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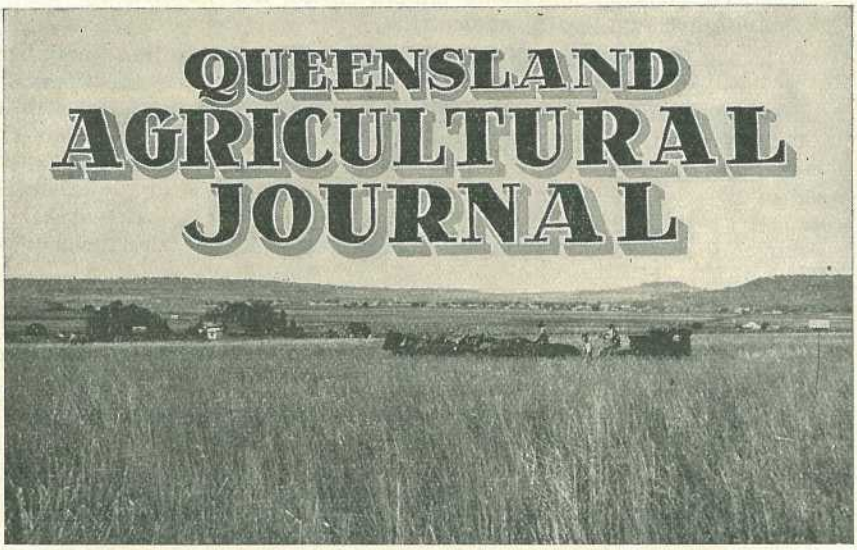


VOL XLII. 1 DECEMBER, 1934. PART 6.

Event and Comment.

An Australian Agricultural Council.

AT a recent conference of Federal and State Ministers at Canberra a proposal to form an Australian Agricultural Council was adopted unanimously. Wide powers and many responsibilities will be given the newly-formed Council, which, it is hoped, will function permanently as a body, having as its objective the promotion of the welfare of agricultural industries and the formulation of national policies. The functions of the Council will be:—

To promote the welfare and development of agricultural industries.

To arrange the mutual exchange of information regarding agricultural production and marketing.

To co-operate for the purpose of ensuring the improvement of the quality of agricultural products and the maintenance of high-grade standards.

To ensure balance between production and available markets.

To consider the requirements of agricultural industries in regard to organised marketing.

To promote the adoption of a uniform policy on external marketing problems, particularly those pertaining to the negotiation of intra-Empire and international agreements.

To consult in regard to proposals for the grant of financial assistance to agricultural industries.

To consider questions submitted to the Council by a new standing committee in agriculture.

The conference decided to create an enlarged standing committee on agriculture, which will be a technical body, to advise the Commonwealth and State Governments and to secure co-operation and co-ordination in agricultural research and quarantine matters throughout the Commonwealth. The standing committee will comprise the permanent head of the State Departments of Agriculture, members of the executive committee of the Council for Scientific and Industrial Research, the secretary to the Department of Commerce, and the Director-General of Health.

Tobacco Experiment Work.

ANSWERING some criticism of departmental activities in respect of tobacco experiment work in the far North, in the course of a recent debate in Parliament, the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, said:—

> Some question was raised as to whether the department should not have taken over the Commonwealth tobacco experiment farm at Mareeba. This Committee is entitled to know why I refused to take this farm over. I was guided in my decision by the considered opinion of experienced agriculturists and experimentalists in all parts of the world. Hon. members will realise that at one time it was a recognised policy in Queensland to have centrally situated experiment farms in each divison of the State. I think the hon. member for Cooroora (Mr. Harry F. Walker) must subscribe to my policy, because during his administration he got rid of two or three experiment farms. I frankly admit that I have got rid of experiment farms since I have been Minister. My reason is that, after all, an experiment farm generally only has one soil type. The result is that notwithstanding considerable expense to the State it may be of very little value in another district, perhaps not 100 miles distant. Experimental work, to be of any advantage, must deal with various soil types and a diversity of agricultural subjects, rather than with one soil type in one climate. It was because those reasons were uppermost in my mind, to which I ardently subscribe, that I refused to take over the Mareeba tobacco experiment station. Several years of experimental work had been done there. That work had not been materially successful. There was one phase, even if other phases did not exist, that induced me to reject the Commonwealth offer. It was a fact that after six or seven years' extensive cropping disease problems of outstanding importance would have hampered any cultural operations we were conducting. The Commonwealth Government has undertaken research work into disease problems in the tobacco industry, and have delegated to the State the cultural work that is necessary. If we are to undertake the cultural work it would not be fair to suggest that we should undertake that cultural work handicapped by having to use an old experimental station that in its earlier days had been saturated with disease spores that are difficult to control, as, for example, frog-eye and blue mould. Speaking from memory, we

have twenty or thirty tobacco plots under experimental observation, and I think our present policy of having the tobacco experimental work scattered throughout the whole of the State is a better policy than its concentration in one area.

I believe that the whole experiment policy of the department, not only in regard to pasture improvement but also in regard to cultural experimental work generally, should be distributed over the widest possible area. There should be no centralised experiments for cultural work. Experiments for pathological observation and research on the other hand should be conducted within easy reach of the most highly skilled officers in my department, who are the men in control of the branches at the head office. That is a policy I have pursued. It is certainly an expensive one. All agricultural research work, indeed all research work, is expensive, but I view the question in this way—and my officers fortunately share my views—that it is not expenditure in the true sense of the word. Rather is it an investment, and if we did not strenuously continue an experimental policy in all its various facets, then agriculture would decline instead of progress.

The Year in Agriculture.

IN the Annual Report of the Department of Agriculture and Stock, the Under Secretary and Director of Marketing, Mr. E. Graham, states that, if viewed solely from the production standpoint, the year was a successful one in practically every branch of rural industry. This result was due to favourable seasonal circumstances, a steady improvement in farming efficiency, and higher standards of animal husbandry, which are becoming more evident every year.

The administrative, advisory, research, and regulatory functions of the Department have been maintained in accordance with the State's broad and comprehensive policy of sound rural development.

The interval between the discovery and application of new knowledge of practical value has been reduced by close correlation of the research and advisory services in respect of the varied and extensive activities of the Department.

The departmental year has been marked, too, with a sincere, sustained, and, to some extent at least, successful endeavour to surmount the perplexities of the economic position. Economically, the agricultural situation is still very serious. The price position, in the dairy and fruit industries particularly, is far from satisfactory. Improved wool values have had, however, a stimulating effect.

Although marketing difficulties continue—difficulties that shall certainly be increased should a policy of further restriction of exports and regulation of crop acreages be enforced—there is some evidence that the worst of the depression, which has affected agriculture in common with other industries so seriously in recent years, has passed.

Every effort to improve the marketing position of all primary products, in the best way possible in the circumstances, was made during the past year. In this connection, it is repeated that Queensland farmers are fortunate in their system of organised marketing which has proved, during recent difficult years, the best protection that they could have.

Queensland Fruit Fly Control.

By ROBERT VEITCH, B.Sc., Agr., B.Sc., For., F.R.E.S.,
Chief Entomologist.

THE maggots of the Queensland Fruit Fly feed voraciously in the fruit of many trees and other plants, deciduous fruit being particularly susceptible to attack. Citrus, papaw, and mango may also suffer severely, but fortunately the banana is very rarely attacked and then only in the case of over-ripe bunches, which should be cut solely for home or local consumption. The maggots tunnel throughout the fruit, destroying much tissue in their progress and setting up decomposition, the combined effect being to render the fruit unfit for marketing.

Life History and Habits.

The creamy coloured slightly curved eggs of the Queensland Fruit Fly are laid in batches of as many as six or seven in the tissue of the selected fruit just underneath the puncture made in the skin thereof by the female fly. The eggs hatch in two or three days in midsummer, and the creamy white legless tapering maggot feeds throughout the tissue of the fruit. The full size of about one-third of an inch in length is attained in a week in the warmer weather, and the maggot then leaves the fruit and pupates in the soil just below the surface. The pupa is formed within a hard-shelled reddish-brown pupal case, and in this non-feeding stage the maggot's tissues undergo a complete reorganisation resulting in the production of the prettily marked reddish-brown fly at the end of about one week in midsummer. The life cycle may thus be completed in a fortnight in summer, but in the colder months all the life-cycle stages are of much longer duration.

Disposal of Infested Fruit.

Successful control of this pest necessitates strict attention to orchard hygiene, and all waste and fly-infested fruit should accordingly be promptly gathered up and adequately disposed of. If fallen infested fruit is allowed to lie on the ground the fruit-fly maggots contained therein will leave the fruit on becoming full grown and will pupate in the soil to produce a fresh brood of flies. When the infested fruit has been gathered up it may be disposed of by burying, boiling, burning, or immersing in water. If the fruit is buried care should be taken to ensure that it has a soil covering of at least 18 inches, for if only a light covering is given the flies will succeed in completing their development and emerging from the soil. None of these methods of disposal are ideal, and hence it has been decided that, at least in so far as the Stanthorpe district is concerned, the pit method of disposal is more satisfactory. The pit should be 6 feet by 5 feet with a depth of 20 feet, and a suitable fly-proof cover should be provided. The waste and infested fruit soon ferments when tipped into such a pit, and the fruit-fly maggots are killed by the fermentation process. Pits of somewhat smaller dimensions are employed in the citrus districts; boiling is also a favourite method of disposing of fly-infested citrus.

Luring.

Luring has been demonstrated to be a successful control measure in the deciduous fruit orchards, and a departmental lure much used

therein has the following formula for a five to one strength:—Five tablespoonfuls of liquid household ammonia; five teaspoonfuls of imitation vanilla essence, and 26 ounces of water—i.e., one winebottleful. An eggcupful of the concentrated lure prepared according to that formula is added to five eggcupfuls of water, and that quantity is sufficient for the baiting of one trap. The lure is placed in glass fly traps, which are generally obtainable at a cost of 1s. 6d. each, and these are placed in suitable trees. Large leafy trees in a sheltered position should be selected and the traps placed in the shadiest portions thereof, being suspended by tie wire. The traps should receive regular attention, the lure being renewed as required.

Readers are reminded that this lure was evolved for use in deciduous fruit orchards, and its application in citrus and other orchards may not be attended with the same degree of success as has been experienced at Stanthorpe. Furthermore, in citrus orchards the best trees for luring may be those in the most exposed position, whereas, as already indicated, sheltered trees are the most suitable in the deciduous fruit orchards. The suitability of particular citrus trees for luring purposes may be determined by observing the amount of fallen fly-infested fruit under the trees.

Repellent Sprays.

Repellent sprays have already been the subject of departmental experiments at Stanthorpe and in connection therewith readers may be interested to know that ½ pine of nicotine sulphate and ½ gallon of white spraying oil to 40 gallons of water gave very promising results as a fruit-fly repellent in a Severnlea apple orchard. Before this repellent spray can be recommended as safe and effective these experiments will, of course, have to be repeated to decide whether this particular spray will live up to the early promise of success and, furthermore to determine whether or no any cumulative ill-effect is produced by the oil in the repeated applications necessary at intervals of one week during the course of a fruit-fly invasion. The effect on fruit other than apples will also have to be determined.

Elimination of Non-commercial Fruit Trees.

Where practicable all useless non-commercial fruit trees known to breed fruit flies should be eliminated, for they merely act as an additional source of infestation for the commercial trees.

Covering Trees.

Covering the trees with such material as old mosquito-netting will prevent the flies gaining access to the fruit for egg-laying purposes. Such a control measure, of course, can be adopted only in cases where a few small garden trees require protection.

Parasites of Cattle.

By F. H. S. ROBERTS, M.Sc., Entomologist, Animal Health Station, Yeerongpilly.

EXTERNAL PARASITES.

The most important external parasites of cattle are lice, mange mites, ticks, and the buffalo fly.

LICE.

Three distinct species of lice infest cattle. Two of these, *Hæmatopinus eurysternus* and *Linognathus vituli,* are sucking lice. The third species, *Bovicola bovis,* is a biting louse.

The Biting Louse (Bovicola bovis).

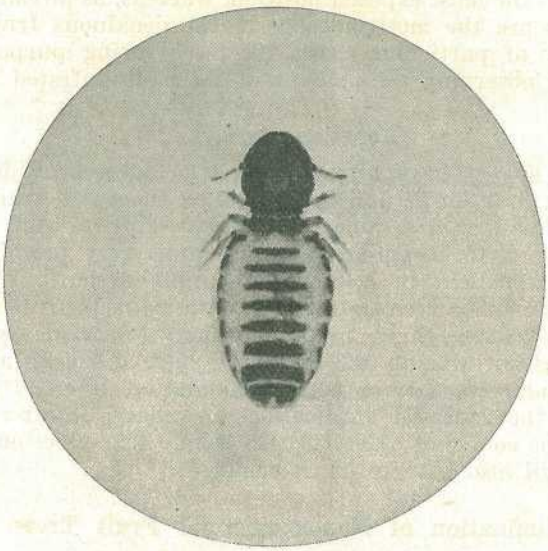


PLATE 284.—THE BITING LOUSE (*Bovicola bovis*).

This is a small yellowish louse with a broad, blunt, reddish-head. This species usually infests the withers and rump, sometimes extending along the back between these two sites. Their presence causes a scurfy condition of the skin, and the constant rubbing and scratching by the irritated animal may cause the formation of raw hairless patches. Eggs laid by the female louse are glued to the hairs and hatch in about ten days.

Sucking Lice.

The two species of sucking lice are quite distinct in appearance, so much so that *Hæmatopinus eurysternus* (Plate 285) is called the short-nosed sucking louse and *Linognathus vituli* (Plate 286) the long-nosed sucking louse.

The short-nosed sucking louse may measure up to $\frac{1}{8}$ of an inch in length. The head is short, bluntly-pointed, and about as broad as long. The abdomen is greyish in colour, the head and thorax yellow. The eggs

hatch in about eleven to eighteen days, and the young lice become mature in another twelve days. This species is usually found on adult cattle.

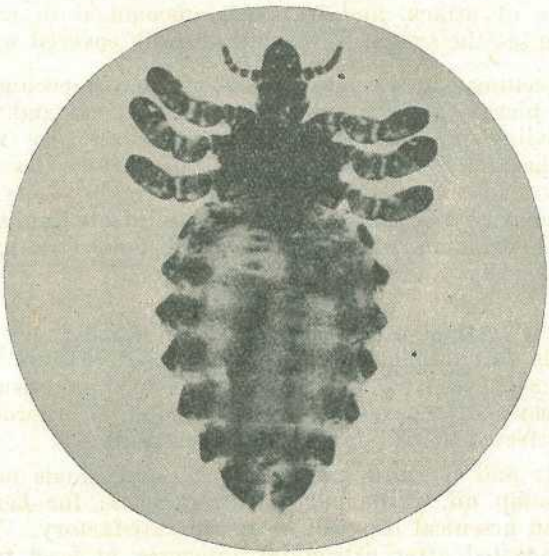


Plate 285.—The Short-nosed Sucking Louse (*Hæmatopinus eurysternus*).

The long-nosed sucking louse is a smaller and more slender species, the head being about twice as long as broad. The eggs hatch ten to fourteen days after being laid by the female, and the young lice reach the mature stage in another eleven days. This is the sucking louse commonly met with on calves and young cattle.

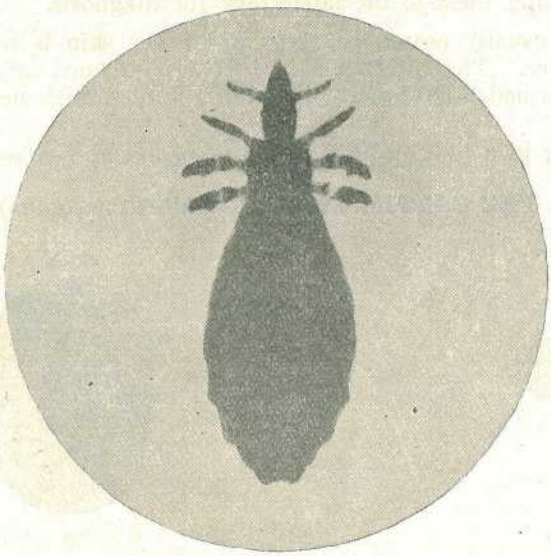


Plate 286.—The Long-nosed Sucking Louse (*Linognathus vituli*).

For the most part sucking lice infest those portions of the body from which it is difficult for the animal to dislodge them. They usually feed in groups and are found on the head, sides of the neck, brisket, back, tail, scrotum, and inner surfaces of the thighs. The tail is a favoured site of attack, and it is not uncommon in cases of heavy infestation to see the switch of the tail literally covered with eggs.

When feeding, the lice, by means of their piercing and sucking mouthparts, pierce the skin and suck up the blood and fluids. Their habit of feeding in clusters not only increases any irritation and annoyance that follows the insertion of the mouthparts into the skin, but may also cause the formation of large scabby areas. In general, sucking lice may so lower the vitality of the infested animals that these are unable to withstand unfavourable conditions, eventually becoming poor and unthrifty.

Control of Lice.

The main method of spread is by contact between infested and clean animals, but it must be remembered that lice are able to live a few days if separated from their hosts. For this reason stables, &c., in which lousy cattle have been housed should be thoroughly cleaned out and disinfected to kill any dislodged lice and eggs.

Moderate and confined infestations of individuals may be treated with oils (sump oil, crude oil) or dip washes; for herd infestation dipping in an arsenical dip will be found satisfactory. The treatment should be repeated after fifteen-day intervals, at least two treatments being required.

MANGE.

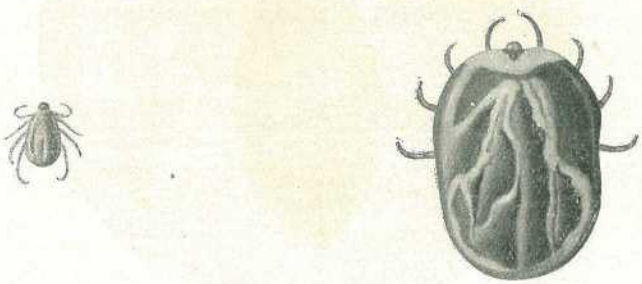
Mange is caused by small species of mites which live under or on the skin. This disease condition is not considered to be prevalent among cattle in Queensland.

Before any treatment is attempted it is necessary to determine the type of mange present. This can only be done by taking skin scrapings and forwarding them to the laboratory for diagnosis.

Mange usually occurs on areas where the skin is tender and the hair is sparce. The infested skin becomes inflamed and swollen and scabs are formed. Eventually the skin becomes thickened and thrown into folds.

Dipping in a lime sulphur dip is necessary to control mange.

THE CATTLE TICK (Boophilus microplus).



A B

PLATE 287.—THE CATTLE TICK (*Boophilus microplus*).

Description.

Several species of ticks have been recorded from cattle in Queensland, the most common and most important species being the common cattle tick, *Boophilus microplus* (*B. australis*). The female tick (Plate 287 (B)) at first is small, grey in colour, with a few irregular yellow markings. As she engorges with blood the grey colour changes to a dark-red, and when fully engorged this sex may measure about half an inch in length. The male (Plate 287 (A) is minute in size, measuring about one-tenth of an inch. In both sexes the mouthparts are placed at the narrower anterior end of the body and are brownish in colour and inconspicuous. The pale, flesh coloured legs readily distinguish the common cattle tick from other species of ticks, such as wallaby ticks, kangaroo ticks, the dog tick, &c., that are occasionally seen on cattle.

Life History.

The female tick when fully engorged drops from the host and crawls to some sheltered spot to begin her egg laying. The eggs are spherical brownish bodies and are deposited in masses, as many as 4,000 being laid by a single female. Under favourable conditions these hatch in about fifteen days, and the tiny six-legged larvæ or seed ticks emerge. After a time, sufficient for the body parts to harden, the larvæ crawl up the grass from which they are brushed on to the animal as it passes by. These larvæ are very tenacious of life and may live as long as 154 days in the absence of cattle. Once on the beast the tiny ticks distribute themselves over the body, seeking spots where the skin is soft and thin. Having found a suitable place the proboscis is inserted and the young tick commences to suck blood. After about six to ten days the larva is fully engorged. It then casts its skin and the next stage in the life history—the eight-legged nymph—appears. The nymph reattaches itself to the same spot on the animal or near it and becomes engorged after about another seven days. A second moult then occurs and the adult stage makes its appearance. Reattaching herself the female tick may be fully fed in seven to ten days. She then drops from the animal, lays her eggs, shrivels up, and dies. The male, on the other hand, following the moulting of the nymph, feeds intermittently and spends its life searching out the females.

The Economic Importance of the Cattle Tick.

The cattle tick first entered Queensland from the Northern Territory in 1891, and at the present time has spread throughout the coastal and northern portions of the State.

It is an extremely important pest of cattle and heavy infestations cause tick worry and anæmia, which may in themselves be serious enough to result in death. Among dairy cattle this tick may produce a serious decrease in the milk yield.

Its greatest importance, however, lies in the fact that it is a vector or carrier of two organisms which are responsible for serious diseases among cattle. These organisms are *Babesia bigeminum* and *Anaplasma marginale*,* which produce "redwater" and anaplasmosis, respectively, in cattle.

* Although the common cattle tick is not as yet implicated in the spread of Anaplasmosis in Australia, experiments conducted in the United States have shown it to be able to transmit this disease.

THE BUFFALO FLY (Lyperosia exigua).

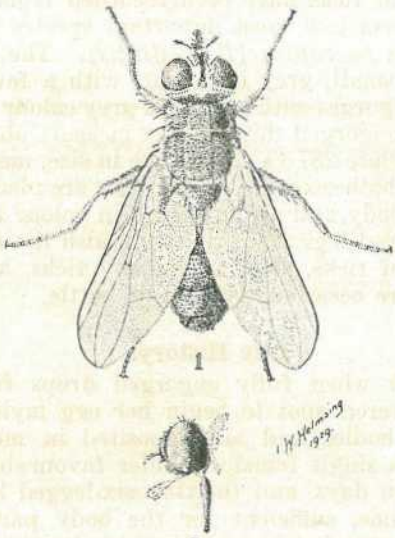


PLATE 288.

(1) Adult × 8. (2) Lateral view of head showing sucking mouthparts.

The buffalo fly affords an excellent example of an insect which, whilst unimportant in its native country, has upon introduction into a new land become a pest of serious dimensions. In the East Indies the fly is almost unknown as a harmful parasite of stock, but in Australia it bids fair to rival the cattle tick as a stock pest of outstanding importance. The reason for this may probably lie in the freedom it enjoys in Australia from the attacks of other insects which in the East Indies so parasitise it as to keep it under control. An alternative explanation may be found in a climatic or some other condition present in Australia which is more favourable to its development and rapid increase.

The buffalo fly belongs to the dipterous family Muscidæ, which, besides the house fly, the bush flies, and blowflies, includes a number of biting flies, other species of which are the stable fly of cosmopolitan distribution and the infamous tsetse flies of Africa.

The genus *Lyperosia* contains representative species in various parts of the world. *Lyperosia exigua* is known from the East Indies and Australia; *Lyperosia irritans,* the "horn fly" of the United States, was introduced from Europe and is a serious pest of cattle in the former country. Three further species occur in the Soudan, all very common, but not regarded as very important parasites of native stock. One of these species, *Lyperosia minuta,* has been introduced to the Transvaal and Zanzibar, but in the latter country only is it regarded as a harmful pest of cattle.

Distribution in Australia.

The buffalo fly is thought to have been introduced into Australia with the first herd of buffaloes which landed at Darwin somewhere

about 1825. For many years it remained confined to the country in and around Darwin, and it was not until 1911 that it attracted attention as a pest of cattle. At this time it occupied a range of country extending from the Liverpool River on the east to the Daly River on the west and bounded on the south by the Roper River, the coast line, of course, representing the northern limit. During the next fifteen years extensive movements of cattle occurred and the fly rapidly spread, so that at the end of this period its area of distribution extended from Broome, West Australia, to the Robinson River on the east, and to the watershed of the coastal rivers on the south—an area practically four times as large as that occupied in 1911. It first crossed the far north-western border of Queensland in 1928, and at the present time is confined to this corner of the State.

Description and Habits.

The buffalo fly is a small dark-grey, biting fly, a little more than half the size of the ordinary house fly. (*See* Plate 288.) Primarily a parasite of the buffalo, the insect has turned its attention to other animals, including cattle, horses, and man, for the purpose of obtaining food, cattle constituting the principal host. Horses and man are usually attacked only at such times as they are among infested cattle.

Unlike other biting flies such as mosquitoes, march flies, and sand-flies, which visit the host only at such time as food is required, the buffalo fly remains on the animals night and day, and only when disturbed or for the purpose of laying eggs does it leave the host. When not feeding they rest in groups on the neck, shoulders, bellies, rumps, and horns. Both male and female flies feed on blood, and for this purpose they force their way down among the hairs, elevate the wings, and assume an almost erect position. When disturbed the speed of their flight is astonishing, for although covered by the hairs of the hide, at a switch of the tail or a toss of the head, the flies instantly rise in a cloud for some little distance, returning again as quickly and resuming feeding.

Life History.

The Egg.

