the paunch and honeycomb. They are extremely common in cattle in the coastal and subcoastal area of the State and are frequently seen in very large numbers.

Life History.

The life history of the conical fluke includes certain species of snails in which the young flukes undergo certain growth and development. This portion of the life cycle being completed, the young flukes then attach themselves to grass and are swallowed by cattle as they graze. Inside the animal the young flukes (Plate 62*b*) then make their way to the small intestine and attach themselves to its wall. Finally the parasites make their way back to the paunch and honeycomb where they grow to the adult stage (Plate 62*a*).

Effect on Cattle.

The adult flukes in the paunch and honeycomb, even when present in large numbers, are not considered to be very harmful. During the time the parasites are present in the small intestine, however, they are capable of causing serious damage. The intestine wall becomes very inflamed and the animal is afflicted with a severe diarrhœa which is dark in colour and evil smelling. Affected animals, particularly young stock, rapidly lose condition and grow weak. The tissues of the mouth and eyes become pale and a swelling develops under the jaws.

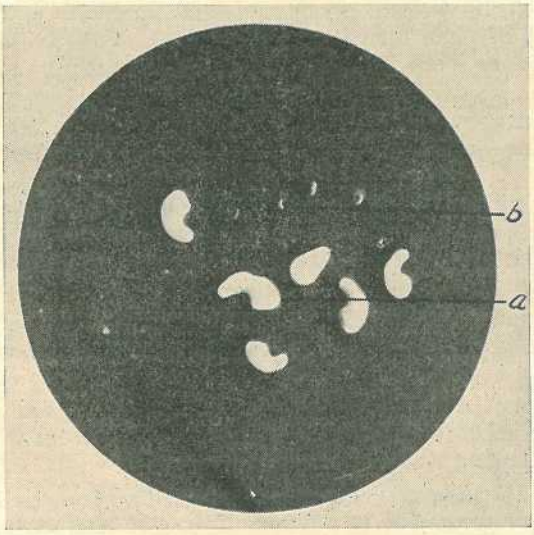

Plate 62.

CONICAL FLUKE.—(*a*) Adults from paunch and honeycomb; (*b*) young flukes from the small intestine (natural size).

Treatment and Control.

Infested animals should be first of all removed from the marshy pastures in which they are picking up the young flukes.

Nothing is known regarding an effective treatment for infested cattle, but tetrachlorethylene as recommended for the removal of the large stomach worm (see page 146) should be tried.

The snail vectors may be destroyed by the measures advised for the control of the liver fluke.

Tapeworms.

Tapewords are elongate, flat, creamy worms, which in cattle attain a length of up to 15 feet. The tapeworm has a very tiny head, which is provided with suckers with which the worm attaches itself to the wall of the small intestine in which it lives. Following the head is a slender neck, which connects the head to the body of the tapeworm. This is composed of a number of flat, short segments which become progressively broader towards the posterior end of the worm.

Life History (Plate 59).

As the tapeworm grows, the posterior segments become filled with eggs. When these eggs have reached a certain stage in their development, the "ripe" segments containing them drop off from the body of the worm and pass out in the manure. The egg must then be eaten by some particular kind of animal, such as an insect, a mite, &c., before

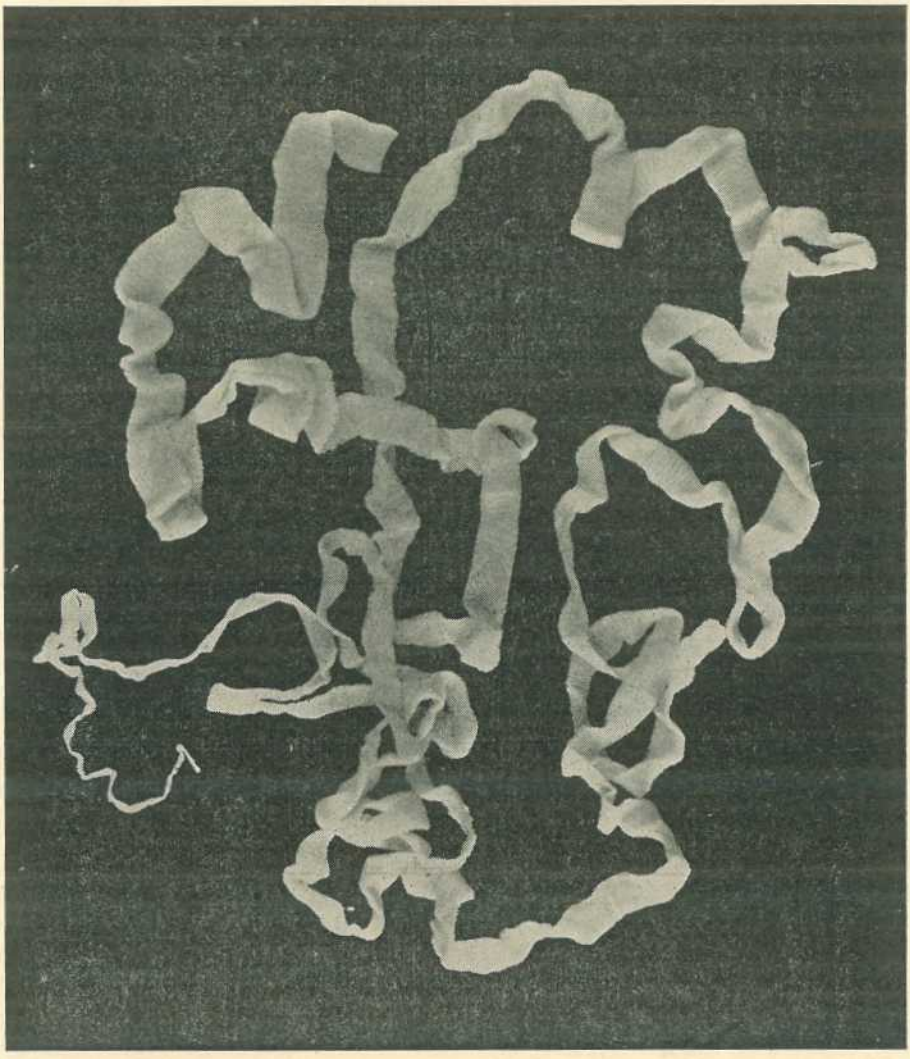

Plate 63.
Tapeworm (natural size).

it can develop any further. Inside the "intermediate host" the egg hatches and gives rise to a larval tapeworm. Should this larval tapeworm, or the intermediate host containing it, be eaten by the animal which passed the eggs, the larval tapeworm settles down in the small intestine and eventually reaches the adult stage.

Cattle harbour both adult and larval tapeworms.

LARVAL TAPEWORMS.

Two kinds of larval tapeworms are found in cattle in Queensland, namely, water ball or *Cysticercus tenuicollis*, and hydatids or *Echinococcus granulosus*. Both of these are found in the adult stage in the dog, and other allied animals, such as the fox and wolf.

The economic importance and control of these larval tapeworms have been discussed fully in a previous article in this journal on "Parasites of Sheep.

ADULT TAPEWORMS.

Three different kinds of adult tapeworms are known to infest cattle in this State. They are very similar in appearance, the commonest form being known as *Moniezia benedeni*. They all occur in the small intestine.

Life History.

The intermediate host of only one species is known and in this case it is a tiny mite which occurs very commonly in the pastures, particularly in damp areas. The mites become infested with larval tapeworms when they swallow tapeworm eggs passed in the manure. Should an infected mite be swallowed by cattle, the tapeworm larva settles down in the small intestine where it grows to the adult stage.

Effect on Cattle.

Very little is known of the effects of tapeworms on cattle. As a rule, these parasites occur only in young animals, and it is considered that many well-grown worms must be present before any symptoms of ill-health are noticeable. In such instances, the calf will have a stunted pot-bellied appearance with a dry harsh coat. Diarrhœa may also be present.

Tapeworm infestation is denoted by the passage of segments in the dung. Before coming to any decision, however, the cattle owner should make sure that the poor condition of the animal is not really due to other worms, such a stomach worms, small intestinal worms, or nodule worms.

Treatment and Control.

Tapeworms may be successfully removed by using an arsenical drench. The formula for this drench is given below.

Formula—White arsenic (95 to 99 per cent. arsenious acid)	2 oz.
Epsom salts	6 lb.
Water	2½ gal.

Calves should be given 1½ fluid oz. to 3 fluid oz. of this mixture according to their age. No starvation is necessary, but water should not be permitted till about four hours after drenching.

Boil the arsenic slowly in 2 gallons of water for half an hour. Allow the sediment to settle then pour off and retain the clear fluid. Add the epsom salts, stirring well till it is dissolved and make up to 2½ gallons.

The mites which carry the larval tapeworms are most numerous in wet pastures, particularly in shaded areas. These should be avoided as pastures for young stock. Attention is also drawn to the general preventative measures discussed on page 139.

ROUNDWORMS.

These, as their name implies, are elongate, rounded, worms, and include some of the most serious worms infesting livestock. They vary tremendously in size. In our cattle, for example, the largest species measures up to 4 inches in length and the smallest less than $\frac{1}{4}$ inch.

The sexes are usually separate, that is, there are male and female worms, the male being the smaller. Some kinds of roundworms require an intermediate host in which to complete their life cycle, in which they resemble tapeworms and flukes, but the majority reproduce in the following manner:—

The female worm lays eggs which are passed out in the manure. Under suitable conditions of temperature and moisture the egg eventually hatches and gives rise to a tiny larval worm. The larva continues to grow and develop in the pastures and eventually reaches a stage when if swallowed by a suitable animal it is capable of growing to the adult stage. The "infective larva," as it is called, crawls up the grasses when these are wet with dew or rain, and is thus available to a grazing animal(Plate 59).

THE LARGE STOMACH WORM OR BARBER'S POLE WORM

(*Haemonchus contortus*) (Plate 64).

This species is found in the fourth stomach. The female worm measures up to one and one-quarter inches in length and is red and white spirally striped. Hence the name barber's pole worm. The male is smaller than the female and pinkish in colour.

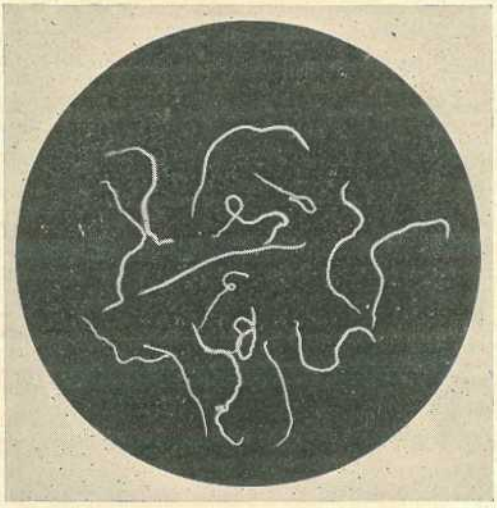

Plate 64.
Large Stomach Worm or Barber's Pole Worm (natural size).

Life History.

During the warm moist conditions of summer, the eggs passed in the manure hatch in about 24 hours. The larvæ reach the infective stage in about four to five days. The larvæ then crawl up the wet grass blades and are swallowed by the animals as they graze. Making their way to the fourth stomach, the young worms settle down and become mature in about three weeks.

Effect on Cattle.

The large stomach worm is the most serious parasite the cattle owner has to contend with, young animals under about eighteen months of age being chiefly affected.

This worm is a blood sucker and the effects of an infestation are principally those associated with a loss of blood. The blood becomes thin and watery and the mucous membranes of the eyes and mouth lose their healthy pink colour and become pale and even white. The coat is dry and rough and a dropsical swelling develops under the jaws. Sometimes diarrhoea is present. Heavily infested animals rapidly lose condition and become weak. They show a disinclination to move about and stand in a dejected manner (Plate 60).

Treatment and Control.

Probably the most effective drug to employ against this parasite is tetrachlorethylene. It is given mixed with an equal quantity of liquid paraffin immediately after administration of half a cupful of a 5 per cent. solution of baking soda (½ lb. of baking soda dissolved in 1 gallon of water). By giving the baking soda first, the tetrachlorethylene goes directly into the fourth stomach in which these worms live. If the baking soda is omitted the tetrachlorethylene may fall into the paunch, where it becomes so diluted that by the time it reaches the fourth stomach, it has little effect on the worms.

The doses of tetrachlorethylene and liquid paraffin are as follows:—

Animals 2 to 4 months	10 c.c. to 15 c.c. of each
Animals 4 to 8 months	15 c.c. to 20 c.c. of each
Animals 8 to 12 months	20 c.c. to 25 c.c. of each
Animals 12 to 18 months	25 c.c. to 30 c.c. of each

Some authorities recommend a bluestone solution which is made up as follows:—

Bluestone	1 lb.
Water	2½ gal.

Doses—

Animals 2 to 4 months old	1½ to 2 fluid oz.
Animals 4 to 8 months old	2 to 3 fluid oz.
Animals 8 to 12 months old	3 to 4 fluid oz.
Animals 12 to 18 months old	4 to 5 fluid oz.

The bluestone used should be fresh and blue in colour, and any white powder should be discarded. When making up this drench use only enamel or earthenware vessels, as bluestone corrodes unprotected metal surfaces.

No starvation is required for either the tetrachlorethylene or bluestone drench.

In the case of outbreaks the animals should be drenched at least twice at an interval of 10 to 14 days.

Cattle become infested during the warmer months of the year, but may not show any obvious symptoms till the winter and early spring. In areas where stomach worms are troublesome, therefore, it is of the greatest importance to send the susceptible young stock into the winter as free from worms as possible. They should be drenched in January and again in April. A further drench is advisable in June or July.

Where these parasites are particularly prevalent, drenching at intervals of two months or less from November to June or July may be necessary to keep the young cattle healthy.

The general preventive measures discussed on page 139 should be enforced as far as practicable, particularly those measures dealing with permanent calf pastures, calf rearing, and nutrition.

THE LESSER STOMACH WORM (*Ostertagia ostertagi*). (Plate 65.)

This is a slender brownish worm, about half an inch long, which is found lying against the wall of the fourth stomach.

The life history is very similar to that of the large stomach worm, differing from it only in detail.

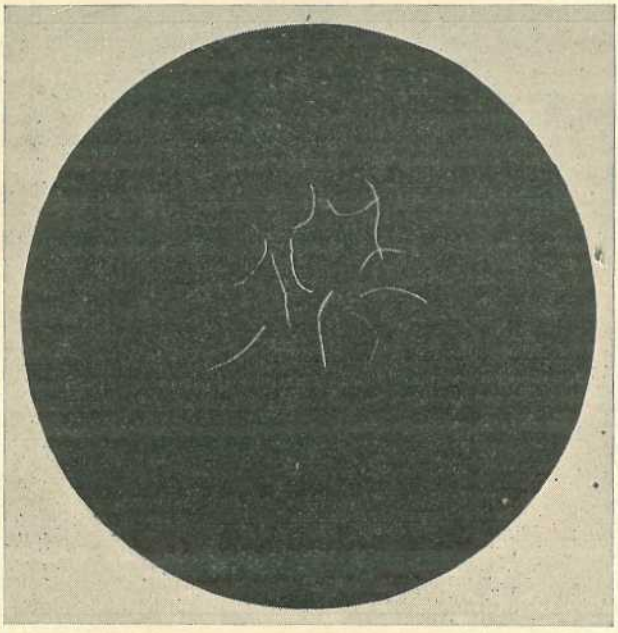

Plate 65.

Lesser Stomach Worm (natural size).

These worms are best seen by scraping the wall of the fourth stomach and examining the scrapings in a glass dish held over a dark background. The worms are most numerous in that part of the stomach which leads into the small intestine.

Effect on Cattle.

In some parts of the world, the lesser stomach worm is a serious parasite in cattle and may cause marked loss of condition, anaemia, and diarrhoea. It is very common among cattle in Southern Queensland, particularly in the south-eastern districts, where it may at times become sufficiently numerous to be a contributing factor in outbreaks caused by other worms, such as the large stomach worm or large bowel worm.

Treatment and Control.

The tetrachlorethylene treatment as recommended for removal of the large stomach worm would be the most promising treatment to use against this worm.

If the preventive measures discussed on page 139 are put into operation, the lesser stomach worm will be of little importance.

THE STOMACH HAIR WORM (*Trichostrongylus axei*). (Plate 66.)

This is an extremely slender, reddish, hair-like worm which rarely attains a length of more than half an inch. It is found in the fourth stomach in the same situation as the lesser stomach worm. Its life history differs only in detail from that of the larger stomach worm.

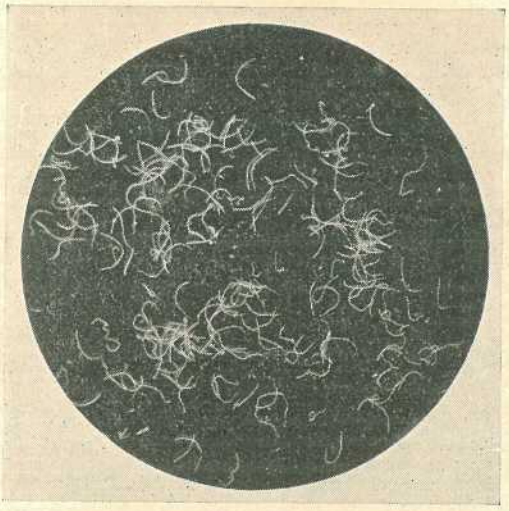

Plate 66.
STOMACH HAIR WORM (natural size).

Whilst an important parasite of cattle in temperate countries like England, it rarely becomes sufficiently numerous to be serious in Queensland cattle. It is to be seen chiefly in the south-eastern areas of the State.

The worms are best seen by the method advised for detecting the lesser stomach worm.

Treatment and Control.

The measures advised for treatment and control of the large stomach worm should be effective against the stomach hair worm also.

THE HOOKWORM (*Bunostomum phelbotomum*). (Plate 67.)

This is a stout whitish worm up to about an inch in length which occurs in the first part of the small intestine. The mouth of this worm is provided with a number of teeth, by which it adheres firmly to the intestine wall.

Life History.

The early part of the life history of the hookworm up to the development of the infective larva in the pastures is similar to that of the large stomach worm. Although infection by the hookworms can

occur when the infective larva is swallowed, it most usually takes place by the larva boring through the animals' skin. This can happen whenever a part of the body comes into contact with soil containing hookworm larvæ. Having penetrated the skin the larvæ reach the blood vessels which carry them to the lungs. From the lungs they then travel via the windpipe into the mouth and are swallowed, thus reaching the small intestine where they settle down and grow to maturity.

Effect on Cattle.

The hookworm is very common among cattle in this State, particularly in the coastal areas.

Like the large stomach worm, it is a blood sucker and consequently affects cattle in much the same way. The membranes of the eyes and

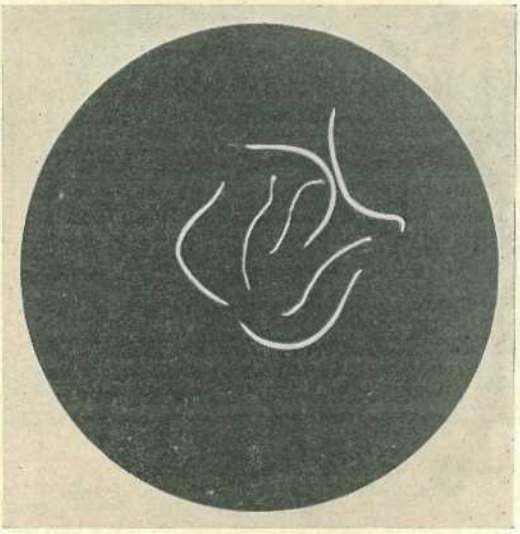

Plate 67.

Hookworm (natural size).

mouth become bleached, the animal suffers from diarrhœa, and loses condition rapidly. A swelling develops unde the jaws and the coat is rough and dry. The animal figured in Plate 60 might be suffering from either stomach worms or hookworms, so similar are the symptoms. As with the large stomach worm, too, hookworms are rarely of any importance among animals over about two years of age.

Treatment and Control.

The tetrachlorethylene treatment recommended for the large stomach worm would probably be effective against hookworm also.

Evidence seems to show that moist sandy pastures and overstocking are particularly dangerous in so far as hookworm is concerned. In considering the general preventive measures discussed on page 139 particular attention should therefore be given to these two factors.

SMALL INTESTINAL WORMS (*Cooperia* spp.).

(Plate 68.)

These are small pinkish worms up to one-third of an inch in length, which infest the first part of the small intestine. They are somewhat stouter than the stomach hair worms, and if scrapings are taken from the intestine wall and examined in a glass dish held over a black surface, the small intestinal worms may be readily detected by their coiled up appearance.

Their life-history is similar to that of the large stomach worm, cattle becoming infested when they swallow the infective larvæ.

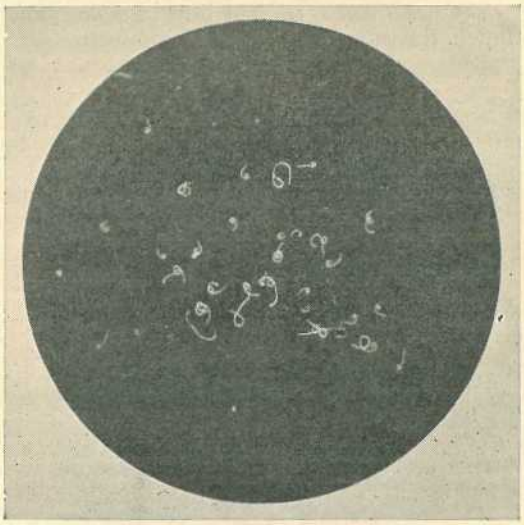

Plate 68.
SMALL INTESTINAL WORM (natural size).

Effect on Cattle.

These small worms are very common among cattle, especially in the coastal belt, and, when in sufficient numbers, can cause diarrhœa and loss of condition. Young cattle are chiefly affected. Anæmia is not a very pronounced symptom and in cattle infested with these parasites one does not see any marked bleaching of the membranes of the eyes and mouth, nor any development of a swelling under the jaw.

Treatment and Control.

Tetrachlorethylene as recommended for the removal of the large round-worm should be tried and the general preventive measures given on page 139 should be practised.

THE LARGE BOWEL WORM (*Bosicola radiatum*).

(Plate 69.)

This is a stout, whitish worm up to three-qarters of an inch in length, which occurs in the large bowel. The worms lie close against the bowel wall, sometimes burying their anterior ends into it and causing a conspicuous pitting.

Life History.

Larva hatch from eggs passed in the manure and develop to the infective stage in the usual way. These infective larvæ on being swallowed by cattle make their way into the intestine, and burrow into the intestine wall, particularly that of the large intestine or large bowel. Later on the worms return to the large bowel, where they settle down and grow to maturity.

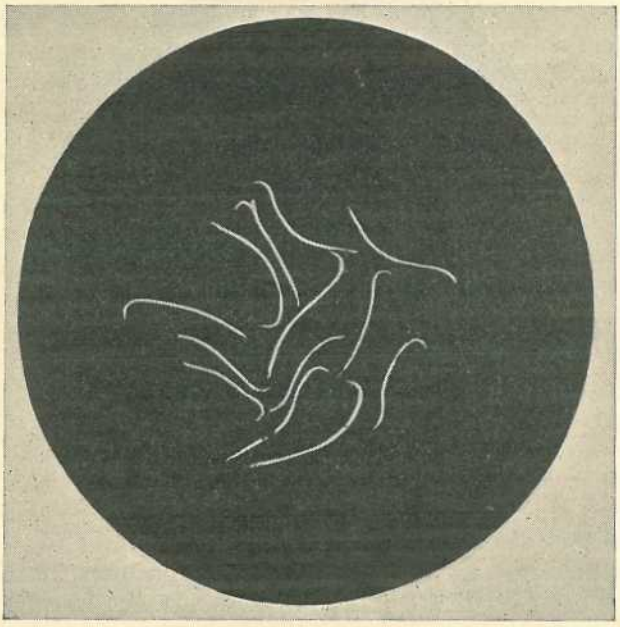

Plate 69.

Large Bowel Worm (natural size).

Effect on Cattle.

This worm is an extremely common parasite in Queensland, particularly in the coastal areas, and when in numbers in young stock can be responsible for anæmia, loss of condition, and diarrhœa. Diarrhœa is a very characteristic symptom, the dung being watery in consistency and containing quantities of mucus.

The larvæ, when they burrow into the gut wall, cause the formation of nodules. Nodules are more conspicuous in older cattle, and, when in numbers, interfere with the movements of the gut and so contribute to the general ill-effects of an infestation.

Among young stock, infestation with this parasite can be fatal. Should recovery occur the animal in many instances may remain stunted in growth and unthrifty.

Treatment and Control.

As no treatment is known which will remove this parasite, control rests entirely upon the application of preventive measures.

THE WHIPWORM (*Trichuris* spp.).

(Plate 70.)

These worms are found in the caecum or blind gut. They derive their popular name from their resemblance to a whip, the anterior portion being long and slender like a lash, and the posterior portion short and stout like a whip handle.

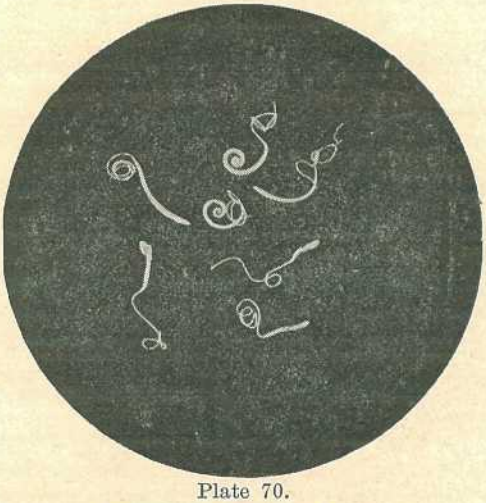

Plate 70.

WHIPWORM (natural size).

Life History.

The whipworm egg is passed on to the pastures in the manure. Under favourable conditions a tiny larva eventually develops inside the egg. Unlike other worms infesting cattle, however, the larva does not hatch out until the egg is swallowed. Then, on being set free inside the animal, the larva makes its way to the blind gut, where it settles down to grow to maturity.

Effect on Cattle.

Although a common parasite of cattle, whipworms are not considered very harmful, unless present in very large numbers, which is a comparatively rare occurrence.

Treatment and Control.

No effective treatment is known and control rests entirely on preventive measures.

THE LUNGWORM (*Dictyocaulus viviparus*).

(Plate 71.)

The lungworm is an elongate, slender, whitish worm which grows up to 3 inches and more in length and is found in the air tubes of the lungs.

Life History.

The eggs laid by the female worms in the lungs are coughed up and swallowed. On their way through the alimentary canal they hatch.

The tiny larva that emerges from the egg is then passed out in the manure. Some eggs may be coughed out of the mouth in the sputum and saliva.

After the usual period of development in the pastures the larvæ eventually reach the infective stage. They then infect an animal per medium of its food or water. Once inside the animal they bore through the intestine wall and reach the lymph glands from which they are eventually carried to the lungs. Here they then make their way into the air tubes, settle down, and grow to the adult stage.

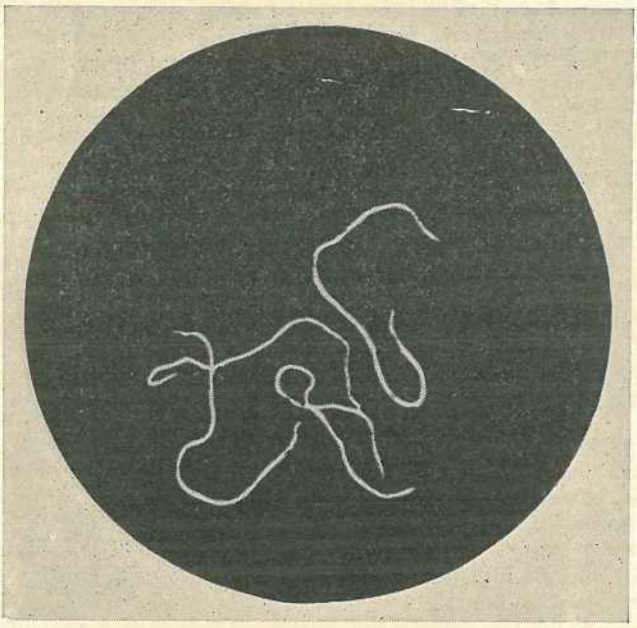

Plate 71.
LUNGWORM (natural size).

Effect on Cattle.

Lungworms are serious chiefly among calves and young cattle. A few lungworms do little harm, but when present in numbers they induce frequent coughing and there are signs that the animal is finding it difficult to breathe. The animal becomes weak and listless and frequently suffers from diarrhœa. Eventually the breathing rate becomes very rapid and the animal may die. Bunches of worms are frequently coughed up in a quantity of blood-stained frothy material.

These effects are due to the masses of worms in the air tubes, which so irritate the lung tissue as to cause pneumonia.

Treatment and Control.

Lungworm disease in cattle is usually associated with two factors—namely, poor nutrition and a heavy infestation of other worms. The following treatment is therefore indicated:—

(1) Remove affected animals from the pasture in which they have been running and provide them with warm quarters and nutritious food.

(2) Drench with tetrachlorethylene as advised for the large stomach worm. This drench removes most of the stomach and intestinal worms and enables the animal's resistance against the lung worms to be increased.

In most cases if these two measures are put into operation, lungworm outbreaks can be controlled.

The only other treatment available is an injection of drugs into the windpipe by means of a sterilised hypodermic syringe. The operation is not an easy one and should be carried out under the supervision of an experienced neighbour or a stock inspector. The formula employed is as follows:—

Turpentine	1 drachm
Glycerine	1 drachm
Chloroform	1½ drachm
Carbolic acid	10 minims

The general preventive measures already outlined, if put into practice will do much to control lungworms. Special attention should be given to the avoidance of damp pastures for calves, as these favour the development and survival of lungworm larvæ.

THE BEEF NODULE WORM (*Onchocerca gibsoni*).

This is an extremely common parasite of cattle in Queensland. The worms occur in the form of nodules, chiefly in the brisket and stifle regions. The nodules vary from the size of a pea up to a diameter of about 5 inches. If a nodule is cut open the worms may be seen inside it, intricately tangled up in the tissues (Plate 72). Each nodule contains a female and one or more male worms. The worms themselves are slender and very fragile. The female worm may measure up to 20 inches and more in length and the male up to 4 inches.

Life History.

Despite the attention by a number of workers in Australia, the life history of the beef nodule worm has not yet been worked out in this country. Recently, however, studies made in Malaya show that the parasite is spread by certain species of sandflies. When these sandflies bite cattle, they ingest the worm larvæ which occur in the skin. These larvæ undergo a necessary part of their development in the sandfly, and when the infested fly bites another animal the larvæ are liberated and eventually penetrate the skin. After moving around in the animal for some time, they settle down in the brisket and stifle. As a result of their presence here, the tissues around them gradually form a nodule.

Effect on Cattle.

The beef nodule worm does not appear to be harmful in any way to cattle themselves, but as nodule-infested briskets are not permitted entry into the United Kingdom, the loss to the beef industry, through the removal of this portion of the carcase from all animals before it can be exported, is very heavy.

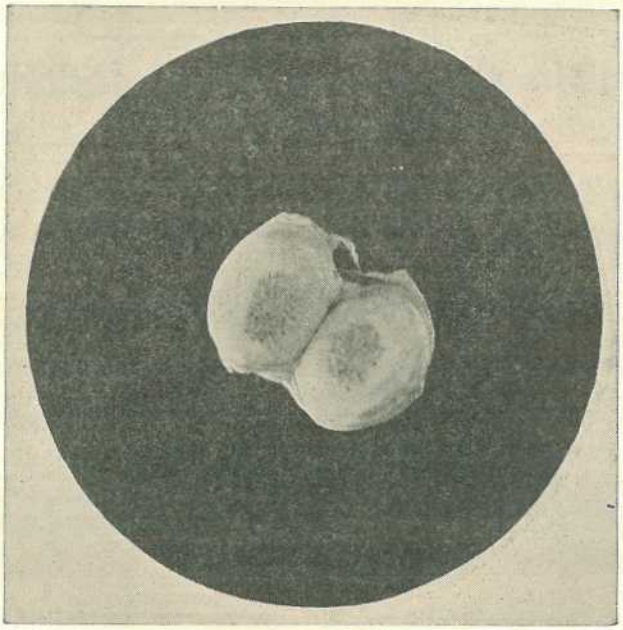

Plate 72.

Beef Nodule.—The nodule has been cut open to show the intricately coiled worm within.

Control.

Obviously any control measures against this worm must take into consideration control of the sandflies which spread it. These tiny flies breed in a wide variety of situations, such as mud, rotting vegetation, manure heaps, &c., and under the conditions present in the areas where the cattle become infected, control of these flies does not appear at the present time to be very feasible.

Fused Needle Disease and its Relation to the Nutrition of Pinus.

H. E. YOUNG, M.Sc.Agr., Assistant Research Officer.

(*Continued from p. 54, January,* 1940.)

The Economic Importance of the Disease.

The economic importance of fused needle disease depends on the combination of the effect on individual trees and the intensity of distribution of these trees throughout the plantation. If the incidence is light, as is the case in most Queensland plantations, affected trees are eliminated in the normal course of time during thinning operations and no loss is sustained. The presence of fused needle, even in small amounts, may be indicative of a general subnormal condition throughout the area thus affected, and the extent of the loss thus caused is difficult to estimate.

(i.) Effect on the Individual Tree.

Severely affected plants lose the habit of a tree and become shrub-like by developing multiple leaders, and in this way become useless for timber purposes. Observations have, however, shown that there is a tendency to throw off the malady after a number of years, depending on the time taken for the formation of a surface litter on the soil or perhaps on successful root grafting with healthy trees. However, the delayed growth experienced (Table II.), even if recovery ultimately occurs, causes a considerably augmented plantation cost, due to the additional tending and protection work which it is necessary to carry out during the longer period ensuing until the trees become mature. There is also the likelihood of the recovered trees being of reduced market value owing to the malformation developed during the diseased period. In California, according to information provided in correspondence with the Director of the Institute of Forest Genetics, considerable loss of time has been caused by fused needle disease when it has attacked trees being used for genetical purposes at Placerville.

(ii.) The Incidence of the Disease in Queensland.

In certain small localized areas in Queensland the incidence of the disease is very marked, but this can by no means be taken as a criterion of the general plantation effect. The high figures recorded (Young, 1935) in one very interesting block of 40 acres at Beerwah have, however, apparently been taken by unwitting readers to refer to Queensland plantations of *Pinus* in general. This is not the case, and the Beerwah plantations as a whole have a relatively low percentage of the trouble, which has been estimated at 6·2 per cent. of the plantation total. The extremely high incidence of affected trees in certain areas was made use of for experimental work, as these places provided the most satisfactory conditions for phases of the investigations requiring enough trees to admit of statistical analysis.

In the field the individual cases of the typical disease occur in a haphazard manner over any affected area and when plotted on a chart show no organized grouping, being randomized amongst the healthy plants. The actual proportion of healthy to diseased trees varies greatly with the location and may range from total absence to over 80 per cent.

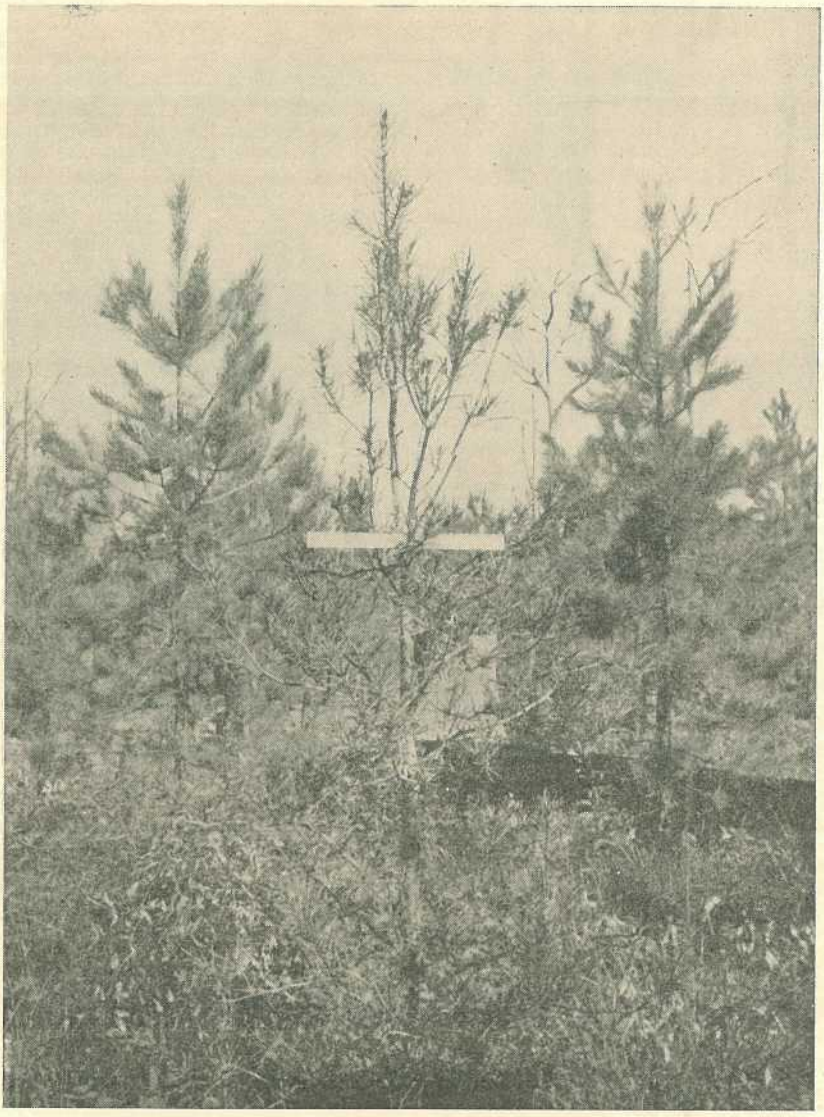

Plate 73.

Fused needle disease in eight-years'-old plantation tree of *Pinus tæda*. (Fifteen-inch rule inserted in tree.)

(iii.) Progressive Distribution in Individual Plantations.

The disease has been noted in nursery seedlings nine months old, and has appeared as a new attack in trees of all ages up to eleven years. Beyond this age effective observations have not been possible owing to the absence of plantation trees in any number older than this. The most critical period in the life of *P. tæda* and *P. caribæa* as regards attack is from the fourth to the sixth year.

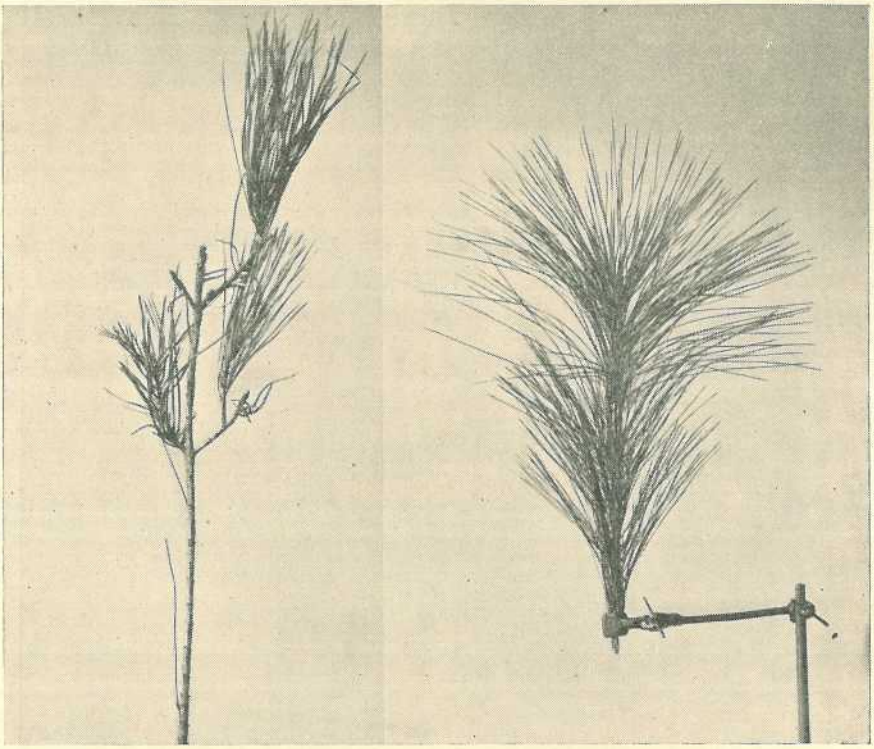

Plate 74.

Needle fusion symptoms in *Pinus tæda*. (Left) Branch affected with needle fusion, showing suppressed terminal growth. (Right) Healthy branch for comparison.

In order to obtain data on the history of trees affected with the disease three observation plots (A, B, and C) were commenced in a very severely-affected area at Beerwah in 1933 and have been continued up to the present, with the exception of plot A, which was abandoned in 1935 as being unlikely to furnish useful information. Two further plots (D and O) were established in 1934 and 1937, respectively, in a different area which is more nearly normal than that first used. The results of the plots to date from the five plots A, B, C, D, and O are contained in Table I. The general incidence of the disease in the areas in which the experiments are established is less than that shown for the sites concerned.

TABLE I.

Progress of the Occurrence of Fused Needle in Five Observation Plots as Illustrated by Percentage Infection at Yearly Intervals.

Year.	Plot A. *P. taeda* (1929 planting.)	Plot B. *P. caribaea* (1929 planting.)	Plot C. *P. tæda* (1929 planting.)	Plot D. *P. caribaea* (1932 planting.)	Plot O. *P. caribaea* (1932 planting.)
1933	53·6	..	..	..	..
1934	74·4	63·5	87·6	5·6	..
1935	79·5	69·0	88·8	29·2	..
1936	..	62·7	82·7	25·8	..
1937	..	56·3	92·6	33·7	22·6
1938	..	76·2	100·0	37·0	32·3
1939	..	61·9	97·0	40·7	40·7
No of trees per plot ..	60	126	109	86	247

Observations were made on all plots at midwinter (June) when the trees were dormant as regards needle production and height growth, and again at the dormant period in midsummer (January), which occurs between the two periods of shoot elongation in Southern Queensland. The midsummer observations entailed descriptive observations of the trees, whilst at midwinter the actual height of the trees from the ground to the terminal bud was measured in addition. The midsummer results for fused needle incidence usually showed a lower percentage than that obtained for the previous and following midwinter. The second winter showed a tendency to a greater incidence of fusion than was the case twelve months before. The reason for this summer fluctuation will be discussed later.

TABLE II.

The Mean Annual Height Increment in Feet of Trees in Observation Plots.

Species.	Plot.	Period.	All Trees.	Healthy.	Diseased.	Difference.	No. Trees per plot.
P. caribœa	B	1934-37	2·53	3·01	2·24	0·77	126
		1937-38	2·83	3·69	2·26	1·43	..
		1938-39	2·80	3·31	2·40	0·91	..
P. tœda	C	1934-37	1·40	2·10	1·35	0·75	109
		1937-38	1·47	1·47	1·47	Nil	..
		1938-39	1·33	1·30	1·31	Nil	..
P. caribœa	D	1934-37	1·96	2·20	1·30	0·90	86
		1937-38	3·64	3·95	3·37	0·58	..
		1938-39	3·58	3·77	3·41	0·36	..
P. caribœa	O	1937-38	2·55	3·25	0·99	2·26	247
		1938-39	3·15	3·14	3·20	Nil	..

TABLE III.

Girth Measurements in Observation Plots.

Species.	Plot.	Mean Girth in Inches at June, 1939.			Difference.
		All Trees.	Healthy.	Diseased.	
P. caribœa	B	9·38	12·07	8·80	3·27
P. tœda	C	7·95	7·95	7·95	Nil
P. caribœa	D	10·86	11·52	9·64	1·88
P. caribœa	O	9·42	9·35	9·38	Nil

The observations obtained from the plots indicate a tendency towards a general increase in the incidence of the trouble on affected sites until it reaches a maximum as shown in plot C with *Pinus tæda.* In the year 1936 there was, however, a lowering of the incidence of the disease in all plots, and this drop interrupted the tendency to increase. This fall was probably due to the better season resulting from an abnormally high rainfall during that period. In the next season (1937) however, there was a return to the general trend towards a worsening of the condition.

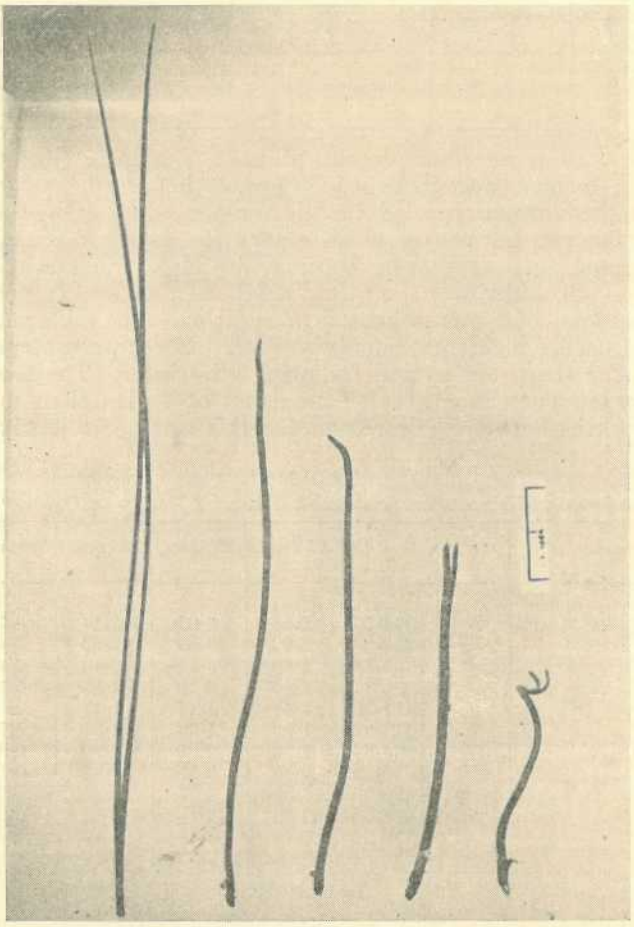

Plate 75.

Fascicles of *Pinus caribæa,* showing various stages of needle fusion. Healthy fascicle on left.

Annual and total height increments taken from observation plots are shown in Table II., and it will be noted that the increment put on by the diseased trees in the majority of the plots is much less than that produced by healthy trees.

In the case of Blocks C and O the height growth for the season 1937-38 and 1938-39 was the same for diseased and healthy trees, indicating that the plot as a whole was really affected although typical symptoms were not present throughout the experiment. The average increment was very small in this plot. It will be seen that the growth difference in trees with definite symptoms and normally healthy trees was appreciable and that it is of definite economic importance.

In several instances it was noted that the height increment was negative in the case of individual trees. These trees were in all cases severely affected ones which were subject to death of the leading shoots. The secondary shoots put forth below the dead ones did not reach the height of their predecessors, and thus an actual decrease in height resulted for the season's growth.

Plate 76.
Typical aspect of area subject to needle fusion (*Pinus tæda*).

General observations have shown that, with the closure of the crowns to form a complete canopy, there is less liability to attack by the disease and that, provided competition within the stand due to the need for thinning is not allowed to become so acute as to cause dieback and death, the trees will continue in good health. The age of crown closure in a new plantation would thus appear to become an important feature of the healthy growth of the species of *Pinus* (*P. tæda* and *P. caribæa*) observed. At Beerwah in South Queensland the age of a healthy stand of *P. tæda* when crown closure occurs is from six to eight years when planted with an 8-feet by 8-feet spacing. It must be understood, however, that, owing to the disabilities concurrent with the incidence

of fused needle disease, it is possible that a severely affected stand will never reach this stage within the limits of plantation life, unless corrective treatments are applied. The effect of the crown closure is intimately connected with the resulting accumulation of a surface litter on the soil as will be discussed later.

III. PRELIMINARY INVESTIGATIONS INTO THE CAUSE OF THE FUSED NEEDLE CONDITION.

The possible causes of the disease were discussed in a previous paper (Young, 1935) and also by Ludbrook (1937). It is agreed by both writers that the possibility of the disease being due to entomological factors is remote and that no parasitic fungus or bacterium is constantly associated as a primary factor in the cause of the disease.

Experimental work in Queensland has been carried out on the primary hypothesis that the disease is due to physiological causes of non-parasitic origin and that the mycotrophic nature of the conifers concerned is in particular bound up with the development of the condition. The possibility of there being other explanations has not, however, been overlooked. The viewpoint that the malady might be due to a virus has also been intensively examined as well as the possible occurrence of factors associated with climate, genetic constitution, and soil constituents. A résumé of the work carried out on these aspects of the problem will now be given.

The Virus Hypothesis in Relation to Fused Needle Disease.

When the problem was first reviewed the possibility of the disease being of a virus nature was given considerable attention and much detailed work was carried out to investigate this aspect of the problem. The chief avenues explored are summarized below.

(i.) Mechanical Inoculations.

Numerous inoculations into healthy plants with material obtained from diseased tissues were made. The methods of inoculation used were by means of a hypodermic syringe with which diseased extractives were introduced into buds, shoots, and stems, and by rubbing scratched foliage with diseased tissues and extractives. The extractives were made by expressing the juice from freshly-gathered diseased specimens, chiefly new growths and needles. In some cases the resulting sap was centrifuged in order to precipitate the larger particles. Inoculations were carried out at all stages of growth of susceptible species, both in the field and in the glasshouse.

In no case did the diseased condition appear in healthy plants as a result of inoculation by these means.

(ii.) Serological Tests.

In order to explore all avenues which might provide evidence of the nature of the disease a series of serological experiments were designed and carried out. The tests were fully described in a previous report (Young, 1935), and the results were completely negative. In the experiments, fused needle and healthy sera were obtained by bleeding rabbits which had previously been inoculated with a series of injections with diseased and healthy pine saps. The sap was cleared before injecting

by means of centrifuging. The sera obtained were used for conducting a series of precipitin tests. The precipitins to normal pine material were first thrown down in the reactive sera by means of adding normal pine extract (purified by centrifuging with barium sulphate) to the diseased sera until no further precipitate was formed. The diseased pine sap prepared in the same way was then added, and if the test were positive for a virus a further precipitate should have resulted. However, no more was obtained no matter what dilutions of sap and sera were used. As a control on the method used, a strain of tobacco mosaic, known to be due to a virus, was treated in a similar way with positive results. The fact that the serological tests for fused needle were negative ones does not, in itself, eliminate the virus possibility, because it is recognized that a number of known viruses have not as yet been demonstrated serologically, but in conjunction with other virus tests the experiments provide some evidence against the possibility of the disease being due to such a cause.

(iii.) Grafting Experiments.

Graft transmission has proved a successful mode of transmission of many virus diseases, and this method of testing for the presence of such a pathogen was attempted with fused needle. A number of successful unions between diseased and healthy tissues of *Pinus tæda* and *P. caribæa* were made both in the field and with potted plants. In grafting the potted plants the method of inarching was used, and this method was also used in several cases in the field. After the union was completed the scion was severed from its parent plant. The majority of the field grafts, however, were made by the cleft or the rind-grafting methods, and with these latter modes of union a 10 per cent. success was achieved.

In the case of all the grafts made, except one cleft graft, the healthy scions worked on to the diseased stocks became diseased in the same or the following season, and, similarly, diseased scions grafted to healthy stocks became healthy. In the exceptional case noted, the healthy scion has remained healthy for five seasons after union had taken place, although there is some evidence of the "thin crown" type of the disease now appearing (1939). *Pinus tæda* united with and grew successfully when grafted on to *P. caribæa,* and *Pinus caribæa* grew successfully with *P. tæda* as a stock (Plate 77). Both lateral and leader grafts were made. Grafts completed five seasons ago have, so far, failed to show any evidence of disease transmission.

It was suggested by G. Samuel, in correspondence, that root grafting should also be carried out as final evidence for or against the virus theory. Root grafts carried out in the field at Beerwah between very badly diseased and quite healthy plants have now been observed for over four years without any evidence of transmission of the disease being noted. Phony disease of the peach is notably a difficult virus to transmit artificially, and it may take up to two years for the healthy member of a root-grafted pair of peach trees to contract the symptoms. It might be expected, therefore, that fused needle, if a virus, would show some evidence of its action within four years. The method used in root grafting the pine trees was to select a severely-diseased tree which was surrounded by normal, healthy trees in the plantation. The surface lateral roots of the trees in the group were then bared of soil and followed out and freed from the substratum. Grafts were made between roots from healthy trees and roots from diseased trees by means of the approach graft method (Plates 78 and 79). In this way as many

as twenty root grafts were made from, in some cases, four healthy surrounding trees on to one diseased tree. Ninety-eight successful unions were thus established, involving eleven diseased trees, the percentage of successful grafts exceeding ninety.

An unforeseen result was obtained from the root-grafting experiment when it was noted that, in cases where a large number of grafts had been successfully achieved between several healthy and one diseased tree, the diseased tree, at the end of the second-growing season after

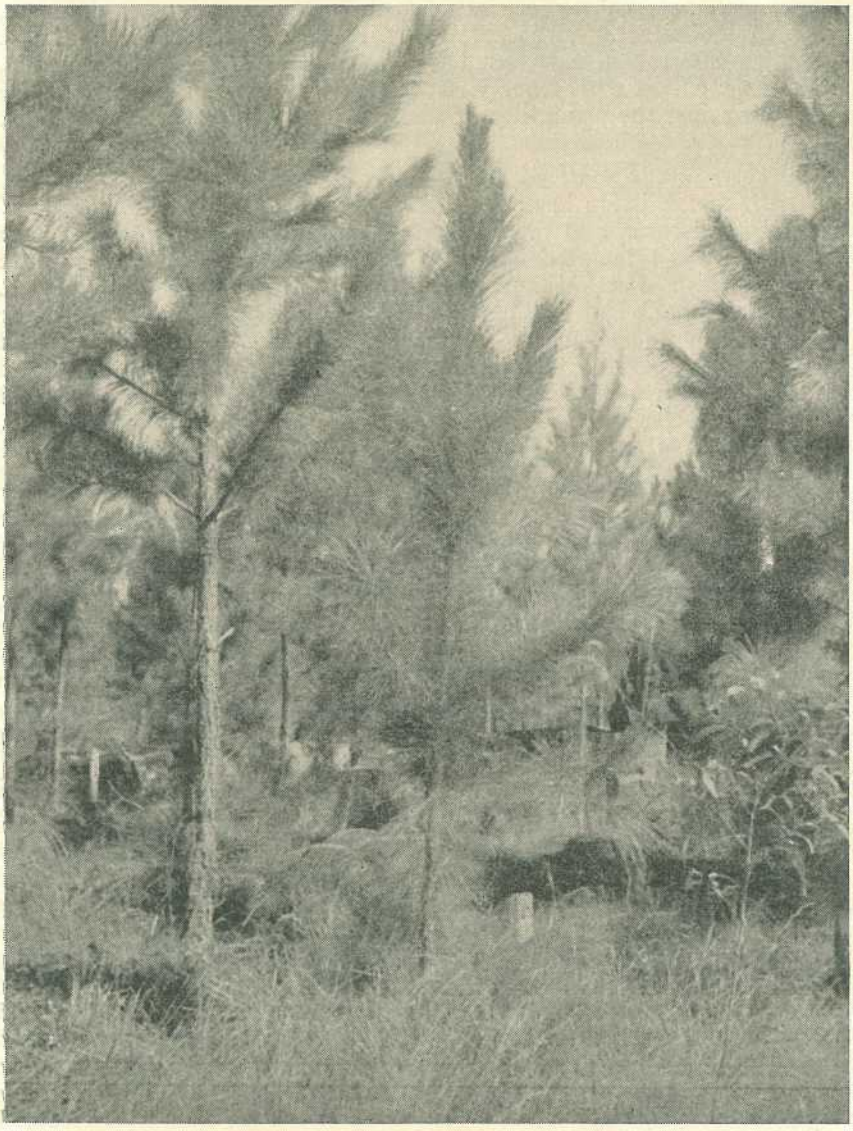

Plate 77.

Tree with peg showing effect of grafting fused leader of *P. caribæa* on to healthy *P. tæda* stock. Union near ground level (cleft graft).

Plate 78.

Root grafting experiment. View showing pegs marking root grafts on to central tree (fused) of *Pinus tæda*.

Plate 79.

Root graft *in situ* on *Pinus tæda* (fused to healthy tree).

union, had become normal and lost its fused-needle symptoms. A possible explanation of this effect will be discussed under another heading.

In carrying out field grafts for fused needle disease investigations it is considered that in the case of root grafting, even-aged established trees should be used as both components of the union. If a younger and/or smaller tree, possessing the diseased or healthy symptoms required, is planted in an already established older stand, any results achieved are liable to be seriously influenced by the effects of suppression brought about by the competition for moisture, nutrients, and light with the established plants. That is, all grafting in a plantation should be carried out with plants growing *in situ*. It is suggested that the absence of response to grafting by some of the scions, as reported by Ludbrook (1937), may have been due to these factors.

(iv.) Search for Insect Vectors.

In entomological surveys carried out by the writer (1935 and later) and Ludbrook (1937), no insects were noted which were constantly associated with the disease and which were likely vectors of a virus. Some attention was given in the Southern States of Australia to *Pineus boerneri*, an insect known generally to Australian foresters as *Chermes*, and which is parasitic on many species of *Pinus*, but which in Queensland, however, only appears to seriously affect those species grown in places in which their normal requirements are in some way lacking. In Queensland this insect has not been found at Beerwah, at which place are to be seen the most severely-affected fused needle areas in the State.

(v.) Conclusion.

The opinion was finally arrived at that a virus effect could not, on the evidence available, be correlated with the occurrence of fused needle disease. This conclusion has been confirmed by Ludbrook (1937). In a preliminary note on the condition by Jones (1938), this one has not been included among the possible causes, neither has Kessell referred to a possible virus cause in connection with his fused needle experiments.

Climatic Factors in Relation to Fused Needle Disease.

It was noted by Rodger (1931) that the disease in California was most prominent in trees planted in regions of high temperature and low humidity such as at San Bernardino and at Placerville and the Director of the Institute of Forest Genetics at the latter place was of the opinion that the trouble was connected with these two climatic factors. Rodger points out in his report that the trouble appears mainly in trees whose habitat is a reasonably humid one. Observations carried out in Australia (Young, 1935) have shown, however, that the disease occurs there in all climatic conditions, from wet tropical North Queensland to the cooler uplands of southern New South Wales and in regions of summer and winter rainfall, and that the humidity-temperature factor is not the sole deciding influence. It is, however, considered possible that the low humidity and high temperature effect may be of considerable importance when considered as an accessory factor in relation to the mycorhizal hypothesis, which will be more fully developed later. Such low humidities and high temperatures could play an effective rôle in checking the formation of a surface litter of vegetable material on the ground in which the trees are growing.

On considering the Australian homoclimes of the native habitats of the principal *Pinus* species grown in this country, it is found that fused needle disease has been recorded in these climatic belts. An exception is to be noted in the case of *Pinus radiata*. The New South Wales Forestry Commission has decided, after considerable research extending over some years, that the most suitable climatic conditions for its growth, if a homoclimatic standard is used as a basis for enquiry, is the Mount Burr district of South Australia. In this area fused needle disease is reported to be of rare occurrence.

It is evident, however, that climate, whilst providing possible accessory factors in causing the trouble, is not directly responsible for the onset of the malady.

Genetic Factors in Relation to Fused Needle Disease.

Consideration has also been given to the possibility that there is some inherent factor of susceptibility to the diseased condition borne in the seed of diseased trees, and researches along these lines have been commenced by Ludbrook and the writer. In Queensland, seed from several diseased *Pinus tæda* trees has been sown in the nursery, and the resultant plants have been put out under field conditions at Glasshouse Mountains for comparative observation purposes. On germination, the seed sown at Beerwah produced seedlings of a uniform, abnormal colour. The stems and cotyledons were a pale creamy pink in contrast with the purple, red, and green colour of the normal seedlings. All the seed from diseased trees produced seedlings which exhibited this phenomenon, but in a few weeks became indistinguishable from the progeny of healthy trees, and, on planting out in the plantation in July, 1939, appeared quite normal. The difficulty with seed studies, however, is the poor chances of obtaining seed resulting from self-pollination of the parent trees, and it is thought possible that the negative results obtained by Ludbrook (1937) from seedlings may be due to this factor when combined with the difficulty of choosing a suitable environment for the production of fused needle symptoms.

The grafting experiments referred to above revealed an instance of a tree with a healthy scion on a diseased stock remaining so, and it is considered that a possible hereditary resistance to the typical form of the condition may explain this occurrence. The healthy scion is probably capable of existing more or less normally on the materials supplied by the stock which might possibly be insufficient for its own normal growth. The same factor is a possible explanation of the recovery of root-grafted diseased trees, which, after grafting, could obtain nutrient supplies from the healthy trees, although they themselves were unable to obtain or elaborate it in sufficient quantities for their own healthy growth.

Dr. Jacobs, of the Australian School of Forestry, at Canberra, has noted the occurrence of a considerable amount of natural root grafting in well developed stands of *Pinus radiata* at Canberra, and it is thought just possible that some of the recovery from fused needle observed in such stands may be due to this factor.

The contradictory results obtained from the transplanting experiment described later might also be explained from a genetic viewpoint.

While there may be, and probably is, a genetic factor influencing susceptibility, the actual cause of the disease in general is, from the evidence available, not due to this factor. For instance, the occurrence of very considerable variations in the incidence of the trouble in plants produced from similar seed, and given the same nursery and planting treatment, when planted in a variety of locations in the plantations, would alone show that the hereditary factor is a secondary one.

It is planned to follow the genetic aspects of the matter further chiefly by growing plants from cuttings obtained from healthy trees in very severely-affected areas, and from diseased trees occurring in good areas. In this way it is hoped to isolate strains of very resistant and very susceptible types for general plantation trials. Such resistant strains should prove advantageous when multiplied vegetatively for use in general plantation work. Attempts at vegetative propagation for this purpose have been commenced.

Mechanical Factors in Relation to Fused Needle Disease.

Consideration was given to the mechanical influence which might be causing the abnormality. It was thought that the exudation of resin which is commonly seen on severely affected trees might, by its glueing action on the bud scales, be hindering the bursting of the buds. In order to try and reproduce this effect, dormant buds of twelve trees of *Pinus caribœa* and twelve *P. tæda* were well soaked, *in situ*, in a solution of resin and turpentine several times before the spring growth commenced, and were allowed to harden off. The treatment had no effect on the growth of the buds, which, although delayed several days after neighbouring trees had commenced to elongate, grew quite normally.

It has also been considered that the twisting of the needles might be due to an osmotic effect brought about by a low sugar concentration in the cell sap, which would hinge upon the correctness of the carbohydrate hypothesis, which will be propounded later.

IV. INVESTIGATION OF SOIL FACTORS IN RELATION TO FUSED NEEDLE DISEASE.

At the commencement of fused needle investigations in Queensland (Young, 1935) and New South Wales (Ludbrook, 1937-39) the possibility of the trouble being due to some soil factor was considered and investigations have been carried out in this regard. Other studies concerning the relation of soil conditions to the growth of *Pinus* have been undertaken by Kessell and Stoate (1938) in Western Australia. Work along these lines in Queensland proved the most profitable of any of the fused needle investigations. The results will be discussed under the following headings:—

Physical condition of the soil.

Soil deficiency in major elements.

Soil deficiency in minor elements.

Soil organic matter.

Soil manuring experiments with special reference to phosphate status.

Physical Condition of the Soil.

The soils in which trees exhibiting fused needle disease occur exhibit a wide variety of physical types. The trouble has been noted on coarsely-granular granite sands, on sandstone gravels, on soils of both a coarse and a fine sandy nature, and on stiff clays. It occurs on the deep pumice soils of New Zealand and on the deep dune sands of Fraser Island in Queensland, and on the badly-drained heaths of England and the shallow soils of the ridge-tops of the Glasshouse Mountains areas in Queensland. Affected trees are frequently noted in swamps with saturated soils in Queensland and on dry, rocky outcrops with little soil. The soil constituency may vary from the crumb structure of red basaltic loams to the heavy plastic black-soil clays and the free sands, but still the disease occurs. It will, therefore, be seen that the disease is one which is not primarily connected with the physical nature of the soil.

Mechanical analyses throw no light on the subject, although carried out on soils from a considerable number of sample sites.

Experimental work involving cultivation of the soil was carried out at Beerwah (blocks K and L) and Glasshouse Mountains (block M). The results of these treatments, which consisted of tillage of the soil in affected areas to a depth of 5 inches, may be seen in the graphs illustrated in the next instalment and may also be studied in Tables VIII. to XIV., inclusive. The results obtained showed that tillage induced no special response, but gave a similar effect to that obtained by keeping the ground surface clean by removing all vegetation. This effect showed an advantage as regards moisture retention in abnormally dry times, but produced a reduction in growth, together with an increase in fused needle disease in a normal year.

Soil Deficiency in Major Elements.

Whilst investigating the pedological aspect of the problem, a considerable number of chemical analyses of soils, on which fused needle disease occurs and on their counterparts which produce healthy tree-growth, have been made. In no case where analyses for available nutrients only were carried out do the results obtained from soil samples taken from areas carrying a diseased pine population show any significant difference to the results obtained from samples taken from comparable sites carrying a healthy development of pine trees. A table illustrating the results of twenty such analyses appears in a previous paper (Young, 1935). A further number of similar analyses have been made since then, with similar results. Material consisting of badly-affected and healthy pine plants growing on the same site has also been analysed by the Queensland Agricultural Chemist, the samples being obtained from both *Pinus tæda* and *P. caribæa* at Beerwah. No significant differences were observed between the proportions of Ca, Mg, K, P, Fe, Al, Mn, Si, or B in the specimens. Applications of dressings of chemicals containing the usual major essential elements—viz., Ca, Mg, K, P, Fe, S, and N—to a series of individual trees in field plots resulted in totally negative results, and it was at first thought that the possibility of there being a primary deficiency in any of these elements could be eliminated.

The pH value of a number of sites has been determined and found in the Beerwah district to vary from 5·4 to 6·3 without any correlation being found to exist between any particular pH range and the incidence

of the disease. A similar result has been obtained by Ludbrook. It has been shown that *Pinus tæda*, under controlled conditions, grows healthily right through the range indicated (Addoms, 1937).

The randomized distribution of affected trees, together with their irregular occurrence in any age class, would also appear to indicate that no particular deficiency of any of the essential elements in the soil make-up is primarily responsible for the onset of fused needle disease, although such a deficiency might, when combined with some other variable factor such as organic matter or individual susceptibility, be a major cause.

Later in the investigations, it was found that the application of phosphatic materials, in certain broadcast fertilizer trials to be discussed later, gave a definite response, and the phosphate distribution in plantation soils was investigated in greater detail. In making this survey two sites, one healthy and one subject to fused needle, were taken for examination. The available phosphoric acid expressed as citric acid soluble is given in Table IV. The samples were collected, ten from each site, to a depth of 8 inches and the analyses were carried out by the Agricultural Chemist. Other than the difference expressed by the growth of the pine trees the two sites were identical and had both carried a well-developed eucalyptus forest before clearing.

TABLE IV.

MEAN AMOUNT OF AVAILABLE AND TOTAL PHOSPHATE PRESENT IN TWO SAMPLE AREAS.

Condition of Trees.	Available P_2O_5 p.p.m.	Total P_2O_5 p.p.m.	No. of Samples.
Healthy	26	135	10
Diseased	44	80	10

Previous to planting with *Pinus tæda*, both areas had been used as pineapple farms. On the healthy site, excellent results were obtained from the trees with reference to both growth and general health, whereas, on the other site, a comparatively high proportion of needle fusion has developed. The pH values determined from all the samples were similar and varied from 5·6 to 5·9. The remaining elements for which analyses were made—namely, K, Ca, Mg, Mn, Al, Fe, and N—were shown to be uniform in their distribution over the two sites. From the results obtained it will been seen that the actual amount of available phosphate is not the limiting factor in the selection of a good planting site, because in this instance the site which proved to be the worst from a disease point of view, contained more than the better site. This was probably due to the manuring activities of the pineapple farmers, who had been the previous occupants of the two sites in question. Analyses of other areas in a similar way have not demonstrated any significant differences in the amount of citric acid soluble phosphate present.

Estimations made of the total phosphate content (20 per cent. HCE extract) of soils supporting healthy and diseased plants have, however, shown very significant differences. On referring to Table IV., it will be seen that the healthy trees grew in a soil containing 135 parts per million total phosphate, while the diseased ones grew in soil containing 80 parts per million. Further investigations regarding total phosphate content of the plantation soils have yielded highly significant results, which will be more fully discussed under the heading of soil phosphate treatments.

The phosphate content of soils which support healthy *Pinus tæda* in Queensland appears to be in the region of 130 to 150 p.p.m. With values in this region an occasional diseased tree is found, but growth on the whole is good. With values below this the disease becomes more evident. *Pinus caribæa* appears to be able to grow healthily with phosphate values as low as 110 p.p.m. For *P. radiata*, in Western Australia, Kessell and Stoate (1938) have found that a minimum amount of 400 p.p.m. of P_2O_5 in the surface soil is necessary for healthy growth. Amounts as low as 300 p.p.m. may be satisfactory if present for a depth of two to three feet. For *Pinus pinaster*, 150 p.p.m. in the surface and sub-surface soils is considered a minimum. The soils at Beerwah and Glasshouse Mountains, in Queensland, which carry stands of *Pinus tæda* and *P. caribæa* definitely affected with malnutrition abnormalities, contain on the average 83 parts per million and vary from 27 p.p.m. to 114 p.p.m. in the top eight inches of soil. Untreated soils in the same area carrying more healthy stands, have total phosphate values of over 110 p.p.m. This value is, however, only on the borderline as regards health, since these stands contain some affected trees.

It would appear that the total phosphate requirement of *Pinus tæda* and *P. caribæa* is less than that of *P. radiata*, and somewhat similar to that of *P. pinaster*. It seems probable that the relative non-susceptibility of *P. pinaster* to fused needle disease in New South Wales and England, when compared with *P. radiata* and *P. muricata*, is connected with its lower phosphate requirement. In a recent publication by Mitchell (1939) it has been shown that with white pine seedlings, the growth response to various concentrations of phosphorus may be divided into the following ranges: From 0 to 50 p.p.m., the region of minima; from 50 to 200 p.p.m., the working region; from 200 to 400 p.p.m., the region of tension; and with greater supplies, the toxic region. These experiments, however, were carried out in the absence of any fungus symbiont.

At Pechey, in Queensland, on a red volcanic soil, with a mean total phosphate value of 2,400 p.p.m., occasional trees affected with fused needle occur in *P. radiata* and *P. tæda*. It is considered that in this instance the effect is due to an organic matter shortage which occurs in young stands in this comparatively dry zone, where the rainfall is 30 inches per annum. When the organic matter supply increases with age, vigorous pine growth results.

The failure of trees treated individually with superphosphate to respond in the experiments mentioned earlier, is attributed to the unsatisfactory nature of the method of application. It is now considered that individual tree treatments in the plantation are unsatisfactory for experimental purposes, and that block treatments are the only suitable method. It has been found by root system dissections in Queensland that the feeding roots of the pine trees are chiefly in the outside area of the radius of root spread, which may be up to fifteen feet, with an eight-foot high tree under Beerwah soil conditions. The feeding roots are thus found to be under neighouring trees rather than the tree in question. The application of chemicals or other manures around the base of any particular tree is thus seen to be of limited value in so far as that particular tree is concerned, and the negative results obtained from such applications are explainable on these grounds. The relatively poor response obtained from phosphate treatments in this manner and also those obtained by Ludbrook (1938) are attributed to this cause. This

method of application was abandoned by the writer in 1935 in favour of broadcast, block treatments in order to reach the root system of all trees within the experiment.

Soil Deficiency in Minor Elements.

The possibility of a deficiency in any one of the minor elements being a direct cause of fused needle disease appeared to be unlikely owing to the random distribution of the affected trees and also because of the variety of soils on which the disease occurs in Queensland and elsewhere. Nevertheless, a considerable amount of experimental work in relation to minor element deficiencies in *Pinus* has been carried out in Western Australia, Queensland, and New South Wales.

In Western Australia, Kessell and Stoate (1938) obtained a response to zinc when this element was used as a spray on rosetted trees. The treatment has been shown by these authors to cause relief from the diseased condition.

Another series of experiments carried out in Western Australia with *Pinus radiata* also resulted in somewhat similar effects (Hearman, 1938). In this case unthrifty trees were treated externally by pouring solutions of ferrous sulphate, nickel chloride, zinc chloride, manganese sulphate, cobalt chloride, copper sulphate, and boric acid over the foliage and bark. The only treatment which gave any response was zinc, which caused vigorous and healthy growth. The negative results obtained by the majority of the salts were investigated further by injection methods. The salts used in this case were zinc sulphate, nickel chloride, manganese sulphate, ferrous sulphate, sodium molybdate, cobalt chloride, boracic acid, and copper sulphate, and were all introduced in solution into the trunks of the trees. The results obtained showed that all the salts used with the exception of copper sulphate, caused vigorous and healthy growth. This indicates that the other salts can, when applied in a suitable manner, take the place of zinc, which therefore is not *per se* a deficient element, but in common with the other elements used, acts as a stimulant. Spectrographic analyses of the salts indicated that they were not contaminated so as to cause false results.

TABLE V.

THE EFFECT OF ZINC SULPHATE SPRAY ON FUSED NEEDLE DISEASE IN *P. tæda*.

Date.	Primary Fusion.	Other Types.	Total Fusion.
	Per cent.	Per cent.	Per cent.
6–10–36 ..	31·5	3·58	34·4
28–1–37 ..	30·0	2·15	39·4
14–7–37 ..	39·4	7·15	46·5
18–7–38 ..	40·4	8·60	49·0

Following on the experiment of Kessell and Stoate with zinc sprays, an experimental plot was designed at Beerwah (Queensland), in a stand of *Pinus tæda*, of which 34·5 per cent. of the trees were affected with fused needle disease. One hundred and forty trees were included in the plot, and the spray was applied by means of a knapsack spray, to trees ranging up to twelve feet in height. The spray mixture was made up according to the following formula:—

Zinc sulphate, 10 lb.; hydrated lime, 5 lb.; and water, 100 gallons.

The first treatment was applied to the trees on 6th October, 1936. A second treatment was given on 28th January, 1937, followed by a third application on 25th March, 1937. All the treatments were applied during the period of active growth of the trees. Forty gallons of the spray mixture were used at each application. The observations made during the course of the experiment are illustrated in Table V.

The results signify that treatment of *P. tæda* during the growing season with the zinc spray gave negative results as regards its effect on needle fusion. The percentage of affected trees in the experimental plot varied directly, as did that in a control plot adjoining the treated area—that is, there was a steady normal increase in the incidence of the disease during the course of the experiment. Observations taken in 1938 showed that there was no delayed response.

Copper is also known to act as a plant stimulant under some conditions (Jacks 1938), and it was decided to carry out a comprehensive treatment with this element involving a number of trees. The experiment consisted in the treatment of a block of sixty trees of *Pinus tæda* at Beerwah with a broadcast dressing of the soil surface with copper sulphate at the rate of three hundredweight per acre. The results obtained over one growing season are shown in Table VI.

TABLE VI.

THE EFFECT OF COPPER SULPHATE ON FUSED NEEDLE DISEASE.

Treatment.	Mean Height (1938).	Mean Height (1939).	Mean Girth (1939).	Per cent. Diseased Trees (1938).	Per cent. Diseased Trees (1939).
Untreated ..	13·35	14·68	7·95	81·0	86·0
Treated ..	13·5	15·33	8·08	75·0	62·2

The results of the experiment indicate that there was a reduction in fused needle in the treated plants and an increase in height growth. The treated plants were clothed with foliage of a deeper colour than that of the untreated ones. The indications were that copper sulphate treatment caused a stimulus to the growth of affected *Pinus tæda*.

A series of single-tree treatments with a number of the minor elements was carried out on *Pinus tæda* at the Beerwah plantations in 1934. The elements used were Cu, B, Zn, Mn, Ni, Al, and Co. The elements were applied as salts to the soil around the base of the trees, where they were worked in. No response was obtained from any of the elements when applied in this way.

In New South Wales, Ludbrook (1939) has used a very extensive range (37) of these elements, including silver, both in mixture and singly, with similar results to those obtained in Queensland, except that indications of some response have been given by boron. No positive results were obtained by him when he used the chemicals in injection methods of tree treatment, save for an inconclusive response which was given by boron in this series also. Spectroscopic analyses of needles which were carried out for him have shown no significant differences for boron content in the needles of healthy and diseased trees. In

England, Jones (1938) has found that spectroscopic analyses of healthy and diseased pines, from Wareham, in Dorsetshire, have indicated that there is a lower boron and zinc content in affected trees than in healthy ones.

The collection of samples of plant material for analytical purposes in regard to fused needle of *Pinus,* is a matter of some complexity. It has been shown above that individual trees vary in their reaction to the factors which cause the disease, some becoming typically fused, others showing some one or other of the other abnormalities described. It seems that all the trees from any one affected area are suffering from some form of the condition and that the collection of material from any of the trees whether typically fused or not, would show little difference when analysed. This factor may explain the results obtained by Ludbrook and the writer, when analyses of such material have been carried out. It must not be lost sight of that a deficiency of an element in the soil and its consequent relative deficiency in the plant ash may not actually mean that the plant is suffering any inconvenience from the lack of that particular element.

It is of interest to note that in citrus orchards in districts adjacent to Beerwah, and on similar soil types, the physiological disease exanthema has been known to be prevalent. Exanthema is considered to result from a copper deficiency, and accordingly, this element may be present in a low amount for the pine trees also. In Western Australia, on soils of a different derivation, it would seem that from the results obtained by Kessell and Stoate, and Hearman, the possibility of a copper deficiency can be ruled out. There is, however, a likelihood of there being a deficiency in zinc or other elements, the treatment of pine trees with which gives no results in Queensland or New South Wales.

The response to zinc treatment obtained by Kessell and Stoate (1936) is perhaps partly explainable along the same lines as the theory concerning the cause of pecan rosette put forward by Woodroff (1933). In this publication it is deduced that the beneficial results obtaining after the treatment of rosetted trees with zinc salts are possibly due to the promotion of normal mycorhizal activity. In the rosetted condition the root-fungus structures are in the form of pseudo-mycorhizas, and are apparently harmful due to the feeble resistance of the tree to the fungal infection. A similar explanation of the cause of mottle leaf in citrus has been suggested by Rayner (1933), and investigated by Reed and Frémont (1934) in California, and it is thought that the curative effect of zinc in the absence of humus mulching is possibly due to a root stimulating action.

Opinions still differ as to whether the stimulatory action of copper when added to soils supposedly deficient in this element is a physiological one or due to a chemical reaction in the soil itself. The best known copper deficiencies are on peaty soils, and in the case of reclamation disease, Smith (c.f. Jacks, 1938), isolated from affected soils a crystalline substance which caused reclamation disease when applied to plants and which was precipitated by copper salts. Vieschlag (c.f. Jacks, 1938), observed that substances toxic to plant growth in peat soils could be rendered non-toxic by applying copper sulphate or nitrate. In Europe, copper deficiency has been reported almost solely from heath regions. Needle fusion in England has as yet only been reported from such a soil in

Dorsetshire, but in Australia occurs on other types which are principally sandy in nature.

Work carried out in Russia (Sovietski Subtropiki, 1938), has shown that boron and phosphorus and boron alone increase the chlorophyll content of citrus leaves when used in small amounts. In larger amounts boron alone and boron plus phosphorus decreased the amount of chlorophyll. Manganese, zinc, and copper both separately and with boron increased the chlorophyll content. The greatest increase was with zinc alone, the least with all four elements. These results accord well with the writer's hypothesis for a carbohydrate deficiency basis for the abnormalities in *Pinus* which are discussed here. The stimulus to chlorophyll production provided by the minor elements would result in increased carbohydrate formation in all the leaves. This would, to some extent, offset the root deficiencies which are shown later to exist in the case of fused needle trees. The treatment with copper sulphate carried out by the author caused a greener appearance of the affected trees and stimulated growth. The results obtained by Kessell and Stoate, and Hearman, conformed to the Russian plan. It would appear likely that the stimulatory effect of the minor elements on the pine trees in all cases described could be largely due to a chlorophyll increase, such as was noted in citrus in Russia. The root stimulus and soil conditioning effect may be present to a subsidiary extent.

It has been suggested by Willis and Piland (1936) that minor elements and organic matter may affect crop yields by a catalytic influence on oxidation-reduction reactions, and by that means, on biological activities. It has also been shown by the same authors (1938) that in a muck soil the application of copper sulphate by catalysing an oxidative process was able to bring about a response to phosphorus. It is possible, therefore, that the effect produced by copper sulphate in the experiment at Beerwah which is described above may be ascribed to this reaction rather than to a direct copper deficiency.