The egg of the buffalo fly is a tiny, elongate, creamy yellow body, and is deposited by the female in the freshly-dropped dung of cattle and buffaloes. It was thought that the dung of native animals—kangaroos, wallabies, &c.—and that of horses might prove suitable for the development of the fly, but so far attempts to breed the flies under natural conditions from the dung of these animals have been negative. Unlike bovine fæces, this type of dung is apparently too dry for larval development. As soon as fresh fæces are dropped, the female flies leave the animal to lay their eggs therein, the egg being deposited either on the surface or else in cracks and crevices. A number of eggs may be deposited in the one spot by a single female, which may lay many such batches in the one season. Under suitable conditions of temperature and moisture the egg may hatch in eighteen to twenty-four hours. Dryness and exposure to sunlight are harmful to the egg, which under such conditions rapidly decomposes.

The Larva.

The larva is a typical fly maggot, small in size and dirty white in colour. On hatching from the egg it immediately burrows into the dung, and keeps on burrowing as the surface layers dry out. Growth occurs fairly rapidly, and in three to five days the maggot is fully grown and ready to pupate.

The Pupa.

When ready to pupate the fully-grown maggot may either remain in the dung or else descend into the soil. The larval skin contracts, hardens, and turns brown. Within this brown, hardened case transformation of the larva to the adult takes place. This stage occupies three to five days, at the end of which the adult fly emerges, dries its wings, and is ready for its parasitic existence.

Duration of Life Cycle.

The complete life cycle occupies seven to eleven days under favourable conditions, the period, of course, being lengthened during the winter months or at any such times as the conditions are adverse to the fly's development.

Seasonal Distribution.

Although the buffalo fly is never quite absent throughout the year, there is a very marked seasonal variation. During the dry winter months the insects are so scarce as to warrant a most careful inspection of individual animals to detect their presence. Commencing with the advent of the rainy season in November they become more numerous, and in the wet months of January and February are at their maximum, gradually becoming less frequent with the approach of May and June.

Economic Importance.

No evidence has yet come to hand that the buffalo fly may be a vector of some deadly disease, but the possibility should always be borne in mind. The cattleman is only too familiar with the worry and irritation cattle suffer through the occasional attacks of mosquitoes, sandflies, and march flies, and with this knowledge the harm that such a parasite as the buffalo fly in its countless numbers and constant attendance may accomplish can well be imagined. Infested animals lose condition fairly rapidly, not only as a result of the blood-sucking habits of the flies, but also through the worry and irritation caused by their presence. When the pest is present in numbers, cattle are kept constantly on the move and feed only at such times as they may gain respite from the fly's attack. As a loss in the milk yield is associated with the presence of the horn fly in the United States, it is reasonable to assume that a similar loss in yield also occurs in the case of the buffalo fly. Moreover, its bite is particularly severe, and the efforts of the beasts to rid themselves of its presence by rubbing the affected parts against posts, tree trunks, &c., causes the formation of large raw areas which attract other muscid flies—the bush fly and blowflies—which are conducive of further distress. Buffalo fly attack is already producing a noticeable effect on the cattle industry of the North, and

should the infestation ever include the dairy and main beef herds of Queensland the loss will become very serious.

INTERNAL PARASITES.

So far as can be ascertained, cattle in Queensland are not affected by internal parasites to the same extent as any of the other domesticated animals. Little is known of the prevalence of worms among the beef herds, but as these cattle are confined for the most part to the driest part of the State it is not considered that worms would be of any economic importance in so far as they are concerned. The dairy herds, on the other hand, occupy country with a comparatively high rainfall. Calves are weaned almost at birth and are subjected to treatment which would considerably lower their resistance to infestation, and it is mainly among animals of this class that losses following worm infestation are reported.

FLUKES.

Two species of flukes occur in cattle, the conical fluke, *Paramphistomum cervi,* and the liver fluke, *Fasciola hepatica.*

The conical fluke (Plate 289), as its name implies, is conical in shape and is found in the large or first stomach. It is extremely common in Queensland and is often present in very great numbers. It is, however, not considered to be harmful to any noticeable extent.

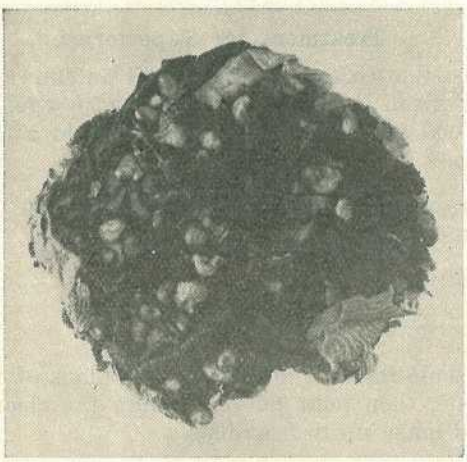


Plate 289.—The Conical Fluke (*Paramphistomum cervi*).

The liver fluke occurs in the bile ducts of the liver, and is the same species as is found in the liver of sheep. Fortunately, it is of little importance, as it is of rare occurrence only.

With both species a snail is necessary as the intermediate host before the life cycle can be completed.

TAPEWORMS.

Cattle may act as the intermediate host of at least two very important tapeworms. The first of these is an extremely important parasite of man and is known as the beef tapeworm, *Tænia saginata*. Its larval form, *Cysticercus bovis*, is found in various parts of the body of cattle, usually in the muscles. Fortunately, beef measles, which is the name given to the infestation of cattle with the larval tapeworm, is unknown in Queensland.

The second species of larval tapeworm found in cattle is called *Echinococcus granulosus*, the common name given to this stage in the life history being "hydatids." The adult tapeworm occurs in the dog, and as hydatids is also a very important disease of man and propagated mainly through feeding raw offal containing the larval stage to dogs, control is only possible when all offal is thoroughly cooked before being fed to the dog. In cattle, the liver and lungs are the principal portions of the body infested with the larval stage which takes the form of cysts or bladders of fluid.

Calves are occasionally infested with adult tapeworms, *Moniezia* spp., which are found in the small intestine. These tapeworms may grow up to 10 feet or so in length, but it is doubtful as to whether they are of any great importance, though in one or two instances in which very heavy infestations were encountered the animals were emaciated and were subject to frequent attacks of scours.

Treatment for Tapeworms.

Calves infested with tapeworms should be starved for twenty-four hours and then given 3 to 4 oz., according to age, of the following preparation. Food and water should be withheld a further four hours after treatment:—

White arsenic (95 per cent. to 98 per cent. arsenious acid)	2 oz.
Epsom salts	6 lb.
Water	5 gallons.

Boil the arsenic for half an hour in 2 gallons of water. Allow the sediment to settle, then pour off and retain the clear fluid. Add the Epsom salts and make up to 5 gallons.

ROUNDWORMS.

Of the numerous species of roundworms that occur in cattle many are inconspicuous and of little importance, and have been omitted from these notes. Others, while producing no outstanding symptoms of infestation, are included owing to their comparatively frequent occurrence.

THE LARGE STOMACH WORM (Haemonchus contortus).

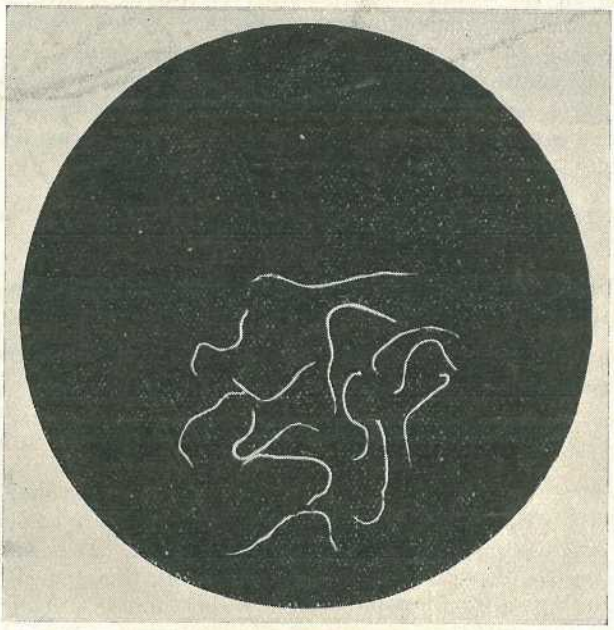


Plate 290.—The Large Stomach Worm (*Hæmonchus contortus*).

The large stomach worm is found in the fourth stomach, and not only occurs in cattle but also in sheep and goats. Of the two sexes the female is more conspicuous, being red and white striped and about an inch in length. The male is smaller and uniformly pinkish or whitish.

Life History.

The eggs laid by the female worm eventually reach the exterior in the dung. Under favourable conditions these hatch and give rise to tiny larvæ. These larvæ feed and develop in the dung and in a few days reach the infective stage, the larva now being completely enclosed in a sheath, which helps to protect it against adverse conditions. Crawling up the grass blades, when moisture is present, the larvæ are taken in by the animal when grazing. Making their way to the fourth stomach they settle down and grow to maturity.

Effect of Infestation.

Only calves and young cattle appear to be affected by the large stomach worm. A heavy infestation causes continuous diarrhœa, anæmia, and emaciation, and also may manifest itself in a large swelling beneath the jaw (bottle jaw), and unless treated the animal may die.

Treatment and Control.

Bluestone will be found a satisfactory drench for the large stomach worm. This is made up as follows:—Bluestone (fresh), 8 oz.; water, 3 gallons.

If desired, 8 oz. of mustard may be included. The bluestone should be dissolved in the water in an enamel or earthernware vessel. The mustard is mixed to a smooth paste and then added to the bluestone solution, keeping the mixture well stirred whilst using. The animals to be treated should be starved for twenty-four hours before and for four hours after treatment, the dosages being as follows:—Calves four months, 3 oz.; calves six months, 4 oz.; calves nine months, 6 oz.; calves twelve months, 8 oz.

This treatment should be repeated at least once after a fourteen days' interval.

In addition to treatment preventive measures should be adopted, the most important of which are—

1. The avoidance of paddocks of a marshy nature as calf pastures.
2. The burning off of the pastures when possible, such burnt off areas to be used only by the calves.
3. Losses due to stomach worm infestation occur mainly in the late winter and early spring; that is, at a time when the pastures contain very little nourishment. It is believed that the use of supplementary foods during this period, especially to "poddies," would considerably increase the resistance of the animal to the effects of infestation. A good bonemeal lick should always be available to the animals as well.

THE LESSER STOMACH WORM (Ostertagia ostertagi).

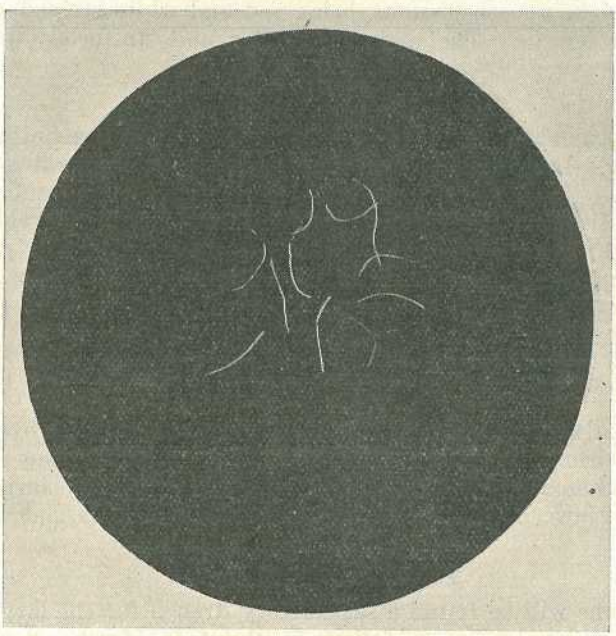


PLATE 291.—THE LESSER STOMACH WORM (*Ostertagia ostertagi*).

This is a slender brownish worm found buried in the mucosa of the fourth stomach. Although one of the commonest parasites of cattle in Queensland it is not considered to be of any importance. The life history differs only in detail from that of the large stomach worm.

THE CATTLE HOOKWORM (Bunostomum phlebotomum).

Plate 292.—The Cattle Hookworm (*Bunostomum phlebotomum*).

This is a conspicuous whitish species about half an inch to nearly an inch in length occurring in the first portion of the small intestine. The mouth of the hookworm is provided with teeth with which it attacks the intestine wall.

Life History.

The eggs laid by the females are passed out in the dung. After hatching the larva develops into the infective stage when it is enclosed in a sheath. Should these infective larvæ come into contact with the skin of the host, they immediately bore through it and reaching the blood vessels are carried to the lungs. After developing in the lungs for some time they move out into the windpipe or trachea and from here to the mouth. They are then swallowed, and reaching the intestine settle down and grow to maturity.

Infective larvæ may also be taken in with food. They then bore through the wall of the alimentary canal and reaching the blood stream are carried to the lungs, returning later on to the intestine via the mouth.

Effect of Infestation.

The cattle hookworm is a not uncommon parasite in Queensland and probably is concerned to a certain extent in the general unthriftiness of calves in many coastal areas. The species is responsible for a

considerable loss of blood, and in other countries where it is found is regarded as a very serious parasite, causing symptoms very similar to those already outlined for the large stomach worm.

Treatment and Control.

No tests so far as is known have yet been made with drugs for the removal of the cattle hookworm. Of the many drugs available tetrachlorethylene seems to be the most promising as well as being fairly safe. Doses of 10 cubic centimetres to 30 cubic centimetres are advised. These dosages, to be as safe as possible, should be followed by a purgative (Epsom salts).

The preventive measures outlined for the large stomach worm should also be enforced as far as practicable.

THE LARGE BOWEL WORM (Oesophagostomum radiatum).

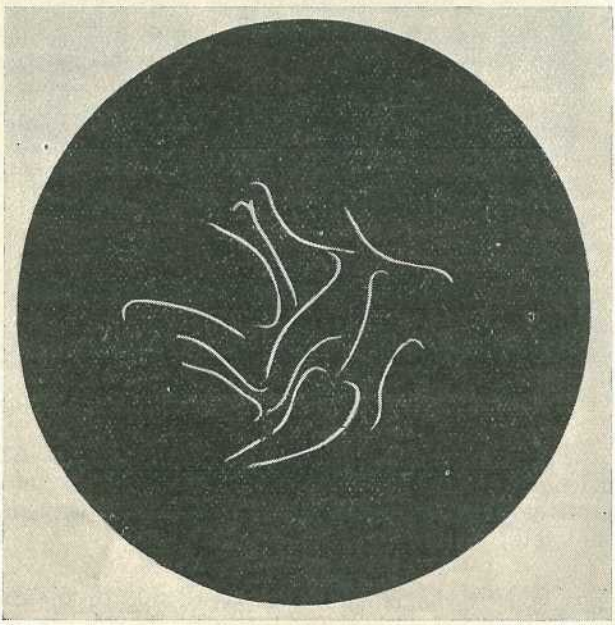


PLATE 293.—THE LARGE BOWEL WORM (*Oesophagostomum radiatum*).

Description and Life History.

This species is a whitish worm up to $\frac{3}{4}$ inch in length inhabiting the large bowel. The life history is very similar to that of the large stomach worm, but in this case the infective larvæ after being taken in by the animal when grazing make their way into the intestines and burrow into the intestine wall. This results in the formation of a small nodule in which the young worm spends portion of its life. Its development in the nodule being completed, the worm then makes its way into the large bowel where it spends the remainder of its existence.

This species is a very common parasite of cattle, and when in numbers is considered to cause unthriftiness, especially in calves.

Control.

There is no treatment available for the removal of the large bowel worm, and the preventive measures advised for the control of the large stomach worm should be practised.

THE LUNG WORM (Dictyocaulus viviparus).

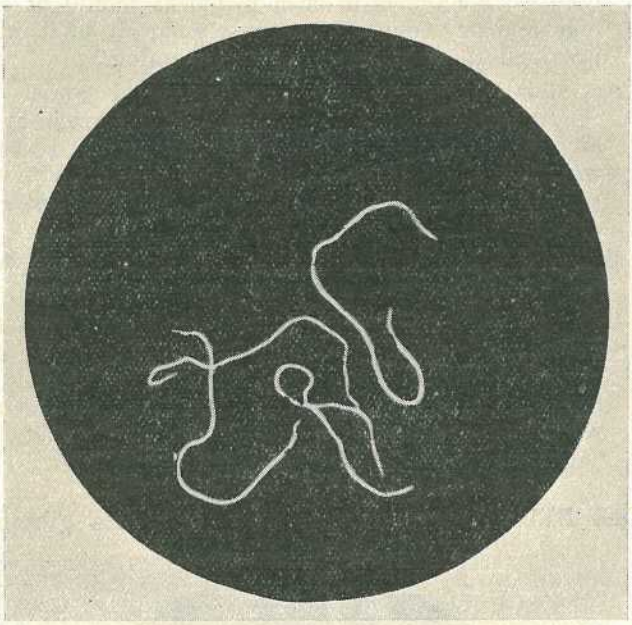


Plate 294.—The Lung Worm (*Dictyocaulus viviparus*).

The lungworm is an elongate slender worm occurring in the air tubes of the lungs. The females may grow up to 3 inches or more in length. The males are smaller and measure 1½ to 2 inches long.

Life History.

The eggs when laid by the female worm contain fully developed embryos and hatch in the lungs. The young larvæ may travel into the mouth, be swallowed, and reach the exterior in the dung, or they may be coughed out in the bronchial secretions.

After a period of development outside the animal they reach the infective stage. They are then taken in by the animal in food or water. Boring through the intestine wall they eventually reach the lungs either in the blood or lymph streams. Once in the lungs the larvæ make their way to the air tubes, where they become mature.

Symptoms of Infestation.

Lungworms are serious among calves and young cattle only. In light infestations no symptoms are observed. When the worms are numerous the calf develops a husky cough. The bunches of worms in the air tubes may interfere with breathing and the animal may exhibit symptoms of suffocation. Large amounts of mucous, sometimes

blood-streaked, may be expelled, and in which bunches of worms may occur.

Treatment and Control.

The following measures, if adopted carefully, should control any outbreak of this parasite:—

1. As the free living stages are favoured by paddocks of a marshy nature, all animals in such paddocks should be removed to high and dry country, and a safe supply of drinking water provided if possible by using troughing.
2. As stomach worms are usually found under the same conditions as lungworms, a bluestone drench by removing any stomach worms will assist the calf to resist the lung worms. This drench consists of 3 to 8 oz. of a solution of ½ lb. of bluestone (fresh) in 3 gallons of water following overnight starvation.
3. Infested animals should have good nutritious food. The greatest factor in treating an infested calf is good nursing.
4. In severe infestations an intertracheal injection of the following formula will be found beneficial, especially if repeated after one week. The injection is made with a sterilised hypodermic syringe between the cartilaginous rings of the windpipe:—Turpentine, 1 drachm; carbolic acid, 10 minims; chloroform, ½ drachm; glycerine, 1 drachm.

THE BEEF NODULE WORM (Onchocerca gibsoni).

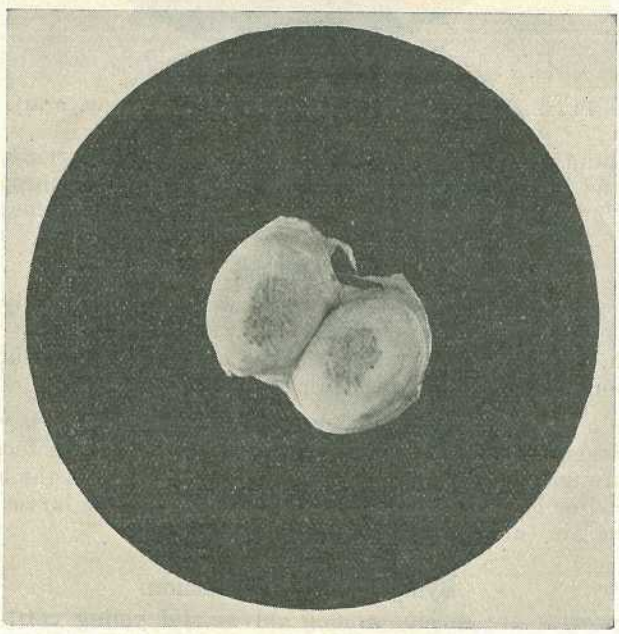


PLATE 295.—THE BEEF NODULE WORM (*Onchocerca gibsoni*).

This parasite takes the form of nodules, varying somewhat in shape and size, which occur in the brisket and stifle joint. These

nodules are generally rounded and may measure up to 4 inches in diameter. In the centre of the nodules or worm nests there lies a long threadlike female worm 20 to 56 inches long, with which may be associated one or more males 1½ to 2 inches long.

The nodule itself is constituted of fibrous tissue and is formed by the host tissues as a reaction to the presence of the parasite. Eventually the worms die and undergo calcifiation but the nodule remains.

Effect of Infestation.

The beef nodule worm is exceedingly common and is found in cattle of all ages excepting young calves. The worm does not appear to be harmful in any way to the animals 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 is very heavy.

Control.

No control measures for this parasite can be recommended until its life history is known. Other worm parasites closely related to the nodule worm require an intermediate host to complete their life cycle, and in several cases species of "sandflies" fill this roll.

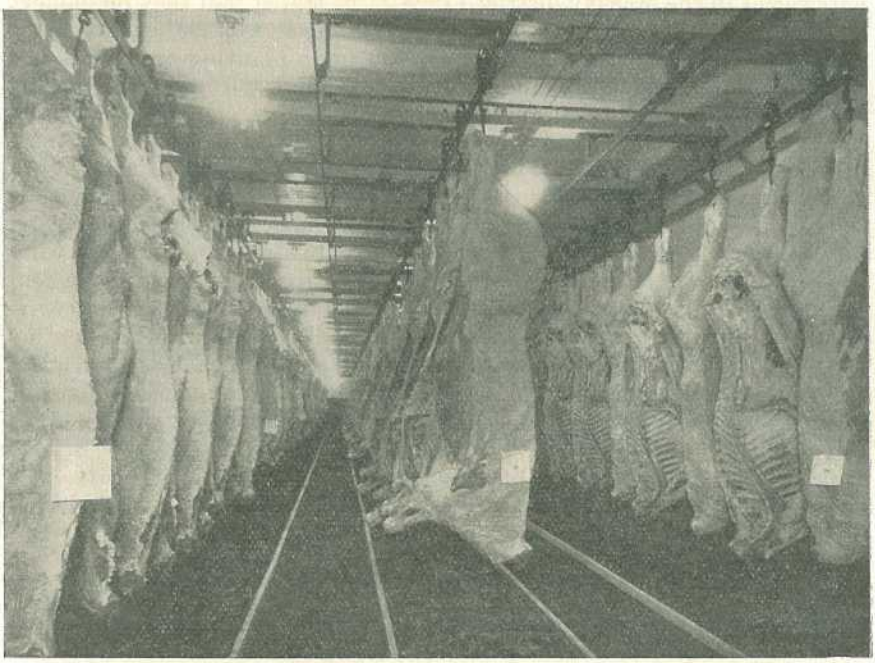


Plate 296.—Section of Beef Carcass Competition, Brisbane Abattoir.

[Block by courtesy Queensland Meat Industry Board.

The Wireworm Pest and its Control in Central Queensland Sugar-cane Fields.

By W. A. McDOUGALL, Assistant Entomologist.

LARVÆ of certain genera of the Elateridæ or "Click Beetles," commonly known as wireworms, are capable of causing great damage to cultivated crops, and for a considerable number of years it has been recognised that wireworms are responsible for damage to sugar-cane in certain parts of Queensland. Jarvis (1927 *b*) stated that in 1910 wireworms had been observed to inflict serious damage to young cane planted on alluvial flats at Mackay, and that in the same year this pest occurred freely in Isis Central district, where it was reported to be causing more damage to cane than was being done by any other insect. This writer further (1925 and 1927 *a*) listed a number of possible wireworm control measures. Illingworth (1919) mentioned that there was evidence of wireworm damage in the Mossman district. During the period 1924-30 officers of the Bureau of Sugar Experiment Stations published various reports embodying some field observations, locality records, and recommendations for the control of these pests. Cottrell-Dormer (1924 *b* and *c*) reported damage in low-lying country at Mooliba (near Babinda) and in the Homebush and Eton districts, near Mackay. Writing of wireworms in the Mackay district (1924 *a*) he stated that they do damage mostly during the colder months of the year; it was claimed by some farmers that such damage was worst following a planting of cowpea as a green manure crop. Mungomery (1926) found wireworms attacking cane in the Pialba district, particularly after spring planting, and Bates (1925) reported *Monocrepidius* sp. attacking eyes of setts at Strathdickie and Tawvale, Proserpine mill area, during July and August. In 1928 the attention of Burns (1928 *a*), then Assistant Entomologist at the Mackay Experiment Station, was drawn to a serious wireworm infestation at Te Kowai. Plants were bored into at the ends, and the wireworms were observed to be voracious feeders capable of rapid movement through the soil. Burns (1928 *b*) observed several species* of wireworms in Mackay canefields, and in his annual report for 1929 mention was made of several large infestations at Walkerston, Te Kowai, Farleigh, Habana, and Racecourse. Following further and more serious damage in this area, a rapid survey was carried out by Mungomery, who reported to the Director (1930) that damage appeared to be most severe in low-lying, poorly-drained land which remained wet and cold. The life cycle of the pest was thought to be at least a year or more, and the period of oviposition of the adults a very protracted one.