Soil Organic Matter.

Whilst surveying and comparing badly affected and healthy plantation sites for the purpose of obtaining any correlations between observable site peculiarities and the incidence of fused needle disease, attention was paid to the occurrence of soil organic matter. As mentioned previously, it was considered very early in the inquiry that mycorhizal relations had some bearing on the trouble. It is well known that the production of healthy mycorhizas depends to a large extent on an adequate supply of soil organic matter (Melin 1925, Rayner 1927), and the fused needle affected areas were examined from this point of view. It was noticed on sites where there was an abundant development of leafy undergrowth that the disease was rare. It was found that the development of this type of undergrowth could not be correlated with any obvious soil features differing from neighbouring sites where fusion was rife. The disease was also found to be relatively absent from plantation areas where a pine litter was forming, due to the production of a canopy of pine branches at the closing of the stand.

At first, attention was paid to the actual organic matter content of the soil itself, excluding the surface litter, but later it was considered that the latter was just as much if not the more important of the two.

A number of samples of soil were collected on Fraser Island from beneath healthy and diseased trees growing on a white marine sand. Another series of samples was collected at Beerwah from beneath trees showing similar effects. All samples were taken to a depth of six inches and excluded the surface litter. The total carbon content of all the samples was determined by the Agricultural Chemist, resulting in the figures shown in Table VII.

TABLE VII.

TOTAL CARBON ESTIMATION IN SURFACE SOIL BENEATH DISEASED AND HEALTHY TREES.

Condition.	Locality.	No. of Samples.	Total Carbon.
			Per cent.
Healthy	Fraser Island ..	5	0·7
Diseased	Fraser Island ..	6	1·17
Healthy	Beerwah	10	1·21
Diseased	Beerwah	10	1·12

The results indicate that the actual quantity of carbon present in the soil itself has little bearing on the incidence of the disease, but do not exclude the possibility of the composition of the organic matter being an important factor.

It has been shown by Heyward and Barnette (1934) that the total organic matter in the top six inches of the soil is actually increased in frequently fired stands of *Pinus caribæa* and *P. palustris* in the United States of America on similar soils to those at Beerwah. However, the feeding root system in this layer of the soil, which is very important in pine nutrition, was adversely affected by the chemical and physical changes brought about by the burning. This may explain the excess of carbon in the soil obtained from beneath diseased trees on Fraser Island which occurred in comparatively recently burned areas, as compared with that in soil from beneath healthy trees on older areas which had had time (over twenty years) to recover from fire effects. In any case observations have shown that, in areas in which fused needle occurs, the threshold between health and disease is very narrow in the case of a number of trees, as evidenced by their change from the healthy to the diseased condition, followed by their recovery, on several consecutive occasions. From this point of view it will be seen that soil samples from below individual trees in any one area where infection occurs are likely to give inconclusive results on analysis.

It has been noted on Fraser Island that the clearing and burning of the rain forest which exists on this marine sand was followed by a reversion of ecologic vegetational type to the heath condition and that species of *Pinus* planted on those cleared areas were early affected with fused needle but after approximately twenty years tended to recover. As time goes on the felled and burned areas on the sand gradually pass through all stages of succession until the rain forest type is again reached, as a result of the *Pinus* producing a complete canopy. It is at this stage that the fused needle trees recover from the disease and commence healthy growth. The changes which have taken place in the soil during the progress of the succession are mainly accounted for by the formation of a duff layer on the soil coinciding with the return to a condition of canopy, and it cannot but be felt that this is also directly connected with the immunity to fused needle disease acquired by the pines with this development.

The area most severely affected with fused needle at Beerwah is on a soil type which is almost identical with other types on the same plantation which, however, support healthy pine growth. One difference only between this and the other similar sites is that the area is adjacent to the railway line and, until protected, was subjected to fires at much more frequent intervals than were locations further from the railway. In fact, this area had the worst fire history in the plantation.

It has been noted above (Heywood and Barnette 1934) that frequent fires have an adverse effect on the soil structure both chemically and physically in the top four to six inches of the soil in the longleaf pine region of the United States. The observations of these authors point out that in fire-affected soils the surface horizon becomes impermeable and extremely compact as a result of exposure to the sun and driving rains and that the evidence of an active macro-fauna is rare. They also noted an absence of feeding roots of the pines in the surface layers of the soil on affected areas, whereas in unburned areas these feeding roots had actually worked their way well into the duff layer which, of course, was absent on the burned soils. A similar state of affairs prevails in the fused needle affected areas in Queensland, and is particularly noticeable in Block K, the area just described. It can only be concluded that fire has played some part in the development of the abnormal condition in this area. Another area in which is situated Block B, referred to in connection with phosphate treatments, has had a somewhat comparable fire history. This block developed more fused needle than a similar type which has been less affected by fire, notwithstanding the fact that the soil of the latter had a lower content of available phosphate.

The occurrence of a relatively low percentage of fused needle affected trees on sites in the plantations at Beerwah which support a heavy covering of blady grass (*Imperata cylindrica* var. *kœnigii*) has been noted by several observers, but it is not found possible to correlate these phenomena in every instance. It is thought, however, that the blady grass supplies sufficient ground cover in the way of shade and litter to parallel the development of rain forest on the Fraser Island sands and thus supplies a medium on the soil surface suitable for the development of the short-rooted surface feeding system of the conifers.

The deficiency of suitable litter appears to be an important factor in the occurrence of fused needle disease at Pechey, in Queensland. Here the *Pinus* plantations are located on a rich soil with total phosphate values of over 2,000 p.p.m., but with a low soil moisture content. This paucity in soil moisture militates against the development of the litter layer suitable for mycorhizal development.

[TO BE CONTINUED.]

Variations in Milk Tests.

E. B. RICE.

VARIATIONS which occur from time to time in the fat content of milk sometimes cause misunderstanding amongst suppliers to cheese factories. It is the purpose of this paper to deal with a number of factors which can influence the percentage of fat—the most variable of milk constituents—in order that producers may understand something of the many conditions which can have a bearing on fat tests. Unfortunately, although the general effect of many factors is understood, very little research has been carried out so far in Australia to determine their exact influence under local conditions. According to their mode of causation, the differences which occur in the fat content of milk may conveniently be placed into two main divisions:—

A.—Natural or inherent causes.

B.—Other causes.

A.—Natural or Inherent Causes of Variation.

A further subdivision of the above may be made under the following headings:—

(1) Breed.

(2) Individuality of the Cow.

1. *Breed.*—This is the most important factor influencing the percentage of fat in milk, it being well known that cows of certain breeds are noted for high fat content. For instance, Jersey and Guernsey milks are usually richer than that of Friesian, with Australian Illawarra Shorthorn and Ayrshire intermediate between them. Within any one breed, however, certain families will be found to give milk above average quality for the breed, while others will be below the average. It is usually found that continual crossing of breeds tends towards a depreciation of fat content. From figures kindly made available by Mr. A. K. Henderson, Inspector of Dairies, Toowoomba, who for many years has supervised the Ground Milking Competitions for the Royal Agricultural Society, Toowoomba, an analysis has been made of the fat content of cows of different breeds which have competed in these competitions for the years 1929-1939, both inclusive. The mean fat percentages determined on separate samples of both night's and morning's milk are tabulated below:—

Breed.	Average Fat Percentage.	Number of Cows Tested.
Jersey	5·27	35
A.I.S.	3·99	146
Ayrshire	3·96	14
Friesian	3·50	5

It should perhaps be mentioned that although cows of a particular breed may usually yield milk richer in fat than the cows of another breed, it does not follow that the total quantity of fat in the milk yielded by an individual cow of the former breed will exceed that in the milk

of a cow of another breed, which may produce a larger quantity of milk with a lower fat test. Furthermore, irrespective of breed, the objective of any progressive breeding policy is to produce animals which give a relatively high daily yield of milk and butterfat over a lengthy lactation period every year rather than cows which may yield well for a few months after calving, but which rapidly decline in production as the lactation period advances.

2. *Individuality of Cow.*—Fat being an hereditary characteristic, there are often wide differences in the milk of individual cows of any particular breed. In order, therefore, to maintain and, if possible, to improve the fat production of the whole herd it should be the aim of every dairy farmer to carry out systematic herd testing with a view to identifying the cows which yield a low test and low total fat return, culling them from the herd as opportunity presents itself and using for replacement heifers from high-producing stock. Equal importance must be attached to the herd sire, for the deteriorative influence of an inferior bull will soon be reflected in a decline in the productive capacity of a herd. In Denmark the pursuance for many years of an enterprising policy of improvement of the native cows—Red Danish Breed—by breeding only from cows combining high yield with high fat content and prepotent bulls of superior quality has been a strong factor in enabling the dairy stock of that country to reach their present high standard of milk and fat production.

Although the milk of some cows shows fluctuating fat tests from day to day, generally there is not a great daily difference in the bulked milk of a herd.

As progress is made in the science of genetics, so will the present meagre knowledge concerning the inheritance of milking qualities in dairy stock be extended.

B.—Other Causes of Variation.

Apart from the inherent or natural causes, the chief factors which are deserving of mention are—

(1) Stage of lactation.
(2) Season of year, temperature, and weather conditions.
(3) Excitement and œstrum.
(4) Efficiency of milking.
(5) Interval between milkings.
(6) Health.
(7) Exercise.
(8) Age.
(9) Feeding and condition of animal.

1. *Stage of Lactation.*—In this State where almost all the cows in the herd calve at approximately the same period of the year (spring), this is a most influential factor in causing the fat content of the bulked milk to vary from time to time. It may be taken as a general rule that cows produce milk of higher than normal fat content for about a fortnight after calving, followed by a gradual reduction in the fat test until it reaches its lowest level about the time of maximum milk yield—that is, three to four months after calving. It then remains fairly stationary

for some time, but a higher fat percentage will be recorded again when the end of the lactation period is approaching and the milk yield is declining to its lowest quantity. Perusal of numerous test records at cheese factories has confirmed this under Queensland conditions. In this State the period of minimum fat content in the lactation cycle coincides with the hottest months of the year and, as high temperatures are also known to reduce the fat content, it can readily be understood why milk tests are at their lowest at this time of the year.

2. *Season of Year, Weather Conditions and Temperature.*—Temperature, weather conditions, and season of year are so closely interrelated in Queensland that they may be considered together. Because of their possible effect on certain other factors, it is difficult to ascribe a clear-cut result to them, but in England and America some experiments designed to furnish information respecting weather and temperature have been made by controlling, as far as practicable, all other conditions.

Temperature has been shown to exert its influence by causing richer milk to be secreted at lower temperatures and milk of lower fat content at warmer temperatures, about 50 degrees F. being the optimum. Similarly, the fat content is lower in summer and higher in winter. Perusal of butterfat test records at a number of Queensland cheese factories has revealed the difference between January and June tests to be about 0·3 per cent. The average tests for January and May, respectively, for several years at the six factories of the Pittsworth Co-operative Dairy Association, representing about 120 suppliers, are given below:—

Month.	Mean Test for All Suppliers.	Month.	Mean Test for All Suppliers.
	Per Cent.		Per Cent.
January, 1925.. ..	3·68	May, 1925 ..	3·99
January, 1926.. ..	3·62	May, 1926 ..	3·98
January, 1927.. ..	3·69	May, 1927 ..	3·88
January, 1936.. ..	3·59	May, 1936 ..	4·04
January, 1938.. ..	3·64	May, 1938 ..	3·90
January, 1939.. ..	3·66	May, 1939 ..	3·79

There is little evidence as to the actual effect of *sudden changes in weather conditions,* as other accompanying factors—food supply, water, exercise, &c.—often disturb the fat content and especially the total yield of milk. For instance, it is usual to change cows from green, succulent feed to dry paddocks during *rain,* and it has been observed that often there is a diminution in milk yield and a sudden appreciable rise in fat content. This is clearly evident from a recent set of figures made available by the Springside cheese factory:—

——	Mean Test.	Quantity of Milk Treated.
	Per Cent.	Gallons.
8-day composite samples (22 suppliers) for period prior to rain	3·6	6,272
8-day composite samples for period in which rain fell	4·1	5,762
8-day composite samples for period immediately after rain	3·6	6,358

Normally, there are *few sudden temperature changes* of a severe nature in this State in the gradual transition from cool to warmer weather, and vice versa, and it is, therefore, to be expected that under our conditions this factor is of little consequence.

Coincident with the dry spell (drought) towards the end of 1938 and at the beginning of 1939 was a period of abnormally hot weather. A slight diminution in the fat content of milk was recorded and the solids-not-fat (especially casein) were considerably reduced. This was repeated in the dry spell from August to October, 1939; because of the scanty pastures and herbage, the solids-not-fat content were greatly depressed. The following table reflects the effect of the former period on the milk tests at the Pittsworth group of factories:—

Month.	Mean Test for All Suppliers.	——
	Per Cent.	
October, 1938	3·70	Normal weather prior to onset of drought and heatwave.
November, 1938 ..	3·76	
December, 1938 ..	3·67	Period of drought and abnormal heat.
January, 1939 ..	3·66	
February, 1939 ..	3·79	Drought broken and normal weather restored.
March, 1939	3·88	

3. *Excitement and Oestrum.*—The cow being a nervous animal, the fat content in its milk may be lowered by any condition which causes undue excitement or nervousness, such as being chased by dogs, subjected to over-exertion in being driven to the milking yards, noise, change from the usual milker, &c.

Sexual excitement, oestrum or "heat" induces varying effects depending upon the individuality of the animal. With some cows there is no appreciable change in the composition of the milk, while in many cases there is a slight rise in fat content, and a slight decrease in milk flow.

The change of environment and other abnormal conditions associated with *showyards*, may cause a marked variation in the percentage of fat. This accounts for the disappointing results given by some cows in show-ground milking competitions in comparison with their tests under normal farm conditions.

4. *Efficiency of Milking.*—Quick and thorough milking is found to have a marked effect on the quantity and richness of milk, sometimes as much as 30 per cent. more milk being yielded by a cow milked by an efficient milker, compared with an unskilled worker. Thoroughness means careful stripping out of each cow, for the strippings sometimes contain twice as much fat as the remainder of the milk. Not only is there a diminished yield and decrease in fat content by incomplete stripping, but, if continued, the practice contributes to the more rapid drying-off of the cow.

A change from the usual milker may cause a drop in the fat content of an individual cow.

5. *Interval Between Milkings.*—The wide divergence which may be noted between the fat content of evening and morning milk is familiar to farmers who have entered cows for advanced registry or grade herd recording purposes. The cause of this variation—the interval between

milkings—constitutes the most important factor in the differences which occur in the fat content of the milk of an individual cow. It is usual for the morning's milk, produced after the long night's interval, to be of greater quantity and lower fat test than the evening's milk. The difference between the fat content of the milk obtained at the two milkings may be as great as one to two per cent., if the periods between milkings are very irregular—for example, if milking is done at 4 p.m. and 6.30 a.m., giving an interval between night's and morning's milk of 14½ hours, and between morning's and night's milking of 9½ hours. Data collected from the results of the 1939 ground milking trials at the Toowoomba Show is set out hereunder:—

NUMBER OF COWS TESTED 43. MILKED AT 6.0 A.M. AND 4.30 P.M.

Number of Cows Tested 43.	Milked at 6.0 a.m. and 4.30 p.m.	
	Mean Weight.	Mean Fat Test.
	Lb.	Per Cent.
Morning milk	19·3	4·30
Night milk	16·4	4·88

The following figures for two competing cows illustrate the degree of variation from the mean which may occur in individual cases:—

Cow No. 1.		
	Weight of Milk.	Fat Test.
	Lb.	Per Cent.
Morning milk	32·5	3·7
Night milk	27·5	5·9
Cow No. 2.		
Morning milk	14·3	3·9
Night milk	12·1	6·0

Although the main trend for yields and fat tests is in the direction just indicated, the writer is aware of a farmer on the Downs, who invariably milks very early in the morning, and after dusk at night, thus reversing the usual order, and who, consequently, obtains a greater quantity of milk of lower fat test in the evening.

It should thus be obvious that any supplier who sends samples to a laboratory, or other place, for check testing must be careful not to select just morning's or night's milk as a check against the factory test. At factories a representative sample of the mixed night and morning milk is taken, and it is therefore essential for the farmer to take a true sample of the mixed milk if he is not to be dissatisfied because the results obtained from his sample are at variance with the factory tests. Likewise, some farmers, in order to obtain butter for household purposes, habitually skim some cream from the evening's milk prior to dispatch to the cheese factory next morning. The effect of this practice in decreasing tests must also be borne in mind if a sample of unskimmed milk be forwarded for check purposes.

6. *Health.*—The fat content is subject to alteration if an animal be indisposed, if recently calved, if the udder receives a chill, or if any other abnormal condition arises.

(*a*) *Mastitis.*—Milk from animals with diseased udder (mastitis) is often of abnormal chemical composition and may continue to be so even after the udder appears normal. Mastitis milk, which often is unusually low in solids-not-fat content (chiefly casein), may cause great difficulty in cheese-making. Some samples of milk from mastitis-infected cows recently analysed, have given the following results:—

Sample No. 1. (Disease in advanced stage).	Per Cent.	Sample No. 2. (Disease in less advanced stage than No. 1).	Per Cent.
Fat	1·3	Fat	2·3
Casein	2·0	Casein	1·9

(*b*) *Three-Day Sickness (Ephemeral Fever) and Drought.*—In the period just prior to the breaking of the drought in March, 1937, and during the incidence of three-day sickness (ephemeral fever) in the dairy herds of the State, cheese factories were having much difficulty owing to the abnormal chemical composition of the milk supplies then being received. As an example, the bulk milk supply at one factory was found to have the following composition:—

	Per Cent.
Fat	3·8
Casein	1·7 (normally 2·5 per cent.)

The extent to which each of the above factors operated in causing such abnormal composition cannot, of course, be estimated. Since, however, cheese yields bear a direct relationship to the casein content of milk, factories were naturally obtaining very low cheese yields from the milk treated during this period.

(*c*) *Colostrum.*—For the first five days after calving, the milk of the cow is of abnormal chemical composition, showing very high figures for albumin and total solids, and comparatively low fat and sugar. The undermentioned analytical figures for a sample of colostrum submitted to the laboratory and normal milk of the same fat content reveal clearly the differences in composition.

	Colostrum.	Normal Milk.
	Per Cent.	Per Cent.
Fat	3·5	3·5
Milk sugar	3·0	5·0
Casein	2·6	2·4
Albumin	16·5	0·5
Total solids	26·9	12·5

7. *Exercise.*—Obviously, under Queensland conditions, where cows are out at pasture day and night throughout the year, they at all times receive ample exercise, and this factor need hardly receive mention. However, in some European countries, cows must remain continuously indoors for seven to eight months every year, and there is little opportunity for exercise. Experiments have demonstrated that there is a slight increase in the fat content if the cows are exercised, and a

decrease if changed from exercise to rest. The experimental animals were walked three miles a day for exercise. Although milk production was maintained, and the fat percentage slightly improved by exercise, the greater food consumption, especially as hand feeding had to be resorted to in such countries during the period in which the cows were kept in the sheds, more than offset any gain by the increased fat content in the milk.

8. *Age.*—The fat content of milk does not alter to any appreciable extent with age, except that between three and five years there is a slight increase and a slight decrease in advanced years. In the milk of a whole herd this factor is unlikely to exert any bearing on the fat content of the bulked milk. It may be remarked that normally, if a heifer produces milk of low fat test in her first lactation period, it cannot be anticipated that the milk will be richer in subsequent lactations, for the capacity to produce rich milk is an inherited characteristic. The quantity of milk yielded will, of course, increase with age until the maximum yield is reached at about seven years of age.

9. *Feeding and Condition of Animal.*—These closely related matters may be grouped together. Contrary to the opinion of many farmers, the conclusions reached from numerous investigations carried out in various countries are that, in herds of cows receiving an adequate and balanced ration, changes in feeding can, at most, cause only a slight and temporary change in fat content, and a permanent alteration cannot be induced by this means.

An authority on dairy husbandry in England, Mr. J. Mackintosh, of the National Institute for Research in Dairying, University of Reading, has the following to say concerning the effects of kind and quality of food on the fat content of the mixed milk of a herd[1].—

(*a*) *Continuous underfeeding* produces less milk of a slightly lower fat content than some cows would yield under adequate feeding.

(*b*) *Continuous over-feeding* improves the condition and may maintain yield, but does not cause continuous high fat percentage. With herds in high condition, an increase in the protein in the diet (i.e., a change to a narrower nutritive ratio) may increase the fat percentage for a short time—probably transference of body fat to milk fat is stimulated. Reducing a high ration to a standard amount will also cause a temporary increase in fat percentage, but with a decrease in yield.

(*c*) *Feeding of Special Oils and Fats.*—Temporary increases in fat percentages have sometimes been obtained by giving oils and fats—such as linseed, soya bean, palm nut, coconut, and cottonseed oil. One cannot be sure of such results with all cows, and effects may not be discovered unless the fat percentage is ascertained daily. Some claim that such increases are not due to the oils themselves, but due to abnormal feeding. Some fats also cause decreases—e.g., cod liver oil, used at the National Institute for Research in Dairying, depressed the fat percentage when 6 to 8 oz. were given daily and the depression continued for six weeks.

The effect of cod liver oil on the fat of milk was also confirmed by Dr. Sheehy, of Albert Agricultural College, University of Dublin, with whom I discussed the matter during my trip to Ireland[2].

It is usually conceded that a cow, if well nourished and fit at calving time, will give a better yield in the ensuing lactation period than if she

calves in poor condition, and overseas research has shown that a higher fat test will also be maintained.

Acknowledgment.

It is desired to acknowledge the courtesy of Mr. R. C. Duncan, secretary of the Pittsworth Co-operative Dairy Association Limited, who made available results of tests for use in this article.

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CREAM BLENDING.

An examination of cream on the receiving platform of almost any factory will indicate the necessity for careful treatment and storage on the farm. Proper blending of the cream after separation is essential.

The process of cream ripening assists the production of delicate butter flavours.

The development of lactic acid in the cream is desirable, because the lactic acid bacteria, if present in large numbers, prevent the undesirable off-flavours and taints from developing.

Small quantities of cream are more difficult to hold in a satisfactory condition than larger quantities, and, consequently, the dairy farmer should keep his supply in as large a bulk as possible.

Objections to blending have been raised by some dairy farmers, who claim that if the cream from each milking is kept separate, only portion of the supply will be graded second-grade when sent to the factory. To this objection, however, it might be stated that the aim of dairy farmers to-day is, or should be, to have all and not merely part of their cream of the highest "choice" quality.

To blend correctly, the cream from each separation is first cooled for about an hour before adding to the bulk supply, which should always be kept as cool as possible.

If the use of the cooler and aerator has been effective, the cream should then be ready for blending—the farmer must satisfy himself, however, in all cases that the cream is sufficiently cooled before attempting to add it to the bulk.

Thorough and frequent stirring with a metal stirrer is necessary for correct blending.

If two or more cans are to be sent to the factory, approximately equal portions of the cooled cream from each separation should be placed in each can. This will ensure that a standard cream is supplied.

Straight Fertilizers and their Incorporation into Fertilizing Mixtures.

F. B. COLEMAN, Officer in Charge of Seeds, Fertilizers, Veterinary Medicines, Pest Destroyers, and Stock Foods Investigation Branch.

IT can be claimed justly that the standard of fertilizers sold in Queensland is particularly high—which is confirmed by a review of the fertilizers registered under the Act.

The following sets out the kinds of materials sold and the respective percentages of nitrogen (N), phosphoric acid (P_2O_5) and potash (K_2O) present in such materials:—

Fertilizer.	Minimum.		
	Nitrogen.	Phosphoric Acid.	Potash.
	Per Cent.	Per Cent.	Per Cent.
Nitrate of soda	15·6	..	..
Sulphate of ammonia	20·6	..	..
Dried blood	11 to 13	..	..
Superphosphate	..	*20·5	..
Bone dust	3 to 3·5	22 to 23·5	..
Meatworks fertilizer	3 to 6	14 to 23	..
Basic phosphate	..	†17	..
Nauru phosphate	..	37	..
Sulphate of potash	..	..	48
Chloride (Muriate) of potash ..	..	..	50

* Water soluble. † Citric acid soluble.

A large proportion of the fertilizers distributed in Queensland is sold in the form of mechanical mixtures, i.e., mixtures containing two or more of the abovementioned ingredients (with the exception of basic phosphate and Nauru phosphate) in varying quantities.

In order that the purchaser may be aware of the composition of the various fertilizers, it is enacted by law that the respective minimum percentages of nitrogen, phosphoric acid, and potash, together with the forms in which they respectively occur, shall be declared on the label attached to each bag. This label should also set out the name of the fertilizer, the net weight, and the name and address of the manufacturer or dealer.

Every sale of fertilizer over the value of 10s. must be accompanied by an invoice setting out the warranty required by the Act.

The labels that must be attached to every bag of fertilizer and the invoice warranty which must accompany the sale are the purchaser's guarantee as to its quality.

It is to the intending buyer's advantage to make himself acquainted thoroughly with the constituents of each fertilizer advertised as useful for his purpose before making a purchase.

The Act also requires that if filler be used in compounding a fertilizer mixture, the proportion of this filler used must be stated on the label; this has had such a deterrent effect on the use of filler, that at the present time, none is used in Queensland.

MIXED FERTILIZER CHART BASED ON ONE TON (2,240 LB.)

Per Cent. Nitrogen Required in Mixture.	Quantity of Ingredient to be used per Ton of Mixed Fertilizer.				Per Cent. Phosphoric Acid Required in Mixture.	Quantity of Ingredient to be used per Ton of Mixed Fertilizer.			Per Cent. Potash Required in Mixture.	Quantity of Ingredient to be used per Ton of Mixed Fertilizer.	
	Sulphate of Ammonia.	Dried Blood.	*Bone Dust.	*Meat-works Fertilizer		Super (Water Sol.)	*Bone Dust.	Meat-works Fertilizer.*		Sulphate of Potash.	Chloride (Muriate) of Potash.
	Cwt. lb.	Cwt. lb.	Cwt. lb.	Cwt. lb.		Cwt. lb.	Cwt. lb.	Cwt. lb.		Cwt. lb.	Cwt. lb.
½	28	46	1 48	1 0	½	28	24	35	½	11½	11½
¾	55	93	2 96	2 0	¾	55	47	70	¾	23½	22½
1	109	1 75	5 80	4 0	1	109	95	1 28	1	46½	44½
1½	1 52	2 56	8 64	6 0	1½	1 52	1 31	1 98	2	93	90
2	1 107	3 37	11 48	8 0	2	1 107	1 79	2 56	3	1 28	1 22
2½	2 49	4 19	14 32	10 0	2½	2 49	2 14	3 14	4	1 75	1 67
3	2 104	5 0	17 16	12 0	3	2 104	2 62	3 84	5	2 9	2 0
3½	3 46	5 93	20 0	14 0	3½	3 46	2 110	4 42	6	2 56	2 45
4	3 101	6 75	..	16 0	4	3 101	3 46	5 0	7	2 103	2 90
4½	4 44	7 56	..	18 0	4½	4 44	3 93	5 70	8	3 37	3 22
5	4 98	8 37	..	20 0	5	4 98	4 29	6 28	9	3 84	3 67
5½	5 41	9 19	..	..	5½	5 41	4 77	6 98	10	4 19	4 0
6	5 96	10 0	..	..	6	5 96	5 12	7 56	11	4 65	4 45
6½	6 38	10 93	..	..	6½	6 38	5 60	8 14	12	5 0	4 90
7	6 93	11 75	..	..	7	6 93	5 108	8 84	13	5 47	5 22
7½	7 35	12 56	..	..	7½	7 35	6 43	9 42	14	5 93	5 67
8	7 90	13 37	..	..	8	7 90	6 91	10 0	15	6 28	6 0
8½	8 33	14 19	..	..	8½	8 33	7 27	10 70	16	6 75	6 45
9	8 87	15 0	..	..	9	8 87	7 75	11 28	17	7 9	6 90
9½	9 30	15 93	..	..	9½	9 30	8 10	11 98	18	7 56	7 22
10	9 85	16 75	..	..	10	9 85	8 58	12 56	19	7 103	7 67
10½	10 27	17 56	..	..	10½	10 27	8 106	13 14	20	8 37	8 0
11	10 82	18 37	..	..	11	10 82	9 41	13 84	21	8 84	8 45
11½	11 25	19 19	..	..	11½	11 25	9 89	14 42	22	9 19	8 90
12	11 79	20 0	..	..	12	11 79	10 25	15 0	23	9 65	9 22
12½	12 22	..	..	..	12½	12 22	10 72	15 70	24	10 0	9 67
13	12 76	..	..	..	13	12 76	11 8	16 28	25	10 47	10 0
13½	13 19	..	..	..	13½	13 19	11 56	16 98	26	10 93	10 45
14	13 74	..	..	..	14	13 74	11 103	17 56	27	11 28	10 90
14½	14 16	..	..	..	14½	14 16	12 39	18 14	28	11 75	11 23
15	14 71	..	..	..	15	14 71	12 87	18 84	29	12 9	11 67
15½	15 14	..	..	..	15½	15 13	13 22	19 42	30	12 56	12 0
16	15 68	..	..	..	16	15 68	13 70	20 0	..	..	..

The above calculations are made to the nearest lb. except with small quantities of the concentrated potash bearing ingredients.

* As bonedust and meatworks fertilizer contain both nitrogen and phosphoric acid, when a per cent. of nitrogen is required a corresponding proportion of phosphoric acid must also be obtained; for instance, to obtain 2½ per cent. nitrogen from a 5/16 meatworks, 10 cwt. must be used, which will also give 8 per cent. phosphoric acid.

In this connection it might be mentioned that in even such a progressive country as the United States of America, a 3-8-3 (grade formula 14) fertilizer mixture is still one of the best selling fertilizers—particularly in certain Southern cotton-growing States—whereas in Queensland, practically no fertilizer mixture having a grade formula of less than 20 is sold.

In order to assist those who desire to calculate the percentage of nitrogen, phosphoric acid and potash in a given mixture, or the quantities of the various ingredients which may be used to compound a given mixture, a table has been drawn up, covering common fertilizers incorporated in mixtures.

Meatworks fertilizer has been included in the table, the value of nitrogen being taken as 5 per cent. and phosphoric acid 16 per cent. As the analysis of the different brands shows a wide variation, this should be taken into account when using the table in relation to meatworks fertilizer.

In connection with the use of this table, it may be here appropriate to give the following words of advice:—

In calculating commercial mixed fertilizers, the ingredients will not always total to the ton. The chief reasons for this are twofold—one is that, although one figure is taken to represent the "active constituent" content of each ingredient in the table given, actually even standardized commercial ingredients vary in analysis to a slight extent. Sulphate of ammonia, for instance, varies from 20·6 to 21 per cent. minimum nitrogen content. Sulphate of potash varies from 48 to 50 per cent. minimum potash, and muriate of potash from 50 to 52 per cent.

Consequently, as it is not known from the label what are the exact percentages of the active constituent present in the original ingredients as used by the manufacturer, particulars calculated must be approximate only.

The second reason is that the Fertilizers Act requires a minimum guarantee to be stated on the label and allows no tolerance—with the consequence that the manufacturers use an over-run, that is, they put an excess of each ingredient into the mixture to ensure that the analysis guarantee is maintained.

Naturally, if a large discrepancy is ascertained, one would suspect the presence of filler.

Analyses taken in compiling the table are:—

Sulphate of ammonia ..	20·6 per cent. nitrogen
Dried Blood	12·0 per cent. nitrogen
Bone	3.5 per cent. nitrogen and 23·5 per cent. phosphoric acid
Meatworks fertilizer ..	5·0 per cent. nitrogen and 16·0 per cent. phosphoric acid
Superphosphate	20·5 per cent. water-soluble phosphoric acid
Sulphate of Potash ..	48·0 per cent. potash
Chloride (Muriate) of Potash	50·0 per cent. potash

To compound a mixed fertilizer to obtain desired percentages of nitrogen, phosphoric acid or potash, it must always be remembered that the quantities of ingredients used *must total* 1 *ton or* 100 *per cent.* Smaller quantities than 1 ton can, of course. be made up, but the

ingredients must still be calculated from the table on the ton basis, and the amounts reduced in proportion.

The following table enables conversions to be made from parts per hundred to cwts. and lbs. per ton (i.e. per cent. to weight).

Conversion Table on the Basis of One Ton.

Per Cent.	Cwt.	Lb.	Per Cent.	Cwt.	Lb.
¼		6	11½	2	33
½		11	12	2	44
1		22	12½	2	56
1½		33	13	2	67
2		44	13½	2	78
2½		56	14	2	89
3		67	14½	2	101
3½		78	15	3	0
4		89	16	3	22
4½		101	17	3	44
5	1	0	18	3	67
5½	1	11	19	3	89
6	1	22	20	4	0
6½	1	33	21	4	22
7	1	44	22	4	44
7½	1	56	23	4	67
8	1	67	24	4	89
8½	1	78	25	5	0
9	1	89	26	5	22
9½	1	101	27	5	44
10	2	0	28	5	67
10½	2	11	29	5	89
11	2	22	30	6	0

Examples: 6 per cent. = 1 cwt. 22 lb. per ton, or 2 cwt. 33 lb. per ton = 11½ per cent.

Above calculations are made to the nearest lb.

How to Use the Table—

To obtain, say, 2 per cent. of nitrogen in a ton of final mixed fertilizer, 1 cwt. 107 lb. of sulphate of ammonia or 11 cwt. 48 lb. of bone may be used.

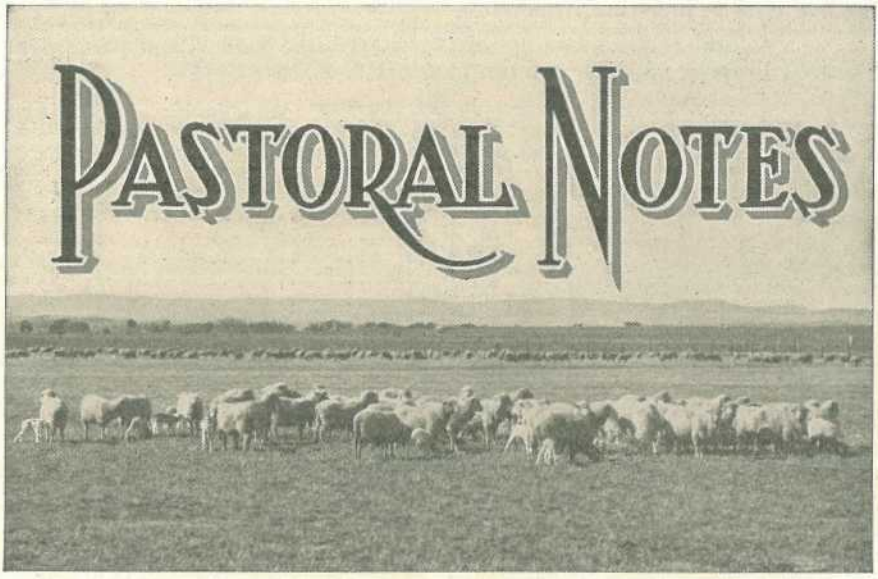
To obtain a complete fertilizer, containing 5 per cent. Nitrogen, 12 per cent. phosphoric acid, and 8 per cent. potash, by consulting the table:—

4 cwt. 98 lb. sulphate of ammonia;
11 cwt. 79 lb. superphosphate; and
3 cwt. 37 lb. sulphate of potash—

totalling approximately one ton, or other suitable ingredients, amounting to a ton may be used.

In the case quoted it will be noted that the amounts given total 19 cwt. 102 lb., which is 10 lb. under the ton. It is, of course, too much to expect that a grade formula consisting of round figures will give quantities that exactly total a ton. The separate amounts of ingredients should therefore be "rounded off"—in this case by adding, say, 3 lb. each to the sulphate of ammonia and sulphate of potash, and 4 lb. to the superphosphate.

In conclusion, it might be well to point out that only a certain number of grade formulae will be found to total anywhere near the ton with the ingredients available; obviously, a 2-10-2 would amount to only a portion of the ton while a 10-10-10 would amount to far more than the ton; consequently, neither of these grade formulae—or other "extreme" formulae—can be found on the market in Queensland.



Drenching Sheep.

ABOUT this time of the year worms are usually very troublesome in sheep. Before drenching, an effort should always be made to ascertain which species of worm is the cause of the trouble, and this can readily be done by a post-mortem examination of a badly infested animal. The fourth stomach, small and large intestines, should be cut open and examined carefully, and if the animals are coughing, attention also should be given to the lungs.

For the worm that occurs in the fourth stomach—the barber's pole worm—bluestone is recommended. Carbon tetrachloride is also very effective against this worm, but there is some risk attached to its use, and it is therefore no longer recommended by the Department of Agriculture and Stock.

Bluestone and nicotine sulphate are used for the removal of the small hair worms, which inhabit the small intestine. Hair worms are the cause of a disease known as "black scours." Infestation is most severe among young sheep, in which the losses may be very heavy. Bluestone and nicotine sulphate is the only drench which is of any value against these small worms.

Where a mixed infestation of stomach worms and hair worms occurs —a frequent experience, especially in young sheep—the bluestone-nicotine sulphate drench should be given, as this drench is effective against the stomach worm also. Moreover, it may be used for the removal of tapeworms from lambs, although these worms may also be removed by arsenic and epsom salts.

For the nodule worms in the large intestine, there is as yet no efficient method of removing them by means of drenches which are given through the mouth. They may, however, be combated by the use of an enema

containing sodium arsenite, which, if administered carefully, has a very high degree of efficiency.

Lung worms are treated with certain drugs which are injected into the windpipe, the formula being—

Oil of turpentine—1 cubic centimetre.

Creosote—0·5 cubic centimetre.

Olive oil—2 cubic centimetres.

Chloroform—0·5 cubic centimetre.

This formula represents a dose for one adult sheep. For lambs, the dose is reduced by one-half.

In country subject to worms, the sheep should be given treatment at regular three to four weekly intervals during the summer months, for otherwise little or no benefit from the treatment may be evident. Treatment is to be regarded only as a temporary measure in the fight against worms, for it must be realised that when paddocks are heavily infested with worm larvæ the animal is no sooner freed of worms by treatment than it is attacked again by larvæ which are picked up by the animal when grazing. In about three to four weeks' time the larvæ have grown and have reached such a size and attained such numbers that the health of the animal is again affected.

Further information on mixing and administration of these drenches may be obtained from the Animal Health Station, Yeerongpilly.

CARE OF SICK ANIMALS.

Stock owners are frequently required to diagnose and treat sick animals and, from their constant observation of stock in good health, are quick to notice any abnormal behaviour due to sickness. A knowledge of the normal temperatures, pulse, and respiration rates of various animals is most valuable in arriving at a correct diagnosis of the trouble. The temperature of all young animals is somewhat higher than that of older animals, and various influences—such as periods of oestrum (heat), time of day, external temperature and so on—may alter the temperature of the mature animal. The temperatures of healthy farm animals are—horse, 99·5-101 degrees; cow, 100-101 degrees; sheep, 103 degrees; pig, 102·5 degrees.

The temperature of an animal is usually measured in the rectum, and a self-registering thermometer, such as is commonly used in ordinary medical or nursing practice, may be used. Care should be taken to see that the column of mercury is shaken down. A small quantity of vaseline smeared on the bulb as a lubricant to assist the passage of the instrument is desirable, and it is inserted with a circular motion between the fingers, forward in a line with the backbone, and allowed to remain for a few minutes before it is withdrawn carefully and the reading taken. If the temperature of an animal is found to be about 2·5 degrees above normal it is said to have a low fever, if it reaches the vicinity of 4 degrees above normal a moderate fever is indicated, and if in the neighbourhood of 6 degrees above normal it has a high fever.

In some diseases, such as tetanus and sunstroke, the temperature may be as much as 10 degrees above normal. Having decided by use of

the thermometer whether the sickness is of a febrile (pertaining to fever) or non-febrile nature, treatment and nursing must be considered.

Good nursing is of the utmost importance. The patient should be provided with a soft bed, shade from sun, wind, or rain, and a rug in cold weather. A supply of water and green feed also should be provided if possible.

Medicines are usually administered by the mouth in the form of a drench, and it is necessary to use care and patience when using this method. The head of the animal should not be raised above a horizontal position, and only small quantities of the drench poured into the mouth at a time, allowing time for swallowing. Pinching the throat to induce swallowing should not be practised, and the head should be lowered if the patient commences to cough.

IMPROVEMENTS ON THE SMALL SHEEP PROPERTY.