Although much had been written about wireworms damaging cane in Queensland and their possible control, no serious attempt had been made to investigate the problem thoroughly prior to 1931. In that

* Specimens at the Mackay Experiment Station labelled by Burns as "Wireworms ex canefields 1928" have been identified as J. sp. *Lacon assus* and *L. variabilis*. All those found damaging cane are of the lastmentioned species.

Fig. 1. A field of four acres completely destroyed by wireworms; note an occasional shoot and damaged plants which had been removed when supplying. This was the first planting since about 1917, when a similar strike failure occurred. Swamp country, Sandiford, July, 1933. (Photo. by W. C. Dormer.)

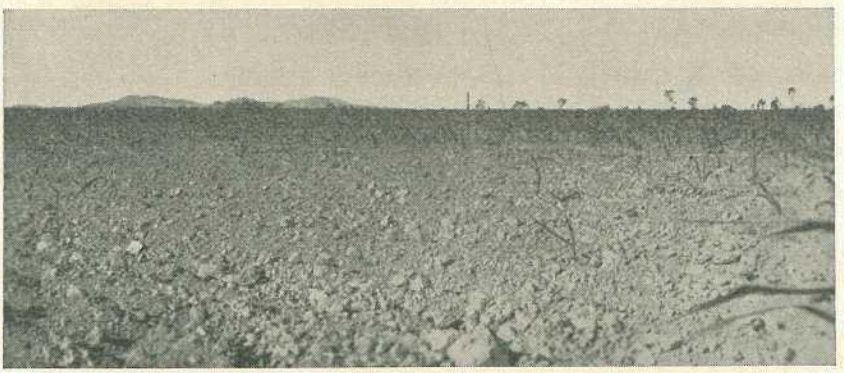


Fig. 2. Poor stand of cane in a low corner of the field; the eyes have been destroyed by wireworms. The planting of this corner always results in a poor strike. Walkerston, 1931.

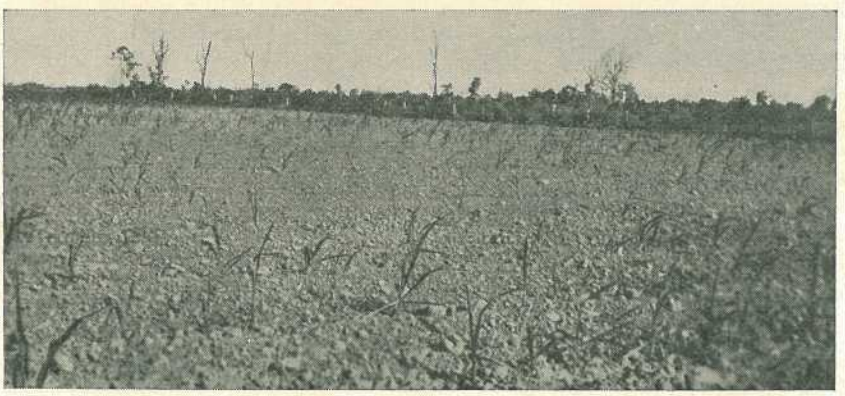


Fig. 3. A poor stand of cane in a badly drained lower end of a field. The eyes have been destroyed by wireworms. Walkerston, 1931.

Plate 297.

year the investigation of the wireworm problem in the Mackay and Proserpine mill areas was made a major project, since in these areas, more so than in any other Queensland cane district, wireworms are, at times, a serious pest. Certain portions of the work carried out by the writer have already been published—McDougall (1934).

Nature of Wireworm Damage and its Economic Importance.

The wireworm larvæ attack the swollen eyes of cane setts, young shoots, or the underground portions of larger shoots. The damage consists in the eating of only a small tunnel which cuts across the centre of the growing point, thus bringing about the death of the shoot or bud; in some cases a considerable portion of the interior of the buds may be eaten. Examples of damage to growing shoots may be seen in Plate 300, fig. 1. When wireworms are found in the act of eating into buds or shoots, it will be noticed that as a rule a considerable portion of the posterior half of the larva is protruding from the tunnel. In contrast to this mode of attack, the larva of the large moth borer (*Phragmatiphila truncata* Walker) enters a shoot by a small hole, and completely houses itself by eating out the centre for some distance above and/or below the entrance hole level (*see* Plate 300, fig. 2).

When all the eyes and small shoots of a set are attacked no stool results, while when larger shoots are attacked the effect is to produce "dead-hearts" in the primary shoots, the formation of the stool then depending on the formation of secondary shoots. On rare occasions the secondary shoots—in fact, all shoots as they arise—may be destroyed by the pests. The effect of wireworm attack on shoots and eyes may thus result in practically a complete failure of germination throughout the field (Plate 297, fig. 1.) Such complete failures are unusual, however, and as a rule the misses are lightly or heavily distributed throughout the block or are confined to small or large patches or to the lower ends of fields (*see* Plate 297, figs. 2 and 3; Plate 298, figs. 1, 2, and 3).

Damage in the Mackay district is almost exclusively confined to low, badly-drained land. During the past fifteen years considerable areas of this type of country have been planted to cane in the Mackay and Proserpine mill districts, and this has been responsible for the appreciably increased proportion of damaged strikes caused by wireworms. Taking the districts as a whole this proportion is not high, and the majority of the farmers are not troubled by wireworms except, possibly, in an occasional low spot in which a poor strike is considered by many of the farmers to be of little consequence. This fact points to one of the most serious aspects of wireworm damage. If the total damage were more evenly distributed, losses would not be so disturbing, but, unfortunately, there is a small percentage of farms which contain quite appreciable areas of wireworm infested country, and here this pest is most serious.

Losses caused by wireworm depredations consist in the decrease in plant and subsequent ratoon tonnages, and an increase in production costs per ton of all cane harvested in wireworm infested fields. This increased cost may be due to the irregular distribution of the stools in the fields, supplying misses (often two or three times) or even replanting,

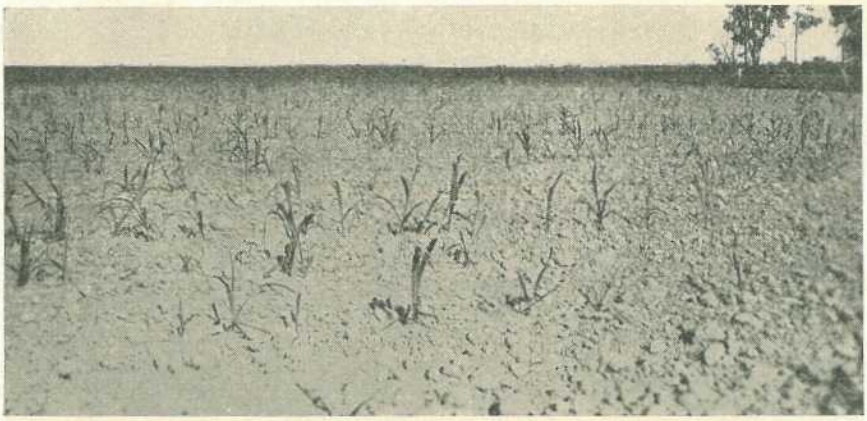


Fig. 1. A poor stand of cane on a badly drained lower end of a field. The eyes and young shoots have been destroyed by wireworms. Walkerston, 1931.

Fig. 2. A complete strike failure in a very badly drained depression. The eyes have been destroyed by wireworms. The Lagoons, Mackay, 1932.

Fig. 3. A poor stand of early plant cane in a badly drained depression in the centre of the field. The eyes and young shoots have been destroyed by wireworms. Te Kowai, July, 1933. When planted in 1928 a similar bad strike was obtained. (Photo. by W. C. Dormer.)

Plate 298.

the initial cost of preparing parts of fields which do not yield any returns whatsoever, wasted fertilizer, increased cultivation costs due to the greater weed growth where poor stands occur, or the cost of some unsuccessful methods of wireworm control which may have been tried after the presence of the pests had become evident in the fields. Ratoon crops do not suffer damage from direct wireworm attack.

The Pest Species.

Jarvis (1927 *b*) stated that he had reared *Monocrepidius* adults from larvæ found in the soil about cane roots in the Bundaberg district, and until 1930 this seems to have been, with one exception,* the only rearing work done with wireworm pests from Queensland canefields. It would seem to have been the custom in the past, if naming the pests at all, to refer any wireworms damaging cane anywhere in Queensland to the genus *Monocrepidius*. The first departures from this custom were when Mungomery (1928) stated that *Lacon variabilis* and many *Monocrepidius* species damaged cane in Southern Queensland and when the same author (1930) considered that apparently one species, a *Lacon* species, was responsible for nearly all the wireworm damage reported from the Mackay and Proserpine districts.

During the three years 1931-33 the following Elaterid larvæ were collected at different times from Central Queensland cane fields: *Lacon lateralis* Schw., *Lacon variabilis* Cand., *Lacon assus* Cand., *Lacon humilis* Er., *Heteroderes carinatus* Blbn., *Heteroderes cairnsensis* Blbn., *Agrypnus mastersi* Macl., and several other species whose adults are either not known, or, if known, are unidentified. Included in the last group is *Lacon* "Q" sp. It was found that very nearly all wireworm damage observed during the above period was due to *L. variabilis*.

Specimens of the wireworms found by Mungomery to be damaging cane in the Mackay district were examined and identified as *L. variabilis*.

It has been established that wireworms have been pests in some particular fields in the Mackay district since as early as 1890, and examinations of the damaged areas in these fields during a planting in 1931, 1932, or 1933, showed the pest to be *L. variabilis*. Inspections of damaged areas proved to be those referred to in some of the literature as localities of damage by *Monocrepidius* spp., have shown the pest in these localities to be *L. variabilis*. It seems evident that this species is and has always been the wireworm pest in the Mackay and Proserpine cane fields. Consequently in this paper unless otherwise stated, all discussion will refer to *L. variabilis* and further references to other species of wireworms found in Central Queensland cane fields will be made only when they may be of help in the identification of the various stages of *variabilis* in the field and in the formulating of a control for this pest.

Description of L. variabilis.

The Adult.—The adult "click-beetle" is a uniform dark-brown colour on both upper and lower surfaces. It is moderately flat in shape and shows a considerable variation in size ranging from one-third to one-half inch in length, with a width of about one-fifth inch. The elytra or wing covers appear as possessing a series of parallel ridges which run lengthwise.

* Mungomery (1927) listed *L. variabilis* amongst the insects reared by him during that year from larvæ to imagines.

The following descriptive information concerning the genus *Lacon* is derived from Elston (1924) :—

> "The mandibles are bifid or dentate on the inside. The apical segment of the palp is securiform. The antennæ are short: the first segment is large and somewhat bent, the second and third small, the third somewhat shorter than the second, the following are triagular, the last at the apex truncate or emarginate. The elytra are usually punctate-triate or with seriate punctures, the shoulders either rounded or angular, and the epipleuræ more than twice as long as wide. The antennal furrows on the prosternum reach only to the middle. The insects of the genus may be divided into four sections according to the presence or absence of well-defined tarsal furrows on the pro- and metasternum. One section is represented by *L. variabilis*, which is without tarsal furrows on the meta- and prosternum, or, if present on the latter, are so ill-defined as to be almost indiscernible."

Elston found that as the name *variabilis* implies, the species is very variable.

> "On some specimens, particularly with the male, the tarsal depression is more or less visible, whilst on others it is entirely absent; the sculpture of the elytra also shows a certain amount of variability, the alternate interstices being more conspicuously elevated on some species than on others."

There is found to be very little variation in the elytral structure of adults reared from larvæ attacking cane or in adults collected in the Mackay and Proserpine canefields. On examining an elytron it will be found that, excluding the lateral ones, the alternate interstices, which are wider and have three rows of hairs instead of two (Plate 303, fig. 4) are nearly always sufficiently elevated to give a general macroscopic appearance of a distinct series of parallel ridges. In specimens from Rockhampton and in a very occasional one collected in Mackay canefields, the alternate interstices are not as conspicuously elevated as in the vast majority of Mackay specimens.

Detailed measurements, in millimetres, of the largest and smallest specimens collected over three years in Central Queensland canefields, are as follows:—

—	Total Length.	Thorax.		After-body.	
		Length.	Width.	Length.	Width.
Largest specimen	14·5	3·9	4·4	9·7	4·7
Smallest specimen ..	8·7	2·4	2·7	5·7	2·8

The Egg.—The egg is opaque to pearly-white in colour, elliptocylindrical in shape, and the ends are broadly rounded and similar. From the measurement of one hundred eggs it is evident that there is little variation in size; the length always approximates very closely to ·58 mm. and the width to ·47 mm., i.e., if placed lengthwise there would be about forty-three eggs to the inch. Under a magnification of 80x the chorion is seen to be quite smooth, and that it is tough is shown by the fact that the eggs are easily handled without any changes in their shape, and that during a considerable period after the hatching of the small larvæ it is difficult to separate the shells from the full eggs.

The Larva.—The active larva or "wireworm" is a worm-like segmented creature, semi-flattened in shape, and, when full-grown, is usually about four-fifths of an inch in length and with a greatest width

of approximately one-eighth of an inch. In general appearance it is pale waxy-yellow with the "head" and forked part of the end segment reddish-brown. The short legs are armed with short brown spines. In the field the larvæ may be recognised by the shape of its end segment as in Plate 299, fig. 2B, and Plate 304.

The greater part of the dorsal and ventral surfaces is pale waxy yellow with the narrower lateral areas a lighter shade. With the exception of the nasale and mandibles, which are very dark brown to black, the head and the pronotum are reddish-brown. The four prongs of the two terminal processes and the five tooth-like structures on each lateral margin of the flattened dorsal portion of the ninth abdominal segment are dark reddish-brown. The spiracles are not conspicuous. The nasale is tridentate, the processes being of equal lengths (Plate 303). The "pseudopodium" (anal segment) is armed with a strong ascending hook (Plate 304). There is one conspicuous variation in larval setation; conspicuous because it concerns the flattened dorsal surface of the ninth abdominal segment. There, the presence of two tuberculate hairs situated at about the beginning of the distal third is constant. Midway between these two hairs and the anterior margin two smaller hairs will be noticed in Plate 299, fig. 2B. In this position as many as five hairs may be present, or none at all.

The following is an example of a detailed measurement, in millimetres, of a full grown mobile larva:—Total length, 20.0; head capsule, length 2.0, width 2.0; prothorax, length 2.0, anterior width 2.1, posterior width 2.5; other two thoracic segments, length of each 1.0, width of each 2.8; length of each of first eight abdominal segments 1.4, width of first 3.0, width of fifth 3.2, width of eighth 2.9; ninth abdominal segment, length 2.4, greatest width 1.9.

The Pupa.—When first formed the pupa is opaque white and, except that the abdomen is slightly longer, very much resembles the adult beetle into which it will change in both shape and size.

The pupa is microscopically spinose. There are two fleshy thorn-like structures or spines on the anterior border of the prothorax above the eye spots. These point upwards, whereas similar ones on the lateral angles of the much broadened posterior angles point upwards and outwards. The spines in the angles formed by the dorsal median line and the posterior border of the prothorax are very small. The bifid nature of the adult mandible is early discernible in the pupa. The antennæ, of similar form to those of the adult, lie along the margin of the thorax on the ventral side and reach to the posterior angles. There are nine abdominal segments. The ninth terminates dorsally in two closely placed fleshy spines covered with brown barbs. At the base of each spine there is a much smaller spine. During early life the wing cases reach on to one quarter of the venter of the fourth abdominal segment and the third pair of legs on to one quarter of the fifth. Later—i.e., during the last four days of pupal life—there are considerable visible alterations, including a darkening in colour; the tips of the mandibles are plainly visible as also are the antennal and tarsal segments. The edges of the antennal furrows become pencilled in brown, and the relative position of tips of the wing cases, the posterior legs, and the abdominal segments change very appreciably. The contents of the eighth and ninth abdominal segments retreat into the adjacent segments leaving an empty case. The shape of the seventh abdominal sternum of the pupæ is very similar to that of the seventh body segment (actually the fifth visible) of the adult. In the pupæ all the abdominal terga and sterna can be seen.

Distribution.

According to Elston (1924) *L. variabilis* is commonly distributed over the whole of Australia and Tasmania. However, with the exception of the records of damage to cane in Central and Southern Queensland it has not otherwise been recorded as a pest. With the exception of five adult specimens labelled "Rockhampton" in the Queensland Museum, a few adults collected in the Bundaberg district, and specimens that had been received from Mackay during the past four years, no adults or

larvæ of this species could be found in any of the Queensland collections of Coleoptera examined. These included those of the Queensland Museum, Department of Agriculture and Stock, at Brisbane, the University of Queensland, and of the Sugar Experiment Stations at Meringa and Bundaberg. Wireworms found by Mr. Mungomery, during the past year, to be damaging cane in the Bundaberg district were reared to adults at Mackay and other specimens collected in the past from southern canefields were examined; none of these is *L. variabilis*. However, Mr. Mungomery has informed the writer that *L. variabilis* larvæ have been found actually damaging cane setts in the Pialba district; this occurrence is responsible for the recording of this species as a pest of cane in Southern Queensland.

In 1931 two species of wireworms reported to be damaging cane setts at Mossman, North Queensland, were forwarded to the writer for examination. The smaller species, one of the cylindrical type of Elaterid larva, was considered by the observer to be the more serious pest; what proved to be the adult of this species could be found in the cane in circumstances similar to those mentioned by Illingworth (1919). The two specimens of the second species could not be distinguished from the sixth larval instar of *L. variabilis*. Moreover, it seems that wireworm infestations in the Mossman district occur under conditions similar in many respects to those concerned with the habits of and damage by *L. variabilis* in the Central Queensland fields.

Other Insects which may be mistaken for Lacon variabilis.

There is but one commonly seen Elaterid adult or "click-beetle" in the Mackay and Proserpine districts which more or less closely resembles *L. variabilis* (*see* Plate 299, fig. 1). This is *Lacon humilis* Er. As will be noticed in Table II. (page 703), *L. humilis* is attracted by light, whilst *L. variabilis* is not. *L. humilis* is darker in colour than *L. variabilis* and there are no apparent ridges on the wing covers.

(When the central portion of an elytron of *L. humilis* is examined it will be seen that the interstices are all of similar width; the clothing is similarly arranged on each, and there is no outstanding elevation of any of them (see Plate 303).)

Dystalica mackayensis Carter (Plate 303) is very plentiful and noticeable in Central Queensland canefields. If wireworm damage is particularly heavy in any field or district, farmers often form the opinion that this beetle is the adult of the wireworm. *D. mackayensis* is not a "click-beetle," being a member of the family Tenebrionidæ and its larvæ are quite harmless to cane.

In the larval or wireworm stage many different Elaterid species, which may have quite different habits, very closely resemble one another, but so far as those in Central Queensland canefields are concerned, it is necessary that the differences between two species only be known. These are *Lacon variabilis* (the lowland wireworm) and *Heteroderes carinatus* (the highland wireworm). They are very similar in colouring and general shape, but in the field they may be distinguished by the differences in the shapes of their end segments as shown in Plate 299, fig. 2, and Plate 304.

(The nasale of *H. carinatus* is pentadentate, the processes being of equal length (Plate 303). There is no strong hook on the pseudopodium (Plate 304).)

Heteroderes carinatus, although quite plentiful in well-drained fields in the Mackay district, has never been known to seriously damage cane.

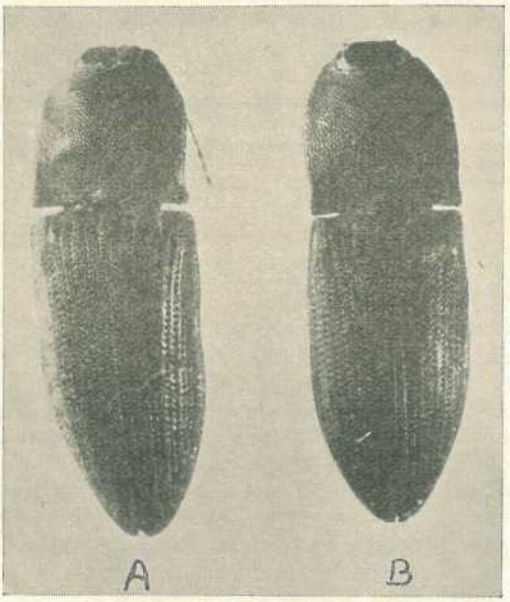


Fig. 1. Adults of A: *Lacon variabilis* Candige, x 5. B: *Lacon humilis* Er. x 5.

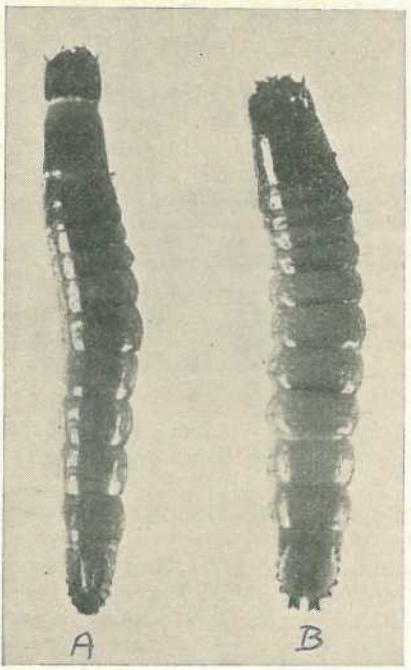


Fig. 2. Dorsal views of full-grown larvæ of A: *Heteroderes carinatus* Blackburn, x 4. B: *Lacon variabilis* Candige, x 4.

PLATE 299.

The carnivorous larvæ of the carab, *Gnathaphanus pulcher* Dej., is generally distributed in many fields and may be present in large numbers in some situations. With its brown head and very pale-yellow to white abdomen it is sometimes mistaken for a wireworm, but it should be easily distinguished from any of the latter by the greater size of its head in proportion to its body, the much softer abdomen, and the presence of two spine-like strucutres (urogomphi) near its posterior end.

The three false wireworms most common in Mackay and Proserpine canefields are the larvæ of the Tenebrionid, *Dystalica mackayensis,* and of the Cistelids, *Hybrenia elongata* Macl. and *Dimorphochilus pascoei* Macl. The latter two when seen in the field are much larger than most of the local semi-flattened wireworms. All resemble the cylindrical type of wireworms (none of which damage cane in ploughable canefields in Central Queensland) more than the semi-flattened type of which *L. variabilis* is a member. The false wireworms possesses a distinct lamrum whereas wireworms and other Elaterid larvæ do not.

Insect Damage which resembles that caused by Wireworms to Cane.

In Central Queensland cane areas there are three insects that may cause damage to cane which superficially resemble that caused by wireworms. These are a small black beetle *Pentodon australis* Blbn.* (Plate 300), the caterpillar of the large moth borer (*Phragmatiphila truncata* Walker), and small white grubs of *Rhyparida* species. Of these *Pentodon australis* is of the most importance, and like the wireworm it causes "dead-hearts" in growing shoots and eats the eyes of setts. This damage may be effected in either high or low land, and damage by Pentodon in high land in which larvæ of *H. carinatus* have been observed, is often debited to wireworms.

When a wireworm attacks a shoot the hole is surrounded by small amounts of fibrous material (Plate 300, fig. 1). On the other hand the Pentodon beetle, which is larger than the wireworm and a much grosser feeder, in its attack on the underground portions of the shoots, makes much larger holes, at the edges of which are considerable masses of frayed fibrous material (Plate 300, fig. 3)—a beetle in the act of feeding is shown on the extreme right). When the Pentodon beetle attacks the eye of a sett it does not tunnel to the centre but gouges it out completely. Damage to strikes by the larvæ or grubs of the Pentodon beetle is more common in early than in late plantings; these grubs chiefly damage eyes and setts by eating out large cavities.

Plate 300, fig. 2, shows the small, neat holes in shoots caused by the large moth borer. This insect does not attack eyes of setts. Attacks by *Rhyparida* spp., although sometimes severe, are comparatively rare.

Habits and Characteristics of Lacon variabilis.

Few eggs or first-stage larvæ have been seen in the field. Washing and sieving (after Shirck (1930)) of soil samples from localities where

* According to C. E. Chadwick, Eltham, N.S.W. (in a communication dated 25th July, 1933) this species was described by Olliff under the name *Heteronychus vulgivagus,* and in the South Australian Museum collection all specimens of this species, including a cotype of *Pentodon australis* Blbn., stand under the name *Meanastes vulgivagus* Olliff. The name *P. australis* is used in this publication for the reasons: (*a*) up to the present no published accounts of the synonymy of this species have been found; (*b*) for many years the insect has been widely known under this name to cane farmers in Queensland and New South Wales.

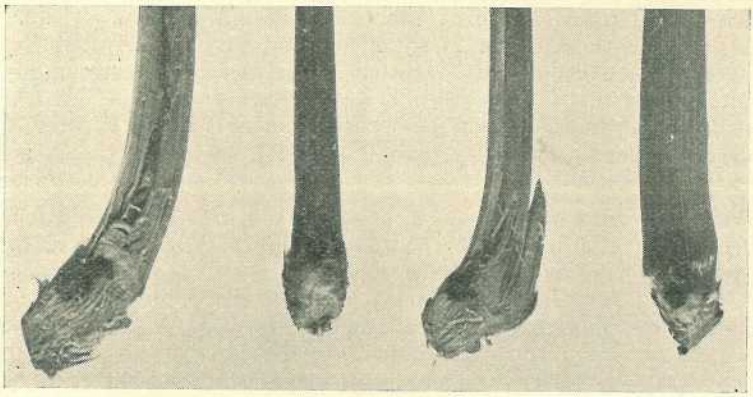


Fig. 1. Wireworm damage. Note that tunnel does not extend beyond the centre of the shoot nor above or below the growing point.

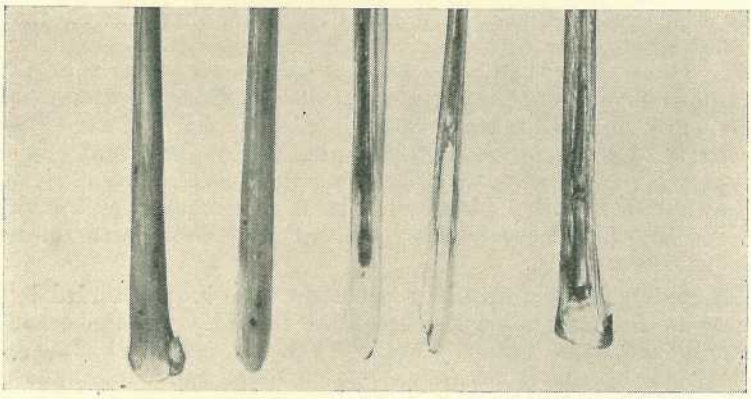


Fig. 2. Underground portion of cane shoots attacked by *Phragmatiphila truncata* Walker.

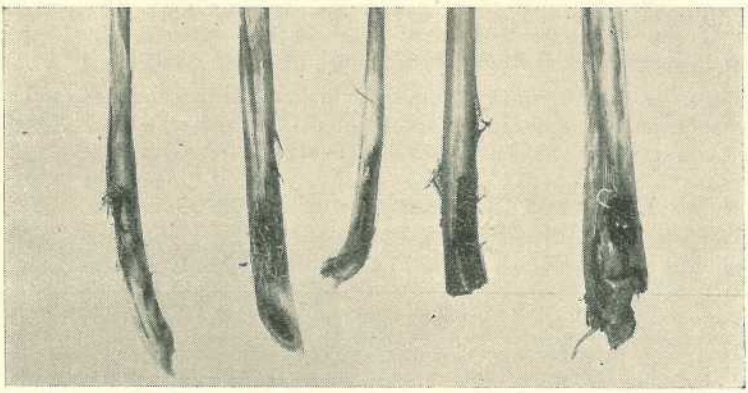


Fig. 3. Underground portions of cane shoots damaged by *Heteronychus arator* F.

PLATE 300.

adults were known to have been present four or five weeks prior to the date of sampling, gave very poor yields. In the laboratory, gravid female adults, caged under conditions made to resemble as nearly as possible those which would most likely be encountered by them in the field, usually deposit eggs either singly on the soil surface or in batches in crevices at a depth not exceeding two inches. The eggs are not covered by any secretion, and when laid in batches are not connected in any way. No egg chambers are constructed. Observed first batches of eggs deposited by an adult have contained from two to seventeen eggs, but usually ten to fifteen, while later batches deposited by the same adult have consisted of as many as twenty-three eggs or as few as two. Table I. is a sample of a series of the recorded observations on the number of eggs deposited (and dates of deposition) by thirteen beetles during the 1931-32 summer, and twenty-three beetles during the summer of 1932-33. The maximum number of eggs deposited by any one female was thirty-six, the minimum two, and the mean for the thirty-six beetles was twenty-three.

TABLE I.

Egg Deposition as Recorded from Observations on 36 Caged Females.

Lab. No. of Female.	Number of Eggs Deposited.	Date of Deposition.	Remarks.
A 1 .. (confined with 2♀♀)	15 11	8–1–32 3–2–33	On 24–2–32 female still alive; dissection showed 65 well-developed eggs in egg-tubes
A 2 .. (with 2♀♀)	13 23	10–1–32 28–1–32	On 24–2–32 female still alive; dissection showed 59 well-developed eggs in egg-tubes
A 7 .. (with 1♀)	4 7 15	3–12–31 1–2–32 3–2–32	
A 5 .. (with 3♀♀)	10 2	20–11–32 5–12–32	All females alive on 29–3–33 with well-developed eggs in egg-tubes
A 8 .. (with 1♀)	12 19	9–12–32 18–12–32	
A 9 .. (with 4♀♀)	12 10	7–12–32 16–12–32	

The eggs have withstood immersion in water for a period as long as five days, and young have hatched out from eggs exposed to a soil environment ranging from moderately dry to free water present. The young larvæ emerge from the eggs through small holes eaten in the shells. Dispersion through the upper two or three inches of soil quickly follows and, at this stage in larval life, feeding largely consists in the ingestion of soil. The average length of the newly-hatched larvæ is 2·1 mm. and the width ·27 mm., the widest parts being the head capsule and the prothorax. Towards the end of the first larval stadium the length may be as great as 3·38 mm. and the width ·43 mm., the abdominal segments being then the widest parts.

During a moult the skin usually splits along the median dorsal line of the thorax only; sometimes the head capsule and the anterior abdominal segments are included in the splitting. The thoracic segments first emerge through the split and are followed by the head and abdomen. The pulling of the abdomen through the unsplit portion of the moulted skin or exuvium causes a certain amount of telescoping of the exuvial segments; the result is that the moulted skin appears as a distinct head capsule and a distinct ninth abdominal segment connected by a mass of telescoped intermediate segments. An exuvium of this type* is comparatively compact and does not break up very quickly in loose soil; such exuviæ from the larger instars are often found complete in the field.

After a number of ecdyses, or moults, pupation takes place in earthen cells at a soil depth which depends upon the disposition of the moisture in the soil at the time when the mobile larvæ assume a torpid prepupal state. This change of state invariably takes place in the top two inches of visibly moist soil. If the weather has been showery the pupæ will be found within an inch of the soil surface, whilst following dry times, pupæ have been collected at soil depths as great as seven inches.

Adults are seldom seen in the field unless special search is made for them in suitable localities at certain times of the year. After light showers of as little as ten points, or after heavy rains in November or December, they may be found in their greatest numbers behind the lower leaf sheaths of cane growing in depressions or in any other low-lying part of a canefield where wireworm damage was evident during germination. In these low-lying areas adults may also be found under clods, at the base of grass clumps, or under any debris which may be present. Often adults of other Elaterid species and false wireworms will be found along with *L. variabilis*. Under one small plant in November, 1931, there were found as adults, nineteen individuals of *L. variabilis*, three of *L. assus*, numerous *H. cairnsensis*, and many *Dystalica mackayensis* Carter, together with larvæ and a few pupæ of the last-mentioned. Occasionally as many as fifteen *L. variabilis* adults have been collected from behind one leaf sheath, but usually not more than five will be so found. When disturbed the beetles drop and remain inert for some time. Structurally they are capable of strong flight but are seldom seen in flight. During three years' observations less than twenty adults have been seen in the field other than under the various previously-mentioned covers. These observations were made during all hours from 4 a.m. to 12 p.m. After suitable rains on one occasion, fifteen adults were taken after flight from cane leaves at 9 p.m.; fairly heavy rain had been experienced during the day.

Migration and Initial Infestation of Fields.

There seems to be no doubt that the adults will in time migrate from their native habitat (i.e., swampy grass lands), and slowly invade

* During ecdyses of the cylindrical type of wireworm, and of the Tenebrionoid larvæ studied, the splitting of the skin along the mid-dorsal line is not confined to the thorax but is continued along the first seven or eight abdominal segments as well. Exuviæ of these larvæ quickly fall to pieces.

any part of a field where structural work such as the building of a railway, road, or tramline, or other cause has made the drainage insufficient. It appears, however, that migration of adults from one locality to another in badly-drained cultivated country is even slower, but once the species is present in a cultivated fields its population density may increase. This is in marked contrast to the behaviour of several other *Lacon* species, such as *L. humilis, L. lateralis,* and "Q" species; larvæ of the first-mentioned two species are seldom found in cultivated fields although their adults are sometimes there. *Lacon* "Q" sp., together with *L. variabilis,* may be found damaging strikes in new, badly-drained country which had been broken up for the first time during the early part of the year.

In future plantings in this type of country it will be found that, when the season is suitable, *L. variabilis* will be present in larger numbers than before, whilst *Lacon "Q"* sp. larvæ will have practically completely disappeared. In the laboratory it is not difficult to induce *L. variabilis* to oviposit in fairly loose soil, but when gravid females of the other three mentioned *Lacon* species are confined under similar conditions only a few eggs are obtained. All these species will, however, lay eggs in flower pots in which the soil has been pressed down and left until grass has grown in them.

Reaction of Adults to Light.

White to yellowish light does not attract *L. variabilis* adults and this species is very seldom found amongst the "click-beetles" which come to light in houses during the wet season or after the early summer rains. Using an acetylene light and white sheet, attempts to collect Elateridæ were made in several localities at different times during October-February periods. In Table II. are found details of some of the collections.

TABLE II.

Results of Collecting at Lights, using an Acetylene Light placed on a White Sheet. Laboratory Number of Collection and Number of Specimens are Given, together with Time and Date.

Species.	No. 1. 4th Nov., 1931, 8 p.m. to 9 p.m.	No. 3. 19th Nov., 1931. 9 p.m. to 10 p.m.	No. 5. 7th Nov., 1931. 9 p.m. to 10 p.m.	No. 10. 13th Nov., 1933. 8.30 p.m. to 10 p.m.
L. assus	7	52	23	..
L. humilis	..	..	98	15
L. variabilis	..	..	..	2
L. lateralis	..	..	5	35
H. carinatus	..	3	..	26
H. cairnsensis..	..	37	..	..
Other Elateridæ	..	..	3	1

It was whilst making collection No. 3 in a field of plant cane which had been slightly damaged by wireworms (this field was bedded up

during the final ploughing), that *variabilis* adults were seen on cane leaves. No. 5 was made in a low, wet scrub following heavy rain during the day and No. 10 in a well-drained stock paddock in very close proximity to a depression in a cultivated field where *variabilis* adults were known to be present. On some occasions, when collecting with lights in a wireworm-infested field, the lower leaf sheaths of cane have been bent down to expose the beetles but none came to the lights. If adults are exposed to light during the day time they may fall to the ground, but in any case, after remaining inert for a short period they seek shelter under any available cover as quickly as their comparatively sluggish movements wil allow.

Adults of the *Heteroderes* species move much more quickly than do those of the *Lacon* species studied; also the former sometimes take wing when disturbed. This shelter seeking is not wholly caused by heat from the sun, as it also happens in cool, shady situations.

Feeding Habits of Adults.

The adult stage of *L. variabilis* is not directly injurious to cane. In the laboratory it was found that females bred from larvæ would not oviposit until after very light feeding, and potato tuber was provided for them. It is thought that, in the field, the softer underground portions of plants are their chief source of food.

Distribution of Larvæ in the Fields.

As previously stated the larvæ of this species are confined almost exclusively to badly-drained country or parts of fields. The soil in most of these situations is from 9 to 14 inches in depth, light in colour, poor to fair in quality, and with an impervious clay subsoil. However, provided drainage is bad, soil type seems to be of little consequence in so far as *L. variabilis* habitation is concerned. (Note briefly Table III.*) These wireworms are present in the darker flood country at Proserpine, in "glue-pot," and during some seasons strikes in excellent alluvial flats with several feet of soil over gravel may show "wireworm" misses here and there in the bottom of depressions.

Distribution of Larvæ in the Soil.

First-stage larvæ seldom leave the top 2 or 3 inches of soil. The other larval instars have been found at soil depths depending upon soil moisture conditions at the times of examination. When fork hoeing, or supplying after rain (also after heavy dews in very low, wet country) many larvæ are to be found within an inch of the soil surface, whilst after a spell of very dry weather the older larvæ, if in the mobile state, descend to immediately above the clay. The movement of larvæ in the soil, according to moisture distribution, has resulted, on occasions, in rather spectacular effects. It has happened that some fields known

* At one time some attention was paid to the water-holding capacity of the soils. Later during this wireworm investigation, but before complete mechanical analyses of the soils were done, it was considered unnecessary to continue with the project. The moisture equivalents and sticky points observed are given in this table.

to be inhabited by a considerable *L. variabilis* larval population had been planted when the soil moisture had been very low. The results were good showings of primary shoots. At this stage a shower of rain was experienced. The larvæ came up to the top 2 or 3 inches of moist soil and, as this moisture quickly disappeared they descended. During this movement of the larvæ they came into contact with primary shoots &c., with the result that within three days following the shower fully 70 per cent. of the originally healthy primary shoots showed "dead-hearts."

TABLE III.

Relationship of Density of Larval Population to Drainage, Percentage Organic Matter, Soil Type, and Location.

No. of Soil Sample.	Farm.	Moisture Equiv. (30 g. per 30 min.)	Sticky Point.	Percentage organic material.	Soil Type and Location.	Density of Larval Population.
		%	%	%		
1	A	30·45	34·84	5·2	Wash in a watercourse planted to cane	Large in suitable seasons, bad strikes result
2	A	25·76	29·18	4·2	In a shallow depression	Very much smaller than No. 1
3	A	35·25	35·76	5·4	In hollow, badly drained	Large in suitable seasons, bad strikes result
4	A	16·55	22·21	3·8	Dark, rather sandy, high well-drained land	No wireworm damage; no *variabilis* larvæ ever found in this country
5	A	31·75	34·20	5·0	In a depression	Similar to No. 2
6	B	16·98	29·37	1·0	Very low, greyish	In suitable seasons a very large population is present; extensive damage
7	B	22·07	29·80	2·8	Depression in higher land	Similar to Nos. 2 and 5
8	B	19·69	29·48	2·0	High land, light	*Variabilis* larvæ not present
9	B	15·55	25·11	2·4	High land, darker than No. 8	*Variabilis* larvæ not present
10	C	15·21	20·00	0·9	Low, light coloured	In suitable seasons a very large population is present; extensive damage
11	C	15·10	20·90	1·9	From same field as No. 10; higher part	Very few *variabilis* larvæ present; no damage
12	C	18·55	19·33	1·3	Low	In suitable seasons a very large population is present; extensive damage
13	C	9·33	17·19	1·4	Sandy ridge in same field as No. 12	No *variabilis* larvæ found on this ridge
14	D	27·86	32·04	4·6	Good river bank soil, well drained	No *variabilis* larvæ found in this country
15	D	28·15	36·00	5·2	Similar to No. 14, but nearer old lagoon	Similar to No. 14
16	D	35·23	47·1	4·4	On slope to old lagoon, much darker than No. 15	In some seasons the population is large enough to cause scattered damage
17	D	38·90	49·3	3 2	At bottom of old lagoon, very dark, badly drained	In most seasons population is very large and strikes are complete failures

On one occasion when making inspections in a field where several trash-bound stools of cane were growing, it was seen that all the soft

eyes amongst the damp trash to a height of 6 inches above ground level had been damaged by wireworms. In three instances a *Lacon variabilis* larva was found in an eye.

No larvæ have been found to enter the clay subsoil although this point has been investigated in suitable localities on a number of occasions. In the laboratory a series of drain pipes were filled with soil and clay in a manner such as to simulate natural field conditions as nearly as possible. Six half to full-grown *variabilis* larvæ were placed in each pipe and a glass tube was let down to a different depth in each of the pipes. The soil and clay were allowed to dry out slowly, except near the ends of the glass tubes down which small volumes of water were poured periodically. Invariably the larvæ, if mobile, were found in the small amounts of damp soil near the ends of the glass tubes which did not enter clay. In the pipes where only the top portion of the clay and the soil immediately above it were slightly damp the larvæ were found in the damp soil only. Where the top portion of the clay and all the soil had very nearly dried out the mobile larvæ were found scattered in the soil.

Food and Feeding Habits of Larvæ of L. variabilis.

The larvæ ingest soil, eat into the soft and distended eyes of setts and the sides of the underground portions of cane shoots, and burrow into the ends of the setts themselves. When soil has been the chief food the straight alimentary canal shows through the integument as a dark line. The eyes of setts are not attacked until they become swollen and soft. The softer rind of top plants, the root bands, root eyes, and rootlets* sometimes show the results of *L. variabilis* feeding. Sliced potato tuber and sprouting seeds of corn and wheat have been successfully used as food for larvæ during rearing work in the laboratory. Attempts to persuade larvæ to attack whole potato† tubers always failed; when this material is used as food the larvæ will burrow into the cut surface only.

As is usual with many wireworm species when a number of *L. variabilis* larvæ are confined together in a small amount of soil cannibalistic tendencies are shown. Even second instars have been observed feeding on the internals of their fellows of somewhat similar size. The older larvæ, when in captivity, will also attack small larvæ of the *Scarabæidæ* and of the *Asilidæ*.

The larvæ are voracious but, normally, feeding‡ is not a continuous process throughout larval life. Under conditions such as the presence

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* Wireworm feeding on rootlets and roots has no appreciable effect on cane under any climatic conditions in Central Queensland.

† Wireworm damage to cane has evidently made such an impression in the Mackay district that these pests are thought by many persons to damage locally grown potatoes, beans, and many other plants. In every case investigated the Potato Moth (*Phthorimæa operculella* Zel.) was responsible for all damage to potatoes, and the Bean Fly (*Agromyzia phaseoli* Coq.) was the cause of damage to beans. The damage to potatoes was usually observed during storage.

‡ More detailed accounts of larval feeding, larval instars and their stadia, and the relationship between larval growth and the moisture and temperature of larval habitat are given in a previous publication (McDougall, 1934).

of vegetable material and suitable soil moisture, it is limited to short periods immediately following each larval moult.

Response of Larvæ to Extremes in Environmental Conditions.

Any of the larval instars can withstand excessively wet soil environments for considerable periods. In the laboratory larvæ have been kept for five months in soil with moisture content well above its sticky point. Larvæ have been found in cultivated fields on which water has been lying for as long as four weeks; such larvæ are always in a healthy condition.

During rearing work it was found that the early larval instars require excessive soil moisture for their existence at summer temperature for Mackay. The smaller instars died if the moisture of the soil was allowed to fall to a point lower than about three-quarters of its sticky point. Half to full-grown larvæ, however, have been kept alive for six months in soil (sticky point 29·8) which dropped during that period from a moisture content of 15·7 per cent. to 5·1 per cent. (calculated on oven-dry weight of soil). Absence of vegetable food has very little serious effect on any of the larval instars other than retarding the normal rate of development. Larvæ have been reared through as many as four instars in pots of fresh soil, moist or wet as required, without addition of other food at any time. A parallel series of larvæ was reared in similar pots, and to these latter small pieces of potato were added at different times. Provided no larva had moulted since confinement and had not progressed as far as the immobile pre-ecdysal state, the tuber was always eaten into within a day of its being supplied.

Life History.*

The species *Lacon variabilis* has one main generation a year; the adults appear from late October to early February, but in greatest numbers in November and early December. Within a fortnight after their emergence from the soil, adults may no longer be found under the various covers as they have by then disappeared into crevices of the soil; the depth to which they penetrate very seldom exceeds 3 inches. At about three to four weeks after the emergence of the females the first batches of eggs are deposited. In the laboratory female adults have been kept alive in pots of damp soil for as long as six months and in glass tubes without soil or food for three weeks but field observations indicate that the life of a female adult under natural conditions seldom exceeds seven weeks. It has been found to be more difficult to keep males alive in captivity for more than four weeks. When adults of both sexes which have been reared from pupæ were confined in pots of damp soil, the males die at or just after the time when the first batches of eggs were laid. The egg stage usually occupies eight days, occasionally seven or nine, and rarely ten. There are eight larval instars and, under suitable conditions, the mean duration in days for each of the stadia was, from first to eighth, 9·5, 14·9, 18·9, 20·2, 28·2, 32·8, 38·2, and 152·0,

* More detailed accounts of larval feeding, larval instars and their stadia, and the relationship between larval growth and the moisture and temperature of larval habitat are given in a previous publication (McDougall, 1934).

respectively. Each stadium is found to be varied by the absence or presence of vegetable food and by soil moisture fluctuations due to the changes in weather conditions. The pupal stage occupies from thirteen to sixteen days, usually fourteen days.

Although of very little economic importance there is a small percentage of the *L. variabilis* population which exhibits a two-generation a year life cycle. From eggs deposited during the period November to January there arise a few larvæ which pupate during the following March or April. Females from the April-March pupation have been kept alive in the laboratory until the following February, but attempts to induce some of them to oviposit at such a late stage of their unnatural existence failed. Intensive search for adults has been made in suitable localities in fields during late June to September, but since none has been found, these autumn adults evidently live no longer, under natural conditions than do those which emerge during early and mid-summer. Some autumn adults occasionally oviposit under field conditions and a few of their progeny become imagines in the following summer. When the stadia of the larvæ which become adults in autumn are compared with those of larvæ which take around three hundred days to complete their larval life a shortening of some is evident. The seventh and eighth are greatly reduced whilst many of the others also experience some reduction. The earlier stadia of larvæ from autumn adults are considerably lengthened at the expense of a shortening of the later ones.

Some of the larvæ of both of the short-timed generations pupate after passing through only six larval stadia. However, the majority that ultimately give rise to adults have the normal number of larval instars.

Control.

Much has been written about the control of wireworms* in many parts of the world, but as remarked by Graf (1914) "probably no other insects have had more remedies tried for their control and with less success." As *L. variabilis* has been a pest to cane in Central Queensland mill areas for many years, it is but to be expected that a number of the remedies referred to above have been tried out by farmers with varying results. Also several field observations have become the bases of hypotheses offered as help in arriving at a successful solution of the problem under discussion. During the present investigation it was considered necessary to undertake some work along the lines suggested by previous recommendations as well as following what is now generally accepted as a standard method of attacking the problem of controlling a wireworm pest of a crop such as sugar-cane. In some instances these two parts of the project overlapped. Methods of control are discussed under the three headings of Biological, Chemical, and Mechanical. The methods which are advocated for the control of this pest under general farm conditions are set out on page 725.

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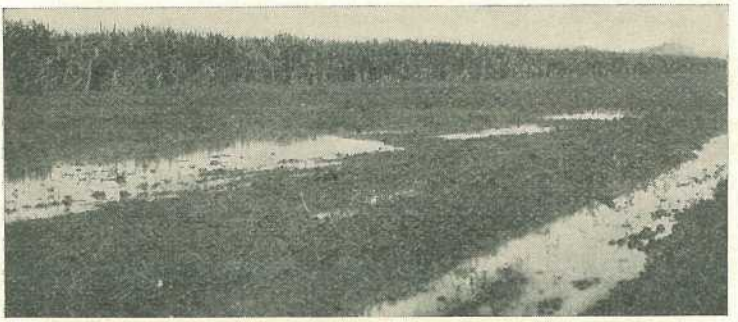
* C. A. Thomas (1930) has reviewed the literature on the control of wireworms up till July, 1930; an excellent bibliography of the more important publications is appended to this review.



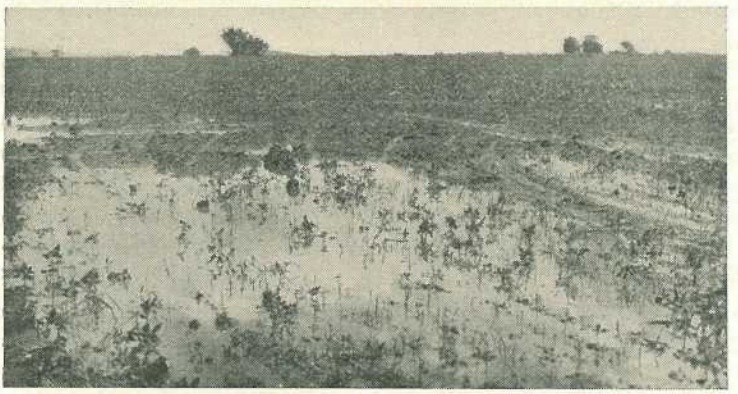


PLATE 301.

Views of "wireworm" fields, three to four days after heavy rain during a wet season. (Photos. by F. E. M. Clarkson.)

Biological Methods.

No parasites or predators of the larval, pupal, and adult stages of *L. variabilis* which could be considered to be of any economic importance have been found. Up to the present the egg is the only stage which has not been intensively studied in the field. The entomologists of the Experiment Station of the Hawaiian Sugar Planters' Association have also searched unsuccessfully for natural enemies of wireworms in some Queensland canefields. The fungi which are sometimes found on pupæ, adults and larvæ in the rearing pots or on pupæ in the field, are considered to be merely saprophytic. Mites, even when present in moderately large numbers, have no apparent effect on larvæ kept in captivity or on adults in the field. It is interesting to record, however, that dissections made during November to January of the somewhat toad-like frog *Phractops* (*Chiroletes*) *australis* Gray; showed *L. variabilis* adults along with several other insects, amongst the contents of the alimentary canal.

Chemical Methods.

All of the chemical methods tried have been directed against the larval stage of *L. variabilis*. It was early found that positive evidence derived from the use of poisons against wireworms in tins of soil in the laboratory was of little value when the experiments were repeated in the field. The experimental results here given concerning chemical methods are, unless otherwise specifically mentioned, from small field plots put out with the necessary checks in suitable localities only during early planting (March-April) or its immediate replanting. Plots put out during late plantings (July-August) were often very unsatisfactory. After taking into consideration larval feeding habits and larval stadia this could be expected (see "Times of Planting," p. 718).