When money is available a small grazing selection frequently carries improvements fit for a much larger property. On the other hand, when money is scarce, the small holding often lacks even the bare improvements essential to the well-being of the sheep and the handling of the clip.

A property has a certain capital value, and unnecessary improvements merely mean over-capitalization. Interest has either to be paid or allowed for this excess expenditure.

However, certain improvements are essential in all cases.

A substantial boundary fence is essential, and, should the district be dingo-infested, netting and top netting are also necessary.

Next in importance is the water supply. Should there be adequate natural water the selector is fortunate. Failing natural water, wells, sub-artesian bores, surface tanks, or bore drains to conduct supplies from neighbouring bores must be provided. The type of watering facilities to be used is essentially a matter of economics. What pays best, particularly in drought emergencies, should be a guiding principle in the grazier's choice.

A horse paddock and yards for the handy working of house cows are among the first provisions to be made. This paddock should be handily situated to the homestead and should contain water.

Subdividing of the property for the convenient working of sheep is seldom given sufficient thought. It involves not only the running of fence lines, but their construction in such a way that water is easily and continuously available to the stock. The fences should be substantially erected to obviate continuous drafting and boxing. Too much money may be spent in wrongly thought-out divisions, but, generally, the smaller the paddocks the better. The posts used for fencing should be of timbers proved in the district for their durability.

The shearing shed and drafting yards may, on a small holding, be close together. The shed should be well constructed and properly designed, but not larger than necessary for the competent handling of

the numbers of sheep ordinarily run on the property. The yards also should be constructed substantially, and their correct design for the drafting of sheep is of first importance. Where shed and yards are together, the latter should be so placed that the shed can be conveniently filled with woolly sheep.

The situation of the homestead should permit the easy working of the property, and its cost should be no greater than the improved value of the holding warrants.

DIPPING SHEEP.

Dipping is the only successful method of freeing the flock from lice and ked. For dipping, a recognized proprietary material should be chosen and the directions for mixing followed implicitly.

Ordinarily, dipping should be done within a month after shearing, but not before all cuts or wounds have healed. A fine day should be chosen for the job. Extremes of heat or cold should be avoided.

Sheep should never be dipped when in a heated state. Yard them, if possible, the night before.

Immerse the sheep completely. Allow them to drain, and, if possible, dry in the shade. Avoid driving them long distances to paddocks after dipping.

Dipping pays, and, in addition, gives some protection against the blowfly.

CRUTCHING AND JETTING.

There is often controversy as to whether crutching or jetting is the better method of combating blowfly attack. There should be no argument on this score, for, with the increasing severity of fly invasion, both methods have their place in the protection of the flock.

There is a school of thought which insists that the wool should be left on the crutch of the sheep and jetting alone resorted to. Other graziers pin their faith to crutching and will not consider jetting.

It is thought that, singly, either of these methods may be unsatisfactory to some extent, inasmuch as both methods should be used in conjunction. To get the greatest immunity from fly strike, the grazier is advised to carefully crutch when—or before if practicable—the first fly invasion is likely to occur. This should give the flocks immunity for about two months. Should further treatment then be necessary, jetting the previously crutched sheep is advised. Thus with the intelligent combination of the two methods, reasonable protection should be assured.

BRUISING OF CATTLE.

The meat export industry is seriously prejudiced by the bruising of cattle when travelling to the meatworks, and the annual loss to both the owner and the State is considerable. Bruising is caused by many factors, particularly so when journeys are long, but the two chief causes are ill-treatment and horning, because of faulty supervision during trucking and in transit.

Cattle travelled to market on the hoof always give a higher percentage of first-class beef than railed stock, provided, of course, they have the condition and weights essential for export. Much of the bruising attributed to train travelling is caused in the trucking yards. In many instances, every endeavour is made to load the trains in a minimum of time. This is a mistake. Care should be taken to avoid crowding in gateways, because, where jamming occurs, the outer beasts are bruised on ribs and hips. Precautions are necessary both at the crush entrance and in the crush. If cattle are trucked in "single file," their sides do not come in contact with the rails. Drovers in charge should insist that no unnecessary force is used to drive the cattle, for every injury affects the quality of the carcase.

Competition in the chilled and frozen meat trade to-day is keen, each competing country endeavouring to produce a better carcase. Therefore, if Australia is to retain or increase her output of first-grade beef, the cattle received at the meatworks must be of prime quality and free from injuries of any kind. Growers and dealers may assist the trade by judicious handling of stock. Dehorning is essential. This is a simple operation and should be done when branding. Records proved conclusively that polled cattle give a much higher percentage of first-quality beef than horned cattle.

Dehorned cattle are also much more docile in the paddocks, cover less country when feeding, and retain condition longer.

LAMB-MARKING.

Lamb-marking should be done under the most hygienic conditions possible. The work consists of castration and the insertion of the registered earmark on the off ear of ram lambs, and of marking similarly the near ear of ewe lambs. In addition, an age mark is frequently placed on the ear opposite the registered mark. Tails are removed from all lambs.

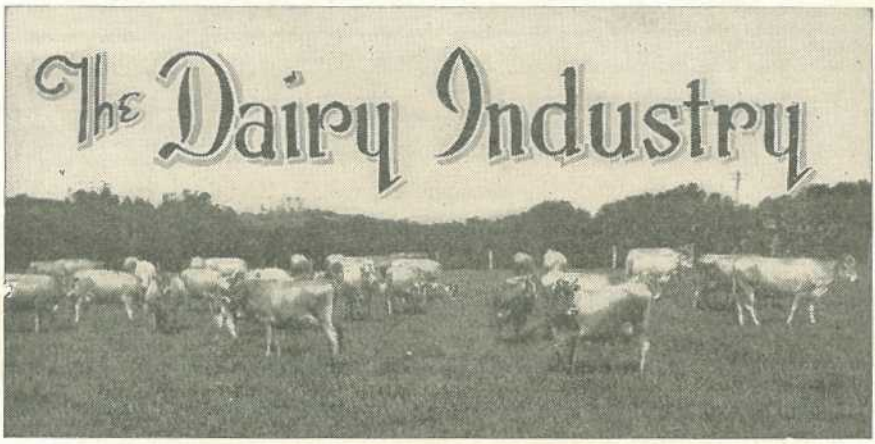
The ewes and lambs should be mustered and yarded the night before marking, thus avoiding operating when the lambs are in a heated condition, which leads to excessive bleeding.

All instruments should be cleaned and disinfected thoroughly. Ear-marking pliers should be frequently dipped in a prepared disinfectant in the course of operations.

There are two recognised methods of castration—viz., slitting and tipping.

Slitting has its advantages in that it leaves the wether with a more pronounced cod. However, when flies are bad there is a greater tendency for the lamb to become fly-blown. In tipping, the tip of the purse is entirely removed. Tipping is the better method of the two in the opinion of many sheepmen, as it leaves a cleaner wound with better drainage. The wound so made also heals more satisfactorily. Moreover, tipping is faster—a fact which counts when thousands of lambs have to be marked.

The best age at which to mark is from a fortnight to three weeks. A proved fly remedy, both curative and antiseptic, should be applied to all wounds. The use of old yards should be avoided if practicable.



Herd Testing and Recording.

THE object of herd-testing is to enable the farmers to estimate the worth of each cow in his dairy herd. The importance of this estimation is obvious. Not only does the farmer discover his best producers, from which to breed, but he also discovers the low producers—the animals which are definitely a liability, and which should be profitably removed from the herd.

Although it is necessary for a dairy farm to have the services of a good bull from a reliable milking strain, and also to practise the best known methods of handling and feeding stock in order to reach as high a production of milk as possible, it will be found that no appreciable standard will be achieved unless these methods are combined with systematic herd-testing and recording. From the knowledge so gained, low-producing animals may be gradually culled.

Queensland is one of the few countries in the world where herd-testing and recording is done absolutely free of cost to the farmers. Notwithstanding this it is remarkable that the response is so small. The fact is that a mere few hundred dairy farmers are availing themselves of this opportunity of improving their herds.

Probably some people have the idea that "something for nothing is not worth having." However, it is the sincere aim of the Department of Agriculture and Stock to assist farmers as much as possible, with a minimum of expense.

When farmers adopt the method of herd-testing advocated by the Department, an "application and agreement" form is sent to the farmer, asking him to sign it and return it to the Department of Agriculture and Stock. This form states that the farmer must be willing to submit his herd for testing five times at intervals of approximately fifty-five days. The lactation period of a cow is regarded as 273 days for the purpose of this testing scheme, and, therefore, it is necessary to test five times, with the required intervals between, if reasonable accuracy is to be attained in the estimation of the production of each cow.

When the "application and agreement" form is returned by the farmer after its completion, a case of composite sample bottles, each containing a few drops of preservative, together with a chart and measuring ladles, is sent to the farmer, with a request for him to take samples and return the case on a given date. One sample bottle is allowed for each animal. When commencing testing, it is not desirable to include cows which are more than 60 days in milk.

It is necessary for the farmer to weigh the quantity of milk produced by each cow over a 48-hour period, and to take a sample of milk from each cow at each milking during that period, using the large ladle for measuring the morning's milking and the smaller one for the evening's milking. The farmer must place each cow's name on the form supplied, and also the weights of milk and the dates of calving. The numbers on the composite sample bottles must correspond with those on the form opposite each cow's name.

When the sampling is completed, the farmer returns the box of samples, together with the chart showing particulars of cows' names and weights of milk, to the Department. This chart is returned to the farmer on completion of testing and recording by the officers of the Department. The cost of railage both ways on the case of samples is borne by the Department of Agriculture and Stock.

Estimating the Value of Each Cow.

Many people imagine that a cow producing a certain quantity of milk is worth more than a cow producing a smaller amount of milk. This would probably be so in the case of a farmer supplying milk for immediate domestic consumption, but it may not be so where cream produced from this milk is supplied to a butter factory.

The percentage of butter-fat varies considerably in milk from different cows. Therefore, the milk from the cow producing the smaller quantity may be much richer in butter-fat than that from the high milk-producing animal. This probably would result in the smaller milk-producing animal being regarded as the more valuable.

When the samples of milk are received from the farmer, they are tested by qualified testers, using the Babcock test. The object of this test is to ascertain the percentage of butter-fat in each cow's milk. When this is determined, it is multiplied by the quantity of milk produced during the preceding twenty-four hours and divided by 100, and this gives the quantity of butter-fat produced during twenty-four hours. This figure is again multiplied by the number of days between the date of calving and the date of the first test. The figure then obtained is the quantity of butter-fat produced during the first testing period. This procedure is followed for each of the five tests, and at the end of the 273-days period the quantity of butter-fat estimated for each test is added together, thus giving the quantity of butter-fat produced by each cow during the whole lactation period. The price of butter-fat is roughly calculated as 1s. a lb.; therefore, the value of each cow over the 273-days period is estimated by multiplying the number of pounds of butter-fat produced, by 1s.

Example.—A cow calved on 1st January and was tested on the following dates:—25th February, 21st April, 15th June, 9th August, and 1st October.

The weights of milk for 24 hours, together with percentages of butter-fat, were:—

14th February—25 lb. milk containing 3 per cent. butter-fat;

10th April—26 lb. milk containing 4 per cent. butter-fat;

4th June—20 lb. milk containing 4 per cent. butter-fat;

29th July—18 lb. milk containing 5 per cent. butter-fat;

20th September—10 lb. milk containing 4·5 per cent. butter-fat.

The quantity of butter-fat produced in the first test = amount of milk for 24 hours multiplied by rate of test, divided by 100, and this result multiplied by 55 (number of days between date of calving and date of first test)

$$= \frac{25 \times 3}{100} \times 55$$

= 41·25 lb. butter-fat.

Similarly, the quantity of butter-fat for the second test = 57·2 lb. butter-fat.

The quantity of butter-fat for third test = 44 lb.

The quantity of butter-fat for fourth test = 49·5 lb.

The quantity of butter-fat for fifth test = 23·85 lb.

Therefore, the total quantity of butter-fat produced during the 273 days = 4·25 + 57·2 + 44 + 49·5 + 23·85

= 215·8 lb.

= 216 lb. (nearest lb.).

Butter-fat is estimated at 1s. a lb.

Therefore, the cow produces 216 lb. butter-fat, which at 1s. per lb. = £10 16s. during 273-days lactation period.

It should be remembered that all the recording work mentioned is computed by the herd-testing staff, and at the end of the lactation period a final return-sheet is sent to the farmer, showing the quantity of milk and butter-fat produced by each cow in his herd over the 273-days period.

The farmer should not be content merely to find out what each cow in his herd is worth. He should take immediate action, if practicable, to remove the lowest-producing females from his herd, and concentrate on breeding from animals yielding the highest returns.

Inquiries about herd-testing should be addressed to the Under Secretary, Department of Agriculture and Stock, William street, Brisbane.

INFERIOR CREAM.

One of the most common sources of the contamination of cream, and one that is often overlooked, is the badly washed cream can.

More cream is spoilt by being stored or carried in a badly washed can than by most other ways. This applies to cans in good order as well as those that are dinted and rusty.

The reason is not far to seek. Hundreds of cans pass through the same rinsing water of the mechanical can-washer at the butter factory daily, and although a final steaming is carried out in the last stage of the washing process, it is not of sufficient duration (nor is it practicable) to sterilize thoroughly all of the cans thus treated.

It should be obvious that cans which have contained second-grade cream will require extra attention, in order to prevent the transmission of taints due to bacterial activity—such as cheesiness and rancidity—to the fresh supplies of cream.

A tallowy smell which is often found in returned cans may be due to inefficient washing, followed by exposture to the heat of the sun, causing deterioration of the fat.

It is, therefore, advisable, in order to safeguard the quality of cream, to rinse all cans on their return from the butter factory with boiling hot water to which a little washing soda has been added. The cans should then be rinsed with clean boiling water to remove all traces of the soda.

The storage of the cleansed cans is important. They should be placed upside down on a suitable rack to allow for cooling and drying. On no account should anything but boiling water be used for the final rinsing, nor should any attempt be made to dry the cans with a cloth. The storage rack should be placed in such a position as to be well removed from any possibility of contamination from the stockyard.

CREAM-STIRRING.

Some dairy farmers show by the cream which they send to a factory that they lack knowledge in regard to the care of cream on the farm. Clean methods in production may be nullified by the spoiling of good cream in the dairy.

As butterfat is the lightest constituent of cream it rises gradually to the top as soon as the cream enters the can. Therefore, in unstirred cream the lower layers, rich in separated milk—which contains a high proportion of casein, and consequently a low proportion of butterfat—are at the bottom. Changes in the separated milk due to bacteria are often such that when the cream reaches the factory it is graded down as sour and curdy.

A dry film on the top of the cream or layers of different colours and texture through the can tells the grader at once that the cream has not been stirred, and he is immediately impressed by the defects in it.

To keep a uniform consistency of cream and to ensure the best possible ripening conditions the cream should be cool before it is added to any existing supply. Regular stirring is then necessary to liberate accumulated gases and aerate the mass, which ensure uniform consistency. Aeration not only reduces the temperature of the cream, but also retards the growth of undesirable bacteria.

Stirring pays because no dairy farmer can afford to lose the difference in price between choice and lower grade creams on each consignment that he sends to the factory.

Live and Dressed Weight of Bacon Pigs.

THE loss of weight in transit of a pig from farm to factory and through the process of slaughter, dressing, and cooling varies with pigs at different weights. Generally lighter weight, unfinished pigs shrink more than heavier weight, prime conditioned stock.

Factors which affect the amount of loss are the size and weight of the pig; the way in which the pig has been fed and "finished"; the weather; distance from farm to factory; conformation and condition of the pig; the amount of food eaten before the pig is weighed alive. There also are variations in animal individuality; for instance, some pigs are of a nervous, excitable disposition, and fret, while others are more contented and are not affected by the journey.

In extensive tests it has been shown that, under conditions similar to those ordinarily ruling in Queensland, pigs weighing 150 lb. to 200 lb. alive on the farm lose about 10 per cent. of this weight in actual transit to the factory, and then another 20 per cent. in dressing and cooling off. Lighter pigs, weighing 100 lb. to 140 lb. alive on the farm, usually lose approximately 33 per cent. by the time they are dressed and cooled off. While these figures are possibly a fair average, individual pigs varied considerably.

On the sale of about 1,000 bacon pigs from experiments conducted conjointly by the Departments of Agriculture and Stock and Public Instruction in Queensland, results were as follows:—

All pigs were weighed after a twelve-hour fast at the sty. They also were weighed at the factory before slaughter not more than twenty-four hours afterwards and were weighed again in the usual way at the factory after slaughter. The average loss from live weight on the farm to actual

cold dressed weight at the factory was 30·5 per cent., varying from 25 per cent. to 34 per cent., with heavier losses on lighter weight stock marketed slightly unfinished for purpose of comparison.

These deductions may be accepted as a guide to the general average of factory deductions in Queensland.

ISOLATION PEN FOR SICK PIGS.

The distance betwen isolation pens for sick pigs and the pig yards or dairy structures is not so important as the relationship of these structures from another point of view. Thus, while advising a minimum distance of, say, 150 feet, it should be emphasized that such isolation should be so placed that—

(*a*) No drainage from it can spread to the main sties or any of the dairy buildings; and

(*b*) That if healthy pigs are allowed to wander, the isolation pen should be so guarded that they cannot make contact with it.

Ordinarily, therefore, the isolation pen should be on lower ground, and, if in the paddock in which pigs wander, should be protected by fencing in such a way that healthy pigs cannot come in contact with it.

CARELESS BRANDING CONDEMNED.

Most pig raisers are now conscious of the necessity for branding pigs offered for sale. Where practicable, the body tattoo method of branding is now in fairly general use. However, there are cases where it is desired to identify live pigs on arrival at bacon factories or saleyards, and for this purpose body tattooing is not suitable; in the absence of a more satisfactory method of branding, the firebrand is used.

The firebranding system is open to abuse in the hands of a careless man, and pigs which have been injured through faulty branding are sometimes noticed at bacon factories and saleyards. Their carcases are so blemished as to lower their value to the trade. The most common mistakes in firebranding are the use of too large a brand, and its application for too long a period—thus causing a deep burn in the skin of the pig which becomes an ugly sore.

Pigs with blemishes caused through faulty branding are not required by the trade. It is frequently observed that exporting buyers at the Cannon Hill saleyards refuse to bid for badly branded pigs. This, of course, reduces competition, and the blemished pigs are sold at a comparatively low price.

Where pigs must be firebranded, a small brand should be used; the pigs should be clean and dry, and the brand used very hot and applied lightly and quickly on the shoulder or neck.

Name and Address.	Name of Hatchery.	Breeds Kept.
G. Adler, Tinana	Nevertire ..	White Leghorns, Australorps, Rhode Island Reds, and Langshans
F. J. Akers, Eight Mile Plains	Elmsdale ..	White Leghorns and Australorps
E. J. Blake, Rosewood ..	Sunnyville ..	White Leghorns, Australorps, White Wyandottes and Rhode Island Reds
R. H. & W. J. Bowles, Glenmore Road, North Rockhampton	Glen	White Leghorns and Australorps
J. Cameron, Oxley Central ..	Cameron's ..	Australorps and White Leghorns
M. H. Campbell, Albany Creek, Aspley	Mahaca Poultry Farm and Hatchery	White Leghorns and Australorps
J. L. Carrick & Son, Manly road, Tingalpa	Craigard ..	White Leghorns
N. Cooper, Zillmere road, Zillmere	Graceville ..	White Leghorns
R. B. Corbett, Woombye ..	Labrena ..	White Leghorns and Australorps
T. G. Crawford, Stratford, via Cairns	Rho-Isled ..	Rhode Island Reds
Dr. W. Crosse, Musgrave road, Sunnybank	Brundholme ..	White Leghorns, Australorps, and Rhode Island Reds
Dixon Bros., Wondecla	Dixon Bros. ..	White Leghorns
Elks & Sudlow, Beerwah ..	Woodlands ..	Australorps and White Leghorns
W. H. Gibson, Manly road, Tingalpa	Gibson's ..	White Leghorns and Australorps
Gisler Bros., Wynnum	Gisler Bros. ..	White Leghorns
G. Grice, Loch Lomond ..	Kiama	White Leghorns
J. W. Grice, Loch Lomond ..	Quarrington ..	White Leghorns
Mrs. M. Grillmeier, Mount View, Milman	Mountain View	Australorps, Minorcas, and Rhode Island Reds
C. & C. E. Gustafson, Tannymorel	Bellevue ..	Australorps, White Leghorns, and Rhode Island Reds
P. Haseman, Stanley terrace, Taringa	Black and White	Australorps and White Leghorns
C. Hodges, Kuraby	Kuraby ..	Anconas and White Leghorns
J McCulloch, Whites road, Manly	Hindes Stud Poultry Farm	White Leghorns, Australorps, and Brown Leghorns
A. Malvine, junr., The Gap, Ashgrove	Alva ..	White Leghorns and Australorps
H. L. Marshall, Kenmore ..	Stonehenge ..	White Leghorns and Australorps
W. J. Martin, Pullenvale ..	Pennington ..	Australorps, White Leghorns, and Langshans
J. A. Miller, Racecourse road, Charters Towers	Hillview ..	White Leghorns

Name and Address.	Name of Hatchery.	Breeds Kept.
F. S. Morrison, Kenmore ..	Dunglass ..	Australorps, Brown Leghorns, and White Leghorns
Mrs. H. I. Mottram, Ibis avenue, Deagon	Kenwood Electric Hatcheries	White Leghorns
J. W. Moule, Kureen	Kureen ..	White Leghorns and Australorps
D. J. Murphy, Marmor ..	Ferndale ..	White Leghorns, Brown Leghorns, Australorps, Silver Campines, and Light Sussex
S. V. Norup, Beaudesert Road, Cooper's Plains	Norup's ..	White Leghorns and Australorps
H. W. & C. E. E. Olsen, Marmor	Squaredeal Poultry Farm	White Leghorns, Australorps, Black Leghorns, Brown Leghorns, and Anconas
A. C. Pearce, Marlborough ..	Marlborough Stud Poultry Farm	Australorps, Rhode Island Reds, Light Sussex, White Wyandottes, Langshans, Khaki Campbell and Indian Runner Ducks, and Bronze Turkeys
E. K. Pennefather, Oxley Central	..	Australorps and White Leghorns
G. Pitt, Box 132, Bundaberg ..	Pitt's Poultry Breeding Farm	White Leghorns, Australorps, Langshans, Rhode Island Reds, and Brown Leghorns
G. R. Rawson, Mains Road, Sunnybank	Rawson's ..	Australorps
J. Richards, Atherton	Mount View Poultry Farm	White Leghorns and Australorps
C. L. Schlencker, Handford road, Zillmere	Windyridge ..	White Leghorns
A. Smith, Beerwah	Endcliffe ..	White Leghorns and Australorps
A. T. Smith, The Gap, Ashgrove	Smith's ..	White Leghorns and Australorps
T. Smith, Isis Junction	Fairview ..	White Leghorns and Langshans
H. A. Springall, Progress street, Tingalpa	Springfield ..	White Leghorns
W. J. B. Tonkin, Parkhurst, North Rockhampton	Tonkin's Poultry Farm	White Leghorns and Australorps
W. A. Watson, Box 365, P.O., Cairns	Hillview ..	White Leghorns
G. A. C. Weaver, Herberton road, Atherton	Weaver's Stud Poultry Farm	Wyandottes, Indian Game, Barred Rocks, Australorps, White Leghorns, Anconas, Rhode Island Reds, Buff Orpingtons, Black Orpingtons, and Buff Leghorns.
H. M. Witty, Kuraby	..	White Leghorns and Australorps
P. A. Wright, Laidley ..	Chillowdeane ..	Brown Leghorns, White Leghorns and Australorps
R. H. Young, Box 18, P.O., Babinda	Reg. Young's ..	White Leghorns, Brown Leghorns and Australorps

Following is a list of new applications received up to the 24th January, 1940:—

J. E. Caspaney, Kalamia Estate, Ayr	Elvington ..	White Leghorns
T. Duval, Home Hill	Duval's.. ..	White Leghorns
F. G. Ellis, Old Stanthorpe road, Warwick	Sunny Corner	Australorps
H. Hufschmid, Ellison Road, Geebung	Meadowbank Poultry Farm	White Leghorns, Brown Leghorns, Minorcas, Australorps, and Rhode Island Reds
F. McNamara, Vogel road, Brassall, Ipswich	Frammara ..	White Leghorns and Australorps
C. Mengel, New Lindum road, Wynnum West	Mengel's ..	Australorps
S. E. Searle, New Cleveland road, Tingalpa	Tingalpa ..	White Leghorns
J. Steckelbruck, The Gap, Ashgrove	Cosy Nook ..	White Leghorns and Australorps
V. White, Cleveland	Pinklands ..	White Leghorns ..

WORMS IN POULTRY.

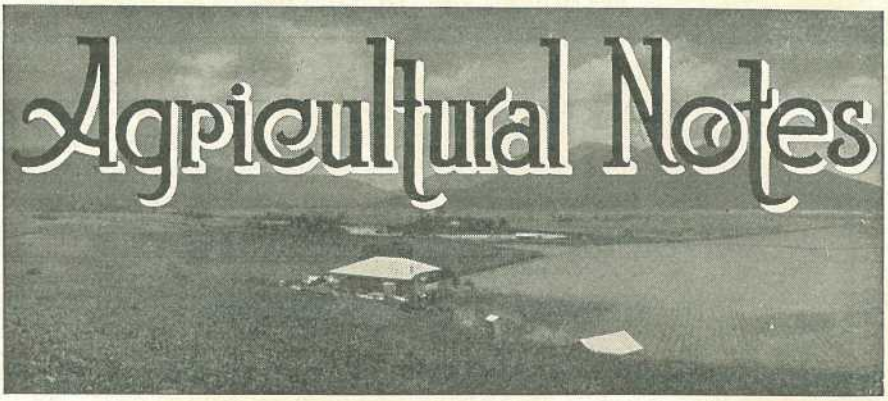
Many young birds will soon be commencing their first season of production. During the rearing of these birds diseases such as coccidiosis, pullorum disease, and roup will have taken their toll. These diseases are spectacular in their onset and the symptoms manifested and the mortalities experienced have compelled the poultry farmer to undertake control measures in order to minimize his losses as much as possible.

In many instances, however, worm infestation has been overlooked. The effects of worm infestation are usually insidious in nature, and being accumulative do not attract attention until the birds are seriously affected. Such effects include failure to make normal growth and even loss of weight, loss of appetite and activity, dull, ruffled plumage, and a paleness of the comb and shanks. The mortality, especially among young birds, may be serious. More important still, young pullets, while maintaining a ravenous appetite and being apparently in fair health, may not be producing their normal quota of eggs.

Of the various worms which infest poultry one of the most important is the large roundworm, which grows up to 4 or 5 inches in length, and is found in the intestine. Where the farmer pays careful attention to sanitation and cleanliness this and other worms rarely become dangerous. By the regular removal of droppings and the adoption of other measures which promote cleanliness, the source of infestation is removed. Prevention of infestation is most important in the control of parasitic worms. There are, however, certain drugs which may be employed to remove the worms from the birds, and if treatment is employed regularly the infestation should be of no great importance. Treatment of poultry for worms may be undertaken either by mixing certain drugs with the mash (flock treatment), or else by giving the drug to each individual bird (individual treatment).

Flock Treatment.—Flock treatment can be applied with success only when the birds are kept under intensive or semi-intensive conditions. The procedure is to mix nicotine sulphate with the mash at the rate of ·5 cubic centimetre of nicotine sulphate for every 1 lb. of dry mash. The amount of nicotine sulphate required is incorporated with just sufficient water so that when mixed the mash is flaky. About 1 part of nicotine sulphate to 400 parts of water is usually adequate. The mixing should be thorough so that no lumps remain. This treated mash is mixed fresh daily and fed continuously for four days.

Individual Treatment.—The best drug to use for individual treatment is carbon tetrachloride. This may be given in capsules or by means of a syringe and rubber tubing. The birds are starved overnight and treated next morning. They may be fed immediately after treatment. The doses range from ·5 cubic centimetres to 2 cubic centimetres, depending on the size of the bird. If the syringe is used great care must be taken to avoid delivering the drug into the windpipe, which would cause instant death. Before undertaking this treatment, farmers should apply to the Animal Health Station, Yeerongpilly, for further details.



Seed Maize Selection.

AS like tends to beget like, the necessity of selecting seed from ears of desired type and known parentage is obvious. Some farmers, however, do not realize the importance of this, and are satisfied to sow seed of any breeding, provided the grain is sound and germinates readily. Uniform tasselling and maturity cannot be expected from such seed. When times of tasselling do not coincide, there is poor fertilization of late-maturing plants and reduced yields follow.

The general improvement of a crop and the rapid elimination of undesirable characters can only be brought about by a regular process of seed selection. Isolation of the growing crop is necessary to ensure that cross-fertilization with maize in neighbouring fields does not occur. That is all the more important because wind and insects frequently carry pollen over long distances. Where isolation is not possible, sowings may be arranged so that tasselling times do not coincide.

It has been proved beyond doubt that locally-grown seed is more suitable for planting that comparable supplies of the same variety secured from outside sources. Farmers should, therefore, endeavour to improve their own seed by rigorous selection from year to year—provided, of course, the variety grown is continuing to give satisfaction—rather than buy seed annually, which cannot always be guaranteed as to its type and purity.

Seed selection may be carried out by the grower both on the field and in the barn.

Field selection is the better way, and it can be done conveniently when the corn is being pulled. More essential characters can be taken into consideration during field selection than are possible in the barn, where characters in the cob are alone considered. In the most rigid field selection the characteristics of only one parent can be determined, but even so seed selected from plants showing the following characteristics should give the best possible crop in the coming season:—

(1) The crop should have matured naturally, be thoroughly dry, and free from disease.

(2) Ears, when compared with the stalk, should be comparatively large and selected from those plants remaining upright.

(3) One good single ear to a plant is better than two mediocre ones, but where possible select from a plant with two good ears.

(4) Position of the ear on the stalk is important, for if too high from the ground harvesting is difficult, and the risk of lodging is greater. If too low there is a danger of loss through weed overgrowth and also slow drying out in showery weather.

(5) Most varieties sucker to a greater or lesser extent, but the smaller the sucker development the better the plant.

(6) The ears should be firmly attached to the stalk and droop when ripe. The point of the cob should be well covered by the husk as a protection against insects and the weather.

(7) The cob itself should be of moderate size, both in length and thickness, cylindrical (not tapered) in shape, having a well-filled butt and tip, yielding when threshed a high percentage of grain. Such cobs are much heavier than the average.

(8) The grain itself should be typical of the variety, uniform in depth and shape, and tight on the cob in regular straight rows.

Of all the characteristics in the grain, the farmer can least afford to overlook mixed colour, for maize showing this defect sells at a disadvantage if the crop is sold in the open market.

THE TRENCH SILO.

Large quantities of suitable fodders—comprising maize, sorghums, panicum, lucerne, and useful native grass and herbage mixtures on cleared pasture areas—are growing at present in many districts. That interest is being taken by more farmers in the conservation of the season's abundance is shown by the number of pit silos being constructed for the storage of the summer fodder surplus. There also is, however, some evidence of apparent apathy in respect of the establishment of fodder reserves. As much of this material has now reached the prime stage, the best way to conserve it would be to place it in a trench silo, and the attention of dairy farmers is directed towards this cheap and effective method of storage.

A few important points in the construction, method of filling, and emptying of the trench are briefly given for the benefit of interested farmers.

Select a reasonably level and well-drained site as near the place of feeding as conveniently possible. Mark it out according to the capacity required. A trench 30 feet in length, 8 feet wide at bottom, 12 feet at top, and 8 feet deep, having an outslope at each end of 1 in 3 grade, would hold approximately 45 tons. By altering the length and retaining the other measurements, the capacity may be increased a ton for each additional foot length.

To construct the trench, excavate according to the desired dimensions, using plough and scoop and depositing the spoil along either

side to back up the logs, which should be placed lengthwise to raise the walls 2 feet above the surface. Complete the job by trimming the walls smooth with mattock and spade.

The cost of construction involves labour only, and the time taken would vary according to the nature of the ground. In ordinary circumstances, two men equipped with suitable plant should excavate a trench of 45-ton capacity in about two or three days.

In filling the trench silo there is no necessity to chaff the material, full-length crops being loaded in the field and drawn through the trench, off tipped, and spread in even layers lengthwise, the empty vehicle passing out the other end. Thus each layer is consolidated as a result of the trampling of the horses' action throughout the whole filling process.

Should the crop be at all dry through over-maturity or as a result of frost, a sprinkling of water may be added during the filling process. The filling should continue well above the surface, forming a parapet of about 3 feet high, sloped towards the sides of the trench.

Complete the filling by covering it with grass well watered, finally topping with a 9-inch to a 12-inch layer of earth.

The material so stored will be fit to use as silage in from two to three months after filling, if so desired, or it may be safely stored for many years without undue deterioration or loss.

To remove the silage for use, the trench should be opened up at one end, taking the earth and grass covering from a portion only as required, and cutting down vertically with a sharp inplement, such as a spade or hay knife. When a complete face section from top to bottom has been removed, an adze may be used to slice off additional material in a semi-chaffed or short-chopped form, resulting in its being in a more acceptable condition for feeding direct to stock without further preparation.

The silage may be fed as it is to practically all classes of stock. For cows in full milk, however, better results are obtained by the addition of a small quantity of protein-rich fodder and concentrate—such as lucerne chaff and cotton-seed meal.

Further particulars about silos and silage may be obtained on application to the Under Secretary, Department of Agriculture and Stock, Brisbane.

ESTABLISHING LUCERNE.

Lucerne is grown for hay purposes chiefly in warm districts on deep calcareous soils provided with abundant moisture. In such situations heavy crops are produced over a number of years. Within recent years the cultivation of lucerne has been extended into fairly dry districts, but most success may be expected on soils rich in lime and with ample moisture available to the plants.

Land intended for lucerne is best cropped with a cereal—such as wheat, oats, barley, or rye—or panicums and millets—prior to its preparation for lucerne. Stubbles should be cultivated to induce volunteer growths of weeds and other seeds; these should be turned in subsequently by ploughing. For a first cultivation, two deep ploughings should be

given at right angles to each other. Moisture should be conserved by frequent cultivation. In dry districts, where a good rainfall cannot always be depended upon at seeding time, fallowing is particularly necessary for the purpose of conserving moisture. The land may therefore be ploughed in late autumn or early winter the year before it is intended to sow. The depth of the ploughing is governed by the character of the soil. Alluvial soils should be ploughed to a depth of about 7 inches, but on other classes of soil of lighter or more porous nature a depth of 4 to 5 inches is sufficient. The ploughed land should then be allowed to lie in the rough state for a month or so and be broken down with harrows after summer rains. During summer the land should be frequently worked with harrows or cultivators, so as to allow neither growth of weeds nor the formation of a hard crust on top. If the seed-bed cannot be worked down sufficiently fine with the harrows, a one-way disc cultivator or roller will do all that is necessary. If the land is rolled, it should be harrowed immediately after the rolling. Where the soil surface shows a tendency to dry out just prior to sowing, a light ploughing may be given and followed by the harrows. Sowing on top of the harrowed surface, followed either by a light rolling, or by brush harrowing, is a good practice—but if rolling is adopted, a set of light harrows should be used immediately afterwards. Rolling assists in bringing the soil particles in closer contact with the seed and works in the same manner as compressing a partly dried-out sponge.

Lucerne is best sown in April or May, the young plants then being sufficiently well established before the onset of cold weather to enable them to survive. Provided the seed is drilled in, a sowing rate of 12 to 14 lb. per acre is ample, and often too much, in the best lucerne-growing districts. If hand broadcasting is practised, slightly more seed should be used. The rate of seeding should be lighter in dry districts, and for grazing purposes, a seeding of as low as 2 lb. per acre is permissible. Seed sown on the surface should be covered by means of a light harrowing.

Though fertilizers are not used to any considerable extent in the main lucerne-growing areas, many growers have obtained payable results by applying up to 1½ cwt. of superphosphate per acre, either drilled in with the seed or used as a top-dressing. Nitrogeneous fertilizers appear unnecessary.

Fully a month or six weeks will pass before the young root system becomes established and the lucerne is fit for its preliminary cutting by the mower. An early mowing, before the young lucerne flowers, acts as a pruning and stimulates the root growth. After the preliminary cutting, a light harrowing may be made if absolutely necessary because of foreign growths.

Often promising stands of lucerne, following good germination, are destroyed through cutworm attacks. Damage at this time is irreparable, for the blank spaces are filled with weeds which considerably lessen the value of the crop. The Paris green-bran cutworm bait broadcast at the rate of 30 lb. per acre gives effective control, provided it is distributed as soon as the depredations of the pest become apparent. The necessary materials should therefore be held in stock on the farm for emergency. Cutworms attack only very young lucerne and intelligently applied baiting is then quite safe. Bait distribution in established crops is undesirable because of the possible risk of stock poisoning.

IMPORTANCE OF MOLASSES AS FERTILIZER.

Reference was made elsewhere in this Bulletin to the danger of a potash shortage with which Queensland is faced, should overseas supplies of this fertilizer not come forward regularly. In this event, the economic utilization of molasses as a fertilizer assumes a new significance. On current production, some 13,000,000 gallons of molasses are utilized annually in the cane areas, either as fuel, feed, or manure. Allowing an average potash content of 3 per cent. (equal to 6 per cent. muriate of potash), the "available" molasses is equivalent to almost 5,000 tons of muriate of potash, which is capable of supplying the annual requirements of the Queensland canegrowers.

Of course, the most economic utilization of this by-product cannot be made to enable the substitution to be complete. Much of the molasses is available in areas where the use of potash fertilizers is not absolutely essential: it is not possible to spread the material conveniently at a rate less than about 5 tons per acre, which supplies potash in excess of the needs of the crop immediately following; and the transportation of molasses more than a few miles from the mill quickly adds to its cost.

At the same time, it is well to recognize that this material does provide the means for overcoming what may be a substantial difficulty. Mills could assist in alleviating a shortage, should it arise, by carefully rationing such molasses (or ashes produced by the burning of the material), so as to confer the widest benefits on all suppliers. Canegrowers, in turn, could also help out by refraining from all potash purchases, in an emergency, for those fields which have just been given a top dressing of molasses. This piece of advice to the farmer is, of course, one which is made by the Bureau at all times. There is little virtue—and possibly much expenditure—in applying, say, 100 lb. of muriate of potash per acre, to land which has already been given the equivalent of 600 lb. in the form of a molasses application.

—H.W.K., in "The Cane Growers' Quarterly Bulletin."

THE PLOUGH.

The plough is still the most important implement in agriculture, in spite of all the engineering progress which has been made. Over and over again it has been claimed that our modern cultivators have reached the stage of development when they are considered capable of doing the whole work of preparing the soil without the use of the plough. But time has proved that the plough still remains indispensable. The rototiller, or some other implement, may one day push the plough on to the farm scrap heap, but that time has not come yet.

Most of the bad ploughing seen on a day's run through farming lands can be traced to the faulty setting of the plough. Apart from other points, the influence of "set" on the draught of the plough is very great. Another serious result of faulty setting is the wear and tear on the plough itself.

Again, disc ploughs with badly-worn discs are frequently seen in use. Provided the plough is otherwise mechanically sound, the obvious remedy for faulty ploughing in such cases is to fit a new disc.

After all, it is not a hard job to set a plough properly. There is no magic or mystery about it. No special skill is called for. All that is required is a fundamental knowledge of the purpose of each part of the implement, and the ability to use that knowledge, so as to make each part work in harmony with the whole, and thus preserve what is known as the "balance" of the plough. Any experienced ploughman will show the new hand how to set the implement, and there is nothing better than a sweetly running plough.

THE HORSE'S NOSEBAG.

The nosebag for working horses is more or less a necessary evil. Usually, it gets scant attention, and yet the owner of horses so fed often wonders why they go off their midday feed, and yet eat greedily at night. He is then inclined to make the midday feed too light and the night feed too heavy. The reason is plain. Food residues in the nosebag have soured, because of the presence of moisture and saliva.

The considerate horse owner will turn the nosebag inside out each day and expose it to sunlight. Further, he will always keep a spare nosebag to use when the other goes to the weekly wash in hot suds.

RHODES GRASS AS A HAY CROP.

While the value of Rhodes grass as pasture is well recognized in Queensland, its usefulness as a hay crop is little appreciated. Not only could fodder reserves be built up on the farm or station by conserving surplus Rhodes grass pasturage as hay, but, in some circumstances, sowing down of special areas to Rhodes grass for hay would be sound agricultural practice.