The criterion which was taken as showing the success or otherwise of any poison was the amount of damage to eyes of setts and shoots. Four methods of applying the different poisons (cyanides excepted) were used:—

1. Dipping or dusting setts.
2. Placing poisons in drills with the setts.
3. Incorporating the poison with the soil surrounding the setts at the time of planting.
4. Introducing the poison into the soil close to the setts at a time when it was considered that the eyes were approaching a condition suitable for wireworm attack.

Table IV. gives results of most of the poison experiments; each has been duplicated in two different fields.

TABLE IV.

RESULTS OF SMALL FIELD TRIALS WITH CHEMICALS AGAINST *L. variabilis* LARVÆ.

Chemical.	Dosage.	Method of application.	RESULTS. (Number of eyes and shoots destroyed by the larva.)	
			Check Plots.	Treated Plots.
Lead Arsenate	10% solution ..	No. 1	14 out of 15 ..	13 out of 17
Mixture of chopped grass, sodium arsenite (1 lb.) and molasses (8 lb. in 10 gallons of water	50 lb. of arsenite per acre	No. 2	19 out of 30 ..	22 out of 30
Paris green	200 lb. per acre ..	No. 1	23 out of 30 ..	20 out of 29
	200 lb. per acre ..	No. 3	25 out of 30 ..	28 out of 35
Sulphur	540 lb. per acre ..	No. 3	31 out of 31 ..	27 out of 28
R.V. 4 Soil Cleanser (33% free sulphur, 30% polysulphides and hyposulphite	680 lb. per acre ..	No. 3	31 out of 31 ..	28 out of 33
Slaked lime	510 lb. per acre ..	No. 1	19 out of 30 ..	23 out of 29
	1,000 lb. per acre ..	No. 2	19 out of 30 ..	17 out of 27
	2,000 lb. per acre ..	No. 3	19 out of 30 ..	15 out of 31
Naphthalene and slaked lime..	400 lb. per acre of each ingredient	No. 2	19 out of 30 ..	17 out of 30
Naphthalene	800 lb. per acre (400 lb. each application)	Nos. 3 and 4 combined	14 out of 15 ..	15 out of 20
	600 lb. per acre* (300 lb. each application)	Nos. 3 and 4 combined	5 out of 20 ..	2 out of 23
Naphthalene (1 oz.) Carbon bisulphide (3 fluid oz.) and soap [after Krauss (1931)]	2 pints of 10 % solution per nine feet of drill†	No. 4	31 out of 31 ..	3 out of 3‡
Carbon bisulphide	350 lb. per acre ..	No. 4	19 out of 35 ..	16 out of 24‡
Paradichlorbenzene and CS_2 ..	300 lb. per acre ..	No. 4	19 out of 35 ..	14 out of 23‡
Paradichlorbenzene	680 lb. per acre ..	No. 2	23 out of 30 ..	24 out of 33
	680 lb. per acre ..	No. 3	23 out of 30 ..	19 out of 30
Paradichlorbenzene and slaked lime	680 lb. P.D.B. and 510 lb. lime per acre	No. 3	14 out of 15 ..	12 out of 15
Orthodichlorbenzene	600 lb. per acre ..	No. 4	25 out of 30 ..	9 out of 11‡
Mustard oil and water. (50 ml. of oil made up to 500 ml.)	One litre per chain of drill at each application†	Nos. 2 and 4 combined	31 out of 31 ..	2 out of 2‡
25% Kerosene emulsion ..	1 litre per half chain of drill	No. 4	25 out of 30 ..	3 out of 4‡

* A late plant plot.

† 147 running chains of drill per acre.

‡ Only eyes not damaged by chemicals were counted.

Kerosene, orthodichlorbenzene, and mustard oil were found to kill sett eyes on contact and, when using carbon bisulphide, it was found necessary to be careful so as not to damage the eyes.

To the above list of poisons which were found to be ineffective in controlling *L. variabilis* when applied by the different methods as indicated, borax and sodium fluosilicate may be added. A chlorpicrin plot was put out during a late plant; both the results of the plot and

methods of handling this fumigant were unsatisfactory. Mention of a laboratory experiment with Paris Green may be of interest. The cut surfaces of twelve pieces of potato tuber were thoroughly coated with Paris Green, but on six of the pieces so treated small areas of the poisoned surface were well cleaned. Each of the twelve pieces of tuber was then placed in a pot containing damp soil and three-quarters grown *L. variabilis* larvæ which had just moulted. It was found that the thoroughly-protected food supply had not been touched, whereas of the other six pieces of potato three had been tunnelled by larvæ entering through the small, clean areas on the poisoned surfaces. It would seem that a similar happening takes place when cane setts, planted in a wireworm-infested locality, are dusted with Paris Green. As soon as an eye swells and shoots a vulnerable portion of the plant is out of range of the poison protection applied during planting.

Various cyanides have been recommended as controls for wireworms attacking a number of crops including sugar-cane. In many instances, mention is made also of the possible harmful effect of these materials on plant life. Using cyanogas (calcium cyanide) no practical method has been found of successfully applying this material to the control of *L. variabilis* in the Mackay district without seriously injuring the eyes of setts. Even assuming the finding of an efficient attractant it is considered that pre-baiting is economically impossible.

Small doses of cyanogas when placed in the drills with the plants killed all the eyes. If placed at a minimum distance from the plants so as not to damage the eyes, the material was of no use in combating wireworm attack.

Portions of a *L. viriabilis* infested field were drilled out (drills 2 feet apart) and a dose of 200 lb. per acre of cyanogas was buried. Four weeks later, cane planted in these areas was attacked to the same extent as in the untreated parts of the field.

Mechanical Methods.

Hand Collecting of Larvæ.—It has been found that the laborious work of collecting larvæ from furrows behind ploughs is of very little help in decreasing the *L. variabilis* population in any field. Very few larvæ of this species will be seen during ploughing, and on a number of occasions two hours' following of the plough in certain portions of fields has resulted in the collection of not more than fifteen larvæ. When these same portions of fields have been planted, however, as much as 50 per cent. of each of the strikes has been affected by wireworms.

The same point is concerned when it is desirable to know before planting (particularly an early planting) if wireworms are likely to be troublesome. It was found that the apparent absence of larvæ during ploughing operations was not a reliable guide and that the planting and subsequent inspections of trial setts, usually in lots of five in the lowest parts of the fields, was the only satisfactory method of obtaining the desired information.

The Utilisation of Cane Varieties.—A few farmers consider that some varieties of cane are able to "resist" wireworm attacks to a greater extent than others. During the establishment of plots against wireworms many different varieties of cane were used and all were, under simlar

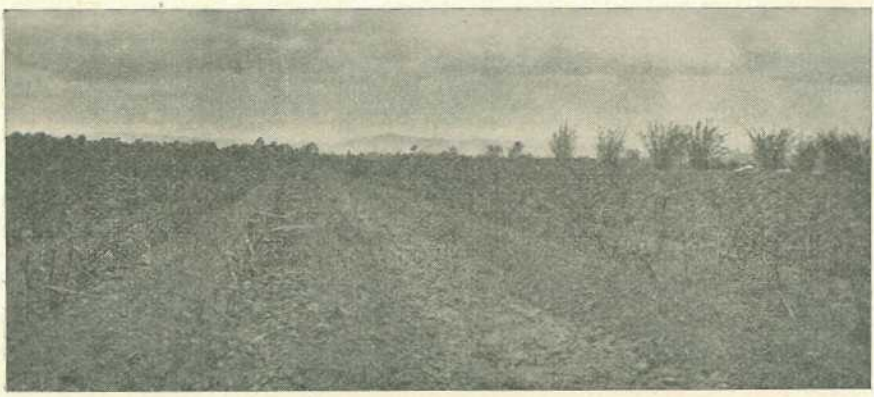


Fig. 1.

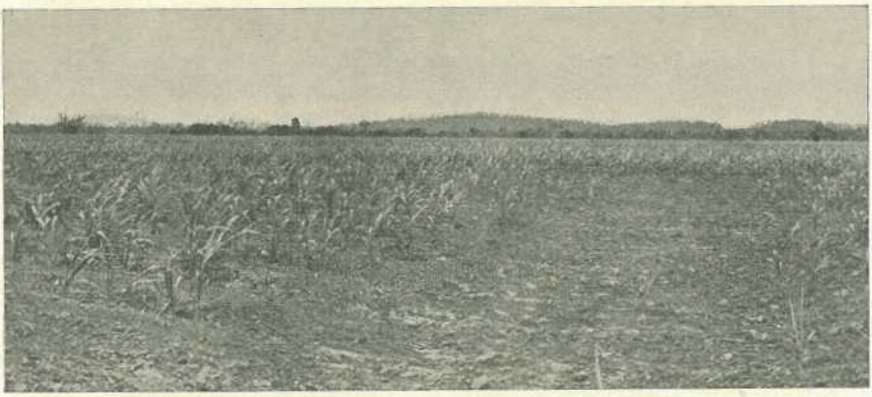


Fig. 2.

Fig. 3.

Good strikes obtained in reputedly bad "wireworm" fields after adequate draining at the proper time—i.e., during the summer previous to planting. Fig. 2 shows a "blind end" drain for taking water from an extensive depression in a field. (Photos. by J. Macmillan.)

Plate 302.

conditions, equally damaged by these pests. When slow-striking varieties were planted out against quick-striking canes in a variety trial, many eyes of the latter class were destroyed before those of the former had been touched. Ultimately, however, the strikes of all the varieties were quite similarly attacked by the wireworms.

In Hawaii cane varieties have been put to good use in helping to solve a wireworm problem. Quoting from a communication (1-2-31) from C. E. Pemberton, Entomologist to the Experiment Station of the Hawaiian Sugar Planters' Association, "At present our wireworm problem has become less important because of the utilisation of cane varieties, such as Uba, which need be planted only once every ten or twelve years. As the plant crop is the only one that suffers, our Elaterid damage to a field is really very slight." Unfortunately, the habitat of the pest, its uneven distribution in many fields, the lack of varieties suitable for the purpose, and climatic and soil conditions make this excellent method of combating wireworms impossible in the case of *Lacon variabilis* in Central Queensland.

Rapid Early Growth and Use of Manures.—The getting away of plants as quickly as possible is often given as a subsidiary recommendation for the reduction of wireworm damage to sugar-cane, it being reasoned that when growth is slow the period of exposure to injury is prolonged. In the Mackay district, farmers point out that in seasons when there is relatively quick striking in "wireworm" country there is very little damage by the pests (*L. variabilis*). Probably, if immediate and apparent planting conditions are similar, the fundamental reason for the quicker striking in some years than in others is that following light or moderate wet seasons the soil has not been waterlogged for as lengthy periods (if at all) as when the wet seasons are heavy. As will be demonstrated later ("Times of Planting and Seasonal Incidence," p. 718) there is a very good correlation between the density of the wireworm population in any year and the intensity of the preceding mid-summer rains. Quick striking of cane and the amount of wireworm damage are both dependent, to some extent, on the wet season, but it has not been found that quick striking is of much help at all in fields where feeding larvæ of *L. variabilis* are actually present in appreciable numbers. It must be remembered that the eyes of setts are not attacked until they are soft and swollen; soaked setts with swollen eyes or small shoots were planted during an early planting in a portion of a field where wireworms were known to be present and the planting moisture was good, but within three days after planting all eyes and shoots had been destroyed.

The use of manures in wireworm control is usually attributed to the stimulating effects on plant growth rather than to any direct contact insecticidal value. In the case of lime it is thought that its real value is due to its effect upon the physical condition of the soil. During 1931 a large lime and fertilizer trial against wireworms was established in the form of a 4 x 4 Latin square. On harvesting it was found that the yields from plots which had received an application of fertilizer in the drills and of lime in the drills were significantly better than the check plots. Results are not significant, however, in so far as the counts of "dead-hearts" and misses caused by wireworms concerned.*

* Yields and percentage shoots and eyes damaged by wireworms:—

C 11·25 46·0%	D 11·79 53·4%	A 9·37 48·6%	B 9·78 42·9%
B 12·56 65·0%	A 11·70 41·6%	D 11·82 70·7%	C 9·95 34·5%
D 12·94 52·4%	C 11·95 53·9%	B 12·79 43·3%	A 11·17 51·2%
A 6·76 59·8%	B 9·40 47·9%	C 8·21 50·0%	D 7·79 42·5%

Variety.—Q. 813.

pH of soil 3·97

Treatments—

A—1½ tons burnt lime per acre, broadcast

B—1½ tons burnt lime per acre, broadcast +(200 lb. super. per ac.), (200 lb. potash per ac.) in drills.

C—No treatment.

D—1 ton burnt lime per acre, broadcast +5 cwt. of lime per acre in drills.

YIELDS.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.	½ loge (Mean Square).
Rows	3	30·51	10·17	..
Columns	3	7·19	2·36	..
Treatments	3	2·67	0·89	1·0930
Errors	6	1·28	0·21	0·3709
Total	15	41·65	..	..

Standard Error=$\sqrt{0·84}$=0·92 or 2·15 per cent.

SUMMARY OF YIELDS.

——	A.	B.	C.	D.
Cane, tons per acre	8·20	8·91	8·27	8·87
Cane, percentage mean yield	95·8	104·0	96·6	103·6

Yields from Treatments B. and D. significantly better than check plots.

PERCENTAGE SHOOTS AND EYES DAMAGED BY WIREWORMS.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.
Rows	3	54·83	18·28
Columns	3	384·75	128·25
Treatments	3	150·80	50·27
Errors	6	677·00	112·83
Total	15	1267·38	..

Standard Error.=$\sqrt{451·3}$=21·2 or 10·5 per cent.

No significant reduction in wireworm infestation resulted from any of the treatments.

Further trials with planting mixtures and complete fertilizers did not indicate that manures would be of any use whatsoever in helping to reduce damage by *Lacon variabilis*.

Some farmers have found by sad experience that it is a waste to place manure in the drills with plants in unimproved wireworm country. Nevertheless, the idea persists in some localities that superphosphates placed in the drills at the time of planting is a control for wireworms, and still other farmers consider that the use of burnt lime alone is helpful in decreasing the damage by this pest. Particular attention has been paid to the use of these materials against *Lacon variabilis*.

Lime (see also Chemical Methods, p. 710).—In addition to several smaller plots, two large plots (4 x 4 Latin squares) were set out incorporating different lime treatments in badly-drained depressions in two fields. The treatments were:—

A.—1 ton of slaked lime per acre, broadcast.

B.—2 tons of slaked lime per acre, broadcast.

C.—No treatment.

D.—1 ton of slaked lime, broadcast, with 3 cwt. of lime per acre in the drills.

Lime was applied broadcast immediately before final ploughing. Neither of the plots could be harvested; in one the strike was a complete failure; while in the second, which had to be very heavily supplied, relevant counts did not give significant results.

A pH survey of wireworm-infested fields showed that *L. variabilis* larvæ inhabited soil ranging in pH (in N/1 KC1) from 3·90 to 5·80, and that parts of any field inhabited by the pests were usually more acid than the remainder of the field. Soil samples for the purpose of this survey were taken from thirty-seven fields in different localities in both the Mackay and Proserpine districts. In the laboratary a series of nine jars containing soils, which at the beginning of the experiment covered a pH (in water suspension) range from 3·5 to 7·0, was adjusted by the addition of calculated amounts of N/5 sulphuric acid and water or burnt lime and water to a soil of pH 5·34. In each of these jars *Lacon variabilis* larvæ not smaller than the fourth instar were placed. It was found that in soil over the pH range under consideration, these larvæ could be quite easily reared to adults. It consequently does not seem that the addition of lime to a wireworm field would affect the wireworms inhabiting it by virtue of changing the pH of their environment. Larvæ have also been kept for considerable periods of time in jars containing half slaked lime and half soil; their behaviour was normal.

Superphosphate.—During the eight to nine months following March, 1932, larvæ were kept in soil and superphosphate; the largest amount of the fertilizer in any of the jars was equivalent to an application at the rate of 150 tons per acre. Ninety-two per cent. of the larvæ, the smallest of which were fourth instars when the experiment was initiated, passed through the larval moults in normal fashion, voraciously attacked

potato tuber when it was supplied to them, and finally emerged as adults. Six out of ten larvæ in the jars containing the very heavy dressing came through to adults. There is no doubt that superphosphate as a direct insecticide, or as a factor in changing environmental conditions, has no deleterious effect on *L. variabilis* larvæ.

In addition to the several trials with fertilizers containing superphosphate, four small plots with superphosphate only were put out. The following is an example of the layout of these small plots and the count (Table V.) as usual, indicates the futility of using this material against *L. variabilis* during a season when the pest is active in any field:—

Check (1) .. .. Super (2)

Check (3) .. .. Super (4)

Super (5) .. .. Check (6)

Check (7) .. .. Super (8)

Date of planting: 3–4–32.

Variety: Q. 813.

Treatment: Superphosphate placed in the drills at the time of planting at the rate of 882 lb. per acre.

Size of plot: One chain by 4 drills.

Four replications.

TABLE V.

Count of a Superphosphate Trial against *L. variabilis*.

Date of Inspection—1–5–32.

No. of Small Plot.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Total number of swollen eyes on plants	79	70	70	74	72	76	72	72
No. of apparently good shoots	14	8	5	4	11	6	10	2
No. of shoots damaged by wireworms	17	14	19	30	16	18	14	27
No. of eyes damaged by wireworms	40	44	44	40	38	49	45	38
No. of shoots and eyes damaged by *P. australis*	6	4	2	..	7	3	3	5
*No. of shoots and eyes being attacked by wireworms at the time of inspection	11 (7)	8 (6)	6 (3)	..	2 (2)	1 (1)	1	1 (1)
Percentage of possible shoots and eyes damaged or being damaged by wireworms	90·14	96·96	97·06	94·59	86·15	93·15	85·51	98·51

*This includes apparently good shoots (in brackets) if, at the time of inspection there were no indications above ground level of "dead-hearts."

The Growing of Green Manure Crops and Clean Fallowing.—Many acres of cane land in the Mackay district are planted to green manure crops each year. On well-drained country it is not asserted that these cover crops, which are normally grown between October and March, have anything to do with wireworm infestations, but where the low lands are concerned—i.e., where wireworm damage occurs—many farmers are

of the opinion that the growing of these legumes encourages wireworms. When a green manure crop is successfully grown and ploughed in in a wireworm-infested field, it is thought that the increase in humus may be responsible for the pests attacking the setts. When the green crop is a failure, through water-logging or other reason, it is often considered that this failure may be the partial cause of the wireworms attacking the plants.

As indicated in Table III., wireworm damage occurs in fields covering a range of percentages of organic material in the soil, which is fairly wide for the Mackay district. Again the ploughing-in of an exceptionally heavy bean crop does not to any great extent effect the position of the percentage organic material in the soil in a range of ·9 to 5·4. From field observations, and the results of field surveys and laboratory experiments, there seems to be no relationship between the percentage organic material in the soil and the incidence of wireworm damage.

It might be thought that the growing of cover corps during November-February—i.e., the period of the adult existence of the pest—may provide excellent and attractive cover for the click-beetles. There is no evidence to show that adults of *L. variabilis* have a preference for green manures as cover; in fact, it has been found that they are not selective in this regard. An attempt to keep a portion of a low, badly-drained wireworm field as nearly a clean fallow as practically possible over a November-February period, did not result in the absence of wireworms in the portion of the field during the following twelve months.

Eradication of Couch Grass.—Of all the true grasses in the Mackay and Proserpine canefields, one of the most persistent and one of the most difficult to eradicate is Couch grass (*Cynodon dactylon*), which is very often to be seen in low hollows or depressions, and sometimes elsewhere in otherwise clean fields. It has been suggested that this grass attracts wireworms, and that its removal from fields would be of some use in freeing the soil of the pests. Probably the true explanation of the observations on which this suggestion is based is that Couch grass is quite likely to be present in the habitat desired by *L. variabilis* larvæ, and also that Carab larvæ have been mistaken for wireworms. Considerable numbers of larvæ of *Gnathaphanus pulcher* (see page 699) are to be found amongst the roots of Couch grass. During the past three years over 200 specimens of this larva have been received by us as wireworms found under Couch grass.

Times of Planting and Seasonal Incidence.—It is well known that while early plantings (March-April) may be severely damaged by wireworms, replants in July-August (the time of late planting) in the same fields may sometimes be affected but little if at all. In this connection, the following points in the life history and habits of the pest are of interest:—

1. The adults are present in the fields in greatest numbers during late November and early December; over the period mid-December to February, the adult population decreases very rapidly.

2. Taking early December as the time when the adult emergence is greatest, and adding four weeks for the preoviposition period, two weeks for the oviposition period, eight days for the egg stage, and 163 days for the first seven larval stadia, the time around which very many of the larvæ pass into the eighth larval instar, may be computed to be early July.

3. As, under normal field conditions, the larvæ feed only immediately after moulting, many of those which passed into the eighth instar during late June and early July will have finished feeding by the middle of July.

4. From a consideration of the normal feeding times of a larva, and the fact that the larval stadia progressively increase, it follows that the percentage of smaller to moderate sized instars in the population at any time will bear a direct relationship to the percentage of the larval population feeding at that time.

Briefly summarising these points and their consequences, it is found that during early planting, when many of the larvæ are small or of moderate size, the feeding of the population as a whole is practically continuous. By the middle of July many of the larvæ have finished feeding, while the majority of those present which are still feeding do so individually at less frequent intervals. From the middle of July onwards, the percentage of the larval population which has finished feeding rapidly increases, and chances of obtaining strikes free from wireworm damage improve accordingly.

In July, 1933, many early plantings were affected by wireworms, and if the usual July-August plantings had been possible, there is no doubt that it would have given these pests an opportunity to add to the total of their damage to cane for that year. Winter and spring rains, however, prohibited late planting in wireworm country before September, with the result that strikes free from wireworm attacks were obtained.

Damage to cane by *L. variabilis* is more extensive and more intensive during some years than during others. It is known (McDougall, 1934) that the weakest point (and it is comparatively very weak) in the life cycle of this pest is during the period of the earlier larval instars which must have excessively wet conditions for their survival, especially at Mackay summer temperatures. In Table VI. is set out the rainfall for the past eleven years during the months when the vast majority of the larvæ are present in the fields as earlier instars. When these rainfalls are correlated with the remarks on wireworm damage to strikes during the different years, it will be seen that, as would be expected, the amount of rain during any mid-summer has a very decided bearing on the amount of wireworm damage during the succeeding year. As the rainfall is concerned with wireworm existenec inasmuch as it helps, with topographical conditions, to provide suitable environments for the smaller larval instars, its distribution as well as its total amount should be noted. Usually, if the total amount is fairly large, the distribution is such that it helps to keep certain localities excessively wet during a considerable portion of a December-February period. Planting year 1924 (Table VI.) provides a possible exception; here the 14·29 inches in the last part of February would have had more effect on the amount of wireworm damage for that year had it fallen, say, during the middle of January.

TABLE VI.

RAINFALLS IN INCHES, DURING SUMMER MONTHS PRIOR TO PLANTING, AND WIREWORM DAMAGE IN THE MACKAY DISTRICT FOR THE YEARS 1924-34; INFORMATION CONCERNING WIREWORM INCIDENCE IS COMPILED FROM VARIOUS PUBLISHED REPORTS, PERSONAL OBSERVATIONS, AND INFORMATION COLLECTED FROM RELIABLE SOURCES. THE RAINFALL RECORDS ARE THOSE OF THE MACKAY SUGAR EXPERIMENT STATION.