The cutting of hay from grassed country will be restricted, necessarily, to cleared land with a fairly even surface, and is practicable only in seasons of abundant growth. When seasonal conditions are such that a surplus of grass is indicated at an early date, the paddocks which can be mown should be closed to all stock and permitted to develop to the hay stage, when the crop may be harvested. In normal seasons, if the cutting is made during summer, the grass will recover quickly.

Apart from lucerne, the main summer-grown hay crops (e.g., Sudan grass and millets) are annuals. Cropping with annuals has the very obvious disadvantages of high cost of production and of exposing soils to erosive influences, particularly storm waters. A perennial or long-lived hay grass costs little to maintain, prevents erosion, improves the texture of the soil, and adds materially to its organic content. Although it is not suggested that Sudan grass and millets should be abandoned as hay crops in favour of Rhodes grass, farmers and pastoralists might well give consideration to the testing of Rhodes grass for hay purposes.

Because of its susceptibility to injury by heavy frosts, Rhodes grass is, however, not likely to prove more useful than a rotation of annuals in the colder regions of the State, such as parts of the Darling Downs.

In the drier localities in which Rhodes grass is grown largely, the hay is easily cured. In most cases it should be in the stack within forty-eight hours of cutting. The yield varies, of course, with seasonal and soil conditions, but on fertile soils young stands should provide at least two cuttings a year, each of 1½ to 2 tons of hay to the acre. The quality of the hay, particularly its palatability, is somewhat variable, but all classes of stock will eat it without much waste.

LUCERNE ON THE DOWNS AND MARANOA.

Although comparatively few settlers in the Western Darling Downs and Maranoa districts have established lucerne stands, it is significant that most of those who have done so plan a considerable increase in acreage. The qualities of lucerne as a grazing proposition, both for sheep and cattle, are gaining wider appreciation outside the recognized agricultural regions. The results obtained on scrub and forest lands during dry spells at Guluguba, Coolumboola, Wallumbilla, and other localities are very encouraging. An adaptation of lucerne to a wide range of soils and a capacity for giving good results under adverse climatic conditions were clearly demonstrated.

In sowing lucerne, high seeding rates are unnecessary and have been the cause of many failures in the past; 3 to 4 lb. per acre is quite heavy enough for the districts named.

With the wide variation in farming conditions and soil types that obtain in these districts, hard and fast rules regarding sowing are not practicable. The following points are, however, important:—Deeper sowing than ¾ inch is inadvisable in all soils, except those of a self-mulching nature where, if necessary, the depth may be a little greater—provided that there is sufficient moisture to give the plant a good start, in addition to germinating the seed.

Where old wheat land is to be converted into pasture, it is usual to sow the lucerne with the last crop of wheat. This method reduces costs to some extent; but, in soil that has a tendency to pack or cake after rain, it is advisable to drill the wheat in first and then follow with the lucerne—having the drill hoes out of the ground, and covering with light harrows. This avoids planting the lucerne at the same depth as the wheat—i.e., 2-2½ inches.

When broadcasting, it is difficult to get an even sowing with the small seed; but, if two sowings are made, one across the paddock and the other in the opposite direction, a more even crop can be obtained. Only light harrows should be used to cover the seed.

On small holdings where more intensive culture is practised, a method of sowing which might commend itself to dairymen, particularly in the Maranoa district, is to plant lucerne in rows 18 inches to 2 feet apart. Inter-row cultivation may then be practised when necessary after rain. Established in this way, the plant has exceptional drought resistance and an area of green feed for emergency use is assured.

All settlers in the reclaimed prickly-pear country might well turn their attention to lucerne as a grazing crop. With light seedlings it is not expensive to establish and is well worth a trial.

CLOVERS ON THE COAST.

A marked increase in milk production in late winter and spring when white clover is plentiful in the pastures is a common experience in coastal dairying districts. Unfortunately, it is not every year that weather conditions are favourable for the development of a good growth of clover in unimproved paspalum pastures.

Generally, the requirements of clovers are a fertile and not too acid soil and a fair supply of soil moisture. Where white clover is naturally abundant in paspalum pastures it may be taken for granted that its requirements are supplied, but it is true that the production of thousands of acres of paspalum pasture could be improved by the encouragement of clover growth.

Soils which are distinctly acid can only be made suitable for clover growth by the use of lime. If the fertility of the soil has been lowered by many years of grazing, it is advisable either to renovate with the plough or paspalum renovator and topdress with fertilizers. On suitable areas it may be preferable to plough out the pasture and grow a green manure or some other form of crop prior to resowing the area with a mixture of grass and clover seeds. Renovation and green-manuring practices, in addition to increasing soil fertility, also tend to increase the water-retaining properties of the soil.

In all cases where pasture has been renovated, or where new permanent pastures are to be sown, it is advisable to add clover seed to the pasture. The clovers which have proven themselves of outstanding usefulness for incorporation in permanent pastures are white clover and red clover, and both should be included in permanent pasture sowings on the sub-tropical coast. White clover provides good grazing from about August until November, while red clover makes the bulk of its growth from September till March. Compared with white clover, red clover is a short-lived plant and dies out in a pasture within two or three years. It is of great use, however, in providing feed during the first year while the white clover is establishing itself.

When sowing on renovated paspalum or in new pasture mixtures, about 1 lb. per acre of each of the clovers should be used. New Zealand strains of white clover are superior to European or local strains of which commercial seed its available; the best seed to use is New Zealand Government-certified white clover seed. New Zealand strains of red clover also are preferable to other commercial types.

PREPARING LAND FOR WHEAT.

Widely distributed rains since December have enabled farmers to go on with the preparation of wheat lands. Fields ploughed during December will now be in good physical condition, provided weed growth has been controlled by judicious cultivation.

Where sheep have access to the fallowed areas weeds will not be troublesome, but elsewhere every effort should be directed towards the eradication of all such growths. If it has been possible to control weed growths, all workings following the initial ploughing can be done entirely with rigid-tine cultivators, or spring-tooth implements, and with harrows. Cultivation to the desired depth in order to break the crust

and form a good surface mulch should be done soon after all substantial rains. As a firm seed-bed is required, it is important to progressively reduce the depth of working towards seeding time, particularly where sheep are not available to assist in consolidation.

Well-prepared land containing ample reserves of moisture is often fit for sowing at a seasonable period, according to the variety selected, independently of favourable rains. On the other hand, hurriedly prepared land may have to await later rains to effect germination—a great disadvantage, for early or seasonably sown crops invariably give the best average returns.

Where wild oats and other weeds are assuming pest proportions, it is suggested that the land be sown to a good fodder oat, which can be grazed as required, ploughing in the residue in sufficient time to prevent the maturity of the wild oat seed.

Weed infestations during the following year can thus be greatly reduced, besides providing valuable feed, and a rotation crop of benefit to the land.

CEMENTED BAGS FOR LIGHT FARM BUILDINGS.

The ubiquitous chaff and cement bag can be turned to good account in the building of fowl houses or similar farm buildings of light construction, according to the following plan, which has proved successful in practice.

A framework of timber is first of all built up, after which wheat or cement bags are opened out and stretched very tightly over it, being nailed down with §-inch clout tacks. Next, a mixture is made up as follows:—

Water, 1¼ gallons,
Cement, 12 lb.,
Lime, 2 lb.,
Salt, 1 lb.,
Alum, ½ lb.

(In damp weather use 1 pint less of water.)

Sieve the salt and lime together through a five sieve—to thoroughly mix the materials and get rid of any big lumps—add the water and then the cement—stirring while adding—and finally the alum. Wet the stretched bags with water and apply the mixture without delay, using a fairly stiff brush, first on the outside, and then on the inside. Before the mixture sets, but after the initial wetness disappears, apply a second coat to the outside. When this sets, the bags will be quite hard and stiff, somewhat like plaster board. Subsequent coatings will, of course, make a stronger board.

The cost of the process, including bags for the foundations, works out at about 8d. a square yard. From this it will be seen that it is a very cheap and easy method of construction. Sheds built according to this plan three years ago show no signs of disintegration.

ENERGY OF GROWTH IN SEED GERMINATION.

With seed germination tests it is the practice to count off the percentages of seeds which have germinated each day, and to report results as so much percentage in so many days.

The following shows the daily counts of three samples of seed put out to germinate:—

	Day Percentages.					Total.
	2nd.	3rd.	4th.	5th.	6th.	
						Per Cent.
Sample A	99	..	..	..	..	99
Sample B	45	20	25	..	..	90
Sample C	20	30	40	..	..	90

These figures give the energy of growth, or germination energy.

Obviously Sample A is the best. Although the total germination of B and C are equal, B, by its capacity to get an early start, would be superior to C.

With seeds for sowing, it is necessary to distinguish carefully between mere capacity to germinate and energy of growth. Rapidity and uniformity of germination, so that the roots in their initial stages may become firmly established and the plants may appear above ground with a degree of uniformity, are desirable qualities. Moreover, slow germination and development generally indicate constitutional weakness of the young plants; anything checking their early progress produces conditions favourable for the attack of insects and fungi.

Adverse conditions of weather and soil often destroy all but the vigorous growers.

FERTILIZER AND MANURE.

Some confusion is often caused by the indiscriminate use of the words fertilizer and manure. Although interpretations or definitions may vary in various parts of the world, in Queensland the terms as implied or defined by the Fertilizers Act have the following meanings:—

Fertilizer is any manufactured or natural substance sold or offered for sale for application to the soil for the use of plants and/or remedying any soil deficiency, and which has been prepared in such a way that it is stable, dry, and in a form fit for storage; if insoluble, it must be ground to the required degree of fineness.

Manure is farmyard, sheep, poultry, or stable manure, or other natural organic material of this type which has not been dried or treated in any way, to render it fit for sale in the ordinary commercial way as a fertilizer.

French Beans.

A CONSIDERABLE variety of beans is grown in Queensland, but certain varieties are outstandingly more popular than others. The Canadian Wonder is an all-round favourite on the market, but because of its susceptibility to disease is not grown to the same extent now as formerly. Brown Beauty is very popular in North Coast districts, where it is known as a hardy and prolific variety. Stayley's Surprise also is grown extensively, and is usually planted two or three weeks earlier than Brown Beauty. Other varieties grown to a lesser extent are Feltham's Prolific and Burnley Selection, the latter being a new variety supposedly blight-resistant.

Plantings may be made at almost any time of the year, depending on local conditions in each district. On the North Coast, on areas free from frost, June and July are the two main months for planting. Other districts prefer spring or summer planting.

In some parts of the State in the past great difficulty has been experienced in raising a crop during the hot months because of the ravages of the Bean Fly, but experiments have shown that it is possible to obtain at least partial control of this pest by spraying. Information on this and other pests and diseases of beans can be obtained on application to the Under Secretary, Department of Agriculture and Stock, Brisbane.

In preparing land for general market garden crops, along with cultivation they generally require the free use of well-rotted stable or other manure, but in the case of beans the application of heavy dressings of such manures often results in the production of an over-abundance of foliage and poor setting of pods. Beans grow best in a well-cultivated soil, and preferably one that has been manured for a preceding crop. Well-drained clayey loams yield the best result.

Fertilizers should be freely used. There are on the market several commercial complete fertilizers for beans, sold by well-known and

reputable firms, which can be purchased with confidence. The customary dressing is 6 cwt. to 8 cwt. per acre. It should be applied in the bottom of the drills, covered with about an inch of soil before planting the seed.

Planting is usually done by striking out drills about 6 inches deep and, after applying the fertilizer and lightly covering this with soil, dropping the seed by hand and again raking in a light covering of soil. During subsequent cultivation the drills will gradually fill up. The rows may be 2 feet 6 inches to 3 feet apart, and the seeds spaced 6 inches to 8 inches in the rows. Thirty-five lb. of small and 52 lb. of large seed is sufficient to plant an acre.

Horse cultivation is usually carried out, but it is not advisable to commence this work in the early morning, or at any time when the plants are wet, as the spores of certain diseases are more easily spread under these conditions.

Weeds should be kept in check, as they will seriously affect the growth of the crop.

The maximum output of beans can only be gained by picking thoroughly as they become fit, that is, when young and tender; otherwise then will begin to form seed, and the plants will cease to bear marketable beans.

APPLE AND PEAR VARIETIES.

Orchardists in the Stanthorpe District who may be planning a planting programme for the coming season are advised to place their orders with reliable nurserymen without undue delay. Early ordering ensures early delivery of the young trees.

As regards varieties to plant, the Granny Smith is likely to be the best commercial apple for many years to come. If reasonably well treated, it will give a good crop every year.

Some growers are inclined to think that the market will be overloaded with Granny Smith apples when young trees already planted come into bearing. This is not likely to happen.

The Stanthorpe Granny Smith is equal to if not superior to any grown in the Commonwealth. The keeping qualities are good, and far more should be cool-stored than at present. Stanthorpe apple-growers should try to supply the requirements of their own State with Queensland-grown apples as long as possible by using the available cold-storage facilities.

If the Granny Smith crop in the Stanthorpe district were doubled, or even trebled, there should be no difficulty in marketing the fruit at existing or even enhanced prices.

In addition to the Granny Smith, which should be the main variety, Delicious, Lalla (Red Delicious), Winesap, and Red Statesman are good types.

Red Statesman, and, in addition, Dougherty are eminently suitable for the late "private order" trade. Growers who specialise in this trade should cater for their customers over as long a period as is possible. Stocks are frequently exhausted long before they should or need be, and then supplies have to be drawn from elsewhere.

The Gravenstein is a good early dessert apple well worth growing. On account of its susceptibility to gnarl or twist, it is advisable to grow a scaffold tree of another strong-growing variety, such as Delicious, and then rework with Gravenstein scions from selected trees free from the trouble.

Growers should be wary of planting new varieties of apples. Generally it is a good plan to plant only standard varieties and let someone else do the experimenting. Though new varieties may have good characteristics, they are seldom better than those already grown, and, being unknown to the trade or the householder, the fruit is viewed with suspicion and is difficult to market.

As regards pears, the best commercial varieties are Williams Bon Cretien, Packhams, Triumph, and Beurre de Box—all are good growers and croppers.

The Winter Cole is a late-maturing variety which is popular in the other States. Stanthorpe growers should, however, limit their plantings of this variety on account of possible fruit fly attacks at the end of the season.

SUBSTITUTE BUNCH COVERS IN BANANA RUST THRIPS CONTROL.

During recent years, paper tubes have been used in some districts as bunch covers for the protection of bananas. In the winter months particularly, when the plants are partly defoliated and the fruit fills out slowly, the tubes reduce the amount of wastage due to sun scald and cracking, which are associated with harsh climatic conditions. They also promote better filling of the fruit.

The possible utility of these tubes as substitutes for the hessian bags which are essential in the recommended measures for banana rust control thus merits consideration. The present recommended control measures prescribe close meshed "sugar" hessian covers for the bunch and weekly dustings with a nicotine dust for a period of four weeks. At the present time hessian is somewhat expensive, and the market is short of supplies. Substitute materials are thus a matter of importance to the banana grower. Recent investigations at Nambour have shown that paper tubes can be almost as efficient as hessian bags in the thrips control programme, under conditions of moderate rust infestation. This holds true only if the tubes remain intact during the growth of the bunch. The tubes must therefore be made from strong paper with sewn rather than gummed seams. They must also be large enough to comportably cover the mature bunch without pressure from the outstretched hands of fruit.

In practice, then, the grower may use paper tubes in his covering plus dusting programme for rust control, proceeding in much the same way as the standard recommendations prescribe. Thus, the tube would be fitted to the bunch as soon as it is thrown, a nicotine dust then being applied through the lower opening. Further dustings would similarly be given at weekly intervals during the next three weeks.

In order to simplify both dusting and harvesting, the tubes should be distinctly branded with symbols to show the approximate date on

which the bunch was thrown. Letters (for the month) and numbers (for the week in the month) have proved suitable; thus "J.1." would indicate a bunch thrown in the first week of January, and "M.3." a bunch thrown in the third week of March. From these brands, the grower can see at a glance which bunches require dusting. He will also know, from his knowledge of the plantation, the approximate date on which the bunch should be cut. No time is lost in examining half mature bunches, and once a bunch is seen to be nearing maturity, some of the leaves can be pulled down to assist in finding it again in later cutting rounds.

LETTUCE GROWING.

Lettuce is one of the most popular vegetables, and with regular sowing and care in cultivation it may be grown the whole year round. In Queensland, the best times for planting are the late summer, autumn, and winter.

Lettuce is a vegetable that must be grown quickly to ensure crisp leaves. If a check is received during growth the leaves acquire a slightly bitter taste, which tends to decrease the market value of the plants. This defect is more prevalent during the late spring, early summer, and autumn plantings.

The soil should be well cultivated, and it is desirable that, where possible, large quantities of well-rotted farmyard manure be incorporated with the soil. Should fresh manure be used some time should elapse before planting.

Lettuce may be grown in a seed-bed and transplanted into rows, allowing 12 inches between the plants. The seed may also be sown directly into the row and the plants later thinned out to the required distance.

Sow the seed thinly and cover lightly with fine soil, and then firm the ground gently.

During the growing period the soil around the plants must be kept cultivated, but care must be taken not to allow any soil to get on or into the hearts of the plants. Constant watering is essential and the soil should never be allowed to dry out. Should the plants appear to be growing slowly an application of liquid manure would be beneficial, or, failing this, a top-dressing of nitrate of soda or sulphate of ammonia at the rate of 1 to 2 cwt. per acre. These fertilizers should be spread lightly over the ground, but under no circumstances on the plants.

Lettuce should be marketed as soon as possible after cutting, as they deteriorate in quality very quickly.

The cabbage type of lettuce is the popular one in Queensland, and should be cut for market as soon as possible after hearting. For home use lettuce may be used earlier.

Popular varieties for planting are:—

New York or Neapolitan.—A very large variety, best suited for planting in the cooler months.

Iceberg.—A large, good-hearting variety, with crinkled leaves and pink tips, suitable for planting in warm weather.

A pamphlet on packing of lettuce for market is obtainable free on application to the Department of Agriculture and Stock.

MARKING CASES.

Banana-growers are reminded of the necessity of marking legibly on each end of the case the variety of banana contained therein when forwarding on to the Victorian market.

To assist growers, the approved abbreviation of each variety is given hereunder:—

Name of Variety.	Abbreviation.
Cavendish	Cav.
Williams Hybrid	W.H.
Mons Marie	Mons
Veimama	Vma.
Samoan China	S.Ch.
Lady's Finger	L.F.
Manilla	Mnl.
Pear	Pear
Sugar	Sug.
Plantain	Ptn.
Laubin, Lobin, or Lubin	Lbn.
Gros Michel	G.M.

The regulations require that the name of the variety shall be in letters of not less than three-quarters of an inch in height if stencilled on the packages, and not less than one-quarter of an inch if printed on a label or sticker.

Growers, therefore, should brand all cases of bananas forwarded to the Victorian markets with the name of the variety.

REWORKING DRONE CITRUS TREES.

In orchards where undesirable types of citrus trees have been cut back for re-working, the final thinning of shoots not required for budding into may be done. Where necessary, the trunks and limbs should be re-whitewashed to continue protection from sunburn. In districts where the growth of new shoots is sufficiently advanced (they should have attained a diameter of some $\frac{3}{8}$ inch at the base), and providing that the sap is flowing freely, they may be budded.

When the shoots are ready to receive the bud, a perpendicular cut is made in the bark at or near the base. The cut should be from 1 to $1\frac{1}{2}$ inches in length, and in depth through to the cambium layer. Another cut is then made horizontally across the top of the perpendicular one, so that the two together form a T.

Budwood should be taken only from selected trees which are healthy and vigorous and noted for consistent production of heavy crops of quality fruit. Budwood should be well rounded, mature wood about the thickness of an ordinary lead pencil or slightly less and not more than one year old. Before the buds are cut from the budstick, the leaves are trimmed off so that a piece of the leaf stalk or petiole is left in each case. By this means the bud can be more easily handled after cutting.

The bud may be cut off the stick either from above or below, but the general practice is to cut from below the bud upwards, commencing about half an inch below and ending about half an inch above. The cut must be made with a sharp, thin-bladed knife, and be just deep enough to remove a very thin layer of wood. In the absence of thorns, the wood may be carefully removed from behind the bud, care being taken not to damage the bud.

The bud is then inserted down and under the bark of the stock by raising the latter with the budding knife. In order to bring the bud and stock in close contact, they are bound tightly together with a raffia tie. In from two to three weeks the bud, if it remains green, will have taken—that is to say, united with the stock. The tie may then be cut and the head shortened back to force the sap into the bud. The stub may be utilized to support the shoot from the bud during its early growth, but when the shoot has made good growth and is strong enough to support itself the stub should be removed altogether.

A SEASONAL REMINDER TO CENTRAL QUEENSLAND TOMATO-GROWERS.

If tomato seedlings are sought from outside sources, they should be obtained from reliable growers offering varieties true to type and free from crop-reducing pests and diseases. Correct attention to the seed-bed is of paramount importance in the production of strong, healthy plants. Hygienic practices in the seed-bed will greatly assist in reducing losses from diseases and pests.

When preparing the seed-bed, select a small area of newly-burnt virgin scrub land on which no lantana has previously grown. Level or slightly sloping ground is preferable. Oblong beds just wide enough to permit the grower to reach to the centre without undue exertion are advisable. They should be dug to the depth of an ordinary garden fork, and raised about 4 inches above the natural surface of the ground to ensure drainage. The soil in the beds should be reduced to a fine tilth and the surface levelled and firmed with the back of a spade before sowing the seed. When seed has been evenly and not too thickly scattered over the beds, cover lightly with fine soil. Treatment of seed with a solution of corrosive sublimate before sowing is a desirable practice. Information on seed treatment methods may be had on application to the Department of Agriculture and Stock.

To assist even germination of seed, the bed may be lightly covered with dry grass or hessian. Should hot sunshine prevail after the young seedlings appear, remove the covering from immediately above them to a higher level on a framework made with light forked sticks and crosspieces.

Harden the developing plants, so that they can withstand conditions in the field, by gradually reducing the grass or hessian covering until they are fully exposed to the sun for a short period before transplanting. Frequent watering of the seed-bed to maintain an even and ample soil moisture condition is essential. During the time the young plants are growing in the seed-bed they should be sprayed and dusted as a safeguard against pests and diseases. A 2-3-40 formula of Bordeaux spray mixture is recommended as a control of tomato plant diseases in

seedlings. The chief seedling pest is the tomato mite, for which dusting with a good grade of dusting sulphur is recommended. The sulphur may be conveniently applied with a dust gun or by shaking it over the seedlings from a sugar-bag or some similar container which allows the dust to filter through the mesh.

When plants have grown to a height of 6 or 7 inches, they are ready for transferring to their permanent location in the field. In removing plants from the seed-bed, care should be exercised to ensure the minimum amount of damage to root hairs during the operation. A thorough wetting of seed-beds before removing plants will greatly assist in reducing undue disturbance of the root system.

A convenient tray for the transport of seedlings from the seed-bed to the field can be made with a shallow box and by affixing two small uprights and nailing a cross-piece between them at the top to serve as a handle. Such a tray will protect plants against damage during transplanting operations.

Sowing seed directly into permanent positions within the field has advantages where irrigation can be practised or where good soil moisture conditions obtain, but it is not a recommended practice for the Central district, because of the unreliability and erratic nature of the rainfall.

QUEENSLAND SHOW DATES FOR 1940.

The Queensland Chamber of Agricultural Societies has issued the following list of show dates for 1940:—

APRIL.

Pittsworth	2nd and 3rd
Millmerran	5th
Toowoomba	15th to 18th
Dalby	22nd and 23rd
Chinchilla	26th and 27th
Kingaroy	30th April and 1st and 2nd May
Tara	30th April and 1st May

MAY.

Miles	1st
Monto	1st and 2nd
Yarraman	3rd, 4th, and 6th
Millmerran Rodeo	6th
Longreach	6th to 8th
Mundubbera	8th and 9th
Beaudesert Show	8th and 9th
Beaudesert Campdraft	10th and 11th
Nanango	9th to 11th
Blackall	13th and 14th
Roma	14th to 16th
Gayndah	15th and 16th
Mitchell	15th and 16th
Murgon	16th to 18th
Warrill View	18th
Ipswich	21st to 24th
Goomeri	23rd and 24th
Biggenden	23rd and 24th
Baralaba	23rd and 24th
Baralaba Rodeo	25th
Kalbar	25th
Gympie	30th and 31st and 1st June
Lowood	31st May and 1st June

JUNE.

Wowan	6th and 7th
Maryborough	6th to 8th
Blackbutt	7th and 8th
Childers	10th and 11th
Boonah	12th and 13th
Bundaberg	13th to 15th
Gin Gin	17th and 18th
Gladstone	19th and 20th
Kilcoy	21st and 22nd
Rockhampton	25th to 29th
Toogoolawah	28th and 29th

JULY.

Mackay	1st to 4th
Esk Show and Campdraft	5th and 6th
Proserpine	5th and 6th
Bowen	10th and 11th
Ayr	12th and 13th
Rosewood	12th and 13th
Cleveland	12th and 13th
Townsville	16th to 18th
Maleny	18th and 19th
Charters Towers	23rd to 25th
Gatton	23rd to 25th
Innisfail	25th, 26th, and 27th

AUGUST.

Home Hill	2nd and 3rd
Pine Rivers	2nd and 3rd
Atherton	6th and 7th
Caboolture	8th and 9th
Royal National, Brisbane	12th to 17th

SEPTEMBER.

Imbil	6th and 7th
Rocklea	14th
Ithaca	28th

OCTOBER.

Warwick Rodeo	5th and 7th

The Fruit Market.

J. H. GREGORY, Instructor in Fruit Packing.

STONE fruits are now well in season. Many Stanthorpe lines are showing signs of the hail visitation, which made some very excellent quality fruit into second grade. In spite of this high prices have prevailed throughout the month, weather conditions being in favour of a continued strong demand.

Mangoes and papaws are in full supply and are of excellent quality. High prices are being maintained, possibly due to the shorter supplies of stone fruits.

Pineapples are in light supply and high prices are being realized.

Growers should consider shipping to the South all tropical fruits now that the hot weather is with us. Some good lines of papaws have been noticed on the Brisbane markets with fruit in an over-ripe condition, due to being allowed to advance too far before harvesting. These lines have to be repacked, with consequent loss to the growers.

The following were the ruling market prices during the last week of the month of January, 1940:—

TROPICAL FRUITS.

Bananas.

Brisbane.—Cavendish: small, 4s. to 9s.; sixes, 7s. to 10s. 9d.; sevens, 8s. to 10s. 6d.; eights and nines, 6s. to 13s. 6d.

Sydney.—Cavendish: sixes, 8s. to 12s.; sevens, 12s. to 15s.; eights and nines, 15s. to 18s.

Melbourne.—Cavendish: sixes, 10s. to 11s.; sevens, 12s. to 13s.; eights and nines, 14s. to 15s.

Adelaide.—Cavendish: 19s. to 21s. per case.
Lady's Finger, 2d. to 8d. per dozen.
Sugars, 1½d. to 5d. per dozen.

Pineapples.

Brisbane.—Smoothleaf, 2s. to 5s. per dozen; 3s. to 6s. per case. Ripley, 6d. to 2s. 6d. per dozen; 3s. 6d to 7s per case.

Sydney.—Smoothleaf, 7s. to 12s.

Melbourne.—Smoothleaf, 8s. to 12s.

Adelaide.—Smoothleaf, 14s. to 15s.
Green fruit unsalable.

Papaws.

Brisbane.—Yarwun, 5s. to 8s. per tropical case; local, 2s. to 3s. 6d. per dump case.

Sydney.—10s. to 16s. per tropical case.

Melbourne.—6s. to 10s. per tropical case.

Mangoes.

Brisbane.—Fancy varieties, 4s. to 8s.; common, 2s. to 6s.

Sydney.—8s. to 10s. half-bushel.

Melbourne.—16s. to 18s. bushel.

Passion Fruit.

Brisbane.—Firsts, 8s. to 11s.; seconds, 5s. to 6s.

Melbourne.—10s. to 14s. half-case.

OTHER TROPICAL FRUITS.

Figs.

8d. to 9d. box; 2s. to 3s. tray.

CITRUS FRUITS.

Oranges.

Brisbane.—18s. to 22s. bushel.

Grapefruit.

Brisbane.—Palestine, 35s. per export case.

Lemons.

Brisbane.—Gayndah, 14s. to 22s. bushel; locals, 8s. to 17s. bushel.
Melbourne.—14s. to 22s. bushel; imported, 50s. to 52s. per export case.

DECIDUOUS FRUITS.

Apples.

Brisbane.—Yates, 9s. to 14s.; Granny Smith, 6s. to 8s., specials to 12s.; Gravenstein, coloured, 10s. to 16s.; Gravenstein, green, 6s. to 8s.; Stanthorpe cookers, 4s. to 6s.
Sydney.—Jonathan, 12s. to 15s.; Granny Smith, 9s. to 12s.

Pears.

Brisbane.—W.B.C., 5s. to 9s.

Peaches.

Brisbane.—Elberta, 5s. to 7s.; Wiggins, 4s. to 8s.; others, lower.

Nectarines.

Brisbane.—5s. to 8s.

Plums.

Brisbane.—Angelina, 10s. to 14s.; Black Diamond, 4s. to 7s.; October Purple, 8s. to 10s.; Doris, 8s. to 12s.; Ponds, 8s. to 12s.; others, 5s. to 10s.

OTHER FRUITS.

Grapes.

Brisbane.—White, 2½d. to 4d. lb.; Cominya, 5s. to 6s. case; black, 3d. to 4d. lb.; Roma muscatels, 8s. to 10s. case; muscatels, 5d. to 6d. lb.

Tomatoes.

Brisbane.—Ripe, 1s. to 3s.; coloured, 3s to 5s.; green, 1s. 6d. to 3s. 6d.

MISCELLANEOUS, VEGETABLES, &c.

Watermelons.—Small, 2s. to 4s. dozen. Choice, 5s. to 10s. dozen. Large, higher.
Cucumbers.—2s. to 4s. bushel.
Pumpkins.—*Brisbane:* 4s. to 5s. 6d. bag. *Sydney:* 5s. to 9s. bag.
Marrows.—*Brisbane:* 6d. to 2s. dozen.
Lettuce.—1s. 6d. to 4s. dozen.
Cabbages.—*Local:* 1s. to 7s. *Stanthorpe:* 6s. to 8s.
Beans.—*Brisbane:* 2s. to 4s. sugar bag.
Peas.—*Brisbane:* 4s. to 5s. sugar bag. *Imported:* 4s. to 11s. per ½ cwt.
Beetroot.—3d. to 10d. bundle.
Parsnips.—3d. to 9d. bundle.
Carrots.—3d. to 1s. 3d. bundle.
Rhubarb.—6d. to 1s. 3d. bundle.

Registered and Rejected Stallions.

REGISTERED STALLIONS.

Subjoined is a list of stallions in respect of which Certificates of Registration were issued under "*The Stallions Registration Acts*, 1923 *to* 1934," during the year 1939-40:—

BLOOD STALLIONS CERTIFICATED FOR LIFE DURING YEAR 1939-40.

Name.	No.	Age.	Colour.	Owner.
Alcmond	2312	Aged	Brown	A. H. Tanzer, Abercorn
Ankobar	2355	6	Chestnut	L. S. V. Oxley, Wilga Vale, Yelarbon
Anorient	2415	5	Black	S. G. Collins, Strathmuir
Arabask	2356	Aged	Bay	D. R. Hutton, Cunningham
Banker	2313	5	Brown	N. Edwards, Gympie
Billie's Willie	2314	6	Dark bay	J. F. Mylett, Nanango
Brightlights	2440	5	Chestnut	J. Y. Shannon, Rodney Downs, Ilfracombe
Brownleigh	2416	Aged	Brown	A. Baxter, Alton Downs, Rockhampton
Crownlea	2393	Aged	Brown	J. Camilleri, Wood street, Mackay
Deer Hunt	2441	6	Chestnut	C. Bradley, Mundubbera
Direct Laddie	2442	5	Brown	W. S. Carter, Hendra
Duke Heroic	2394	Aged	Bay	A. H. W. Cunningham, Strathmore
Fern Coolin	2357	5	Black	P. A. Wright and Sons, Kindon, Goondiwindi
Garrio	2311	Aged	Bay	F. J. C. Martin, Kumbarilla
Glen Esk	2444	5	Chestnut	J. C. Webb, Manson road, Hendra
Golden Wisdom	2445	5	Brown	B. J. Keiran, Breakfast Creek
Good Lad	2467	5	Brown	F. P. Wieland, Herberton
Great Scott	2395	5	Chestnut	F. A. Ross, Waitara, Nebo
Grey Craft	2396	6	Grey	A. F. Butterworth, Nebo
Heckler	2468	6	Brown	Wharton and Longwell, Lolworth
Homevale	2397	6	Chestnut	Bell and Co., Croydon, St. Lawrence
Idol Answer	2315	6	Brown	R. Webb, Childers
Javalot	2446	5	Bay	A. Jarvis, Cracow
Khyber	2447	5	Chestnut	B. C. Bell, Boonah
King's Command	2448	5	Brown	B. J. Wagner, Brighton terrace, Sandgate
Lavender	2337	Aged	Bay	J. H. Summerville, Kholo, *via* Ipswich
Lord Hazrat	2316	Aged	Brown	W. L. Savage, Fernbank, Kingaroy
Lord Nelson	2449	5	Brown	Anderson and Gargett, Hendra
Mark Antony	2466	6	Black	W. T. Kelly, Brisbane
Matanta	2298	5	Bay	C. W. Persse, Warra
Melody Mac	2299	Aged	Bay	W. J. Butler, Toowoomba
Merry Felt	2450	5	Brown	J. Leahy, Kinbombi
Mr. Felt	2451	5	Brown	J. H. Walker, Oakey
N.E.F.	2398	Aged	Bay	A. H. W. Cunningham, Strathmore
Noble Son	2452	5	Bay	C. H. Skuse, Grafton street, Warwick
Oak Listowel	2358	Aged	Bay	R. J. Glasby, Goondiwindi
One Star	2453	5	Brown	W. Hennessy, Harding street, Hendra
Oxford	2399	Aged	Brown	Estate E. G. Lascelles, Goorganga
Parth	2437	6	Chestnut	J. S. Moorehead, Armidale
Pavonian Prince	2417	5	Chestnut	E. T. Kelly, Glen Isla, Kunwarara
Phar Chip	2418	Aged	Bay	J. F. Rowe, Nagoorin
Plain Persse	2382	5	Chestnut	C. Elleray, Beaudesert
Pleiades	2454	5	Brown	Estate H. J. Winten, Rosalie Plains
Polyveil	2317	6	Chestnut	M. McDonnell, Gympie
Prince Veil	2455	5	Brown	Gibson Bros., Gunnadorah, Quilpie
Quasimodo	2318	Aged	Chestnut	G. C. Tye, Cynthia
Red Jim	2400	5	Chestnut	Wallis and Wright, Nebo
Resilguard	2419	5	Chestnut	S. and D. Urquhart, Baralaba
Rewan Lad	2420	Aged	Brown	Woorabinda Aboriginal Settlement, Woorabinda
Roman Castle	2456	5	Brown	T. J. Evans, Stanley street, Coorparoo
Roynissa	2421	5	Chestnut	G. P. Winslade, Pink Lily, Rockhampton
Rufus	2401	5	Chestnut	A. D. Shannon, Oxford Downs, Nebo
Sarchedon Lad	2422	6	Bay	B. McCamley, Bajool
Secret Air	2338	5	Chestnut	H. C. Spletter, Dugandan
Semetic	2457	Aged	Brown	A. R. Olive, Brigg's road, Ipswich
Serecirclet	2402	6	Chestnut	A. H. W. Cunningham, Strathmore
Shellawong	2463	6	Bay	J. C. Cadell, Charleville
Silver Gift	2458	5	Bay	J. B. Shannon, Tooloomba, St. Lawrence
Sir Magnum	2339	6	Black	J. Griffiths, Coochin, Boonah
Some Day	2319	5	Brown	R. E. Pickels, Coolabunia
Somerset	2340	Aged	Grey	W. Armstrong, Glencoe, Esk
Spearon	2359	Aged	Bay	T. Jennings, Greenmount
Sternula	2403	Aged	Black	A. H. W. Cunningham, Strathmore
Substitute	2459	5	Bay	W. Allen, Brisbane
Sunstream	2460	5	Brown	J. Y. Shannon, Rodney Downs, Ilfracombe
Superspear	2461	5	Brown	J. Y. Shannon, Rodney Downs, Ilfracombe
Twig	2469	Aged	Bay	Cashmere Pastoral Co., Cashmere
Valley Glen	2462	5	Chestnut	W. G. Peters, Glenore Grove
Walla Spear	2423	Aged	Bay	Julia J. Chapman, Calliope
Warwick Lad	2341	6	Bay	G. A. Heise, Minden
Whitenose	2470	Aged	Black	R. Jenkins, Julatten
Young Pasha	2424	Aged	Grey	J. R. White, Belmont Park

PONY STALLIONS CERTIFICATED FOR LIFE DURING YEAR 1939-40.

Name.	No.	Age.	Colour.	Owner.
Abdul	2360	6	Grey	H. M. Cunningham, Redgate, Stanthorpe
Black Jewel	2342	5	Black	A. Anderson, Teape street, Silkstone
Black Prince	2323	5	Black	A. J. Manning, Mondure
Bosca	2308	5	Creamy	J. W. G. Taylor, Newstead, Warra
Comet	2325	5	Brown	A. F. W. Pool, Charlestown, Wooroolin
Faraam Prince	2383	5	Grey	K. Hargraves, Coomera
Grey Boy	2438	5	Iron grey	V. P. Walsh, Nanango
Little Jim	2343	5	Bay	W. L. Clem, One-mile Estate, Ipswich
Master Signet	2361	5	Bay	F. Burns, College road, Stanthorpe
Patches	2309	6	Skewbald	L. O'Brien, Highfields
Pidgeon	2434	Aged	Bay	W. J. Ferguson, Kokotunga
Playboy	2411	Aged	Creamy	B. Cole, Walkerston
Prince Reuben	2310	5	Bay	H. A. Ruhle, Oakey
Shaza	2297	5	Iron grey	Jean Thomas, Russell street, Toowoomba
Silver King	2324	5	Chestnut	Ed. Litfin, Mount McEwan, Mondure
Silver Thread	2435	5	Taffy	F. W. Tully, Mount Larcom
Simple Jim	2362	Aged	Bay	L. Thompson, Stanthorpe
Sparkler	2322	5	Chestnut	S. B. Trigger, Lakeside
Tommy	2384	5	Iron grey	E. V. Dwyer, Pomona
Wee Jim	2363	5	Chestnut	R. A. Newman, Goondiwindi

TROTTER STALLIONS CERTIFICATED FOR LIFE DURING YEAR 1939-40.

Broadwood	2320	5	Bay	A. C. Underwood, Tingoora
Cobba-da-mana	2305	5	Black	P. Hughes, Macdonaldtown, Toowoomba
King Broad	2321	5	Bay	G. H. Woodall, Boonenne, Kingaroy
King David	2344	5	Black	P. Staines, Milbong
Sparkling Wilkes	2306	5	Black	E. Darr, Mount Irving
Steel Globe	2465	Aged	Grey	G. H. Adams, Chelona, Mackay
Win Direct	2307	6	Black	E. Fox, Gray street, Toowoomba

DRAUGHT STALLIONS CERTIFICATED FOR LIFE DURING YEAR 1939-40.

Abbotsford Chancellor	2439	Aged	Black	Forge Bros., Tamworth
Afton	2471	Aged	Bay	Longton Station, *via* Pentland
Alan	2404	5	Brown	Estate E. G. Lascelles, Goorganga
Arolla's Heir	2364	5	Bay	D. Ryan, Allora
Balwherrie Intent	2326	5	Bay	F. Tucker, Ellesmere, Kingaroy
Balwherrie Intention	2472	Aged	Brown	Trustees J. Allingham Estate, Southwick
Barron Bold	2473	5	Bay	Cashmere Pastoral Co., Cashmere
Benowrie Chief	2327	5	Black	E. W. Tye, Cynthia
Berriew Premier	2436	5	Bay	F. D. Arthur, Helidon
Black Boy	2405	5	Black	Estate E. G. Lascelles, Goorganga
Blue Prince	2406	5	Blue grey	Mrs. M. McAfee, Gumlu
Bluff	2474	5	Bay	W. R. Trembath, Paxton street, Townsville
Bold Exchange	2328	5	Bay	H. V. Petersen, Kolan River South
Bold March	2329	6	Bay	L. W. Horne, Takura
Brittany Intent	2475	5	Black	Hy. Orr, Sala Siding
Bully Bar	2425	5	Bay	V. R. Katte, Dingo
Captain	2300	6	Bay	D. G. J. Stone, Miles
Captain	2426	5	Bay	W. J. White, Milman
Captain	2427	5	Bay	C. T. Johnson, Gracemere
Carlvale	2365	6	Bay	M. O'Leary, Wheatvale
Ceren Chief	2476	Aged	Bay	Cashmere Pastoral Co., Cashmere
Clematic Bold Prince	2330	Aged	Bay	R. Stark, Wondai
Clifton Sunray	2428	6	Bay	P. Egan, Rockhampton
Cornish Laddie	2345	6	Bay	H. O. Meischke, Grantham
Cowley	2366	6	Bay	G. F. W. Goodrich, Inglewood
Crystal Tide (Imp.)	2367	Aged	Bay or brown	W. P. Canning, Tannymorel
Dale Pride	2346	5	Bay	A. R. Zischke, Hatton Vale
Dark Chief	2477	5	Black	H. Webb, Reid River
Don	2368	5	Bay	W. A. Lyell, Bony Mountain, Cunningham
Doolin Carlyle	2369	5	Bay	W. Tonissen, care of J. Rickert, Elphinstone
Douglas Credit	2370	Aged	Black	C. E. Lack, Back Plains
Duke of Windsor	2385	5	Bay	C. J. Maas, Waterford
Emu Valley	2487	5	Dapple grey	F. M. Trembath, Charters Towers
Eumara Valley	2488	5	Bay or brown	F. M. Trembath, Charters Towers
Fairview Great Hope	2491	Aged	Brown	J. M. Smith, Melbourne
Fairymead Baron Knight	2371	6	Bay	J. P. Warden, Goondiwindi
Fairymead Bold Lorraine	2430	5	Bay	H. C. Dougall, Littlemore
Gindie Lad	2478	Aged	Chestnut	J. F. Quilter, Tolga
Glenmore II.	2431	5	Black	Mrs. A. E. Ziebarth, Biloela
Jollie Gloucester	2386	5	Bay	S. O. Mear, Carrington road, Toowoomba
Kelso Marshall	2479	Aged	Bay	Cashmere Pastoral Co., Cashmere
Kerrston's Ideal	2432	6	Black	Archer Bros., Gracemere
King Billy	2387	5	Bay	A. Bishop, Caboolture
Knight Superb	2331	5	Bay	H. Norgrove, Bundaberg
Lad	2332	5	Bay	W. J. Murphy, Lower Wonga
Lincoln	2407	Aged	Brown	G. Bonaventura, Eton
Lion	2347	5	Bay	W. Frohloff, Upper Yarraman
Loyal Carlisle	2372	5	Black	W. Doro, Glassy Mountain, Pozieres
Major	2333	5	Bay	C. A. Taylor, Brooloo

DRAUGHT STALLIONS CERTIFICATED FOR LIFE DURING YEAR 1939–40—*continued.*

Name.	No.	Age.	Colour.	Owner.
Major Wallace	2408	5	Bay	W. H. Gillham, Suttor Creek, Nebo
March On	2334	5	Bay	C. E. Pascoe, Ceratodus
Master Dale	2348	6	Bay	E. J. Weigel, Thornton
Maxwell	2349	5	Bay	M. W. Kruger, Coleyville
Montie	2433	Aged	Bay	R. T. Cross, Marmor
Navillus Extent	2388	5	Black	B. T. Smiles, Palen Creek
Nelson	2480	Aged	Bay	W. R. Trembath, Paxton street, Townsville
Nobby	2409	Aged	Brown	P. H. Atherton, Koumala
Oxford Don	2335	5	Bay	S. J. and C. Jenkins, Theebine
Palomar King	2381	Aged	Bay	H. J. Crothers, Dirranbandi
Play Boy	2410	Aged	Bay	Mrs. S. Bidgood, Gumlu
Prince	2350	5	Bay	W. T. D. King, Neurum
Prince	2351	5	Bay	D. B. O'Day, Linville
Prince	2481	5	Grey	A. J. Buck, Baringha
Prince	2412	5	Bay	A. Carena, Inneston
Prince of Hillview	2389	6	Bay	E. W. Hill, Hillview
Punch	2373	6	Bay	J. J. Kelcher, Pratten
Punch	2390	5	Bay	P. Sultmann, Woongoolba
Punch	2482	5	Black	J. J. E. Hillier, Brandon
Red Robin	2374	5	Bay	W. A. Deacon, Allora
Rich Lad	2336	5	Bay	A. C. H. Marquardt, Mondure
Royal Carline	2375	5	Bay	J. E. Lysaght, Maryvale
Royal Kerrston	2391	5	Brown	W. and S. Welk, Nambour
Royal Pride	2490	5	Dark bay	Cashmere Pastoral Co., Cashmere
Scottish Farmer	2352	5	Bay	J. B. Pennell, Kalbar
Sergeant Bruce	2302	5	Bay	A. J. Kruger, Goombungee
Sherlock	2353	6	Bay or brown	G. A. Wieland, Boonah
Sir Lisle	2413	Aged	Bay	A. H. W. Cunningham, Strathmore
Speewar Chief	2392	Aged	Bay	J. Cosgrove, Samford
Squaredale Pride	2376	5	Bay or brown	B. A. Hoffman, Emu Vale
St. Ninian's Royal Slade	2377	5	Black	P. Fogarty and T. O'Rourke, Headington Hill, Clifton
Studleith Premier Lad	2483	Aged	Bay	Cashmere Pastoral Co., Cashmere
Sturgon	2484	5	Brown	L. Stallan, Long Pocket, Ingham
Talgai Duke	2303	5	Bay	J. D. Learmonth, Hillview, Pittsworth
Talgai Warrior	2485	5	Bay	J. Kelso, Box 389, Townsville
Tent Hill Victory	2354	5	Bay	W. H. Grams, Upper Tent Hill
Victoria Pasha	2486	6	Dark bay	J. Godfrey, Kairi
Wallace Lad	2378	Aged	Bay	Teresa Nolan, Freestone
Wattlebank Sensation	2414	5	Brown	Wagner and Co., Marylands, St. Lawrence
Wellburn Punch	2301	5	Bay	J. Wharram, Wellburn, Jandowae
Westphalia Laddie	2379	5	Bay	T. J. Turkington, Pilton
Woolamia Lionel	2380	5	Bay	W. Gunn, Kildonan, Goondiwindi
Young Ngapuna	2304	6	Bay	A. J. Harris, Yarranlea

BLOOD STALLIONS CERTIFICATED FOR THE YEAR 1939–40.

Black Beau	1862	4	Bay or brown	F. W. Stenzel, Minto Vale
Bright	1907	4	Bay	J. A. Collett, Box 8, Pomona
Cannon Fly	1812	4	Chestnut	S. Otto, Bum Bum Creek, Crow's Nest
Capple Bar	1839	4	Brown	H. G. Stockill, Proston
Clansman	1917	4	Brown	Cook and Cook, Wandoo, Nebo
Elope	1937	4	Bay	H. W. Kirkwood, Ingham
Flying Cloud	1840	4	Brown	T. A. Bellotti, Murgon
Gold Dust	1863	4	Bay	A. H. Kunde, Hazeldene, Kilcoy
King Rufus	1813	4	Bay	F. J. Turner, Irvingdale, Chinchilla
Last Eiffel	1892	6	Grey	S. L. Moore, Goondiwindi (Provisional)
Mannar	1841	4	Chestnut	W. Titmarsh, Yerra
Pavokoff	1918	4	Bay	W. H. Bell, Nebo
Pentator	1814	4	Bay	J. Banks, Wandoan
Pollytrone	1864	7	Bay	F. E. G. Pullen, Station street, Toowoomba (Provisional)
Rivory	1923	3	Bay	H. A. Burgess, Miriam Vale
Royal Mace	1865	4	Bay	E. G. Bell, Box 5, Toogoolawah
Saracen	1919	4	Blue grey	W. H. Gillham, Suttor Creek, Nebo
Warpaint	1893	6	Bay	G. V. Walker, Maryvale (Provisional)

PONY STALLIONS CERTIFICATED FOR THE YEAR 1939–40.

Black Prince	1867	3	Black	J. C. Davey, Gatton
Braw Lad	1929	4	Brown	C. Cotter, Ipswich
Bright Gay Lad	1868	3	Bay	F. Huth, Haigslea
Cabulcha Cinnabar	1928	4	Chestnut	J. M. Newman, Caboolture
Cabulcha Quicksilver	1915	3	Bay	J. M. Newman, Caboolture
Cannon Lad	1916	3	Bay	Mrs. K. Cox, Fourth avenue, Sandgate
Dickie Boy	1869	4	Black	B. J. Friske, Blenheim, Laidley
Don	1834	3	Bay	J. C. Naumann, Frogmore, Pittsworth
Gold Cuffs	1894	4	Taffy	E. E. Belford, Wilga Park, Texas
Image	1844	3	Dark bay	J. R. Perrett, Mount Hope, Kingaroy
Jeepere Creepers	1924	4	Brown	W. C. Geddes, Glen Geddes
Jubilee	1870	4	Black	E. Clarke, Thornton, *via* Laidley
Master Don	1835	4	Black	W. J. Smith, Pittsworth
Mecca's Choice	1871	4	Bay	P. J. Connole, Helidon
Playmate	1873	4	Black	R. W. Pitman, Mulgowie

PONY STALLIONS CERTIFICATED FOR THE YEAR 1939-40—*continued.*

Name.	No.	Age.	Colour.	Owner.
Rocket	1836	3	Steel grey	F. W. Pukallus, Murra Murra, Crow's Nest
Sheik	1845	4	Grey	R. B. Jefferies, Murgon
The Imp	1895	4	Dappled grey	A. J. Savage, Gore
Theo	1837	4	Creamy	E. G. Lister, Shenstone, Warra
Tim	1846	4	Grey	B. N. Trott, Mundubbera
Tommy Dod	1874	3	Chestnut	J. C. Logan, Gatton
Walker Pride	1875	3	Bay or brown	Mrs. E. C. Hayes, Harrisville
Warpaint	1876	4	Piebald	H. Badrick, Forest Hill
Wee McGregor	1838	4	Creamy	G. H. Ruhle, Mount Irving
Young Cygnet	1896	3	Bay	P. H. Elks, Stanthorpe

TROTTER STALLIONS CERTIFICATED FOR THE YEAR 1939-40.

Billy Wilkes	1914	4	Bay	W. F. Ludwig, Loganlea
Broad Wilkes	1842	3	Chestnut	F. Tucker, Ellesmere, Kingaroy
Sparkling Arrow	1833	4	Black	T. Walker, Maclagan
Stormalong	1843	4	Brown	T. Mancktelow, Mondure
Teddy's Pride	1866	3	Cream	A. Wendt, Marburg

DRAUGHT STALLIONS CERTIFICATED FOR THE YEAR 1939-40.

Abbey's Gift	1815	4	Bay or brown	J. V. Willis, Meringandan
Admiral Gaiety	1877	4	Bay	Boyle and Winks, Harrisville
Altacraig Lustre's Dignity	1930	4	Brown	J. Hunter, Mulgowie
Ballymena Intent	1816	3	Brown	McCullough Bros., Rocky Creek
Balmedie Superb	1817	4	Brown	Mrs. R. V. Breydon, Haden
Balwherrie Intent's Chance	1897	4	Bay	W. Sprott, Pilton
Banker	1847	4	Bay	W. Taylor, Gayndah
Bobs	1898	3	Bay	J. Buckley, Rosehill, Warwick
Bold Dignity	1818	4	Bay	G. and H. Tewes, Pittsworth
Boomer	1848	3	Light brown	F. Brazier, Tingoora
British Prince	1849	3	Bay	W. J. Brims, Tiaro
Bruce	1938	4	Bay	H. H. Steinhardt, Tarzali
Captain Lustre	1908	4	Bay	J. T. Collett, Pomona
Carlyle Dobbin	1819	3	Bay	A. J. Paake, Wandoan
Chief	1820	3	Bay	L. S. Gordon, Broxburn
Dignity's Lad	1821	3	Bay or brown	J. H. L. von Pein and Sons, Quibet, Pittsworth
Douglas Credit	1899	4	Bay	W. G. Frey, Inglewood
Duke	1927	5	Bay roan	G. C. Seierup, Gracemere
Everton Duke	1822	3	Bay	A. C. Tuppack, Jimbour
Fairholme Eclipse	1850	4	Bay	A. and J. Sippel, Murgon
Fairval Noble	1879	4	Bay	H. M. H. Warneminde, Elizabeth street, Brisbane
Gaiety	1925	3	Bay	S. Titmarsh, Rawbelle
Gaiety's Favour	1880	4	Bay	W. F. Ehrich, Kulgun, Dugandan Line
Glenbrae	1900	4	Bay	J. O'Leary, Leyburn
Glengoon Hiawatha	1851	4	Brown	F. E. Mitchell, Byee
Glen Wallace	1852	4	Bay	S. B. Trigger, Biggenden
Heir's Like	1901	4	Bay	H. McMahon, Wheatvale
Irton Choice	1909	4	Bay	J. Drynan, Telemon Crossing
Kerrston's Joker	1881	4	Bay	H. M. Chaille, Esk
King	1853	3	Bay	W. R. Nichol, Biggenden
Kirkcaldy Flash Len	1823	4	Bay	A. Kahler, Geham
Kirkclady Journalist	1931	3	Roan	F. A. Lehmann, Lismore, Victoria
Kirkcaldy Preference	1882	3	Bay	W. Profke, Glamorgan Vale
Lion	1854	4	Bay	W. J. Patteson, Mundubbera
Lion	1939	4	Roan	W. R. Trembath, Paxton street, Townsville
Lochiel	1940	4	Bay	S. W. Smith, Ravenshoe
Lord Nelson	1824	4	Bay or brown	E. M. Schefe, Coalbank, *via* Wutul
Lustre's Perfection	1932	3	Brown	Mrs. A. R. Elliott, Laidley
Mailboy's Royal Prince	1855	3	Bay	Mrs. J. Lye, Monto
Major	1941	4	Bay	A. G. Spotswood, Box 231, Home Hill
Major Dawn	1933	4	Brown	F. A. Lehmann, Lismore, Victoria
Majuba Lord Nelson	1826	3	Bay	S. O. Mear, Carrington road, Toowoomba
Ngapuna's Pride	1883	3	Bay	P. J. Connole, Helidon
Noble King	1902	4	Bay	D. C. O'Leary, King's Creek
Oakdale Favourite	1825	4	Bay	E. C. Stark, Pinelands, Crow's Nest
Pinevale Darnley	1934	3	Bay	F. A. Lehmann, Lismore, Victoria
Premier's Pride	1827	3	Bay	A. Walker, Rockmount, Helidon
Pretty Robin	1828	3	Bay	R. Hamilton, Southbrook
Pride	1903	3	Bay	C. H. Kedwell, Post Office, Texas
Pride of Marcellus	1910	4	Black	W. and S. Welk, Nambour
Prince	1911	4	Bay	N. V. Burnett, Telemon
Prince	1922	3	Bay	H. Lott, Kensington, Bowen
Prospect	1904	4	Bay	R. E. Gillespie, Junabee, *via* Warwick
Ranger	1856	4	Bay	H. C. Taske, Bundaberg
Rare Gaiety	1884	4	Black	R. Harsant, Warril View, Harrisville
Rosebank Kerrston's Pride	1857	4	Bay	F. Benson, Gundiah
Rose Farm Regal Lustre	1885	4	Bay	R. Drew, Forest Hill
Royal Add	1829	3	Bay	W. T. Gillies, East Cooyar
Royal Dignity	1858	3	Bay	E. Reinbott, Kingaroy

DRAUGHT STALLIONS CERTIFICATED FOR THE YEAR 1939-40—*continued.*

Name.	No.	Age.	Colour.	Owner.
Royal Duke	1859	4	Bay	A. H. Lowe, Kandanga
Royal Laddie	1886	3	Black	W. C. Heit, Obum Obum, Kalbar
Royal Lustre	1935	3	Bay	H. A. Stuhmcke, Glenore Grove
Royal Reserve	1887	4	Bay	J. Morrow, Peak Crossing
Scotland Yet	1920	3	Bay	A. Smith, Merinda
Sir Dale	1888	4	Bay	Mrs. I. M. Arndt, Rosewood
Sir Dignity	1832	3	Bay	P. Keane, Linthorpe
St. Helen's Major Dignity	1936	4	Bay	Forge Bros., Tamworth, New South Wales
St. Hilda's Nugget	1912	4	Bay	W. Drynan, Glenapp
Sudbourne Esq.	1942	3	Chestnut	P. Kidd, Malanda
Talgai Streamline	1943	3	Bay	J. Tate, Tolga
Tamar Kerr	1889	4	Bay	C. A. Gnech, Boonah
Terang Duke	1905	3	Bay	C. A. H. Head, Swanfels
The Iron Duke	1860	4	Bay	C. A. Kington, Monto
Top Boundary	1890	4	Bay	A. Wienholt, Kalbar
Trementheere Royal	1861	4	Bay	A. H. Tanzer, Abercorn
Valetta Horoscot	1921	4	Bay	A. H. W. Cunningham, Strathmore
Vamphire Heir	1891	3	Bay	F. H. Hahn, Coulson
Wee Willie	1830	4	Bay or brown	Barlow and Little, Wandoan
Wellcamp Sox	1831	4	Bay	P. Crotty, Wellcamp
Wheatley Lustre's Pride	1944	4	Brown	J. Favier and Sons, Kairi
Wigton's Pride	1906	4	Bay	W. V. Noble, Freestone
Wolsingham Imperialist	1926	4	Bay	T. Clark, Bororen
Young Douglas	1913	4	Bay	J. Martin, Tambourine

REJECTED STALLIONS.

List of stallions in respect of which Certificates of Registration were refused on account of lack of type and/or conformation, lack of size or unsoundness during the year 1939-40. These horses are prohibited from service, either public or private.

BLOOD STALLIONS REJECTED DURING THE YEAR 1939-40.

Name.	Age.	Colour.	Reason for Rejection.	Owner.
Arabia	6	Grey	Unicrypt	C. Clark, A.M.P. Buildings, Brisbane
Blackboy	4	Black	L.T.	J. Peters, Nanango
Buoyant Son	5	Bay	Unicrypt	W. S. Smith, Brisbane
Calm Simon	3	Dark bay	L.T.	O. N. Winter, Kumbia
Eucalyptus	4	Brown	L.T.	W. Chapman, Gin Gin
Nigger	6	Black	L.T. and C.	D. J. Kildey, Cootharaba
Peter Pan	5	Bay	L.T.	T. J. Scott, Proston
Prince	Aged	Chestnut	L.T.	O. J. Hair, Watalgan
Rustic	4	Chestnut	L.T. and C.	H. G. A. Hickman, Bororen
Westcott	6	Bay	L.T.	T. Toomey, Boonenne

PONY STALLIONS REJECTED DURING THE YEAR 1939-40.

Grey Dawn	3	Iron grey	L.T.	Dick Neilson, Bundaberg
King Pin	5	Blue grey	L.T. and C.	Robertson and Co., Killarney Station
Mick	4	Brown	L.T.	C. Sharp, Biggenden
Shakespeare	4	Bay	Unicrypt	V. N. Bauer, Mount Sylvia

DRAUGHT STALLIONS REJECTED DURING THE YEAR 1939-40.

Allendale	3	Bay	L.T. and C.	E. Edwards, Tarzali
All John	4	Bay	L.T. and C.	Bergl Australia London Ltd., Pandanus Creek Station, Pandanus Creek
Ardlaw's Son	4	Bay	L.T. and C.	B. Hegarty, Back Plains, Clifton
Baldie	4	Brown	L.T. and C.	S. J. Haughtey, Box 90, Ingham
Barron Intent	6	Black	L.T. and C. and S.B.	E. G. Harte, Kaban
Bischof	4	Bay	L.T.	F. Sbresni, Watalgan
Black Prince	6	Brown	L.T. and C.	G. Ellrott and Sons, Sliepner Junction
Bowler	Aged	Bay	L.T. and C.	R. Campbell, Peeramon
Brown Carlita	6	Brown	L.T. and C.	F. M. Trembath, Charters Towers
Captain	5	Bay	L.S.	C. F. Wilkinson, Grantham
Clinker	5	Bay	L.T. and C.	J. Moran, Taragoola
Darcy	5	Bay	L.T.	Mary F. Tobin, Dallarnil
General Gordon	8	Brown	L.T. and C.	H. G. Walters, Proserpine
Havelock	6	Brown	L.S.	D. H. Butler, Miles

DRAUGHT STALLIONS REJECTED DURING THE YEAR 1939-40—*continued.*

Name.	Age.	Colour.	Reason for Rejection.	Owner.
Joker	7	Bay ..	L.T. and C. ..	T. J. Devine, Proserpine
Kingdale	7	Bay ..	S.B. ..	W. Eastwell, Willowvale
Larry	7	Brown ..	S.B. ..	A. H. and E. M. Kelland, Wowan
Lightfield Chief ..	4	Bay or brown	L.T. ..	J. A. Reibel, Gympie
Lord Eacham ..	6	Bay ..	L.T. and C. ..	J. G. Winfield, Yungaburra
Major	4	Black ..	L.T. and C. ..	W. H. F. Wordsworth, Manton
Major	7	Grey ..	L.T. and C. ..	H. Bawden, Reid River
Mast Gamble	4	Bay ..	L.T. ..	I. C. Bubke, Biggenden
Noble	5	Bay ..	S.B. ..	M. McMahon, Sladevale
Nugget	4	Blue roan ..	S.B. ..	R. Welch, Palen Creek
One	8	Chestnut ..	L.T. and C. ..	W. Kohn, Mareeba
Patch	6	Bay ..	L.T. and C. ..	T. Kersnovske, Ubobo
Patch	4	Bay ..	L.T. and C. ..	E. Sparksman, Mount Marshall
Pigeon's Pride ..	5	Bay ..	L.T. and C. ..	W. T. Brown, Calliope
Prince Royal	4	Bay ..	S.B. ..	M. E. Glasheen, Clifton
Royal Chief	6	Chestnut ..	Unicrypt ..	W. R. Lester, Gin Gin
Royal George ..	4	Bay ..	L.T. and C. ..	P. B. Nutting, Harrisville
Square William ..	5	Bay ..	Stringhalt ..	G. H. Rettke, Emu Vale
St. Helen's Ivo ..	5	Bay ..	S.B. ..	R. W. Matsen, Homebush
Tiger	5	Roan ..	L.T. and C. ..	W. R. Trembath, Paxton street, Townsville
Worthy Carlisle ..	9	Bay ..	S.B. ..	S. H. Andrew, Laidley
Unnamed	7	Bay ..	L.T. and C. ..	Bruce Bros., Taragoola
Unnamed	5	Steel grey ..	L.T. and C. ..	F. M. Trembath, Charters Towers
Unnamed	Aged	Chestnut ..	L.T. and C. ..	F. M. Trembath, Charters Towers
Unnamed	7	Black ..	L.T. and C. ..	F. M. Trembath, Charters Towers
Unnamed	4	Chestnut ..	L.T. and C. ..	E. Stern, Caboolture

HORSE BREEDING A NATIONAL DUTY.

Discussing probable wartime demands for good quality horses, a well-known horse breeder remarked recently that latterly there has been very little doing in the breeding of both light and heavy horses. Now that horses are sure to be required in large numbers—that is, if the war lasts very long—the question of guaranteed purchase is worth while considering as a stimulant to the industry. To every farmer with good stock the advice is offered not to miss the opportunity to breed as early as possible, whether for remounts, light cavalry horses, active or heavy draughts. To breed horses looks like a national duty these days, not only because horses are still wanted for military purposes, but because they are an essential part of our agricultural economy.

There may be no need to worry yet awhile over petrol and fuel oil supplies for cars and tractors, but the first call on these must be for the defence forces. Should our petrol supplies be seriously interrupted for any length of time, it is certain that farm production will be considerably lessened, and that would mean that there would be a restriction in our export trade at a time when we should be able to send every surplus bale, bag, or box of produce to the Old Country. With horse power we know where we are, with mechanical power we may never know where we stand against all sorts of outside influences.

In other countries—Britain, Canada, and the United States—schemes for the encouragement of horse breeding have been in working order for a number of years, in anticipation of just such an emergency which has been forced upon us. Even in New Zealand, a Remount Encouragement Act has been in operation for over a year now, and it has already proved its advantage to both breeders and the Dominion Government. Something of the kind is well worth consideration by all concerned in our own security.

Brisbane Milk Board.

THE Minister for Agriculture and Stock (Mr. F. W. Bulcock), referring recently to the operations of the Brisbane Milk Board, indicated that apart from other material benefits under "*The Milk Supply Act of* 1938," such as protected and improved markets, equity of supply, guaranteed payments, improvement in quality through specialized assistance in production, the economic position of producers generally has been improved considerably.

Since the inauguration of the provisional Board there have been only two variations in the price paid to producers for milk supplied. For the year 1938 the average price paid was 10·216d. per gallon, and for 1939 the average price was 10·716d. per gallon. This represents an advance in price of ½d. per gallon.

Since 1st January, 1939, producers paid a levy of ⅛d. per gallon on milk supplied under the board's jurisdiction, which leaves a net increase of ⅜d. per gallon on milk supplied during 1939, as compared with milk supplied in 1938, representing an additional net income to producers of approximately £6,450, and an average increase of nearly £15 per annum to each producer last year.

The following table shows the average price paid to producers since 1931:—

1931	8d. per gallon.
1932	8·333d. per gallon.
1933	8d. per gallon.
1934	7·875d. per gallon.
1935	8·5d. per gallon.
1936	9·6d. per gallon.
1937	10·2d. per gallon.
1938	10·216d. (Provisional Board).
1939	10·716d. (The Brisbane Milk Board.

For the seven years prior to the establishment of the provisional Milk Board, the average price to producers was 8·644d. per gallon, compared with an average price of 10·466d. per gallon for the years 1938 and 1939 during which the provisional Board and the Milk Board have been operating.

For the eight years 1931-1938, prior to the establishment of the board, the average price was 8·8d. per gallon, compared with an average of 10·7d. per gallon in 1939.

After allowing for the payment of ⅛d. per gallon levy, the net average price payable to producers since the passing of the Milk Supply Act is a little more than 1¾d. per gallon in excess of the average price paid to producers for the eight years prior to that date. This, in effect, stated the Minister, means that for the year 1939 milk producers received an additional net income of over £30,000 on milk supplied under the board's control as compared with the average price paid during the eight preceding years, and this represents on the average an additional income of approximately £65 pr annum to each producer.

The Acid or Base Forming Property of Fertilizers Sold in Queensland

By R. A. TAYLOR, A.A.C.I., Inspector and Examiner, Seeds, Fertilizers, Veterinary Medicines, Pest Destroyers, and Stock Foods Investigation Branch.

FOR some years it has been recognised that certain fertilizers increase the acidity of the soil to which they are applied. The accumulated effect of numerous additions of acid-forming fertilizer can bring the soil to such a condition that the growth of crops may be adversely affected.

A review of fertilizers in use over a large number of years in the United States of America shows that, whereas average fertilizers in 1900 were actually base-forming to the equivalent of 40 lb. calcium carbonate per ton (2,000 lb.), in 1932 they had become acid-forming to the equivalent of 150 lb. calcium carbonate[2]. The development of ammoniacal fertilizers (such as ammonium sulphate) is put down as the chief cause of this state of affairs.

One American authority,[5] speaking of the State of South Carolina, states that the use of acid-forming fertilizer materials on naturally acid soils has resulted in a large proportion of the soils becoming too acid for the successful production of even such acid-tolerant crops as cotton and tobacco.

He goes on to say that recently it was realised that soil acidity was one of the basic limiting factors in determining the productivity of the soil, and soil acidity determinations were made on over 2,000,000 soil samples—covering about 95 per cent. of all the farms in the State. A large proportion was found to be too acid to support a type of agriculture capable of maintaining an adequate standard of living.

In a review of American investigations on the subject, W. H. Pierre[1] states that the following conclusions with respect to the different types of fertilizers have been reached:—

1. *Nitrogenous fertilizers.*—Ammonium compounds tend to produce acidity, except in the presence of sufficient base-forming elements. Nitrate compounds of sodium (or calcium) have a basic effect on the soil.

2. *Phosphatic fertilizers.*—Dicalcic phosphate and tricalcic phosphate have a basic effect on the soil. Monocalcic phosphate has, in general, no residual effect.

3. *Potassic fertilizers.*—These, generally, have no residual effect on the soil.

Ammonium compounds tend to have an acid reaction because of the process of nitrification which takes place in the soil; the amount of nitrogen absorbed by the plant in the form of ammonia before nitrification is generally considered very small. Because of further absorption of nitrogen by the plant as nitrate, however, the theoretical residual acidity is considerably reduced.

With sodium nitrate, apparently the plant absorbs more nitrate than sodium—leaving a basic residue.

On actual field test, superphosphate, although theoretically acid-forming, is, practically, almost neutral.

Generally, it may be assumed that the effect of any fertilizer on the soil may be taken as represented by its acid-base balance—that is, the ratio of acid-forming elements to base-forming elements in the fertilizer. Only one-third of the phosphoric acid and only one-half of the nitrogen should be considered as acid-forming, however—as deduced from field tests.

The acid-forming and base-forming elements may be set out as follows:—

Acid-forming—	Base-forming—
Sulphur.	Calcium.
Chlorine.	Magnesium.
$\frac{1}{3}$ of Phosphorus.	Potassium.
$\frac{1}{2}$ of Nitrogen.	Sodium.

If the amounts of the elements present in the fertilizer are known, the equivalent acidity or basicity can be readily ascertained.

The following definitions may be taken as covering equivalent acidity or basicity as supplied to fertilizers:—

The equivalent acidity of a fertilizer is taken as the acidity produced in the soil by the fertilizer, measured in terms of calcium carbonate necessary for its neutralisation.

The equivalent basicity of a fertilizer is taken as the basicity produced in the soil by the fertilizer expressed as its equivalent of calcium carbonate.

These terms, as used in the United States of America, take calcium carbonate ($CaCO_3$) as the standard of measure; fertilizer labels in Queensland bear the percentage of lime (CaO), 56 per cent. CaO being equal to 100 per cent. $CaCO_3$.

In actual practice, a direct method—evolved by W. H. Pierre[1]—of estimating this acidity or basicity may be used.

This involves taking a known quantity of the fertilizer, and igniting to remove organic material—after adding sugar (to help ignition) and sodium carbonate (to retain sulphates, chlorides, and phosphates)—adding a fixed quantity of standard acid, and titrating the excess acid against a standard alkali. In the presence of nitrates, carbon black is added instead of sugar. A blank is run off, using sodium carbonate and acid as in the original test, and this also is titrated against the alkali. If more alkali is required with the original than with the blank, the fertilizer is acid-forming; if less is required with the original, the fertilizer is base-forming. Different ignition temperatures show little variation in results; a maximum temperature of 650 degrees C. is given as being apparently the optimum. This test does not include any acid formed by nitrogen, as this is lost during ignition.

Only one-third of the phosphoric acid is included. This is ensured by titrating with methyl red as an indicator—the first hydrogen of the phosphoric acid (H_3PO_4), only, being neutralised.

It must be realised that the American ton is 2,000 lb., whereas the British ton is 2,240 lb. Therefore, all figures relating to units of nitrogen, phosphoric acid, or potash, in American literature, should be corrected by multiplying by 1.12—e.g., a fertilizer containing 20 per cent. nitrogen in the United States of America would be used in the proportion of 100 lb. to the ton to obtain 1 unit (1 per cent. per ton) of nitrogen. In Queensland 112 lb. would be needed. The equivalent acidity per unit of nitrogen of a 21 per cent. nitrogen sulphate of ammonia is given in the United States of America as 107 lb. of 100 per cent. calcium carbonate. Approximately 120 lb. would be the equivalent per unit of nitrogen for 21 per cent. nitrogen sulphate of ammonia in Queensland.

The acidity due to nitrogen is calculated directly from the nitrogen present in the fertilizer. Nitrogen in the soil acts as nitrate, and its neutralisation may be represented thus:—

$$2N \longrightarrow 2HNO_3$$

$$2HNO_3 + CaCO_3 \longrightarrow Ca(NO_3)_2 + H_2O + CO_2$$

The acid-forming capacity of 2 parts of nitrogen (whether as nitrate or ammonium) is the equivalent of the base-forming capacity of 1 part of calcium carbonate.

The atomic weight of nitrogen and molecular weight of calcium carbonate are 14 and 100 respectively; therefore, as 2 parts of nitrogen equal 1 part of calcium carbonate, the equivalent values of nitrogen and calcium carbonate are 28 and 100—that is, the nitrogen percentage must be multiplied by $100/28 = 3{\cdot}57$.

As before mentioned, however, only $\frac{1}{2}$ of the nitrogen (because of the absorption by the plant) is taken as producing an acid residue. Therefore, 1·785 is the factor by which the nitrogen percentage must be multiplied to obtain the equivalent of calcium carbonate.

For each unit of nitrogen (1 per cent. per ton), the factor would be $22{\cdot}4 \times 1{\cdot}785 = 39{\cdot}98$ (approximately 40). The United States of America factor for obtaining the equivalent of 1 unit of nitrogen is 35·7[1]; this, of course, is based on 2,000 lb. This value, as mentioned above, must be added to or subtracted from the value obtained by the actual analytical acidity test.

For instance, sulphate of ammonia containing 21 per cent. nitrogen is found to give an acid value on analysis equivalent to approximately 1,675 lb. of $CaCO_3$ per ton. The nitrogen acidity calculated is equivalent to 840 lb. (21×40) $CaCO_3$ per ton. The total *acidity* is, therefore, equivalent to 2,515 lb. $CaCO_3$—120 lb. per unit (2,515/21).

Nitrate of soda, 16 per cent. nitrogen, gives an analysis *basicity* equivalent to approximately 1,300 lb. $CaCO_3$ and calculated nitrogen acidity equivalent to 640 lb. (16×40) $CaCO_3$—the difference being a *basicity* of 660 lb. $CaCO_3$ per ton—41 lb. per unit (660/16).

United States of America figures give acidity 107 lb. and basicity 36 lb. respectively as corresponding figures—on a 2,000 lb. ton basis.

The accompanying table sets out equivalent acidity or basicity values for the common fertilizers used in Queensland.

The figures given are approximate, calculated from the net equivalents based on all constituents of the fertilizer—by titration of the non-nitrogenous residue, and adding or subtracting the nitrogen acidity.

Name of Fertilizer.	Analysis.	Equivalent in lb. $CaCO_3$.			
		Acidity.		Basicity.	
		Per Ton.	Per Unit.	Per Ton.	Per Unit.
Nitrogenous Fertilizers—					
Ammonium sulphate	21% Nitrogen (N)	*2,515	120	..	..
Sodium nitrate	16% Nitrogen (N)	..	..	660	41
Dried blood	13% Nitrogen (N)	500	39	..	..
Phosphatic Fertilizers—					
Superphosphate	20·5% Phosphoric Acid (P_2O_5) (Water sol.)	Neutral			
Rock phosphate	37·0% Phosphoric Acid (P_2O_5)	..	..	‡1,300	35
Potassic Fertilizers—					
Muriate of potash	50% Potash (K_2O)	Neutral			
Sulphate of potash	48% Potash (K_2O)	Neutral			
Nitrogenous-Phosphatic Fertilizers—		Ranges from			
Blood and bone	†6–10% Nitrogen 16–6% Phosphoric Acid	†340	..	270	..
Bonedust	†3% Nitrogen 23% Phosphoric Acid	..	..	†950	..

* These figures for sulphate of ammonia are converted from values obtained in the United States of America. Values obtained by the Agricultural Chemist on two samples of sulphate of ammonia offered for sale in Queensland, however, are given as 2,510 and 2,521 lb. $CaCO_3$ per ton, respectively.

† Meatworks fertilizers consist of varying proportions of animal protein and tri-calcic phosphate—ranging from dried blood to digested bonemeal. In this progression from a preponderance of "nitrogen" to a preponderance of "phosphoric acid" they alter from acid forming to base-forming—covering the ranges shown above, i.e., dried blood, 500 lb. acidity; blood and bone, 340 lb. acidity to 270 lb. basicity; and bonedust 950 lb. basicity. Digested bonemeal may give up to 1,360 lb. basicity.

‡ Although rock phosphate is given a high basicity value by this method, actually—at normal degree of fineness—its rate of action in the soil is very slow compared with superphosphate.

In calculating the acidity of any mixed fertilizer, the percentages of nitrogen, phosphoric acid, and potash should be multiplied by the unit acidity or basicity given for the forms concerned, and addition or subtraction made where required.

With blood and bone, or bonedust, it is necessary to calculate approximately the amount of ingredient used and take that proportion of the equivalent per ton given in the table; no unit equivalent is given for these fertilizers, as they contain both nitrogen and phosphoric acid—which would necessitate a complex apportioning of values.

In the United States of America, steps have been taken to correct the soil acidity—chiefly by internal neutralisation of mixed fertilizers by incorporating dolomite, and by stating on the fertilizer label the equivalent acidity or basicity. Legislation is in force in certain States, requiring the latter to be carried out. The State of North Carolina, for instance, requires all official samples of fertilizers taken by inspectors to be analysed for acidity or basicity.[6]

The general use of lime (burnt or pulverised limestone) as a separate application to the soil is also advocated.

The reason for using dolomite in fertilizer mixtures, as against limestone, is that investigations[3] have proved that no reversion of mono-calcic phosphate (as in superphosphate) occurs with dolomite; whereas some reversion can take place under certain conditions of temperature, moisture, and pressure, with limestone.

Two main reasons for the adoption of the method of "internal neutralisation" in the United States of America are given:—

One is that, because of lack of appreciation of the position, and failure to use lime as a routine practice, the soils in certain areas have apparently become so acid that a neutral or basic fertilizer is absolutely necessary; with respect to this, it is stated that the six South-eastern States of the United States of America—where acidity trouble is experienced—use more than 50 per cent. of the fertilizer and less than 5 per cent. of the lime used in the United States of America.[5] The other reason is that a large proportion of the fertilizers used in the United States of America contain filler—mostly sand—and the incorporation of dolomite in place of such filler is a logical step.

In Queensland, however, a stage such as is mentioned in the first reason, has not been reached; also, filler is not used in fertilizer mixtures in Queensland.

If the farmer uses lime fairly liberally as a routine practice, an acid-reacting fertilizer may be used regularly without ill-effect.[4]

Consequently, although the danger arising from excessive application of acid-forming fertilizers should be fully appreciated, there does not appear to be justification in Queensland for adoption of the steps taken in the United States of America—routine liming of soils admittedly being an efficient means of prevention.

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[3] MACINTIRE, ET AL.: (Ind. and Eng. Chem. Vol. 24, pp. 933-941, 1932).
[4] MORGAN, M. F.: (American Fertilizer, Jan., 1938, p. 24).
[5] COOPER, DR. H. P.: (American Fertilizer, July 22, 1939, p. 7).
[6] REPORT OF AMERICAN CHEMICAL SOCIETY: (American Fertilizer, 16 Sept., 1939, p. 8).

VALUE OF FORESTRY IN WAR TIME ECONOMY.

Britain's forests are one of her lines of defence. Science workers now know the secret of extracting sugar from the softwoods of the English countryside, such as birch, ash, elm, and sycamore. Clothing material, motor fuel, dyes, many essential chemicals, various cattle foods, transparent paper, and even sausage skins are among other things yielded by trees.

If all other supplies of these commodities were cut off, Britain could "live on her forests" for at least six months, and very likely a year. Apart from private plantations, hundreds of thousands of acres of trees have been planted by the Forestry Commission since the war of 1914-1918.

"We can now produce many of the vital necessities of life from wood," stated the chief chemist of the Forest Products Research Laboratory recently. He goes on to say:—"There is no waste, for science has made every part of a tree valuable for something. So-called waste wood has been used for a year by one of our own research workers as fuel for his motor car. Using it in a special and inexpensive generator, he gets speed of over fifty miles an hour and covers great distances at the cost of a few pence. A substitute for glass, used chiefly for aeroplane windows, is yet another product of the woods and forests of the British Isles."

HOW TO SHOOT A HORSE.