Planting Year.	November.				December.				January.			
	1–7	8–14	15–21	22	1–7	8–14	15–21	22	1–7	8–14	15–21	22
1924 ..	·14	·09	..	..	·15	·76	·07	2·18	·01	..	..	1·81
1925 ..	3·52	·57	1·80	·02	·42	·89	4·59	·27	..	·50	3·78	1·57
1926 ..	..	·31	·17	·05	..	10·90	·03	1·84	1·43	1·32	·87	..
1927 ..	..	..	·44	·69	..	·44	3·96	2·64	·20	1·94	1·63	4·55
1928 ..	·25	1·17	..	1·73	..	13·29	9·72	13·60	..	·24	1·68	1·56
1929 ..	1·47	·27	·05	5·10	·29	5·89	1·91	·56	2·35	7·74	1·73	4·51
1930 ..	..	..	..	·90	·36	..	..	2·37	3·79	·78	5·33	19·04
1931 ..	·01	..	..	1·21	·83	·10	1·68	·10	..	·23	·56	3·33
1932 ..	·61	..	1·14	3·92	5·08	·16	..	·93	·45	..	23·70	1·36
1933 ..	·18	..	·02	1·82	·09	1·83	·74	5·37	..	..	·02	7·25
1934 ..	·42	9·46	1·93	·01	·16	4·91	·39	·26	·66	·40	·78	3·17

Planting Year.	February.				March.				Rainfall for period Dec.-Feb.	Wireworm Damage.
	1–7	8–14	15–21	22	1–7	8–14	15–21	22		
1924 ..	3·33	2·09	1·47	14·29	2·10	1·70	·09	..	26·16	A few strikes damaged
1925 ..	4·13	·23	..	2·83	1·99	1·71	9·71	1·27	19·21	Strikes damaged by wireworms scarce
1926 ..	·01	3·78	·04	·06	·46	3·70	·68	4·52	20·28	A few strikes only damaged by wireworms
1927 ..	1·69	4·38	·07	1·54	3·48	5·87	·95	·42	23·04	A few strike only damaged by wireworms
1928 ..	3·43	6·02	9·60	9·44	8·97	·09	·15	13·31	68·56	The worst "wireworm" year on record. Damage both intensive and extensive
1929 ..	1·47	·44	·41	10·45	·03	7·48	1·58	3·08	37·75	Damage plentiful
1930 ..	2·10	·36	..	1·92	2·56	·03	·43	1·37	36·05	Damage plentiful
1931 ..	5·13	·01	·01	·17	·04	·13	2·03	3·11	12·05	Very little damage
1932 ..	..	·24	·74	1·02	·36	·15	·05	·20	33·68	A fairly bad "wireworm" year
1933 ..	5·30	9·23	4·97	1·42	·65	..	..	·31	36·22	Many strikes damaged during early plantings (*see* also p. 719)
1934 ..	2·72	·03	3·62	2·91	2·59	·81	·75	1·15	20·01	A few strikes only damaged by wireworms

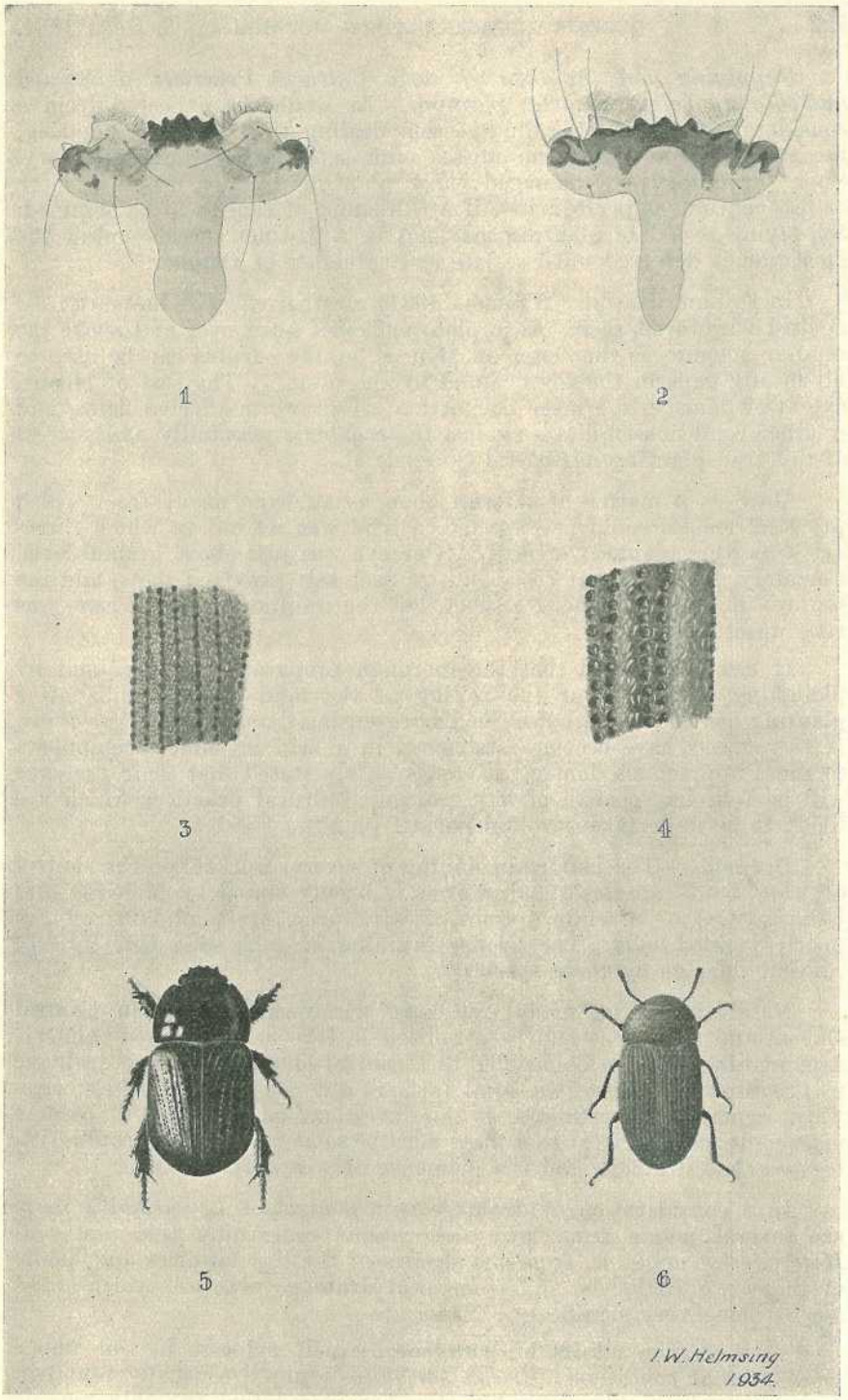


PLATE 303.

Fig. 1. Epistome and nasale of *H. carinatus* Blbn. x 24.
Fig. 2. Epistome and nasale of *L. variabilis* Cand. x 24.
Fig. 3. Portion of left elytron of *L. humilis* Er. x 15.
Fig. 4. Portion of left elytron of *L. variabilis* Cand. x 15.
Fig. 5. Adult of *Metanastes vulgivagus* Olliff x 2.
Fig. 6. Adult of *Dystalica mackayensis* Carter x 3.

Supplying and the Uses of some Cultural Practices performed immediately before or after planting.—As would be expected from a consideration of the preceding section dealing with times of planting, the supplying of wireworm misses with setts is very unsatisfactory. Such supplying to a damaged early planting usually means a more or less continuous performance if a full stand of cane is to be obtained. Supplying to a late planting may not be a distinct success unless the operation is deferred until as late as September or October.

In Fiji and Hawaii (Williams, 1931) a rather effective measure used against wireworms there "is to plant sufficient setts, over and above the regular amount, so that later on, if need be, the surplus can be used to fill in any gaps in the rows caused by the pests." The cost of labour, extent of damage in a large proportion of wireworm-affected fields, and weather conditions militate against the economic possibility and success of this transplanting in Central Queensland.

More as a matter of interest than as an experiment from which practical results could be expected, a trial was set out in which three-eye setts were planted vertically. One eye was just above ground-level. Certainly, the two lower root-bands of each sett provided roots, and the top eye, in many instances, a shoot, but the resultant stand of cane was very unsatisfactory.

It has been found that the thorough preparation of the land by ploughing operations or the rolling of the land and/or drills after planting has no effect whatsoever in preventing damage by *L. variabilis*. If these pests have become established in a field in sufficient numbers to cause appreciable damage, it can be safely stated that their presence will be felt, irrespective of any economic cultural practices which are likely to be undertaken around normal planting times.

Drainage.—The important finding of several workers on the control of "low land" species of wireworms is briefly stated by Metcalfe and Flint (1928):—"Certain species of wireworms are abundant only in poorly-drained soils The proper draining of such soils will entirely prevent damage by these species."

Naturally, as on many occasions, wireworm damage in Central Queensland mill areas had been noticed in low, badly-drained country, drainage had been recommended as a control of the pests, but drainage as practised by most of the local farmers did not seem to reduce wireworm damage. Nevertheless, as this investigation proceeded, it became more and more apparent that there must be some fundamental connection between bad drainage and the incidence of wireworm damage.

In a consideration of drainage as a control of *L. variabilis* there are several points from field observations concerning this pest and *Heteroderes carinatus*, from the studies of the life histories and habits of these two Elaterids, and from local drainage practice, which stand out as being very significant. These are—

1. The adults of both species will oviposit in soil under similar conditions. *Lacon variabilis* adults are usually found in very damp situations, but it is considered that the only reasons for this are—(*a*) the disinclination of the species to migrate; and (*b*) the secluded habits of the beetles making the finding of them in the fields, if they are not present in numbers, rather difficult.

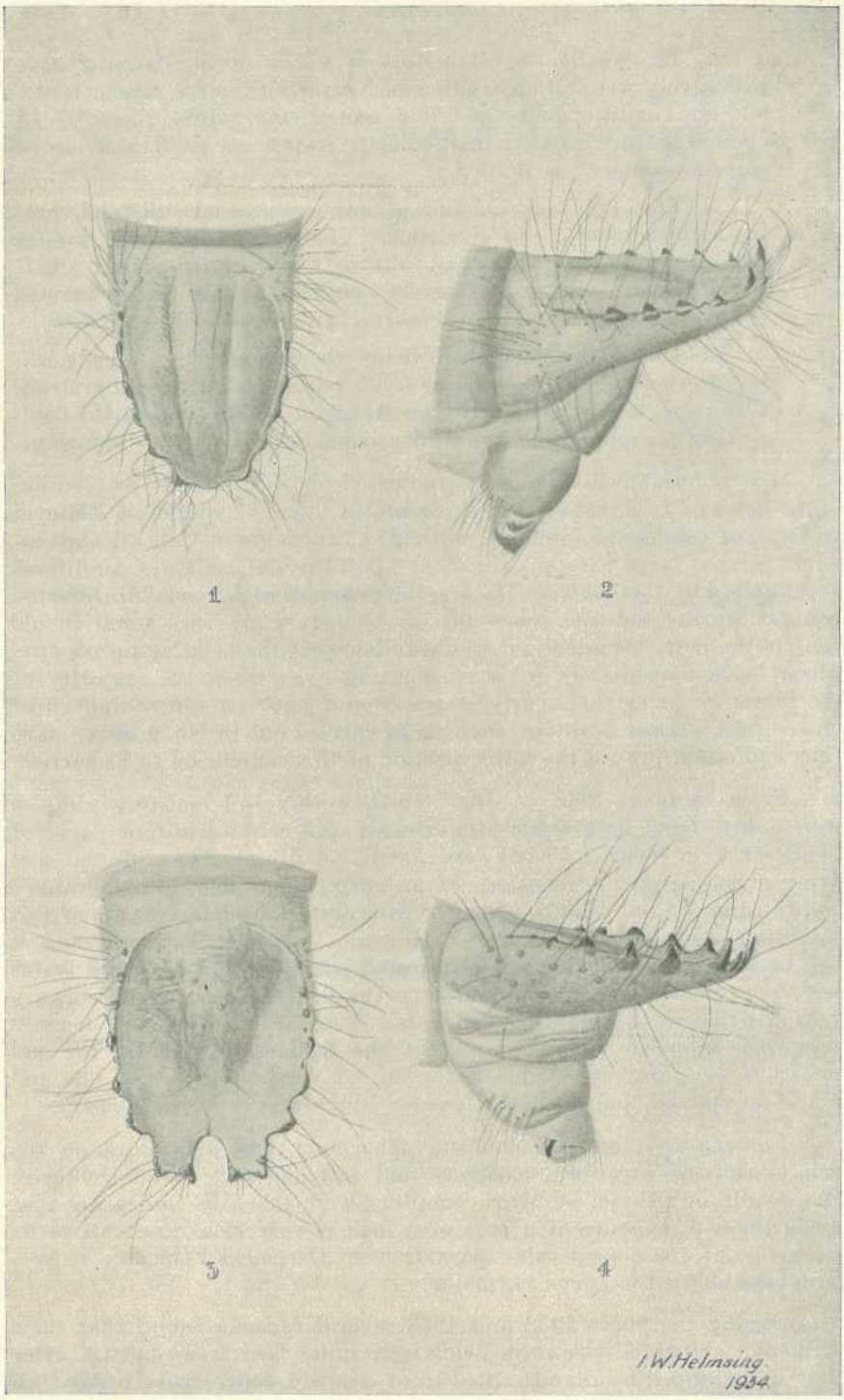


PLATE 304.

Fig. 1. Dorsal view of 9th abdominal segment *H. carinatus* Blbn. x 15.
Fig. 2. Lateral view of 9th abdominal segment *H. carinatus* Blbn. x 15.
Fig. 3. Dorsal view of 9th abdominal segment *L. variabilis* Cand. x 15.
Fig. 4. Lateral view of 9th abdominal segment *L. variabilis* Cand. x 15.

2. The smaller larval instars of *Lacon variabilis* must have excessively wet soil environments for their survival, whilst under similar conditions at the same room temperature those of *H. carinatus* cannot exist; in this latter instance a moderately moist soil environment is needed.

3. The older larval instars of both species can withstand varying environmental soil conditions. They flourish under similar conditions in the laboratory, but in the fields the larvæ of *L. variabilis* are almost exclusively confined to low, badly-drained country, and those of *H. carinatus* to the well-drained lands.

4. In fields or portions of fields where damage by *L. variabilis* occurs there are no natural or other permanent drainage systems. Drainage, if any, generally consists of the bedding-up of the fields during the ploughing operations immediately prior to planting.

If it is feasible to assume, as indicated above, that the distribution in the fields of *L. variabilis* and *H. carinatus* (the two species of Elaterid larvæ most commonly found in cultivated canefields in Central Queensland) is, to a large extent, dependent upon the soil moisture conditions encountered by their smaller instars, the drainage of *L. variabilis* infested country during the time when the larval instars are very small should control the pest. Similarly, it would follow that the bedding-up of wireworm fields immediately prior to planting—i.e., when the majority of the larvæ are over their early stages, would have no controlling effect on the pest. Local drainage methods as carried out in No. 4 above have time and again proved the latter portion of this conclusion to be correct.

From October, 1932, to June, 1933, weekly soil moisture samples were taken from both wireworm-infested and wireworm-free parts of fields on four farms in widely-separated localities. The different soil types encountered and the lack of an entirely suitable "single value" soil constant do not tend to make the interpretation of the results of this sampling either easy or accurate. However, for most field purposes, it can be said that on *L. variabilis* infested parts of fields, surface water will be present during considerable portions of the December-February period prior to the planting year (*see* Plate 301). The most heavily wireworm-infested portion of any of the fields concerned in the soil moisture sampling was under water for six weeks (periods of one and a-half weeks and four and a-half weeks) during December-February.

For the purpose of correlating laboratory and field work on the relationship of wireworm existence and soil moisture of environment, the results of the soil moisture sampling were taken as indicating that when the soil moisture of a part of a field is very close to or above its sticky point for considerable periods over December-February it is a suitable habitat for *Lacon variabilis*.

During the years 1932 and 1933 several farmers found that their strikes in erstwhile wireworm fields were quite free from damage after they had scooped headlands, filled in or drained depressions, bedded up the fields, and provided efficient outlet channels for the surface water during the mid-summer rains prior to plantings (Plate 302, figs. 1, 2, and 3).

RECOMMENDATIONS.

The following methods, given in order of preference, for combating the wireworm *Lacon variabilis* as a pest of sugar-cane in the Mackay and Proserpine mill areas, are recommended as worthy of being put into general farm practice. Several progressive farmers have used these methods and, up to the present, have found them to be quite satisfactory:—

1. Permanent drainage of low-lying fields.

2. If, for economic or other reasons, permanent drainage is not practicable, the fields should be thoroughly drained as early as the mid-summer rains or wet season immediately prior to planting, and *not* left on the flat until ploughing operations during the month before planting.

3. If proper drainage is not carried out, planting should be left until as late as possible. Perhaps two reasons why fields may not be adequately drained could be mentioned:—(*a*) It is well known that the incidence of wireworm infestations in many fields is seasonal, and it is considered by some to be worth while trusting to luck for good strikes on these low fields or parts of fields at normal planting times. Often the initial expense of improving say, a depression of 1 acre in a field of 5 acres is not considered to be worth the immediate benefits obtained from such work. The fact that such an improvement is nearly always a permanent improvement and asset to the farm is overlooked; (*b*) some fields are so low that during most wet seasons it is not possible to drain them efficiently other than by a community drainage scheme, or at a very high cost. Many of these very low fields consist of a rather sandy soil above impervious clay. The low sticky point of the soil adds to the difficulties of draining these fields to a degree of efficiency sufficient to prevent wireworm habitation. The few damaged strikes found during a poor "wireworm" year are on this type of country.

Those who entertain reason (*a*) should be prepared, if their normal plantings are failures, to replant in September-October, and hope that the following early and mid-summer rains are such as to allow of reasonable working of the young cane.

ACKNOWLEDGMENTS.

It is desired to acknowledge the courtesy of Mr. R. Veitch, Chief Entomologist, Department of Agriculture and Stock, in making available the services of Mr. T. W. Helmsing, to whom thanks are due for the plates which have been prepared in such an excellent manner.

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The Toxicity of Yellow-wood.

(*Terminalia Bursarina*).

By K. S. McINTOSH, B.V.Sc., Animal Health Station.

ON the 1st October, 1931, a report was received from the District Inspector of Stock, Emerald, stating that losses among sheep were occurring in the district. Yellow-wood came under suspicion.

Later in 1931, a specimen of Yellow-wood was forwarded to the Botanist, who identified it, and stated that he did not know of any feeding tests or chemical analyses conducted with it.

The Chemist reported that the presence of saponins, alkaloids, hydrocyanic acid, was not detected on chemical analysis of the plant.

In March, 1933, the Senior Instructor in Sheep and Wool reported "Rickets" or "Staggers" in sheep and suspected Yellow-wood as the cause.

On 28th May, 1933, Mr. D. F. Stewart, B.V.Sc., visited Codenwarra and planned an experiment to test the toxicity of Yellow-wood, Mr. McCosker, owner of the property, having generously offered the Department sheep, pens, and all facilities for conducting the test.

On 18th August the sheep were penned, twelve test sheep numbered 1 to 12 and eight controls numbered 1*a* to 8*a*. The sheep were Merino wethers, 4 years old, and brought to Codenwarra from Barcaldine. There is no Yellow-wood at the latter place. The sheep were in fair store condition when the experiment started. The yards used are concrete draining pens. They are well fenced and shade is provided by means of a piece of hessian.

Although this experiment is not yet complete, the following progress report is submitted as it is felt that the results so far are typical of natural grazing on Yellow-wood leaves.

The Experiment.

The test sheep are given just as much Yellow-wood as they would clean up, night and morning, commencing on 18th August, 1934. The amount given was not weighed as the leaves are not removed from the branches.

The Yellow-wood was collected on the property from trees carrying most abundant foliage. Leaves were fully matured old leaves, no young leaves were fed. Trees were not in flower.

The control sheep were first given 1 lb. of lucerne chaff each per day. Later this was increased to 1½ lb. and later still 2 lb. The chaff is of good quality and free from molds and foreign plants.

At first water was supplied in kerosene tins, but later the sheep were allowed to water at a creek near by.

On 5th September, 1934, No. 1 sheep was off feed, dopey, and sick. Conjunctiva was yellow and icteritic; this sheep died on 11th September, 1934. Post mortem revealed enteritis and impaction. Solid lumps of plant fibre were found in the intestines. Liver and kidney appeared smaller in size than normal.

Following this, half an ounce of Epsom salts was given to test sheep as they were slightly constipated, but not to controls as these were normal.

On 24th September, 1934, test sheep were given ½ lb. lucerne chaff per day each, which was later increased to 1 lb. As the sheep put on condition the amount of lucerne chaff was decreased.

On 25th September, 1934, No. 2 had first "fit." Two more followed in yard whilst sheep were being weighed. On 28th September, No. 4 sheep showed symptoms of dopiness, loss of appetite.

October 3rd, No. 2 still taking "fits."

October 3rd, No. 4 still "sick" and "dopey."

October 6th, No. 8 appeared sick.

October 8th, No. 4 sheep appeared to be dying. It was killed and a most-mortem examination was held. All organs appeared normal. A nasal bot (*Oestrus ovis*) was found in the upper part of the nasal cavity.

October 13th, No. 8 began to take "fits."

October 18th, No. 11 sick.

October 22nd, No. 11 began to take "fits."

Since 25th September, 13th October, and 22nd October, Nos. 2, 8, and 11 respectively have been taking "fits."

On 25th October I visited the holding to make observations.

When pen was approached No. 11 immediately took a "fit," which lasted about ten seconds, then took another about five minutes later. When milled about in the yard Nos. 2, 8, and 11 all took several "fits" within half an hour. The sheep were raced up and down about 100 yards lane when the three affected ones took several "fits."

All three sheep were poor in condition, being much thinner than control and non-affected test sheep. On examination there were no demonstrable lesions except abrasions which were sustained during the "fits."

Nature of "Fits."

The sheep drops in its tracks as though stunned and lies trembling and rigid with extensor muscles of the neck and limbs strongly contracted. The sheep sometimes lies quite prone and sometimes props itself up and sways its head from side to side. The attack lasts from ten to forty seconds and recovery is quick. The sheep struggles to its feet and stands for a few seconds swaying unsteadily, then runs away to join the mob.

The presence of strangers, loud noises, and driving all seem to induce the attacks. Whilst sitting on the fence of the pen, No. 11, which appeared to be the worst affected, took "fits" about every five to ten minutes for about forty minutes. If sheep are driven continuously after "fits" no harm seems to result.

General Remarks.

Mr. McCosker informed me that the Yellow-wood tree sheds its leaves from autumn to late spring, depending on the season. In a cold dry season, practically all leaves fall in cold weather. Sheep eat leaves when they fall particularly when grass and herbage are scarce.

There is a clump of Yellow-wood trees just inside the gate of one of the paddocks, and when sheep are put in here they immediately feed on the Yellow-wood trees.

There does not appear to be any mineral deficiency on this property. In 1931 the owner supplied lick for sheep, but hardly any was taken.

Season.

No rain from the time sheep were penned till 12th October when 66 points fell. There have been a few showers since.

Since this report was submitted Mr. Hardy, District Inspector of Stock, Emerald, has reported that Nos. 11 and 2, which were placed in the control pen, have gradually improved, and Nos. 5, 10, and 12 have begun to take fits.

Summary.

1. Yellow-wood causes a peculiar type of nervous disorder, or fits in sheep fed on it.
2. The leaves are not unpalatable to sheep.
3. Losses of weight in experiment were probably due largely to the unnutritious nature of the leaves as compared with lucerne chaff (fed to controls) except in the case of affected sheep, which showed marked emaciation.
4. No actual deaths following nervous symptoms have yet occurred. The two deaths recorded seem to have been caused by the indigestible nature of the plant.
5. From information supplied by the owner losses by death appear to be almost, if not solely, due to sheep collapsing among branches and stones or falling into waterholes, &c., when seized with a fit.
6. According to Mr. McCosker's experience and my own observations considerable loss in wool production and condition results from the ingestion of Yellow-wood.
7. Unlike the nervous symptoms caused by Stachys arvensis, no harm seems to result if affected sheep are driven continuously.

Acknowledgments.

This experiment was planned by Mr. D. F. Stewart, B.V.Sc., and is being supervised in the field by Mr. Hardy, District Inspector of Stock, Emerald.

The Department is very grateful to Mr. McCosker, of "Codenwarra," who supplied sheep, pens, and other facilities for carrying out the test.

TO SUBSCRIBERS—IMPORTANT.

Several subscriptions have been received recently under cover of unsigned letters. Obviously, in the circumstances, it is impossible to send the Journal to the subscribers concerned.

It is most important that every subscriber's name and address should be written plainly, preferably in block letters, in order to avoid mistakes in addresses and delay in despatch.

The Story of Butter and Cheese throughout the Ages.

By O. ST. J. KENT, B.Sc.*

THE story of butter and cheese takes us back to the early history of mankind, when dairying was in a very primitive state, and when dairy herds consisted of goats, cows, camels, mares, and sheep, owned by wandering tribes.

The milk from these animals was used as food, and entered largely into the diet of these early people. But milk, under ordinary conditions, does not keep very long, and it would have gone badly with these people, in times of scarcity, if they had not discovered some means of preserving the valuable nutritive constituents of milk. This they did by converting milk into butter and cheese. Just how long ago the first butter and cheese were made cannot be definitely stated, but the early writings give us some conception of the age of these two important articles. In the Scriptures, butter and cheese are mentioned on many occasions, and as far back as the Book of Genesis (18:8), we read that "Abraham took butter and milk and the calf which he had dressed, and set it before them." Other very early references appear in the writings of the Hindoos about 2000 B.C. The remarkable feature about all such early references is that the mention of milk, butter, and cheese is, in every case, incidental, and implies their previous use for an extended time.

Herd-testing an Ancient Custom.

While these two products were primarily made for food, they were utilised by different races for different purposes, and some of the uses to which they were put are very interesting, indeed.

In India, about 4,000 years ago, butter was well known, and besides being used as a food, it was also used for sacrificial purposes. In passing, it should be mentioned to the credit of the Hindoos of that period (i.e., about the year 2000 B.C.) that they valued their cows according to their yield of butter. Herd testing is therefore a very old custom.

A Highly Developed Art.

The Greeks and Romans ate plenty of cheese, but they did not use butter very much for food. This was probably due to the fact that cheesemaking was a highly-developed art with the Greeks and Romans, whilst the making of butter was confined to Germany and other northern European countries. It was quite possible that, by the time the butter reached Rome and Athens, its flavour was anything but pleasing, a factor that evidently influenced its consumption by those Mediterranean people. The Greeks and Romans used butter more as an ointment to enrich the skin and as a dressing for the hair. They also used it for skin injuries, and considered that soot from burnt butter was good for sore eyes. In Tartary, a piece of butter dropped into a cup of tea was considered very delicious by these people.

* In a broadcast address from Radio Station 4QG.

Butter as a "Cure-all."

In Spain, as late of the seventeenth century, butter was on sale in chemists' shops as a cure-all, to be used, as was specifically stated on the label, "for external use only." Its use as a dressing or cooling salve for burns and bruises has been practised all through the ages, and even to-day we find butter recommended for this purpose. Less than 100 years ago, large quantities of butter were burnt as oil in lamps, in no less a country than Scotland. Times must have been hard for the dairymen in those "good old days," for Scotch folk certainly have the reputation of being thrifty.

To-day, butter is almost exclusively used as a food, and few of us would consider purchasing it for any other purpose. In its early history, butter was enjoyed as a food by comparatively few people. Those who did use it, seldom ate it fresh. The practice was to melt the butter before storing it, and it was usually employed in cooking, rather than as a spread. In India to-day a substance known as Ghee is essentially melted butter fat, and its preparation undoubtedly follows a method that has been handed down through many generations.

Butter and Class Distinction.

Apart from the uses already mentioned, the possession of butter and cheese by these ancient people was long regarded as indicating wealth, and served as a means of distinguishing the rich from the common people. Butter was often stored by burying it in the ground, allowing it to remain there for years, and very often a tree was planted over it so that it would not be disturbed. Under these conditions it turned deep red and was highly prized. The owner's wealth was determined by the quantity that he had stored up in this manner. Even at the present time, evidences of this old custom are to be found in certain towns of northern India.

In years gone by, the Irish people used to bury their butter in bogs, either for the purpose of storing it against a time of need, or to hide it from invaders, or for the purpose of developing a flavour. It has been said that the Irish, and other peoples of early times, acquired a taste for rancid and high-flavoured butter; and this is supported to some extent by a quotation from Butler's Hudibras, which runs—

"Butter to eat with their hog
Was seven years buried in a bog."

Samples of this Irish Bog butter are dug up from time to time even to-day, although the practice of burying butter ceased in Ireland about the end of the eighteenth century. Quite recently two lots of butter were found buried in a peat bog, one in County Leitrim, wrapped in a skin, and the other in County Tyrone, contained in a tub with perforated wooden handles. The colour of these butters was greyish white, but they showed a few small specks of the original butter yellow in the interior. They were brittle and waxy and smelt like rancid tallow, and did not contain salt. Many such samples have been claimed from the bogs of Ireland, and archæologists have been able to show, from the nature of the decorations on their containing vessels, that these butters were buried, in some instances, as far back as the eleventh century.

In modern times we reckon the wealth of nations in terms of butter and cheese, and we also bury these products, but instead of putting them

under the ground, we bury them in cold stores under conditions that are well regulated and hygienic.

Ancient Methods of Manufacture.

Butter and cheese in olden times were evidently not the choice flavoured, attractive foods which we know to-day. It should be interesting, therefore, to see what methods were adopted in ancient times for the manufacture of butter and cheese, and to compare them with modern methods. Let us consider the methods of making butter first of all. The principle underlying butter-making is a simple one. Milk or cream is simply agitated until the small fat particles unite to form butter granules. The process of agitation or concussion necessary to make butter is called churning, and the churning may be accomplished in two ways. In the first method the milk or cream is churned by rocking or swinging the churn. In the second method, the churn does not move, but the cream inside the churn is agitated by means of a revolving paddle, or some similar contrivance inserted into the cream.

Both of these methods were adopted by the early primitive people, and they have been used in butter-making right down through the ages, even to the present day. The only difference is in the design of the apparatus employed, and the conditions under which the manufacture is carried out.

The earliest references to butter-making comes from India, and these were recorded in the sacred songs of the Hindoos about 2000 B.C. According to the historian Martiny, these ancient people made butter in a stationary type of churn. The milk was placed in earthern vessels and given a querling motion, either by beating it with the hands or by stirring it with a stick, flattened at one end. These were the forerunners of the modern dash-churns, which are used on many farms and in many households to-day. In a modern dash-churn, the dasher or agitator is either a piece of perforated wood or metal, which fits closely into a vertical churn.

The ancient Arabs and Hebrews used churns, of a rolling, swinging, or revolving type. Animal pelts were sewn up to hold milk, and thus constituted the churns. These crude churns were fitted to the bough of a tree, or in some other manner, and swung to and fro, after the fashion of a child's swing, until butter was formed. Sometimes a portion of the trunk of a tree would be hollowed out to form a churn and swung in a similar manner.

As civilisation progressed, churns of a better type were constructed, and to-day in our up-to-date factories we have huge barrel-shaped churns, driven by machinery, which are capable of turning out a ton of butter in one batch. There is a vast difference in the size, design, and mechanical perfection of the modern churn, when compared with the crude ancient churns, but the principles involved are the same to-day as they were 4,000 years ago. The modern churn has simply developed as a result of the gradual improvement of primitive equipment. It is easy to realise now, that butter obtained from churns made of animal skins could not have the same appeal to the consumer as does our modern butter, which is manufactured from pasteurised cream, and churned under excellent conditions.

The principles underlying cheesemaking to-day are also the same as they were thousands of years ago, but in modern times the methods employed are much improved, and are more scientific. Cheesemaking

is a simple process to describe. Milk is made into a junket as a result of the addition of rennet. The junket is cut up into small pieces, which are warmed to enable the curds to separate from the whey. The whey is drained from the curds, which are then salted and pressed into the shapes which are so well known as cheese. When the first cheese was made, we do not know; but it must have followed closely on the use of milk of animals as food. The processes adopted in different countries differed slightly, with the result that cheese of many different names were soon known. To-day there are more than 500 different varieties of cheese listed. The commonest and the best-known cheeses have taken their names from the country in which they were first made. Thus we have Stilton and Cheddar from England, Camembert and Roquefort from France; Gruyère from Switzerland, Limburger from Germany, Edam and Gouda from Holland, and Parmesan from Italy. As people from these countries migrated to other countries, they naturally carried with them the knowledge of cheesemaking peculiar to their native land, and established their methods in their new homes.

Cheddar Cheese.

The cheese which is made almost universally in Australia is called Cheddar cheese, introduced in the early days by settlers from England. Something of the history of Cheddar cheese may therefore be of interest. The first written record concerning this class of cheese is given for the year 1635, although it was evidently made for many years before that date. It receives its name from a little village in Somerset, where it was first made. At that time, almost 300 years ago, Cheddar cheese was in great demand, particularly when well ripened, and the cheesemakers found it difficult to supply that demand. In 1742 the price of Cheddar cheese was stated to be 6d. per lb. in England, a price which is rather interesting, in view of the fact that present prices are not so very different.

Progress in Manufacture.

In Australia some other types of cheese are being manufactured on a small scale. Swiss cheese or Gruyère cheese is made here now, and contrary to a somewhat common belief, it is made from cows' milk and not from goats' milk.

The most recent advance in the cheese industry is the preparation of a rindless cheese which is usually wrapped in tin-foil and attractively packed. This type of cheese is called "processed cheese," and is manufactured from Cheddar cheese by heating it in a special apparatus.

The great progress which the butter and cheese industries have made in the last thirty years or so has been due to many influences. The application of the Babcock test, which has enabled the farmer to be paid according to the butter fat which he sends to the factory, is amongst the most important. Another factor which had a tremendous influence on the dairying industry was the introduction of the farm separator. This machine changed the system of selling dairy produce entirely. Instead of the farmer conducting a milk business, it enabled him to conduct a business in cream, with its many obvious advantages.

The application of pasteurisation to butter and cheese has also had a profound influence on the development of this great industry, and last but not least, the application of scientific principles in regard to all phases of manufacture, has been instrumental in bringing butter and cheese to the standard of quality attained to-day.

H. W. BALL, Assistant Experimentalist.

EXCELLENT rains were experienced throughout the farming areas during November, so that the main summer crops should now be well established. November and early December is generally regarded as the most favourable sowing period for maize in this State, so that the tasseling stage will coincide with the late summer rains. Maize is Queensland's chief grain crop, large areas of fertile coastal and downs land being suitable for its production. The favourable seasonal conditions have also given a great fillup to the dairying and grazing industries.

WHEAT.

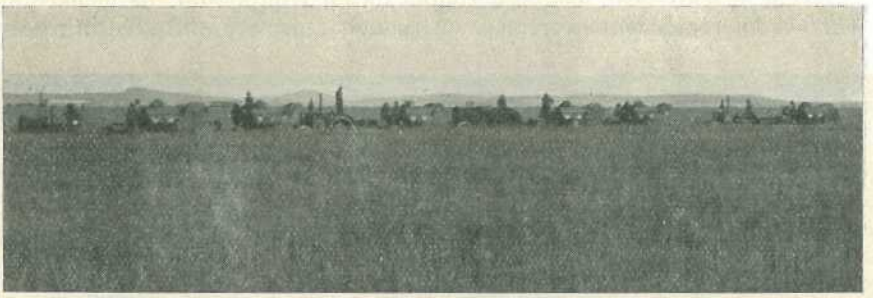
Reports of early harvesting operations indicate good average yields throughout the Downs area, many crops going over ten bags per acre. Unfortunately, the rains experienced have caused delay in harvesting the later crops, which, if prolonged, will affect the quality of the grain. The modern header harvester will gather all but the worst storm-lain crops, but some bleaching and shelling out of varieties such as Florence is naturally expected. However, harvesting prospects at the time of writing are much better than in 1933.

SUGAR.

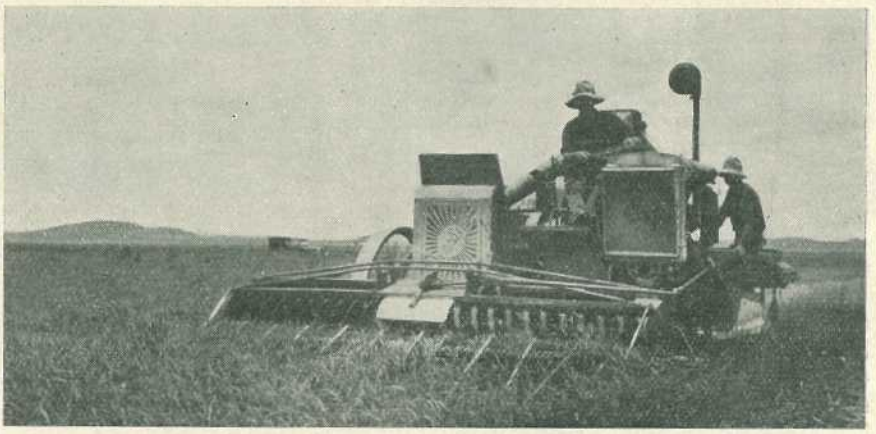
The month of November has been characterised by higher temperatures and beneficial thunderstorms in all cane areas. The crop is, therefore, making rapid growth, and prospects are bright for the 1935 crop.

The majority of the mills have completed crushing. Though the crops in the far North have been light, those of the Central and Southern areas approximate to record tonnages. The Burdekin mills have a large proportion of the crop still to harvest, while several of the Southern mills ceased crushing when an appreciable proportion of the crop was left as standover cane for 1935.

ON QUEENSLAND'S WIDE WHEAT LANDS.



Tractor-drawn Auto-headers at Work on Zeisemer Bros.' Crop, Bongeen, Darling Downs.



Auto-header Working on a Lodged Crop on Mr. J. Flegler's Farm, Evanslea, Darling Downs.

Grist for the Mill.—After the Auto-header has passed through Mr. J. Flegler's Farm, Evanslea, Darling Downs.

PLATE 305.

RECLAMATION OF PRICKLY-PEAR LANDS.

The prickly-pear has been routed on all fronts, and the menace of further encroachment overcome. Although regrowth and seedling pear

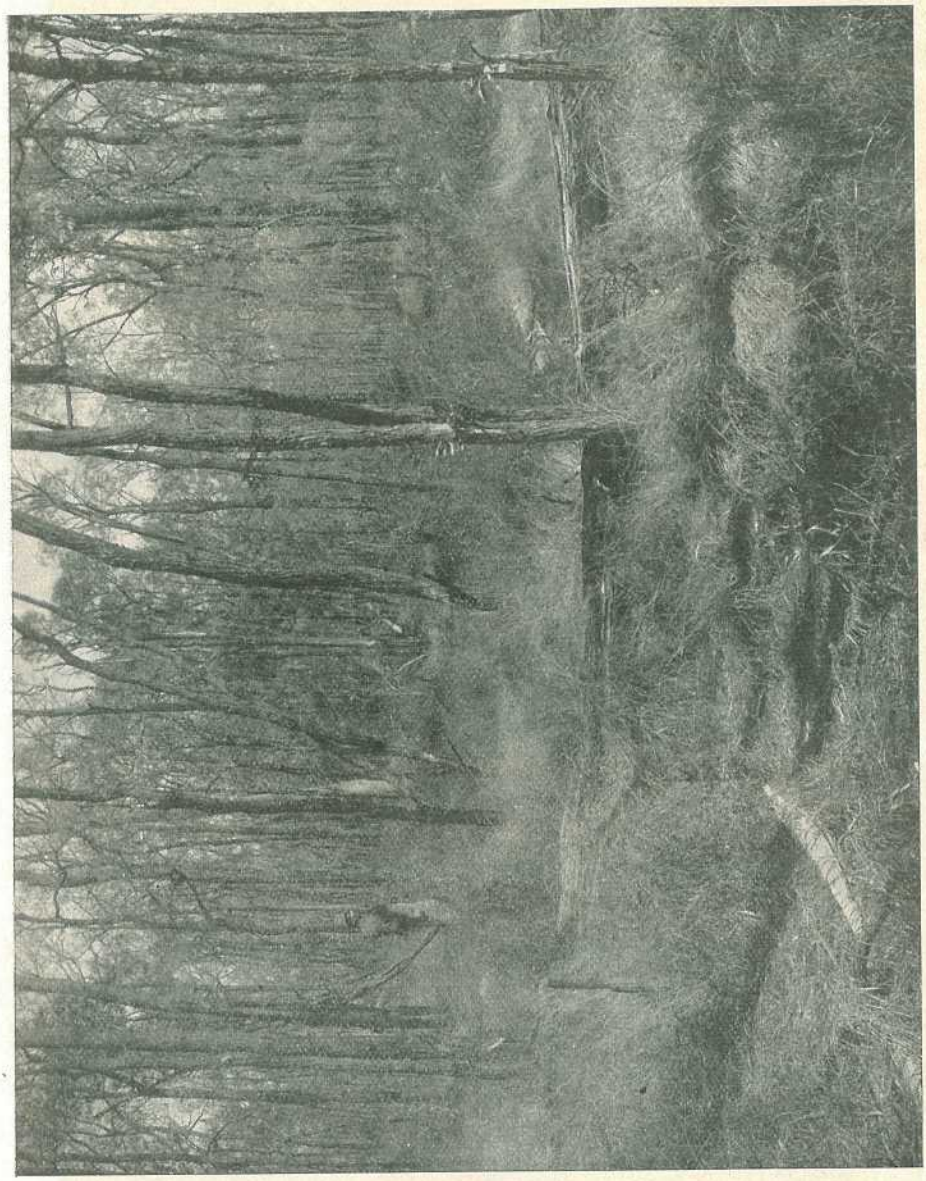


PLATE 306.—BRIGALOW AND BELAH SCRUB RINGBARKED EIGHTEEN MONTHS AGO NOW CARRYING A HEAVY COATING OF NATURAL AND NUTRITIOUS GRASSES. [*Photo., J. A. Lunn.*

will be in evidence for many years, it is safe to say that the cactoblastis will attack it with equal success. When the biological campaign was begun, about 60,000,000 acres in Queensland and New South Wales were either infested or subject to infestation, much of it so dense as to be regarded as lost territory. These lands have now been recovered, and ringbarking and other development works are proceeding. As much

of the land will carry a sheep per acre when improved, the reclaimed lands will be supporting many millions more sheep within ten years.

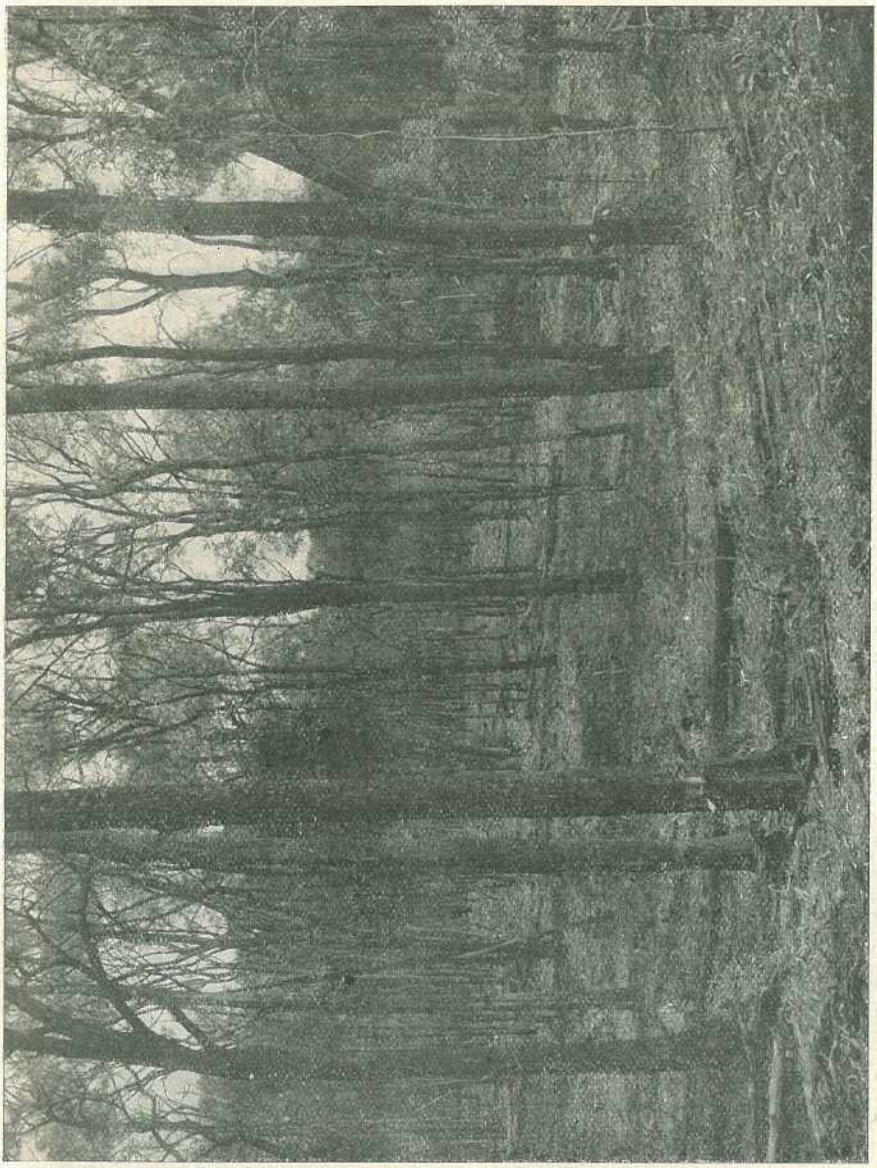


PLATE 307.—LIGHT BELAH SCRUB JUST RINGBARKED.—RECLAIMED PRICKLY-PEAR LAND, WESTERN QUEENSLAND. [*Photo., J. A. Lunn.*

Many selections are now changing over from cattle to sheep, and considerable demand exists for any resumed lands as they become available. For instance, 286 applications were received for one block of land recently balloted for at Chinchilla.

COTTON.

The cotton areas, with the exception of a few favoured sections, may be described as about a fortnight late in obtaining general planting rains. Generally speaking, most of the crop was planted in the latter

half of October, following light storms which occurred frequently enough to ensure good strikes being obtained where well-prepared seed beds had been established early. A considerable acreage was ploughed following the first of the October rains, and fortunately ample soaking rains have occurred in the first half of November to allow these areas to be planted in good shape. Altogether, it is anticipated that fully 60,000 acres are under cotton this season.

The value of thorough early cultivation of the young cotton crop was well demonstrated during the past excessively wet season, and growers are making determined efforts to keep ahead of weed growth this year. The rains during the latter part of November have thoroughly soaked the soils to sufficient depths in practically all districts to ensure ample supplies of soil moisture, and clear warm weather is now required to enable the thinning and cultivating of the crops to be carried out properly.

TOBACCO.

Early sowing is favoured in the Texas and Yelarbon districts, the plants being now well established in the field, and the first gathering of leaf is expected in January. Seed beds are still being prepared in the Northern areas, where growers favour periodical sowings until assured of adequate supplies. Planting-out is mainly accomplished during December. Control methods adopted for preventing disease are proving effective, although prolonged wet conditions will necessitate increased vigilance. Some damping-off is reported, owing to keeping the seed beds closely covered up after watering. This can be prevented by adequate ventilation. The excellent tobacco lands in the Bowen district are attracting attention, two growers having averaged 33d. and 36d. respectively for their entire 1934 crop. In this district good results have followed planting-out as late as February and early March.

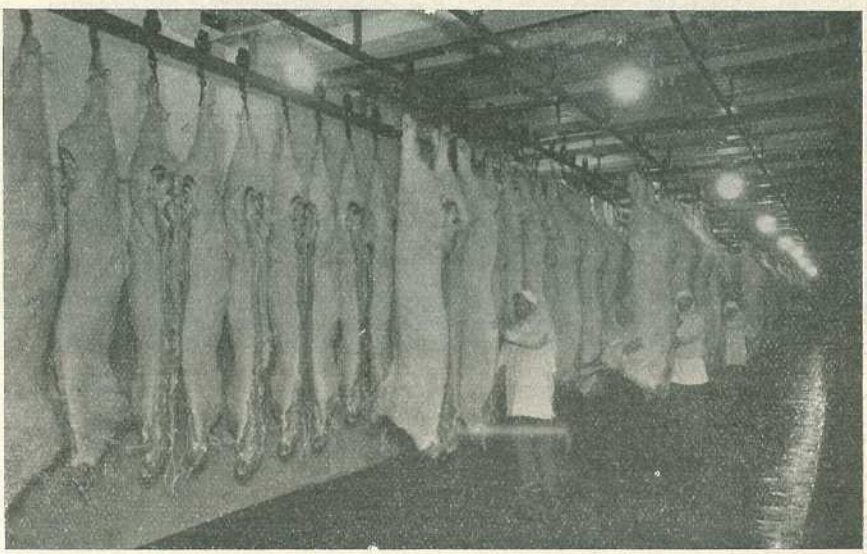
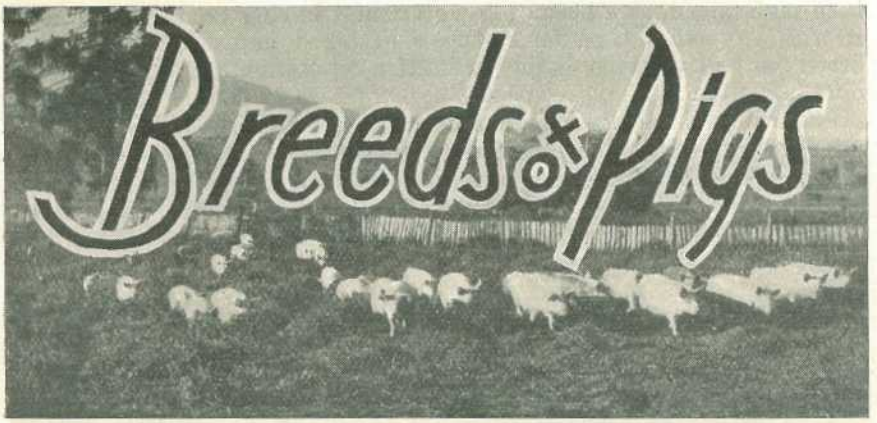


PLATE 308.—CHILLING FOR EXPORT OVERSEAS.

[*Photo. by courtesy of Queensland Meat Industry Board.*



E. J. SHELTON, H.D.A., Senior Instructor in Pig Raising.

PART V.

THE WESSEX SADDLEBACK.

THE most recent introduction to Australia of the lesser-known British breeds, the Wessex Saddleback, has an historical record full of interest to the student of live stock husbandry.

History of the Breed.

The breed originated, like several other breeds in that part of the world, from the mating of two of the original types indigenous to England, a black-coloured breed originating in the New Forest—from whence sprang the Tamworth—and the old English Sheeted breed, so called because of its peculiar colour markings. It is on record that this new Wessex breed was not influenced in any way by the types which made the Yorkshire and Berkshire pigs famous—the Chinese and possibly the Neapolitan breeds. Perhaps this isolation was due to the locality in which the Wessex originated—the Isle of Purbeck, in the early days a part of the New Forest country. Later, a similar type was bred in Hampshire, an offshoot of which in these days has gained fame in America, where it is still referred to as the Hampshire, in colour and type not unlike the Wessex Saddleback as we know that breed to be.

Among other names that have characterised this breed in England is the Sheeted Hampshire, the type reputed to be the originator of the American breed of similar name. W. J. Malden informs us in his review of this breed in the Jubilee Issue of the "Pig Breeders' Annual," that the maintenance of the Wessex pig in pure-bred form was due largely to two families, one at Plaitford and the other at Langford, where they had been maintained pure for over ninety years. These and their descendants in the neighbourhood formed the main basis of the pure Wessex as we know the breed to-day.