Unfortunately, it becomes necessary sometimes to destroy a horse. Shooting is probably the most humane method, and this is how it is done:—

Theoretically, the best path for the bullet is one going through the brain and along the spinal column, but in practice that is rather difficult to achieve. The practice of shooting in the centre of the forehead between the eyes is one that has caused needless pain to many a wretched animal, as the bullet usually passes into the throat without touching the vital centres. If two lines are imagined running from the top of the eyes to the base of the opposite ears, as shown in the diagram, and the point where they intersect is taken as the target, a shot aimed more or less parallel with the ground will pass through the brain and sever, even if it does not follow, the spinal cord. If the animal's head is lowered as when feeding at an ordinary manger, the bullet will probably traverse the spinal column for some distance, although a bullet through the brain will in most cases cause instantaneous death.

A revolver is the best type of firearm to use, with the exception of the specially-designed "humane-killers," but a rifle or shotgun may be used. The muzzle of the weapon should be almost touching the skin of the animal's forehead when the shot is fired.

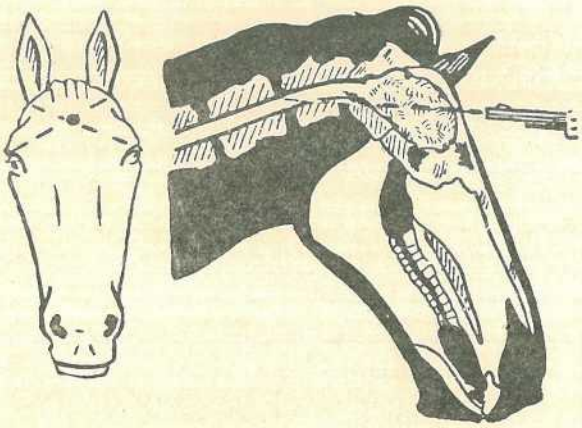


Plate 80.

Shooting Pigs.

When killing a fairly large pig, shooting the animal will avoid the hideous squeals which usually make this task even more than usually unpleasant. Where the sole armament is a low-powered pea-rifle, it frequently happens that the bullet fails to penetrate the skull when fired into the centre of the forehead. The pig has a fairly thick ridge of bone running down the centre of the head, and for this reason it is advisable to shoot diagonally from a position a short distance above but nearer to the centre of the skull than the eye.

Much suffering is caused by people who are not intentionally cruel simply through ignorance of the structure of an animal's skull, and it is hoped that these few notes will enable readers to kill their animals with a minimum of pain and suffering.

A SWISH OF A TAIL—AND A TALE OF A SWISH.

An unusual accident happened on a farm recently. At threshing time a horse standing near the thresher switched his tail at a fly. The tail was caught in the thresher and torn off. So badly was the machine damaged—to say nothing of the damage to the unlucky horse—that threshing had to be postponed for repairs. The fly escaped.

General Notes

Staff Changes and Appointments.

By an Order in Council under "*The Dairy Products Stabilisation Acts*, 1933 *to* 1936," Mr. H. S. Hunter, Director of Marketing, has been appointed to be a member of the Dairy Products Stabilisation Board. The approval of the Executive Council also has been given to Mr. Hunter's appointment as a member of the Committee of Direction of Fruit Marketing.

Messrs. St. G. Thorn (Bacteriologist) and J. A. Rudd (Government Veterinary Surgeon) have been appointed members of the Veterinary Medicines Board until the 22nd January, 1942. The other board members are the Agricultural Chemist and the Chief Inspector of Stock.

Mr. E. T. Lewin, inspector under *The Stock, Slaughtering, and Dairy Produce Acts*, has been transferred from Dalby to Brisbane.

Mr. D. Aiken, Bundaberg Cane Disease Control Board, has been appointed an honorary inspector under *The Sugar Experiment Stations Acts*.

Sergeant A. F. Kahler, Boulia, has been appointed also an inspector under *The Brands Acts*.

Messrs. F. F. Bishop, Don River, Bowen, B. M. Hannan, Conway Station, via Collinsville, and J. B. Henderson, Collinsville, have been appointed honorary protectors under *The Fauna Protection Act*.

Mr. G. P. Lambert, New Farm, a scoutmaster of the Boy Scouts' Association, has been appointed an honorary protector and honorary ranger, respectively, under *The Fauna Protection Act and the Native Plants Protection Act*.

Cane Prices Board.

Under *The Regulation of Sugar Cane Prices Acts*, the following persons have been appointed, as representatives of the owner or owners of the mills and as representatives of the canegrowers, to be members of the respective local sugar cane prices boards:—

Bingera—
Millowners' representatives—B. A. Bourke and R. T. N. Smith.
Canegrowers' representatives—J. F. Cromarty and L. G. Scotney.
Chairman—C. D. O'Brien.

Cattle Creek—
Millowners' representatives—P. H. McLean and G. W. Shaw.
Canegrowers' representatives—Jas. Turner and J. M. Pratt.
Chairman—H. L. Kingston.

Farleigh—
Millowners' representatives—E. Evans and John Smith.
Canegrowers' representatives—A. Fordyce and J. R. Malcolmson.
Chairman—C. B. Buxton.

Goondi—
Millowners' representatives—J. Ross Kerr and D. A. Williams.
Canegrowers' representatives—H. Klarwein and R. J. Wright.
Chairman—C. Burchill.

Hambledon—
Millowners' representatives—R. T. Easterby and E. W. Segaert.
Canegrowers' representatives—W. W. Chapman and W. D. Ishmael.
Chairman—A. Anderson.

Invicta—
Millowners' representatives—H. B. Burstall and J. L. Mullins.
Canegrowers' representatives—H. F. Hecht and W. E. G. Smith.
Chairman—T. E. Dwyer.

Isis—
Millowners' representatives—A. Adie and J. Alison.
Canegrowers' representatives—B. Foley and W. M. Duncan.
Chairman—E. H. Baker.

Kalamia—
Millowners' representatives—J. W. Gray and J. W. Inverarity.
Canegrowers' representatives—J. Breen and M. A. Coyne.
Chairman—T. E. Dwyer.

Macknade—
Millowners' representatives—N. S. Beatty and N. R. Dowling.
Canegrowers' representatives—G. Cantamessa and K. Livingston.
Chairman—A. E. George.

Marian—
Millowners' representatives—A. J. Coyne and R. J. Leck.
Canegrowers' representatives—G. Ollett and E. C. Walz.
Chairman—C. B. Buxton.

Mourilyan—
Millowners' representatives—G. R. Blair and H. G. Selby.
Canegrowers' representatives—G. F. Hudson and B. B. Ross.
Chairman—C. Burchill.

North Eton—
Millowners' representatives—B. F. Hogan and N. F. Lever.
Canegrowers' representatives—S. F. Lowther and A. Smoothy.
Chairman—H. L. Kingston.

Pioneer—
Millowners' representatives—G. R. Ashwell and B. C. J. Martin.
Canegrowers' representatives—B. S. Donovan and L. W. J. Hoey.
Chairman—T. E. Dwyer.

Plane Creek—
Millowners' representatives—A. Innes and S. H. Scougall.
Canegrowers' representatives—C. W. Davidson and J. Lawrie.
Chairman—C. B. Buxton.

Rocky Point—
Millowners' representatives—W. H. Heck and F. W. Heck.
Canegrowers' representatives—B. A. Ernst and H. W. Koppen.
Chairman—J. J. Leahy.

South Johnstone—
Millowners' representatives—A. J. McRobbie and C. E. Myers.
Canegrowers' representatives—A. H. Reichardt and W. J. Henderson.
Chairman—C. Burchill.

Victoria—
Millowners' representatives—N. R. Dowling and M. Mackellar.
Canegrowers' representatives—E. L. Burke and G. G. Venables.
Chairman—A. E. George.

Wild Life Preservation—Toowoomba.

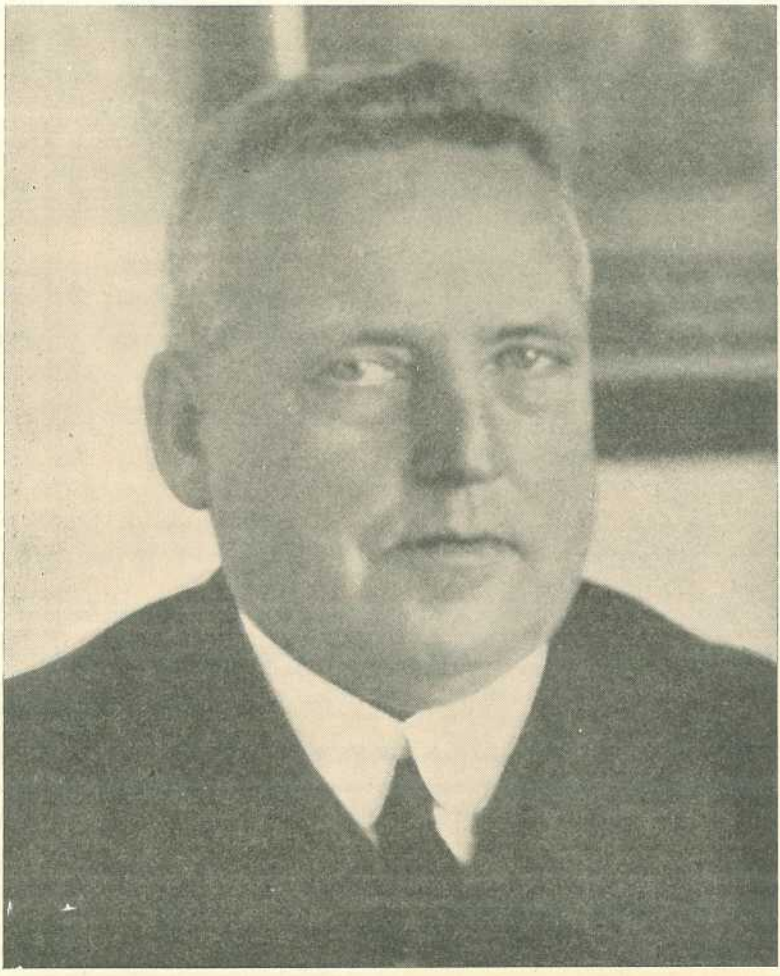
An Order in Council has been issued under "*The Fauna Protection Act of* 1937," declaring the residential district of the city of Toowoomba to be a sanctuary under the Act.

Size of Apples.

An amendment of regulations under *The Fruit and Vegetables Acts* raises the present minimum size of apples intended for sale from 2 inches to 2¼ inches. The amendment sets out the size requirements for the different varieties of apples.

In Memoriam.

LIEUTENANT-COLONEL A. H. CORY, V.D., M.R.C.V.S.



[From an official group photograph, Department of Agriculture and Stock.]

Plate 81.

THE LATE LIEUT.-COLONEL A. H. CORY.

THE passing of Lieutenant-Colonel Arthur H. Cory, who died at his home, Wynnum, on 18th December, after a very brief illness, is recorded with deep regret.

The late Colonel Cory, who had been Chief Inspector of Stock for nearly twenty-five years, retired from the Public Service in November. He had completed arrangements for commencing private practice as a veterinary surgeon in Toowoomba.

He was born sixty-five years ago in Devonshire, England, where his family had been landholders for many generations. After graduating from the Royal College of Veterinary Surgeons, London, he practised his profession in different centres in the West Country. In 1901, he came to Queensland, and soon after his arrival obtained an appointment as veterinary inspector of stock in the Department of Agriculture and Stock. After a brief sojourn in England, he re-entered the service of the Department in 1908, and in the following year was appointed lecturer in veterinary science at the Queensland Agricultural College. In 1915 he was appointed Chief Inspector of Stock in succession to the late P. R. Gordon. As a veterinarian, he was intensely practical, with a gift for ready and accurate diagnosis of stock diseases. Among the recognised leaders of his profession, his name became a household word throughout rural Queensland.

At a large gathering of his fellow officers and representatives of the pastoral and agricultural interests only a few weeks before his death, high tributes were paid to the valuable services he had rendered to the Government and the land industries of Queensland in the course of his long and successful career.

The late Colonel Cory will be held in affectionate remembrance by all who had the privilege of association with him, either officially or socially. To those who knew him intimately, his chief hobby seemed to be doing good turns to his fellow man. A winning and genial personality, he had the gift of friendship, and was, above all things, a fine Englishman, in whom had grown an intense love of Australia and Australian ways.

In a fine tribute to his memory, the Minister for Agriculture and Stock (Hon. Frank W. Bulcock) said: "The State has lost a distinguished veterinary officer, but his work will endure in the Department in which he had served so long and so ably."

To his bereaved family, profound sympathy is extended.

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of Mr. C. T. White, Government Botanist.

"Bamboo Grass."

G.A.W. (Meandarra)—

The specimen is bamboo grass (*Stipa ramosissima*), a very common grass in Southern Queensland. It is frequent on cleared brigalow country, but more especially on cleared, mixed, rather dry scrub. It is not generally regarded as having much value as a fodder, although stock will eat it, especially when other grass is short.

Star Thistle—A Serious Pest.

S.C. (Crow's Nest)—

The specimen is star thistle (*Centaurea Calcitrapa*), a native of southern and western Europe. This plant, because of its very rigid, long spines, is a very serious pest. It has not previously been recorded for Queensland, but is fairly common on the New England Tableland of New South Wales, where it is regarded as a very serious pest. Naturally, it is imperative that a plant of this character should be eradicated immediately.

Hemlock—"Carrot Fern" or "Parsley Fern."

M.M.G. (Southport)—

The specimen is hemlock, *Conium maculatum*, commonly grown as an ornamental plant under the name of "carrot fern" or "parsley fern." The plant is a well-known poisonous one, and recently we received a record of its having poisoned a child in Queensland. This is the first record of its kind so far as we know in this State, although it has been accused of causing deaths in England and America.

Yellow Oleander.

J.E.H. (Rathdowney)—

The specimen is *Thevetia neriifolia*, sometimes called the Yellow Oleander. It makes a handsome shrub and is fairly drought resistant. It belongs to a poisonous family of plants, and we have always regarded it as poisonous. We have, however, heard at times of people eating the fruit without any ill-effects.

Cape or Balloon Cotton.

J.R. (Yeerongpilly)—

The specimen is Cape Cotton or Balloon Cotton, *Gomphocarpus fruticosus*, a native of South Africa, with a wide distribution as a weed in Australia. The plant belongs to a poisonous family, the Asclepiadaceae, and has several times been suspected of poisoning stock. Feeding tests at Yeerongpilly have proved the toxicity of the plant.

Horehound.

J.McG. (Coominya)—

The weed forwarded is the Horehound, *Marrubium vulgare*. The leaves and tops of this plant are used in making up cough mixtures. The plant also is used in the manufacture of herbal beer.

There is a small market for the leaves here, and if you are interested you may get in touch with Taylors and Elliotts Limited, Charlotte street, Brisbane.

There are no particular methods of eradication, and if the land can be put under cultivation the weed generally disappears. Arsenical sprays would be effective, but have the disadvantage of rendering the plant poisonous. Although stock do not eat it under normal conditions, they sometimes have a partiality for these arsenically sprayed weeds. Sodium chlorate in weak solutions is not poisonous to stock, and you could try this or some of the commercial weedkillers in which it is used as a basis.

Yellow Pea.

M. (Tara)—

The specimen is *Cassia Sophera*, commonly known as yellow pea. The name arsenic bush is sometimes applied to this and other allied species of cassia. Feeding tests with them, however, have given negative results. They belong to the same genus as the plants which produce the senna leaves of commerce, and if eaten in any quantity by stock have a purgative effect.

Germination of Wattle Seeds.

Project Club, Boonarga—

Sometimes wattle seeds can be germinated by simply sowing in flats or seed beds in the ordinary way, in rather sandy soil, but usually special treatment is advisable. The easiest method is to place the seeds in a cup and pour boiling water over them, leaving them to soak for some hours. A New South Wales nurseryman, who specialises in the collection and sale of Australian native tree seeds, has the following to say about them:—"In sowing the seed of the Acacias my method is to plant them in seed beds. After getting the ground prepared, pull the soil back from where you are going to sow the seed, then after sprinkling the seed in, cover the soil about 1 inch over the seed and bat it down with the back of a spade or roller lightly and pour boiling water all over the seed bed, and throw some bags on top to keep the steam in until it cools off. This is the best method that I know for bringing the seed up quickly. You would have to keep the ground damp until they come up. This may be two or three weeks before they show. Acacia seed is one of the hardest to germinate, owing to its hardness; but the boiling water softens them and does not hurt the germ. It may be important to know that most of the Acacia seeds will keep ten years and then germinate well. When the little plants are about 3 or 4 inches high they could be transplanted out, about 10 to 12 feet apart, on a suitable damp day, and if no rain, keep watered about once a day for two weeks, or even longer, according to the weather." Regarding transplanting under Queensland conditions, it is sometimes advisable to put the young plants out into pots or tins, and later transplant to permanent positions.

Josephinia Burr.

O.L.H., Rockhampton—

The plant has been identified as *Josephinia Eugeniae*, the Josephinia Burr. This is a native plant which is fairly common in the western parts of the State. The burr, when plentiful, becomes entangled in the wool and thus reduces the price of the wool.

Medick Burr.

R.W.B., Hughenden—

The specimen is the Medick Burr (*Medicago denticulata*). This is an annual leguminous plant which is a native of the temperate parts of Europe and Asia. It is very common on the Darling Downs. It is also frequently found as a weed in lawns during the winter months of the year. It is an annual, and has a good reputation as a winter fodder plant, being comparable in food value to White Clover.

Knot Grass. Summer Grass.

G.M.L., Boyland—

The weed is Knot Grass, *Polygonum aviculare*, a very common weed in cultivation in Australia, and widely spread over the temperate regions of the world. It is not known to possess any poisonous or harmful properties, but it has been reported on occasions that the long, wiry stems have caused impaction in stock.

The grass is Summer Grass (*Digitaria adscendens*), a very common grass in Queensland, mostly occurring as a weed of cultivation. When it occurs in ordinary pastures, it favours rather light sandy soils. It is generally regarded as quite good fodder for stock.

Climbing Buckwheat.

S.L., Ramsay—

The specimen is the Climbing Buckwheat (*Polygonum Convolvulus*). This plant is not particularly abundant in Queensland, but has the possibilities, when introduced into a locality of becoming a bad pest in cultivation. Its eradication is therefore recommended.

Rural Topics

Grass and Water.

The water question always looms large, and, no doubt, the time will come when every stock route will have a water supply at the end of every daily stage, though, at the moment, that sounds like a drover's dream. Still it must come as the result of a growing "water consciousness" among the powers that be. Dr. Bradfield has set many people thinking on the feasibility of his proposal for diverting ever-running coastal streams in that region in North Queensland where the yearly rainfall is measured with a 3-foot rule, to the dry interior where the rivers rarely become anything else than a chain of waterholes. The recent Macrossan Lectures, of which water conservation was the theme were certainly of topical interest; likewise a public discussion on Queensland's natural water storage system, which was instituted by Dr. Whitehouse, of the University of Queensland. Amongst other things, he spoke of the peculiar way in which the West is watered. Fed by monsoonal rains—when they do occur—the Western rivers and channels fill and spread out in seas of fresh water 30 to 40 miles wide; the waterholes are scoured and kept clean and the grass grows high like wheat on the Downs after a good October storm. It's a fine picture, but actually that doesn't happen every year; but when it does happen there are no half measures about it.

The Western artesian water system is no less fascinating, and the fact that bore flows have diminished to a large extent in recent years is causing a lot of worry, but Australia is not alone in this experience, as the same thing is happening in the United States and other countries. It is interesting to theorize about it, but the water problem generally will have to be faced. An enormous population is supported by irrigation and water conservation in India, and there seems no reason why our own water supply projects should not be extended. In the higher rainfall districts of the State—especially in the coastal country—shortage of water should never happen, even in the driest season. Whether Dr. Bradfield's dream is realizable or not, these public discussions have done an immense amount of good, and more people are thinking water—as well as drinking water—as a result, and this increased interest must lead eventually to comprehensive schemes for conserving water and intelligently using the enormous volume which runs to waste every year. After all, we all subsist on grass and water which is meat and drink to everyone of us.

Pigs Being Divorced from Cows.

In Canada, pig feeding is drifting further away from the dairy cow. Nor is this trend limited to specific districts, according to a director of an experiment farm in the Dominion. This is what he says:—

> This change has required pig feeders to substitute other forms of protein and other nutrients formerly obtained from milk.
>
> To-day, the purebred pig incapable of making desirable bacon economically has no place on a farm. The purebred must have a direct commercial application. A third factor is that in some districts there are a lot of by-products from quick-growing crops that can be converted into marketable products by feeding them to livestock. Cull potatoes and other more or less waste stuff can be fed to pigs.
>
> At this Canadian experiment farm they are seeing how much corn can be used and still obtain A grade pig carcases. Other crops like cull beans also are being used, but beans have to be cooked to obtain the best results. Tests with corn show that to produce the right type of pigs, no more than 30 per cent. of corn can be fed until the pigs weigh 100 lb. After that from 50 to 60 per cent, of corn may be fed.

That is very interesting, but it is safe to say that it will be a long time before pig raising is divorced from dairying in Queensland.

Why Eggs are Small.

Here's a story with a farm flavour that is going the rounds: The young housewife complained to the grocer that the eggs were very small. He assured her that the eggs were "straight from the farm this morning." "There," she replied, "that's the trouble with these farmers. They're so anxious to get their eggs sold that they take them off the nests too soon!"

The Farmer in War Time Britain.

Unlike the position in 1914, the British farmer is well prepared for any emergency with a measure of efficiency which is reassuring to all concerned. Everything is now in train to direct the production and distribution of food. Prices have been fixed from the outset. No loophole has been left for profiteering on farm produce, and strict rationing of essential commodities will secure a fair deal for everyone.

So far as farming is concerned, no full-scale measures will be put into operation until after the present harvest which is approaching completion. The reserve of farm tractors will then be brought into service for ploughing every available arable acre. Very complete plans have been prepared for central and local organizations to increase the production of food and feedingstuffs. The Ministry of Agriculture is responsible for the central direction, and executive committees have been set up in each county to whom important functions will be delegated. These committees have already appointed sub-committees, one for each of these sections of the farming industry: cultivation; farm labour supply; machinery supply and use; livestock and fodders; general farming supplies; drainage; pest and disease control; and land utilization.

Each county has been divided into convenient districts, and each district sub-committee will serve as the eyes and ears of the executive committee.

Control of prices of food and feeding stuffs will be exercised by the Food Controller. Commodities are bought on the farm at fixed prices, which will be adjusted as circumstances require. From this point, the Food Controller takes charge. A Ministry of Food has been organized and its aim is to provide every consumer with a regular and fair share of essential foodstuffs. Planning has been done in close collaboration with trades and labour councils.

Large reserves of foodstuffs have been stored and these are being distributed on a rationed scale.

The Ministry of Food buys all overseas foodstuffs and is looking after their importation; it also buys all home-produced supplies, and aims to eliminate all competition and speculation. Prices of all important foodstuffs sold to the public have been fixed.

As approximately half of Britain's food requirements are imported—mostly from the Dominions—the Queensland producer of export commodities has a very special interest in the war-time food policy of the Old Country, and any measure which will prevent profiteering—the Queensland farmer doesn't ask for more than a fair price, and certainly has no desire to profit from any distress which may arise in the motherland—will be welcomed by all concerned in seeing the Empire safely through the present international crisis.

Beware of Gas in the Silo.

It is always necessary to be very cautious before enclosing a silo which has just been filled with fresh silage. Under certain conditions carbon dioxide, and other gases more or less equally deadly, are given off by the green stuff during the process of fermentation.

This is what the British Ministry of Agriculture advises:—

(1) The crop should have reached the proper stage of maturity and should not be too dry. With an immature crop the extent and nature of the fermentation that will take place is uncertain. An abnormal volume of carbon dioxide, or possibly other gases, may be generated. If the material is very dry it will not tread down closely, the additional air so retained causing the evolution of a larger volume of carbon dioxide than usual.

(2) The material should be well trodden down before work is done for the night.

(3) No door should be sealed up unless it is absolutely certain that the material will not sink below the level of the bottom of the door.

(4) Before work is resumed, the lower door should be opened. No one should be allowed to enter the silo until a reasonable time has elapsed.

(5) When the silo is being filled by an elevator, as long an interval as possible should be allowed to elapse after the lowest door has been opened, to allow any harmful gases to escape.

Money in Mud.

A farmer in New Zealand has been experimenting with tidal river mud as a top dressing for pastures. As reported in *The New Zealand Farmer Weekly*, this is what he says:—

"There is a mint of wealth lying waste in our tidal river mud, and few ever give it a thought. It is the best fertilizer we have, and I believe that if our paddocks could be top dressed with it, it would help to solve the problem of a lot of sickness amongst our stock. Only the weight of it and the bother of getting it out is against it.

"I have a large mound in one of my paddocks caused by the uprooting of some trees ages ago. The grass would never grow on it, although it got its share of the top dressing that went on the paddock every year. About ten years ago, I sledged mud out of the river and left the wet, sticky mass on the bare mound in shovelfuls. It set as hard as cement through the summer months, and I thought it was useless and that I had all my work for nothing. But in the autumn, when the rains came, it all crumbled down like fine flour. I raked it all over the mound. It could not have been more than an eighth of an inch thick, but the good grass soon grew on it, and it is as good to-day and as green as any other part of the paddock. And all due to the mud."

A Handy Maize Weeder.

From Gisborne, New Zealand, comes the report of a handy maize weeder invented by a local farmer.

The implement comprises a double row of long spring steel teeth which taper gradually to a point. These teeth scratch along the two rows of maize with a chattering action and weed the crop in a most efficient way. It is designed to handle the weeding of maize from the two-leaf stage until the crop is about 1 foot high. The depth of penetration of the teeth can be altered to suit varying conditions by adjustible wheels. The draught is light, one horse easily pulling the machine, and one man can efficiently deal with an acre on hour.

—*New Zealand Farmer.*

Great Britain's Three-Year Food Plan.

Consolidation continues on the home food front in Great Britain. County war committees have got well into their stride. Certain agricultural produce has been exempted from war insurance risks.

The great job of preparing on a three-year basis for feeding the nation has got into swing so smoothly and rapidly that it speaks volumes for the effectiveness of pre-war planning.

Government action has been taken to safeguard both the farmer and the consumer. The dual aim is to safeguard the primary producer against sharp rises in costs of production and to make available a sufficient supply of food over the counter and butcher's block at reasonable prices.

In cereal production all limits have been removed. Cattle, sheep and pig prices are fixed, and a fair average price has been placed on milk.

Things to-day are very different in the Old Country for the farmer than they were in 1914. Food and feeding stuffs, fuel and other requisites are stored. Over 60,000 tractors are in private hands—that is, on the farms—and there is a large reserve stock for release as required. Great Britain has entered on the conflict in a far better position for ploughing up the country than it was at the end of 1918.

Grooming the Milking Cow.

Grooming of dairy cattle is a refinement in farm management which calls for comment. High-producing animals are usually kept on high-priced farms, where natural scratching or rubbing-posts—trees or stumps— have been removed. Frequent milking and stall feeding prevent during much of the day the natural function of self-licking. Both these small inhibitions have a marked effect on milk production, and it has been observed that, under these conditions, some grooming is decidedly beneficial.

Treatment of Cream.

Dairy farmers are again advised to give close attention to the cooling, aerating, and stirring of cream. The flush growth of grass in the wet season often causes a gassiness in cream, as well as a "feedy" flavour. Aeration and cooling will do much to offset the development of these defects.

Prolific Berkshires.

Mr. W. J. Kajewski, of Glencoe, in a letter to Mr. T. Jones, Superintendent of the Farm Home for Boys, Westbrook, writes:—

"I desire to send you a report of two Berkshire sows I purchased from you in 1930. They both came in on their first litter in January, 1931, and each sow produced two litters a year, ranging from no fewer than ten pigs or more than fourteen pigs in each litter, and rearing on an average of over eleven pigs in each liter. One sow, up to date, has had eighteen litters, and is at present rearing thirteen out of the fourteen pigs, at the age of nine and a-half years. During her lifetime she reared 203 pigs, which were marketed as baconers.

The other sow had seventeen litters and, showing age, I thought she had had her day. She has produced and reared over eleven pigs on an average, and during her lifetime 195 pigs were sent to the bacon factory as her progeny.

You will notice both were good mothers, rearing the number they did."

War and the Farmer.

Probably the thought has come to the minds of many of us that the outbreak of war has automatically ended our marketing problems, particularly the familiar problem of what we have to do with our exportable surplus. It is just possible, too, that the idea that the war will be a "good thing," financially, has taken root in the minds of some of our farmers. Apart from the fact that producers are not so very keen on profiting unduly from the awful business of war, it is just as well not to be over-optimistic about export prices. Memories of what occurred twenty-five years ago when the Great War started—when prices of wool, butter, and other commodities were allowed to soar to the limits of demand—should not lead us to the belief that similar conditions will be experienced during this, possibly, greater war. There can be no reasonable expectation that anything more than the "fair price" level will be permitted. It is probable—if we may judge from official views already expressed—that the whole of the British Commonwealth will be under price control. At the same time, it is practically certain that prices will be profitable—that is, reasonably profitable—to the producers, and that every ounce of butter and cheese and every pound of wool and meat will be needed. Elaborate plans for maintaining Britain's food requirements during the war period have been made, and supplies from the Dominions will, of course—or, at least, it is reasonably supposed—be governed by those plans. It may be taken for granted that profiteering will not be allowed in any form—especially by the speculator in foodstuffs.

Maintenance of sea transport is, naturally, of vital importance, but farmers and everyone else concerned may rest assured that nothing has been left undone to prevent any dislocation of the export of our primary products.

Consequently, productive enterprise should not be checked in the slightest degree. The successful issue of this war will depend largely on the primary producers in the Dominions as well as in the Old Country, and farmers may get on with the job of producing to the limit of their holdings with the assurance that their efforts will be suitably acknowledged and rewarded. No one can say how long the struggle will last, but it is clearly the job of the producer, as for every other unit in the community, to keep on keeping on.

A Relieving Farmer.

A professional man always arranges for another to relieve him when he wants to take a holiday. If it is good for, say, a doctor to have a locum tenens, it also should be good for a farmer.

So what appears to be an unusual offer was made to a district executive of the New Zealand Farmers' Union, when a well-known local farmer said that he was willing to act as a relieving farmer to allow other farmers to go on holiday. He said his wife's services also were available. There's a practical idea in that proposal.

White-striped Cows in a Blackout.

Here's a news item from England:—Ponies in the New Forest are not the only animals to suffer the indignity of having stripes painted on them. Black-coated cows on English farms have been painted with white stripes so as to be visible to motorists if they stray on to the roads at night during the black-out.

Weather Wisdom.

It is undoubtedly true that certain animals can foretell rain when man cannot. For example, the aborigines have a saying that it will rain when the porcupines take to the hills. Even the city-dweller has several reliable rain signs; firstly, the domestic cat, which invariably seeks some sheltered spot in the house or under a shed when the sky looks threatening.

Then, of course, one may find one or more "huntsmen" spiders, or triantelopes, as they are sometimes called (they often measure as much as 6 inches across the span of the outstretched legs) on the wall of a room. . . .

Birds are fairly reliable rain guides. When, for instance, the domestic fowl starts to preen its feathers, rain is imminent. Also, seagulls fly towards the land and keep up a chorus of deafening cries when a storm is approaching.

By the same token, frogs will always croak at the first sign of a downpour. Apropos of which there is the story of an outback publican, who, in order to increase trade in times of drought, caught some frogs and put them in a tin under the bar. He then filled a can with water, and occasionally poured some over the frogs slyly, which caused an outbreak of joyous croaking. At this stage he would fill a glass with beer, and remark: "Well, gents, the frogs are croaking, so let's drink to the breaking of the drought."

This procedure always had the desired effect upon sales.

—*R.B.M., in "The Sydney Morning Herald."*

Doing Without a Horse Collar.

A new type of collarless harness now being sold in the United States makes it possible for a horse to pull with its body rather than with its shoulders. Side pads distribute the load evenly to the back, barrel, chest, breast, and neck. This gives free movement to the horse's legs and shoulders, and does away with the risk of shoulder sores.

Weed Killing—Three Golden Rules.

Weeds reduce the productive capacity of farms to a much greater extent than many farmers realize. Some farmers and graziers make a practice of carrying a light hoe with them whenever they have occasion to cross a paddock, and it is surprising the number of weeds they remove in the course of a year, almost without conscious effort. Here are three golden rules which it would pay every man on the land to observe:

1. Examine all crop seed for impurities before sowing. If impurities are found, send a sample to the Department of Agriculture, with a request for advice on them.
2. Keep a look out for any strange plant which makes its appearance on the farm. The Department will give information as to whether any such plants are weeds or otherwise.
3. All strange plants which are either known weeds or likely to become weeds should be destroyed before their seeds ripen and drop to the soil.

Unless these elementary precautions are taken, the time, labour, and money spent on destroying the plants are wasted, as a fresh crop of weeds, larger than before, will appear in the following season.

—*From "The New Zealand Farmer."*

Ploughing up Britain.

British farmers have now got 70,000 tractors ready to plough over a million and a-half acres of grass land for crops to maintain Britain's food supply.

In 1914, not one British farmer in a hundred had even seen a tractor. To-day, British tractors show a vast improvement in design over the few thousand which were put on the land in 1917. As they are much lighter, they can everywhere replace the horse; and with pneumatic tyres in place of the old steel wheels, not only are their upkeep and fuel consumption both lower, but they can now be used for road haulage work.

In many districts of Great Britain the methods of application of machinery are to-day second to none in the world, and this wider experience, coupled with the huge contingent of tractors now available, assures the fighting forces of the Old Country of more than adequate support on the home front.

The British Farmer and the War.

In his cropping and breeding plans, the British farmer is preparing for a three years war.

It is already very obvious that in this war the expansion of home agricultural production is going to be a matter of tremendous importance to the British farmer as well as to every household in the Old Country. Every farmer seems to be out to do his level best to make greatest contribution he possibly can to that end in the knowledge that he will be doing his bit to bring the war to a successful conclusion.

Every branch of primary industry has been organized on a war-time basis in accordance with plans previously prepared for the purpose. These plans were worked out in the light of the lessons of the last war of 1914-1918, and of the general economic position at home and abroad. The National Farmers' Union is working in complete co-operation with the British Government in the application of these war-time plans.

The British farmer, in his essential service of food production, is animated with the idea that the advantage of farming is that the effect of effort is cumulative. The better he does this season, the better he shall be prepared for the next; and it will take many years before there could be any automatic check from nature.

Farmers in the Old Country are in a better position now than they were in the last war for making the necessary effort, and the principle of bringing prices into relation with the cost of production—and this point has a very special interest for Queensland farmers—has now been accepted. At present, returns are regulated on the basis of the normal costs of production of crops now being marketed or already grown, but it is pretty certain that the British farmer has not heard the last of price-fixing.

Prices must, of necessity, follow costs, and they must follow costs after the emergency passes, especially for whatever time is necessary for returning to what is to be the normal. Further, effort in producing food can never be wasted, as it may be in the case of some war-time necessities.

Increased production means, of course, increased expense and the British farmer has not been slow in emphasizing that fact in his dealings with the authorities, but, no doubt, this is a matter which will be adjusted on a fair economic basis.

A Word for the "Waler."

An Austrian farmer, now working on a property just below the border in New South Wales, remarked the other day that since coming to Australia he had been greatly surprised to find how little interest was taken in horse breeding. He had heard so much about the "waler" as a military horse during the last war that he had expected to see great numbers of them in the country districts, but had been disappointed.

Despite the mechanization of armies in Europe, he said, the horse is still of great military value, and can be used over country where tanks and tractors could not. The war in Spain confirmed his belief, for there it was found that an army could not be kept constantly mobile, especially in bad weather, without horses.

Many horses may be wanted in the near future, and if there are any difficulties about petrol, wheatgrowers and other farmers would find it impossible to get on without them.

In any case, what horses were in Palestine during the last war they would be in a much greater degree in Australia in the event of our having to fight on our soil against any aggressor.

A Wonderful Wheat Yield.

Here is the record of a wheat yield—the sort of yield a farmer pictures in his mind when he gets a cheque from the Wheat Board:

A yield of 112 bushels of wheat an acre from a field of 7½ acres reported from Southland, New Zealand, has been confirmed by the New Zealand Wheat Research Institute. The institute considered the reported yield so remarkable that inquiries were made and confirmation was received from the field superintendent of the New Zealand Department of Agriculture, both of the measurements of the field and the total yield. The variety was Cross 7. It was not, however, purely an accident that it was Cross 7, because it is doubtful whether any other wheat grown in New Zealand would have stood up so as to allow of the harvesting of the great weight of grain it produced.

Effectiveness of the Electric Fence.

Two farmers installed an electric fence, and ran their pigs in the enclosed paddock. When the grass and herbage were eaten down the farmers decided to remove the pigs and took down the fence. But the pigs refused to budge beyond the limit of the former temporary paddock. Finally the pigs had to be lifted bodily and trucked a hundred yards or so to the new paddock. There they rooted around peacefully, confined by their new "mental hazard."

A example, surely, of the effect of matter over mind! There is no doubt about the effectiveness of the electric fence.

Something Like a Tractor "Speedo."

Savings in operating costs are reported by American users of a new instrument which records the engine revolutions of trucks or tractors. On the dial are two red pointers, set to indicate the revolutions per minute range within which the engine will operate at greatest efficiency. The gauge also records the total revolutions which show the "invisible" miles run when the engine is idling, when gears are being shifted, and so on.

Back to the Horse in England.

Interesting sidelights of the effect of war-time petrol restrictions in England are given in these two news items:—

The first report says that at a farm sale an ordinary sulky was sold for £26 10s. Until the outbreak of the war many of these vehicles, in good condition, were put aside as scrap. Now they are worth real money, as petrol is rationed.

The second item is that only two horses, the lowest number on record, were offered under the hammer at a horse sale. Farmers, evidently, are finding that horses are too useful to sell.

That Top Layer of Soil.

Erosion is probably the most important single factor causing loss of soil fertility. A large percentage of the available plant food in soil is present in the weathered surface layer, and may be permanently lost through the removal of that layer by erosion. A familar example may be observed in the loss of productivity caused by the formation of gullies. The loss which results from the gradual, uniform removal of surface soil by sheet erosion may be less apparent than by gullying, but it is no less real.

Egg Storage in Oil.

A new oil treatment to keep cold storage eggs in good condition for a period of at least six months has been announced by the Research Bureau of the United States Department of Agriculture.

Casein for Aeroplanes.

Because casein is used in the building of military aeroplanes, it has become scarce and trebled in price since last year, when casein was hard to sell at any price. All the casein made by one dairy company in New Zealand is to be sent to Canada to be used in aeroplane manufacture.

The development of the Canadian scheme for the making of aircraft for war purposes has been primarily the reason for the raising of the price received by the company to between £55 and £60 at the present time.

Pride in the Pasture.

This is from the New Zealand *Journal of Agriculture*:—

"A really good pasture is a continuous source of pride, as well as of profit to its owner. It is seldom the result of chance or good luck, but it is rather the reward of a period of consistent good management, during which expediency, or the prospect of immediate gain, has been subordinated to the ultimate objective of establishing a perfect grazing area.

"Bolshevisation" of Bees.

Russian science workers are trying to induce bees to work on plants they ordinarily dislike. On 230 farms on which their methods were applied, it is claimed that the pollination of various plants was increased tenfold. The yield of lucerne, which is usually not popular with bees, is said to have been trebled.

A "Spot" for the Lambing Ewe.

Whisky and milk has long been recognized as a suitable stimulant for the lambing ewe. However, the prohibition forces are now at work, and strong tea is being recommended instead of spirits—from half a pint of strong tea being given two or three times a day, or even oftener, if thought necessary.

Tea is regarded as a valuable restorative for ewes after lambing and one that is easily prepared. In parts of the South Island of New Zealand, if a lambing ewe continues to be in pain a little chlorodyne is added to the tea, although the chlorodyne should not be given more than three times daily.

A New Point in Fertilizing Practice.

It is a practice in parts of New Zealand to scatter superphosphate through hay and ensilage material when harvesting is under way. According to American experiments, it now appears that the use of super in hay, but more especially in ensilage making, has a very definite effect in increasing the phosphate value of the manure from animals fed with super-fortified feed. So encouraging have been the results of experiments along these lines that it is deemed possible that the regular spreading of such manure may yet become the cheapest form of phosphatic fertilization of the soil.

Giant Star Grass for Soil Erosion.

Giant Star grass, which is receiving attention as a controller of soil erosion in South Africa, is already under observation in New South Wales.

Star grass is a common name of all the couch grass varieties and species in East Africa. Trials in Kenya indicate that it is best suited to the lower, moist regions of that colony. It has shown, however, considerable drought resistance in Africa.

Great care is necessary in introducing new species to Australia, for some grasses develop prussic acid at certain stages of growth. Giant Star will, therefore, have to be put through the same tests as every other introduced plant before there can be any thought of making it available to farmers.

When Mr. Bulcock (Minister for Agriculture and Stock) was in the Argentine and Brazil recently, he arranged for the sending of some grasses new to Australia, and which are likely to be valuable additions to our pastures. These, of course, will have to be submitted to similar exhaustive tests.

Practical Patriotism.

Here is very commendable instance of practical patriotism:—The residents of Amiens in the Stanthorpe district have decided to take community action for the care of orchards if their owners, owners' sons or employees enlist in the defence forces. A committee of six residents has been formed to obtain the names of fruitgrowers enlisting or in camp, and of sons of orchardists who otherwise would be assisting their parents on the orchard. The idea is to see that orchards and properties are not allowed to be neglected during their absence on military service. This committee will ascertain whether arrangements have been made for the adequate care of the orchard, and, if not, it will do everything necessary to ensure that the property will be looked after. If local residents cannot do the whole task, they will ask the Deciduous Group Committee of the Committee of Direction of Fruit Marketing to co-operate with them in this very worthy and self-imposed work. The harvesting of fruit crops will be considered when the time for gathering them arrives.

This is just another instance of how the real Australian spirit is applied.

Arsenate of Lead—Its Danger on the Farm.

Like so many other poisons, arsenate of lead should be handled and used with the utmost care. It is dangerous to livestock. Experience has proved that, but the proof offered by one American farmer is much out of the ordinary. He had twenty-eight Jersey heifers in a paddock bordered by elm trees. The trees were sprayed with a mixture of arsenate of lead. Four days after the spraying there was heavy rain, and, presumably, the downpour washed some of the spray off the trees on to the grass beneath. All the heifers were affected, as indicated by temperatures and the functioning of internal organs. After two days of constant effort by veterinarians, all but twelve of the heifers were in fairly good shape. Seven of the twelve died later. Paralysis of the digestive and breathing organs and blindness preceded the deaths.

Farm Notes

MARCH.

LAND on which it is intended to plant winter cereals should be in a forward stage of preparation. Sowings of lucerne may be made at the latter end of the month on land which is free from weed growth and has been previously well prepared.

The March-April planting season has much in its favour, not the least of which is that weeds will not make such vigorous growth during the succeeding few months, and, as a consequence, the young lucerne plants will have an excellent opportunity of becoming well established.

Seed wheat should be treated with copper carbonate for the control of bunt. For oats and barley seed the use of formalin or a reliable mercury dust is advisable.

Potato crops should be showing above ground, and should be well cultivated to keep the surface soil in good condition; also to destroy any weed growth.

In districts where the potato crop is subject to Irish blight it is advisable to spray the plants for the control of this disease. Bordeaux mixture of 4.4.40 strength should be applied at least three times at intervals of ten days to a fortnight, commencing when the plants are about six weeks old.

Maize crops which have fully ripened should be picked as soon as possible and the ears stored in well-ventilated corn cribs, or barns. Selected grain which is intended for future seed supplies should be well fumigated for thirty-six hours and subsequently aerated and stored in airtight containers. The germination of the maize is not normally affected by this treatment if dry and mature when treated.

The following crops for pig feed may be sown:—Mangel, sugar beet, turnips and swedes, rape, field cabbage, and carrots. Owing to the small nature of the seeds, the land should be worked up to a fine tilth before planting, and should contain ample moisture in the surface soil to ensure a good germination. Particular attention should be paid to all weed growth during the early stages of growth of the young plants.

As regular supplies of succulent fodder are essentials of success in dairying operations, consideration should be given to a definite cropping system throughout the autumn and winter, and to the preparation and manuring of the land well in advance of the periods allotted for the successive sowings of seed.

The early-planted cotton crops should be now ready for picking. This should not be done while there is any moisture on the bolls, either from showers or dew. Picked cotton showing any trace of dampness should be exposed to the sun for a few hours on tarpaulins, bags, or hessian sheets before storage in bulk or bagging or baling for ginning. Sowings of prairie grass and *Phalaris tuberosa* (Toowoomba canary grass) may be made this month. Both are excellent winter grasses. Prairie grass does particularly well on scrub soil.

Dairymen who have maize crops which show no promise of returning satisfactory yields of grain would be well advised to convert these into silage to be used for winter feed. This, especially when fed in conjunction with lucerne or cowpea, is a valuable fodder. Where crops of Sudan grass, sorghum, white panicum, Japanese millet, and liberty millet have reached a suitable stage for converting into silage, it will be found that this method of conserving them has much to recommend it. If permanent storage facilities are not available on the farm the stack method offers a practical alternative. Stacking with a framework of poles, and well weighting the fodder, are necessary for best results. All stacks should be protected from rain by topping off with a good covering of bush hay built to a full eave and held in position by means of weighted wires.

Orchard Notes

MARCH.

THE COASTAL DISTRICTS.

IF the weather is favourable, all orchards, plantations, and vineyards should be cleaned up, and the ground brought into a good state of tilth so as to enable it to retain the necessary moisture for the proper development of trees or plants. As the wet season is frequently followed by dry autumn weather, this attention is important.

Banana plantations must be kept free from weeds, and suckering must be rigorously carried out. There is no greater cause of injury to a banana plantation than neglect to cultivate. Good, strong suckers will give good bunches of good fruit. Weedy, overcrowded suckers will only give small bunches of undersized fruit hard to sell, even at a low price.

Cooler weather may tend to improve the carrying qualities of the fruit, but care should still be taken to see that it is not allowed to become over-developed before it is packed; otherwise it may arrive at its destination in an over-ripe and consequently unsaleable condition. The greatest care should be taken in grading and packing fruit. Small or inferior fruit should never be packed with good, large fruit.

There has been a marked increase in the banana thrips population in some districts in which this pest is well established. Growers who consider it necessary to deal with banana thrips are advised to apply to the Department for the latest information on how to deal with this pest.

The marketing of the main crop of pineapples, both for canning and the fresh fruit trade, will be completed in the course of the month, and, as soon as the fruit is disposed of, plantations, which are apt to become somewhat dirty during the gathering of the crop, must be cleaned up. All weeds must be destroyed, and if blady grass has got hold anywhere it must be eradicated, even though a number of pineapple plants have to be sacrificed, for once a plantation becomes infested with this weed it takes possession and soon kills the crop. In addition to destroying all weed growth, the land should be surface-worked and brought into a state of nice tilth.

In the Central and Northern districts, early varieties of the main crop of citrus fruits will ripen towards the end of the month. They will not be fully coloured, but they can be marketed as soon as they have developed sufficient sugar to be palatable; they should not be gathered whilst still sour and green.

As blue mould is likely to cause heavy loss in coastal citrus, especially in long-distance consignments, special precautions should be taken for minimizing this loss.

It must be remembered that the blue mould fungus will only attack bruised or wounded fruit; hence it is necessary to be careful that no injuries are given by the clippers or finger nails during picking. Fruit should be cut and not pulled. Long stalks which may injure other fruit must be cut away.

The fruit must be carefully handled and accurately packed so as to avoid bruising. Any injured fruit should be discarded. In order to reduce the number of fungus spores present in the plantation, all waste fruit in the orchard or packing shed should be collected at frequent intervals and destroyed by fire or burying.

Fruit must be carefully graded for size and colour, and only one size of fruit of one quality should be packed in one case. The standard bushel case, the inside measurements of which are 18 by 11½ by 10½ inches, is the best for citrus. The fruit must be sweated for seven days before it is sent to the Southern markets, in order to determine what fruit has been attacked by fruit fly, and also to enable bruised or injured fruit liable to blue mould to be removed prior to despatch.

Growers are reminded that the control of the bronze orange bug is best achieved by spraying with the resin-caustic soda-fish oil mixture normally either late in March or early in April. Applied at this time of the year, the spray can give a mortality of 98 per cent. of the bronze bugs, which are then present solely in the very young stages. This spray is also very effective against several of the important scale insects infesting citrus.

Red scale is a pest to which citrus-growers will shortly have to give attention, it being considered that control is best established from the middle of March to early in April. Fumigation with hydrocyanic acid gas is most effective against red scale, but success may also be achieved with white oils or with the resin-caustic soda-fish oil mixture evolved for the control of the bronze orange bug. Red scale, of course, is pre-eminently a pest of the hotter, drier citrus districts.

Strawberry planting may be continued during the month, and the advice given in last month's notes still holds good. Remember that no crop gives a better return for extra care and attention in the preparation of the land and for generous manuring than the strawberry.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

THE advice given in these notes for the last few months regarding the handling, grading, and packing of fruit should still be followed carefully. The later varieties of apples and other fruits are much better keepers than earlier-ripening sorts, and as they can be sent to comparatively distant markets, the necessity for very careful grading and packing is, if anything, greater than it is in the case of fruit sent to nearby markets for immediate consumption. Instruction in the most up-to-date methods of grading and packing fruit has been published by the Department, which advice and instruction should enable growers to market their produce in a much more attractive form.

The same care is necessary in the packing of grapes. Those who are not expert cannot do better than follow the methods of the most successful packers.

As soon as the crop of fruit has been disposed of, the orchard should be cleaned up, and the land worked. If this is done, many of the fruit-fly pupæ that are in the soil will be exposed to destruction in large numbers by birds, or by ants and other insects. If the ground is not worked and is covered with weed growth, there is little chance of the pupæ being destroyed.

Where citrus trees show signs of the want of water, they should be given an irrigation during the month, but if the fruit is well developed and approaching the ripening stage, it is not advisable to do more than keep the ground in a thorough state of tilth, unless the trees are suffering badly, as too much moisture is apt to produce a large, puffy fruit of poor quality and a bad shipper. A light watering is therefore all that is necessary in this case, especially if the orchard has been given the attention recommended in these notes from month to month.

FRUIT JUICES AS SUMMER DRINKS.

In fruit marketing the Californian fruitgrowers have attained very high standards for both fresh and processed fruits. Now they are going one better by developing the fruit juice industry, and this recent development suggests a way out of our own problem of over-production which most fruitgrowers have to face at one period or another in every year.

In a warm climate, people should be induced to drink their fruit as well as eat it.

There has been an extraordinary increase in the quantity of fruit juice consumed in America, and this has had a remarkable influence on the food habits of the whole nation. Great strides have been made in nutrition research, and commerce has been quick to adapt itself to the new food technique. In all these changes the fruitgrower has come definitely into the picture. Primary products have hitherto found their markets without science or system, although they are just as adaptable to modern merchandising methods as those of the manufacturer.

The primary producers, obviously, should keep on organizing themselves and their industry, especially on the marketing side. Rigid standardization of high-grade products, duly branded and guaranteed, and widely advertised, is the chief requirement. With summer upon us, it would be an excellent plan to concentrate on advertising our wonderfully nutritious fruit juices—natural juices, not synthetic substitutes.

Maternal and Child Welfare.

Under this heading is issued each month an article, supplied by the Department of Health and Home Affairs Maternal and Child Welfare Service, dealing with the welfare and care of mother and child.

THE VALUE OF SLEEP AND REST IN CHILDHOOD.

ACCOMMODATION AND COT.

Without restful sleep, and plenty of it, a child does not grow as he should, although he may be correctly fed, properly clothed, and in other respects well cared for. The best part of growth takes place while a child is asleep. Sleeping should be the main occupation of a child during the early months of his life. Hunger interrupts the sleep of a normal healthy baby, and the feeling of satisfaction and comfort which should follow the taking of a meal induces sleep. It must be mentioned, however, that, if a baby during the first few days of life, when he is usually very sleepy, does not wake for his food and is allowed to sleep undisturbed, at the end of this time he may be unwilling to suck the breast. There is no more difficult child to manage than one who has not been trained to suck properly. Much of the time of the child welfare nurse is occupied in overcoming the results of this form of mismanagement.

As a child grows older he sleeps less, but up to the time he is twelve months old he should have at least two hours' sleep in the morning and a sleep in the afternoon, in addition to the twelve hours' sleep at night, which is broken by one feeding for the first nine months. Insufficient sleep will cause a child to be irritable and fretful and will interfere with his normal development. Up to the time he goes to

school he should continue to have his morning sleep or morning rest period. The value of this is recognised by many mothers as well as by nursery school and kindergarten directors.

Sleeping Accommodation.

The room in which the child sleeps should be well ventilated. A suitable veranda provides excellent sleeping accommodation, particularly during the day and also at night, if it has been made weather-proof.

Cot.

Baby should have his own cot which should be placed so that he is protected from strong winds and the direct rays of the sun. Do not use a swinging cot, but a fixed one with wire gauze sides which can be let down. Make sure that there are no spaces in the sides or between the mattress and the frame into which part of the child's body might pass.

Mattress.

The foundation mattress should be firm, well studded, and fairly thick. A shakedown containing light oaten chaff should be placed on the mattress. The purpose of this is to provide a soft, cool nest for baby, which can be readily renewed if it becomes soiled. The chaff should be carefully picked over to remove any prickly pieces and baked in a tin before being used. This may be done very satisfactorily by putting the chaff into half a kerosene tin and keeping it in a moderately heated oven for about one hour. It is advisable to stir the chaff periodically while it is being baked. The case of the shakedown is usually made of unbleached calico and this should be half filled with chaff.

If it is necessary to use a hot water bag or bottle on account of the cold weather or because the child is poorly nourished, this can be placed conveniently and safely between the mattress and the shakedown.

Bed Clothing.

During the warmer weather very little bed clothing is required. It should be light and placed loosely over the child and tucked in at the sides of the cot. A sleeping bag is useful on certain occasions. It is well to bear in mind that the temperature tends to fall in the early hours of the morning. During cold weather the cot may be made warm and comfortable by placing across it a blanket large enough for its edges to come well over both sides and the foot of the cot. The mattress and shakedown are placed on top of the blanket and upon the shakedown a piece of blanket is laid. This is covered with a sheet which is tucked in well all round. Across the centre of this is placed a piece of waterproof sheeting which is covered with a strip of flannelette long enough to be used as a draw sheet. Upon this is placed the baby who is clad in an easily fitting gown and covered loosely by a large, light shawl made of radianta, cashmere, or Kremlaine, depending upon the season of the year. Finally each side of the large blanket is lifted over and tucked in on the opposite side of the cot and the piece at the foot is brought up and pinned.

Pillow.

Actually baby does not need a pillow at all, but a small thin one does no harm and helps to make him comfortable. Large soft pillows are unhealthy because they tend to interfere with his breathing. A baby has been known to suffocate by burying his face in a large soft pillow.

Light oaten chaff makes an excellent filling for a pillow, and as in the case of the mattress this should be carefully picked over, baked, and enclosed in a cover of unbleached calico. Care should be taken to avoid having lace or embroidery where the baby's head will lie.

Baby's Position.

Mothers used to say that a baby should not be allowed to sleep on his back because the back of his head would become flattened. Others said that he should not be allowed to sleep on his stomach because he might smother. Baby may be safely placed on his back or on his side, providing the mother has carried out the directions already given in regard to making his cot. It is usual to change baby's position from time to time. As he becomes older he will change his position as he pleases.

In placing baby in the cot it is advisable to keep his head about six inches away from the top. In the case of an older child a small flat pillow may be attached to the top by means of tapes in order to prevent him from rubbing his head on the wire.

Mosquito Net.

A sound mosquito net should be placed on the cot and made secure under the mattress to protect the child from flies and mosquitoes. Care should be taken to prevent the net coming into contact with the child's body. If a mosquito-proof cot can be secured, the net, of course, will be unnecessary.

Spare No Trouble.

When it is remembered how much time baby spends in his cot, it will be realized that no trouble should be spared to make it as comfortable as possible.

Indifference to Ordinary Sounds.

A healthy child should be able to sleep undisturbed by the sounds associated with the ordinary activities of the household.

Information on all matters concerning infant and child welfare may be obtained from the nearest Maternal and Child Welfare Centre (Baby Clinic), or by writing to the Sister in Charge, or by communicating direct with the Maternal and Child Welfare Centre (Baby Clinic), Alfred street, Fortitude Valley, N. 1, Brisbane.

COCKROACH CONTROL.

Cockroaches are nocturnal, hiding during the day in dark corner and crevices, where they congregate in large numbers. In the house, they usually hide near the sink and drainboard, behind the kitchen cabinet, and in similar places. If disturbed when foraging at night, they run rapidly for shelter, and a knowledge of where they conceal themselves is usually the key to their control.

In Queensland, houses are constantly being reinfested by adults crawling and flying in from outside, and no control measures can keep a building continuously free from the pest, if reinfestation is possible. Therefore, it is first necessary to clean up all outbuildings and burn accumulated rubbish of any kind. All cockroaches found hiding in

packages of food and merchandise being brought into the house should be destroyed. They may be killed mechanically or by spraying with a proprietary fly spray. Crack fillers, such as putty or plaster of paris, can be used effectively to close many openings used by cockroaches as avenues of escape to hiding places. This is particularly important if cockroaches are coming in from adjacent apartments, through wall spaces or along the plumbing fittings.

Sodium fluoride is the best cockroach remedy for use in homes which have already become infested. If the power is not readily available in pure form, suitable commercial preparations, generally known as insect powders, containing up to 80 per cent. sodium fluoride, can be obtained from any grocer. Sodium fluoride is poisonous to man if taken internally in sufficient amounts, and it should be kept out of food and away from children and pets. If used with reasonable care in cockroach control, however, no harm will follow. It may be sprinkled by hand along the back of shelving, draining boards, and other places frequented by the pests. When so placed in the runways the powder adheres to the limbs and is subsequently taken in through the mouth as the insect cleans itself. Sodium fluoride therefore acts as a stomach poison. The powder remain effective indefinitely in dry situations, but in very damp places it may cake and become useless.

Sodium fluoride is best applied with a small duster or bellows and blown into the hiding places. In this way more cockroaches are directly affected, for they die rapidly when the powder is blown directly on them. The application should be made in the evening and the powder left for two or three days. Frequent treatments are usually necessary at intervals of one or two weeks if the pest is to be kept under control.

GARDENING FOR GRACE.

Gardening is the best form of exercise for the woman of forty odd. It will also help her to retain a graceful figure.

The suppleness of youth has a disconcerting habit of disappearing with increasing years ,and it is absolutely essential for the "not so young" to take some sort of outdoor exercise.

There are women, well past middle-age, who still play a strenuous game of tennis, or indulge in other energetic forms of sport, but for the average woman of forty odd, medical opinion is that a less vigorous form of exercise is desirable, and for this gardening is ideal. The muscles are kept supple, there is no chance of joints getting stiff, and that bugbear—the "middle-aged spread"—is kept well at bay!

Walking about inspecting one's handiwork, bending, stooping, squatting, exercising different muscles with each movement is definitely slenderizing, and there will be little likelihood of that "spare tyre" round the middle making its appearance!

It is unnecessary to acquire that weather-beaten look usually associated with the woman who spends her time in the open air indifferent to wind or sun. A shady hat will protect skin or eyes, a scarf, one's neck. No woman coverts a supple figure at the expense of a reddened complexion, or network of fine wrinkles round the eyes caused by insufficient protection from the dazzling sun.

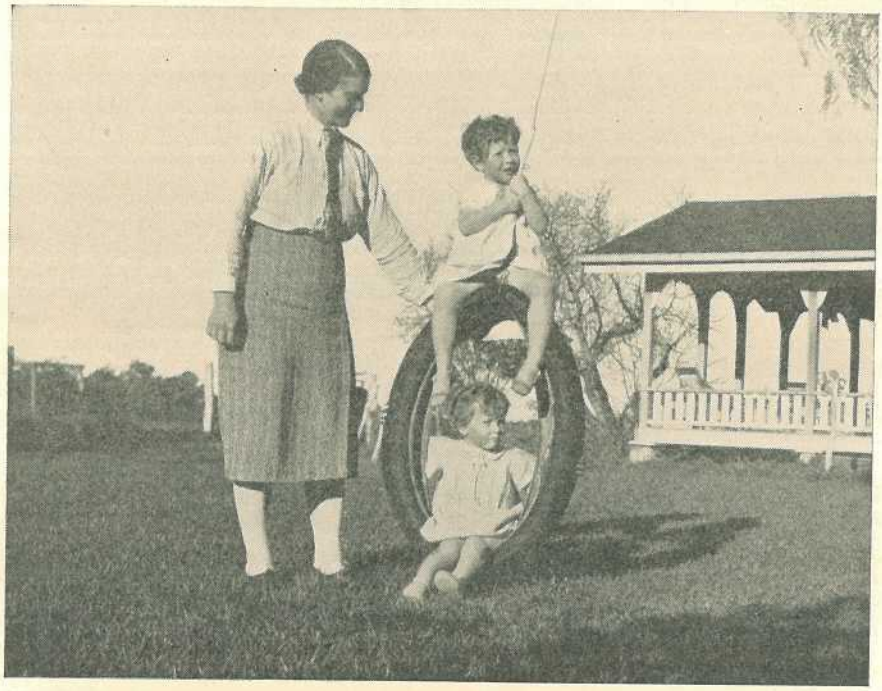


Plate 82.

Young Australia.—On the lawn at "Bostocks," Mr. R. Bligh's home, near Brookstead, Darling Downs.

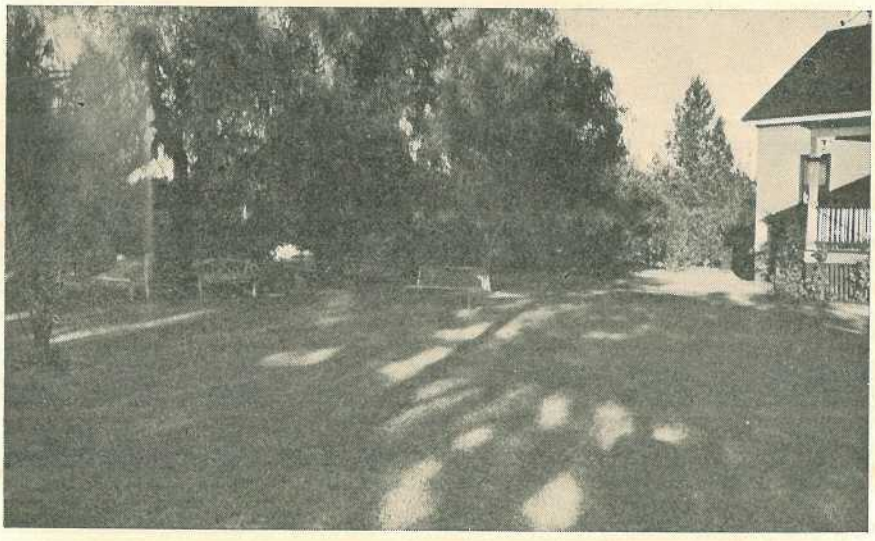


Plate 83.

The Morning Sun Casts Deep Shadows Across the Lawn.—A corner of the garden at Condamine Plains, Mr. A. C. V. Bligh's station home, Darling Downs.

Gardening gloves can be worn to protect the hands, but they are rather cumbersome. Scratch your nails on the soap before you garden, it will prevent them from becoming filled with earth. Never wash your hands in hot water if they are very dirty, it will only open the pores of skin and the earth will become ingrained. Wash them in cold water until quite clean, if necessary remove any stains with pumice stone, then rub well with cucumber or hand lotion.

It is hard work—gardening—you will want to pause for breath; when you do, do a little deep breathing. Few people really fill their lungs to capacity when they breathe normally, now is your opportunity to do so. Take deep breaths of the pure air, it will exercise your chest muscles, and invigorate your blood with life-giving oxygen.

There is nothing more steadying for the nerves than an hour or two in the garden—alone. Household cares and worries are forgotten, or if too urgent to be entirely put aside, at any rate can be regarded with a certain detachment and often seen in better perspective. There is time to *think*, but try and let your thoughts dwell on happy, peaceful things, give your mind a rest, just for a spell, and wrinkles of worry and anxiety a chance to disappear.

For the woman of forty odd, who cannot indulge in strenuous exercise, but who wishes to keep her muscles supple, and her figure youthful and full of grace, there is no exercise that will accomplish this as perfectly as gardening.

—C. I. M. Courtney in "South African Gardening," Spring Number, September-November, 1939.

IN THE FARM KITCHEN.

SUMMER SALADS.

THE food value of salads cannot be over-estimated, especially those served with oil dressings. The oil furnishes heat, while uncooked fresh vegetables and many fruits also used in salads contain many valuable mineral salts which contain essential elements.

Care and judgment should be used in selecting the combinations that make up the salad, and which should be chilled, crisp, attractive, and simple.

Choose a large bowl to mix a green salad; place a clove of garlic in a crust of bread, rub the bowl well with it, then remove the garlic and allow the bread to remain in the bowl during the mixing. When ready to serve, remove bread.

Tomato Cups.

Scald six medium tomatoes and remoke skin. Place in ice chest to chill. Peel and cut a long young cucumber into very thin slices, add 1 cup finely shredded celery (best part), 1 finely chopped apple, ½ cup chopped walnuts, 1 tablespoon red or green pepper, finely shredded. Moisten with a cream salad dressing, and fill tomatoes. To scoop out centre of tomatoes, use a vegetable scoop; it is much easier than using a spoon. Arrange tomatoes in crisp lettuce leaves; sprinkle over them a few very finely chopped chives or finely chopped parsley. Serve very cold.

Ham and Vegetable Salad.

Mix together 1 cup lean diced ham, ½ cup cooked beans cut into dice (not shredded), ½ cup diced cooked carrot, beetroot, haricot beans, peas, and diced potatoes. Add ½ cup French dressing, and allow to stand for one hour. When ready to serve, place on crisp lettuce cups, put a dab of mayonnaise on top, sprinkle with a little finely chopped parsley, and serve.

Lobster Salad.

Remove meat from lobster and chop into small squares. Sprinkle over it a little French dressing and chill thoroughly. When ready to serve, mix with enough mayonnaise to moisten, place in lettuce cups and garnish with curled celery, grated raw carrot, and small peeled and well-chilled tomatoes. Rub any lobster coral through a sieve and sprinkle over top of lobster.

Rice and Prawn Salad.

Combine 2 cups well-cooked unpolished rice (cold), 2 tablespoons very finely minced onion, 2 cups chopped prawns, 2 teaspoons chopped capers, 4 chopped olives, 4 sour gherkins, and 1 tablespoon cold cooked bacon, chopped finely. To 1 cup French dressing add 1 teaspoon chopped parsley, 2 tablespoons chili sauce; mix well together, then place a layer of broken lettuce, a layer of rice, &c., and so on, till the bowl is full. Separate 2 hard-boiled eggs, put through a sieve, and sprinkle over top.

Mayonnaise.

Place 2 egg yolks in a basin, add pepper and salt to taste, and 1 teaspoon lemon juice. Now add ¼ cup olive oil drop by drop, stirring well all the time. These first few drops are the most important. Now whisk with an egg whisk as it is much quicker, adding 2 tablespoons oil at a time until used up. Mix ½ teaspoon mustard with 2 tablespoons vinegar, and add to oil mixture. Do not keep oil mayonnaise in ice chest, as it would cause oil to separate and come to top. If this should happen, place 1 egg yolk in another basin and gradually add oil mixture.

French Dressing.

Place ¼ cup vinegar in a bottle, add salt and pepper to taste, ¼ teaspoon mustard (optional), 1 teaspoon sugar, and a little paprika. Now add ¾ cup best olive oil and shake well together. A sliced clove of garlic may be added, but should be removed before serving. Place dressing in ice chest, and when ready to serve, shake well.

Boiled Salad Dressing No. 1.

Melt 1 tablespoon butter in double saucepan, add 1 tablespoon flour, salt and pepper to taste, 1 teaspoon made mustard, and a little paprika. Add the yolks of 3 eggs beaten with 1 tablespoon water, add ¼ cup vinegar, and stir until thick. Allow to cool, then add ½ cup cream or milk.

Boiled Dressing No. 2.

Heat ¼ cup best olive oil in saucepan with ½ cup vinegar, and 2 tablespoons water. When hot, add 4 well-beaten eggs gradually, stir well, and add salt, pepper, paprika, and 2 teaspoons made mustard. Cook until mixture thickens. Place in jar and seal. When ready to serve, thin with cream or milk.

Cabbage Combination Salad.

Shred very finely 1 small solid head cabbage, soak until crisp in ice-cold water; drain and dry well. Finely chop 1 large onion, 1 red or green pepper, 1 grated carrot, ½ cup chopped celery, and, if liked, 3 or 4 radishes, finely chopped. Mix all well together with a little French dressing. Arrange dome-shape on a shallow serving dish, sprinkle over with grated carrot, and serve with water biscuits.

COOLING MILK DRINKS.

The following recipes, which have been tested by the American National Dairy Council, provide considerable variation and new ideas for summer use. They were suggested to those participating in a "Dairy Month" held in the States recently. This was a nation-wide campaign, sponsored by the Institute of Distribution Inc., with the object of increasing the consumption of milk:—

Lemon Milk Punch.

Two eggs, ½ cup ice water, 3 cups milk, 6 tablespoonfuls lemon juice, ½ cup sugar. Beat eggs, add water, lemon juice, and sugar, mixing thoroughly. Add slowly to the cold milk, stirring constantly. Serve at once. Yield: 4 or 5 glasses.

Milk and Honey Nectar.

One-third cup mashed banana, 1½ tablespoonfuls orange juice, 1½ tablespoonfuls honey, 1 drop almond extract, pinch salt, 1 cupful milk. Mash banana. Add fruit juice, honey, salt, and flavouring. Mix well. When ready to serve, add cold milk and beat with egg beater. Garnish with whipped cream and serve immediately. Yield: 1 tall glass.

Apricot Milk Shake.

Half cup apricot nectar, 1 teaspoonful lemon juice, 1 cup milk, 1½ tablespoonfuls sugar, pinch salt. Dissolve the sugar and salt in the apricot and lemon juice and chill. When ready to serve pour into the cold milk and mix well. Serve immediately. Yield: 1 tall glass.

Fruit Milk Punch.

Half crushed banana, 2 tablespoonfuls orange juice, ¼ cup pineapple juice, 1 tablespoonful lemon juice, pinch salt, 1 cup milk. Mash banana. Add fruit juice and salt; chill. When ready to serve, pour into cold milk and beat with egg beater. Serve immediately. Yield: 1 tall glass.

Prune-Ade.

Half cupful prune juice, 1 teaspoonful lemon juice, 1 cupful milk, 2 tablespoonfuls sugar, pinch salt. Dissolve the sugar and salt in the prune and lemon juice and chill. When ready to serve, pour into the cold milk and mix well. Serve immediately. Yield: 1 tall glass.

Grape Blossom.

Half cupful grape juice, ½ teaspoonful lemon juice, pinch salt, 2 tablespoonfuls sugar, 1 cupful milk. Combine chilled ingredients and beat with egg beater. Serve immediately. Yield: 1 tall glass.

Strawberry Milk Drink.

One quart strawberries, 5 cupfuls milk, 2½ teaspoonfuls lemon juice, ¾ cupful sugar, ¼ teaspoonful salt. Wash, hull, and drain strawberries. Crush and press through a coarse sieve. Combine puree with milk, add other ingredients, and mix thoroughly. Chill before serving. Garnish with whipped cream. Yield: 8 to 10 servings.

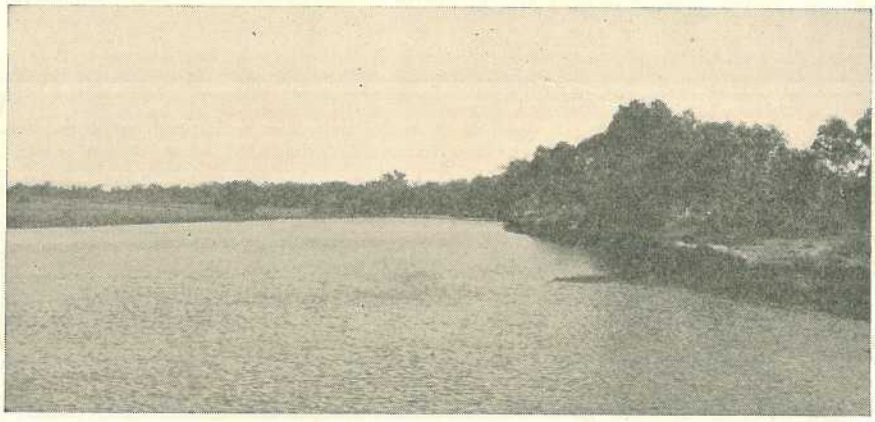


Plate 84.
THE LEICHHARDT RIVER AT KAJABBA, NORTH-WESTERN QUEENSLAND.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF DECEMBER IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1939 AND 1938, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Dec.	No. of years' records.	Dec., 1939.	Dec., 1938.		Dec.	No. of years' records.	Dec., 1939.	Dec., 1938.
North Coast.	In.		In.	In.	*South Coast—contd.*	In.		In.	In.
Atherton	7·14	38	4·89	1·20	Gatton College ..	3·67	40	..	0·05
Cairns	8·59	57	1·04	4·19	Gayndah	4·12	68	4·55	0·10
Cardwell	8·10	67	0·81	2·86	Gympie	5·38	69	5·02	1·91
Cooktown ..	6·53	63	0·99	3·87	Kilkivan	4·51	60	3·56	0·29
Herberton ..	5·66	53	4·11	0·96	Maryborough ..	5·01	68	4·24	0·34
Ingham	6·79	47	1·81	1·12	Nambour	6·61	43	3·05	0·54
Innisfail	11·55	58	1·40	3·08	Nanango	3·75	57	3·77	0·26
Mossman Mill ..	9·91	26	4·37	3·15	Rockhampton ..	4·74	68	3·53	1·01
Townsville ..	5·35	68	0·47	0·17	Woodford ..	5·42	52	4.13	0·08
Central Coast.					*Central Highlands.*				
Ayr	3·88	52	2·58	0·50	Clermont ..	3·75	68	2·92	1·45
Bowen	4·34	68	1·89	..	Gindie	2·72	40	1·14	0·48
Charters Towers ..	3·20	57	1·59	0·06	Springsure ..	3·19	70	2·90	0·29
Mackay P.O. ..	6·97	68	3·10	1·61	*Darling Downs.*				
Mackay Sugar Experiment Station	7·84	42	..	1·91	Dalby	3·29	69	4·90	0·23
Proserpine ..	7·42	36	3·38	0·57	Emu Vale ..	3·41	43	1·75	0·79
St. Lawrence ..	4·66	68	3·26	0·86	Hermitage ..	2·94	33	..	..
South Coast.					Jimbour	3·23	51	6·03	..
					Miles	3·09	54	1·39	0·06
Biggenden ..	4·58	40	4·52	1·45	Stanthorpe ..	3·57	66	2·85	1·48
Bundaberg ..	5·00	56	9·90	0·23	Toowoomba ..	4·39	67	5·98	0·30
Brisbane	4·84	87	3·28	0·41	Warwick	3·41	74	3·07	0·56
Caboolture ..	5·14	52	3·80	0·27	*Maranoa.*				
Childers	5·61	44	4·82	0·94					
Crohamhurst ..	7·08	46	2·52	0·24	Bungeworgorai ..	2·84	25	..	..
Esk	4·60	52	4·52	..	Roma	2·52	65	1·43	..

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—DECEMBER, 1939.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Atmospheric Pressure, Mean at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.				Total.	Wet Days.
		Max.	Min.	Max.	Date.	Min.	Date.		
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·87	90	75	92	31	71	14, 15	99	6
							29		
Herberton	..	85	63	94	7	55	8	411	6
Rockhampton	29·92	90	71	98	5	64	8	353	10
Brisbane	29·98	83	67	94	1	61	11	328	12
Darling Downs.									
Dalby	29·95	89	62	96	5	51	1	490	8
Stanthorpe	..	83	56	91	22, 23	40	1	285	9
Toowoomba	..	82	59	90	23	49	6	598	12
Mid-Interior.									
Georgetown	29·86	98	71	104	6	67	15	577	13
Longreach	29·86	100	70	106	16,17, 27	51	8	47	3
Mitchell	29·89	94	65	100	26	50	7	62	2
Western.									
Burketown	29·86	98	76	107	15	69	11	700	7
Boulia	29·80	101	72	110	18	63	8	..	..
Thargomindah ..	29·83	97	69	110	18	59	6	71	2

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	February, 1940.		March, 1940.		MOONRISE. Feb., 1940.	March, 1940.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					a.m.	p.m.
1	5·25	6·46	5·46	6·24	..	11·36
2	5·26	6·46	5·46	6·23	12·2	a.m.
3	5·27	6·45	5·47	6·22	12·49	12·29
4	5·27	6·45	5·47	6·21	1·40	1·22
5	5·28	6·44	5·48	6·20	2·31	2·15
6	5·29	6·43	5·48	6·19	3·25	3·8
7	5·29	6·43	5·49	6·18	4·15	3·58
8	5·30	6·42	5·49	6·17	5·12	4·49
9	5·31	6·41	5·50	6·16	6·5	5·41
10	5·32	6·40	5·51	6·15	6·54	6·38
11	5·32	6·39	5·51	6·13	7·45	7·19
12	5·33	6·38	5·52	6·12	8·34	8·11
13	5·34	6·38	5·53	6·11	9·26	9·6
14	5·35	6·37	5·53	6·10	10·17	9·57
15	5·35	6·36	5·54	6·8	11·6	10·53
					p.m.	
16	5·36	6·36	5·54	6·7	12·3	11·44
						p.m.
17	5·37	6·35	5·55	6·6	12·56	12·39
18	5.37	6·34	5·55	6·5	1·55	1·30
19	5·38	6·33	5·56	6·4	2·47	2·21
20	5·39	6·33	5·56	6·3	3·42	3·8
21	5·39	6·32	5·57	6·2	4·35	3·56
22	5·40	6·31	5·57	6·1	5·25	4·44
23	5·41	6·30	5·58	6·0	6·12	5·31
24	5·41	6·29	5·58	5·59	6·56	6·15
25	5·42	6·28	5·59	5·58	7·42	7·1
26	5·43	6·27	5·59	5·57	8·26	7·48
27	5·43	6·26	6·0	5·56	9·14	8·37
28	5·44	6·25	6·0	5·55	9·59	9·29
29	5·45	6·24	6·0	5·54	10·47	10·22
30	..	..	6·1	5·53	..	11·15
31	..	..	6·1	5·52	..	..

Phases of the Moon, Occultations, &c.

1st Feb.	☾	Last Quarter	12 47 a.m.
8th ,,	●	New Moon	5 45 p.m.
16th ,,	☽	First Quarter	10 55 p.m.
23rd ,,	○	Full Moon	7 55 p.m.

Apogee, 11th February, at 12 noon.
Perigee, 24th February, at 8 a.m.

The Moon, in its monthly journey through the 12 zodiacal constellations, must in turn pass all planets, above or below our horizon. During this month it will pass Venus on the 12th and Jupiter on the 13th in Pisces, and Saturn and Mars on the 14th in Aquarius, which shows how near the planets are to each other.

The rare and interesting gathering of four "wandering stars," Jupiter, Venus, Mercury, and Saturn, and their varying positions above the eastern horizon in the early morning hours of April and May last, will now be repeated in the western sky, moreover, with the addition of Mars.

On the 7th of last month the Martial planet passed to the eastward of Jupiter; on the 13th of this month it will overtake and pass Saturn; on the 20th the two most beautiful planets, Venus and Jupiter, will be seen very near each other, within two hours after sunset. On the 28th, when Mercury will be at its greatest altitude, 18 degrees above the western horizon, we shall see the five planets visible to the naked eye, and our Earth, on which we run against one another, moves in perfect harmony with the heavenly bodies, and all the planets rise and set with regularity unhindered, as of old.

Mercury rises at 5.24 a.m., 1 minute before the Sun, and sets at 6.53 p.m., 7 minutes after the Sun, on the 1st; on the 14th it rises at 6.21 a.m., 46 minutes after the Sun, and sets at 7.13 p.m., 36 minutes after it.

Venus rises at 8.7 a.m., 2 hours 42 minutes after the Sun, and sets at 8.40 p.m., 1 hour 54 minutes after it; on the 14th it rises at 8.27 a.m., 2 hours 52 minutes after the Sun, and sets at 8.31 p.m., 1 hour 54 minutes after it.

Mars rises at 10.37 a.m., and sets at 10.6 p.m., on the 1st; on the 14th it rises at 10.27 a.m., and sets at 9.39 p.m.

1st Mar.	☾	Last Quarter	12 35 p.m.
9th ,,	●	New Moon	12 23 p.m.
17th ,,	☽	First Quarter	1 25 p.m.
24th ,,	○	Full Moon	5 33 a.m.

Apogee, 9th March, at 3.0 p.m.
Perigee, 23rd March, at 10 p.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S., add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.