A Wessex society was formed in 1918; it issued herd books regularly, and amalgamated with the National Pig Breeders' Association of England quite recently.

The Wessex breed was originally developed for, and all along has been maintained, as a bacon pig, no attempt having been made to cross it with any other type for purposes of breed improvement. Such a breed must of necessity build for itself a reputation, for breeds are not established in a day, considerable effort and patient work being necessary to gradually mould a type into a recognised breed. It is unnecessary in this short review to discuss the early breeders of this type; sufficient to say they were and are well known to British stud masters, and the fact that the National Pig Breeders' Association thought so much of the breed as to be prepared to sponsor its interests speaks for itself.

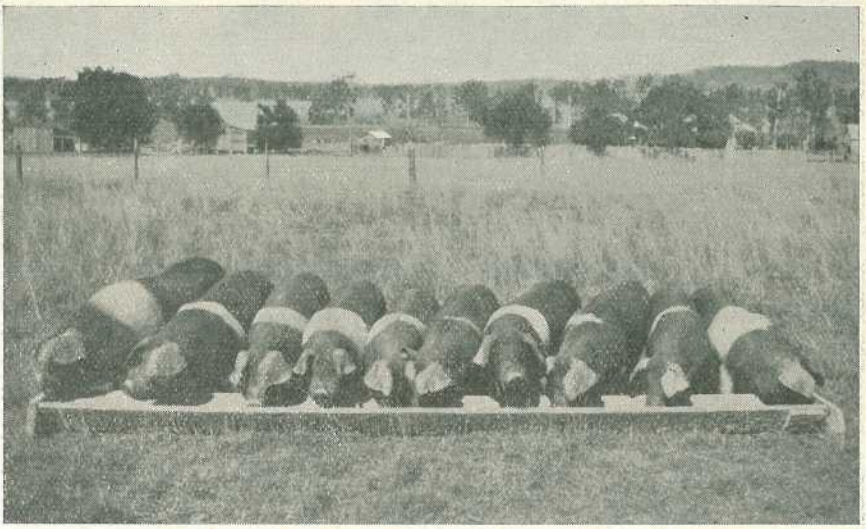


PLATE 309.

Lined up at the feeding trough.—A scene on Mr. R. Turpin's farm at Lowood, in the Brisbane Valley district.

Characteristics of the Breed.

In his review, Mr. Malden offers the advice worth consideration here that it is unwise in a breed of this description to strain too much after length to the detriment of other qualities. It is claimed that the Wessex breed is a meaty and not a fatty breed, hence a medium length, thick, meaty carcass will be preferred to one with more length but less meat. As a breed, the Wessex is included in the list of medium-framed breeds, not as large as the Large White and not as compact as the Berkshire.

As regards their suitability for Queensland and Australian conditions it is early yet to commend strongly or condemn a breed of which we have had but very limited experience. I would say that, from my experience, I consider the Wessex distinctly a bacon pig in its purebred form. As a purebred pig, and judging from the standpoint of the stud pig breeder, it would be fair to say this breed is disappointing, in that the number of well-marked pigs suitable for sale as show animals is very small, too limited in fact to make the breeding of Wessex pigs as purebreds a payable proposition. If colour is to be a secondary consideration, a very doubtful and risky procedure, the breed would

figure to more advantage; but as they have to compete with whole-coloured breeds like the Large and Middle White and the Tamworth, and with a breed like the Berkshire, which produces a higher percentage of well-marked pigs, progress in the breeding of Wessex Saddlebacks will be slow and difficult.

Insufficient purebred animals of this breed have been available for slaughter in Queensland to be able to make a fair comparison, and with such a limited number of purebred animals available the future of the breed is certainly still in the balance—in fact until more data favourable to the breed is available locally one could not honestly recommend them except for experiment purposes. Their colour, and the fact that for choicest grade porkers they do not dress out to the same advantage as pure white pigs, present a slight hindrance not so noticeable in bacon pig production. It is possible, too, that where breeding is neglected or carried out on rough and ready lines, the Wessex would not show up to advantage in competition with, say, the Berkshire-Tamworth cross.

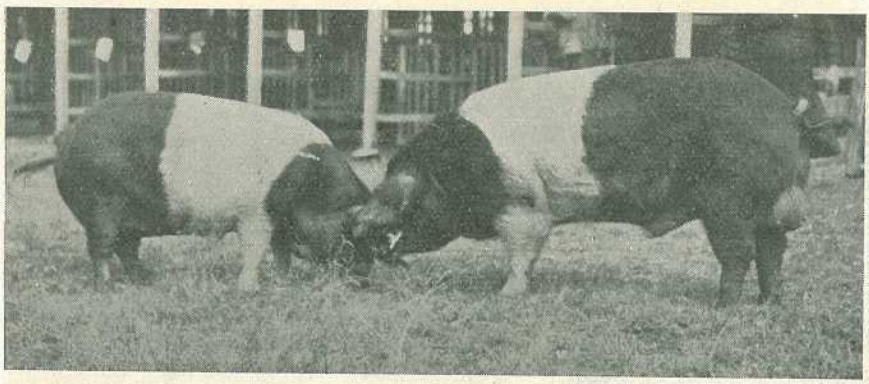


Plate 310.

Championship winners at the Gympie District Show—the property of Mrs. A. Alford, of Traveston. These Wessex pigs are thoroughly typical of the best in this breed in Queensland.

OTHER BRITISH AND AMERICAN BREEDS.

This review of breeds of pigs would not be complete without passing reference to other British and American breeds that have been tested out and used in Australia, and in Queensland in particular.

The Large Black Breed.

This breed, formerly known as the British Large Black and the Devon breed, originated in Devonshire and has had a fairly wide distribution throughout the world. This breed has been bred and distributed widely in Australia.

Large Blacks were bred at the Hawkesbury Agricultural College, New South Wales, and at many other farms in that State, and Victoria; also to some extent in Queensland. Unfortunately, although this breed has points in its favour and could be used to advantage, there are so few really good Large Blacks in the Commonwealth that one is compelled to issue a warning against the use of this, one of the oldest of British breeds. They have, however, a long and honourable record

in the land of their origin, and, perhaps, may some day regain some of their former popularity in Australia.

The Gloucester Old Spot.

This breed is another having its birth in the environs of Gloucestershire, in the British Isles.

Somewhat large and loose in frame, having long-lopped ears and generally regarded as a very growthy breed, these Old Spotted pigs appealed to many breeders, especially as the sows, like the Large Blacks, are prolific and heavy milkers. Unfortunately, there is a coarseness about the G.O.S. which makes it unpopular, and unless breeding is very carefully controlled—which, unfortunately, is not the case on many farms—best results are not obtained.

It is quite unlikely that the G.O.S. will regain its former but temporary popularity, especially as even in Great Britain they are giving place to more popular types like the Large and Middle White.

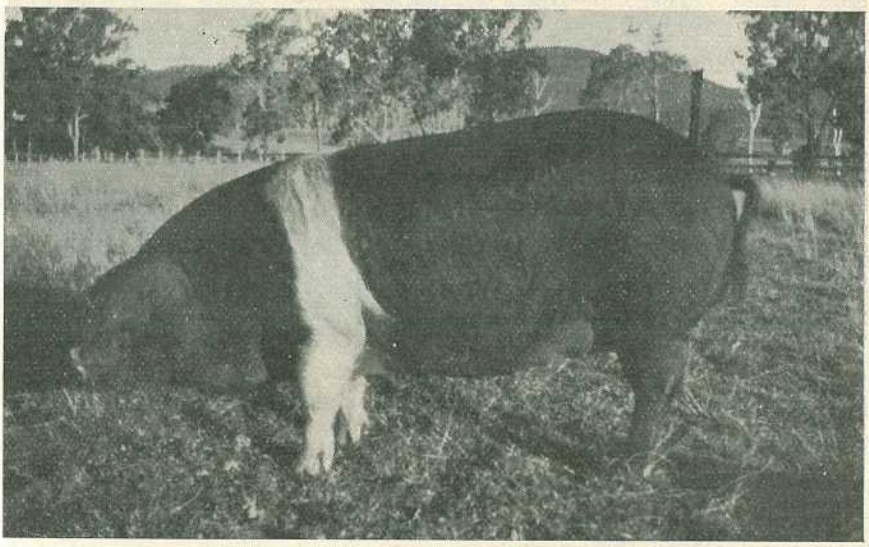


PLATE 311.

Born and bred in Queensland from imported parents, this young Wessex sow is the property of Mr. R. Turpin, of Lowood.

Other British Breeds.

Other British breeds that have not been introduced into Australia, but have their share of popular favour in the United Kingdom, are:—The Cumberland, the Essex, Large White Ulster, Lincolnshire Curly Coated, National Lop Eared, and the Welsh National Pig (sometimes referred to as the British Landrace pig).

American Breeds.

Of a number of breeds of pigs originating in the United States of America, three only have been introduced into Australia. Named in order of merit as judged by length of time bred here, they are:—The Poland-China, the Duroc-Jersey, the Chester White.

The first two mentioned only will be referred to herein, as the Chester White, apart from being introduced and tried out, has not proved suitable, and has been deleted from our list of breeds. In fact, American breeds generally are not favoured in Australia, and are gradually being eliminated in favour of the more popular and suitable British breeds.

In America the hog is considered as the principal medium for converting corn into coin, and as the American people are great believers in both corn and coin, they have specialised in the production of animals that will most efficiently "walk their crops to market," and convert their corn crops into dollar bills with the least waste, in the quickest time, and with the expenditure of as little labour as possible.

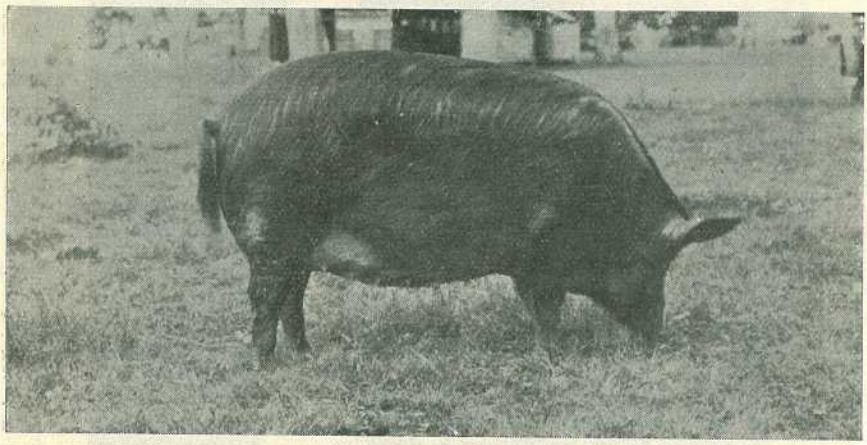


Plate 312.

A comparison of type between the Wessex and the Tamworth, this prize-winning Tamworth sow, "Traveston Alice," bred by Mrs. A. Alford, won several championships for Mr. Mat. Drummond, of the Wide Bay Stud Piggery, Gympie, Queensland.

In pursuance of this policy of developing live stock specially suited to the purpose, several breeds have been evolved that have earned for themselves an enviable reputation, particularly in the United States, the world's greatest hog-producing country.

Of these, the first two referred to have had the widest distribution, the Poland-China having been bred in Australia for fifty years or more, although the modern type, of which there are still a few representatives available here, is comparatively a recent introduction.

In actual cross-breeding tests carried out in Queensland over a series of years, the Poland-China, in its association with breeds like the Large White and Tamworth in particular, gave very satisfactory results; even although the type of Poland-China available was not considered the most suitable.

Market requirements have changed so much in recent years, and the demand for more flesh and less fat has become so pronounced, that any breed with a tendency to produce an excess of fat must be discounted. For this reason, both the Poland-China and the Duroc-Jersey must be looked upon as undesirable breeds. They are not recommended by Queensland bacon-curers, although lengthy lean types of similar conformation are not actually objected to.

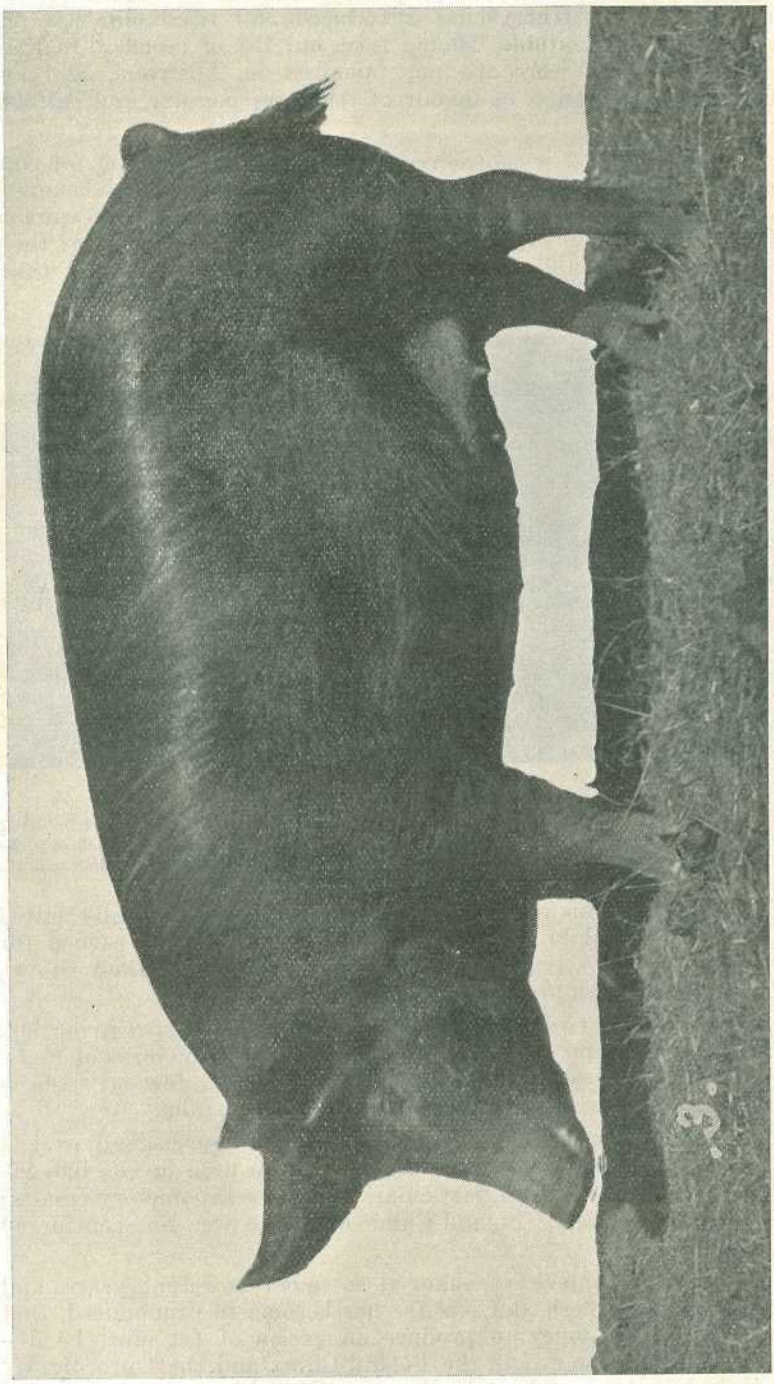


PLATE 313.

A foundation sow in the herd of Mr. C. G. Dale, of Lagoon Pocket, Queensland, this prize-winning Tamworth sow was bred by Mr. J. Barkle, of Kingaroy.

Our recommendation is to concentrate on the four breeds specially commended by the bacon-curers—the Large and Middle Whites, the Berkshire and the Tamworth—for in these breeds there is a sufficient range of types to enable selection to be made to suit varying needs. Besides, any advantage possessed by American breeds can be developed in British types by careful breeding, feeding, and management.

As we have it, the Poland-China is marked much the same as the Berkshire, although more white marking is permissible. In America there is another type—the Spotted Poland-China—very similar to the type that existed here thirty years ago.

The Duroc-Jersey is the red hog of America, developed like the Poland-China for purposes of utilising maize as the principal food.

The Chester White is a more lengthy, upstanding type fashioned along bacon lines.

All the American breeds we have possess small drooping ears; they are more cylindrical in frame than the Berkshire, which is squarely set; and they have an aptitude for fattening very readily on a minimum of food. There are several other American types that have not been introduced, two already referred to being the Hampshire and the Spotted Poland-China. The Mule Foot is one of the lesser-known American breeds reported to be immune to the more serious diseases like swine fever, in America known as hog cholera.

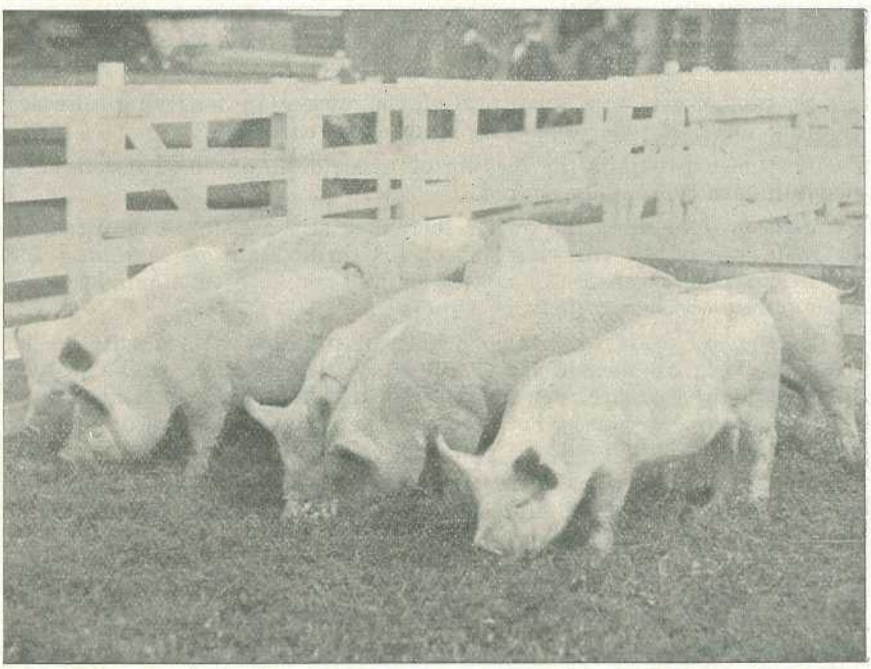


Plate 314.—Good-quality Export Porkers.
[*Photo. by courtesy of Queensland Meat Industry Board.*

The Queensland Pig Industry Act.

PROVISIONS EXPLAINED.

DESIGNED entirely in the interests of Queensland farmers who are producing pigs as a profitable branch of live-stock husbandry, "*The Pig Industry Act of* 1933" was assented to on 11th October, 1933, in the Queensland Legislature, having received Royal Assent in accordance with State law. The Act actually came into operation on 23rd August, 1934, which date is referred to as "the commencement of this Act." The Act is divided into twenty-five sections, while there are twenty-three additional provisions in the Schedule to the Act, which latter are largely covered by the Regulations. Sections 1 to 4 of the Act may be referred to as the administrative portion, covering, among other things, interpretation of various terms used in the text—thus, the word "dealer" is interpreted as meaning "any person who engages in the buying and selling of pigs or pig carcasses"; "piggery" means and includes any land, buildings, or place where pigs are depastured or kept; and similarly with other terms.

Inspectors under this Act have, for the purposes of the Act, all the powers and functions of an inspector under "*The Dairy Produce Acts,* 1920 *to* 1932," "*The Diseases in Stock Acts,* 1915 *to* 1931," "*The Slaughtering Act of* 1898," or any Act or Acts amending the same or in substitution therefor respectively.

Section 5 gives the inspector power of entry and inspection, and in his official capacity he may enter and inspect any premises or place where pigs are depastured or kept, and any factory. He is empowered to deal with any position arising as a result of unclean piggeries, disease in pigs, impure or unwholesome water or food, &c.; and he may forthwith order the necessary steps to be taken to remedy the defect.

Section 7 sets out the duty of the owner in notifying disease; isolating diseased pigs; disposing of diseased carcasses.

Section 8 prohibits the feeding of meat, offal, or blood unless such foodstuffs are thoroughly cooked.

Section 9 requires the owner to render any assistance required by the inspector in the carrying out of his duties, and in searching for and discovering the cause of disease or any source of contamination or infection to which pigs may be exposed.

Section 10 deals with the marking of pigs by a representative of a factory—i.e., a sufficient mark to ensure identification of the vendor or consignor if pigs are forwarded direct to a factory. Such identification marks are, of course, necessary in the ordinary course of marketing; otherwise there would be endless confusion.

Section 11 requires every auctioneer, agent, dealer, factory, or butcher to keep a record in respect to every transaction in pigs with which he is concerned—that is, the date, number, description, distinguishing marks, name and address of vendor and of purchaser, and such other particulars as may be prescribed.

Section 12 prohibits payment for the whole or any part of a carcass which has been condemned by an inspector as unfit for food of man; this is an important section, as payment for diseased carcasses has proved to be a most unsatisfactory way of eliminating disease.

Section 13 deals with grading of carcasses, and is more fully described in dealing with the Regulations.

Section 14 provides the inspector with power in marking of quality of carcass pork and bacon sides.

Sections 15 to 25 give powers of administration under this Act and provide for penalties in case of offence, &c.

The Schedule to this Act covers a fairly wide range of provisions and deals with subject-matter covered by regulation.

THE REGULATIONS.

In the Regulations additional terms are interpreted—thus, the grader is the person duly appointed as such under the Act and/or his assistants duly appointed under the Act.

A saleyard is a live-stock market operating as a saleyard, a receiving and/or trucking yard, or place where pigs are sold, bartered or exchanged, or otherwise disposed of, &c.

Regulations 1 and 2 are purely administrative.

Regulation 3 sets out requirements in conduct of examination of graders and/or inspectors under this Act, and is largely an administrative clause.

Regulation 4 provides that no person shall be employed in the grading of pork or bacon pig carcasses unless he holds the necessary certificate of competency under this Act.

Regulation 5 deals with management of piggeries which are not specifically provided for in any of the other Acts under which inspectors work in administering this Act.

Provision is also made that pigs shall not be allowed to trespass or to pollute running water. This Regulation also provides the inspector with powers to prevent introduction and spread of disease among pigs, &c.

Regulation 6 deals with identification of pigs, and requires that every pig offered for sale, barter, or exchange be identified in accordance with this Act and its Regulations, the object being to facilitate tracing of disease to source of origin. This Regulation is a particularly important one that will require the hearty co-operation of everybody interested in the progress of the pig industry.

Regulation 7 deals with grade definitions and defines the various grades into which carcasses will be graded by the grader at the factory.

Provision is made for two particular grades in each group—thus, there will be in baconers for the Australian trade a grade defined as choicest, and another first grade; carcasses not coming within these grades will be second grade or smallgoods grade, as the case may be.

In export baconers and in export porkers the grades are those required by the *Commerce (Trade Descriptions) Acts,* 1905 *to* 1930, and are the grades in operation at present under Commonwealth veterinary inspection.

In porkers for the Australian trade, in addition to the two grades referred to as "G.A.Q." (good average quality) and "F.A.Q." (fair average quality), there is a second grade and a reject porker grade. Boars and stags shall be accepted, graded, and paid for only when of suitable quality and age for manufacturing into edible products.

Regulation 8 deals with payment for pigs sold for slaughter, and requires that in the case of choicest or highest grade carcasses there shall be paid a premium of one halfpenny per pound above the rate paid for next grade. It is felt that the introduction of this system of payment will be entirely satisfactory, and will do much to encourage the breeding and marketing of better quality and properly finished pigs. This Regulation provides that when live pigs are sold at public auction and where carcass pork graded as provided is sold at public auction and/or by private contract, the clause requiring payment of premium shall not apply, for the reason that purchase of pigs at public auction and carcass pork ditto or by private contract requires the buyer to pay maximum value to secure the best quality offering, and, therefore, payment of an additional premium would not be workable.

Regulations 9 and 10 deal with the sale of live pigs by public auction and sale of carcass pork respectively.

Regulation 11 provides for the issue with account sales of grade certificates—i.e., where pig carcasses are paid for on a basis of grading. It is desirable the farmer be informed as to the reason why carcasses are paid for at below choicest or highest-paid grade, if they are so graded and paid for; and this Regulation paves the way for this information to be supplied.

Regulation 12 provides for check grading and for vendor to be supplied with a certificate of grade of all carcasses other than those of highest-paid grade.

The check grader shall also determine the grade of any carcass reduced in value by causes obviously occurring after purchaser has taken delivery from vendor. This clause provides for losses due to injuries in transit, &c., not actually covered by any preceding or following clause.

Check grading protects interests of the farmer and should be the means of providing him with necessary information, for, as stated, the farmer is to be informed in all cases where his pigs are not of choicest grade. It is hoped to be able to follow up grade certificates and indicate to the farmer how to overcome faults in type and condition, and how to produce and market the most desirable class of animal.

Regulation 13 deals with grade marks, and paves the way for identification by indelible grade marks of graded carcasses, thus preventing errors and enabling a more accurate check to be kept of the different grades. Where grading is carried out by Commonwealth officers (as in the case of pork for the export trade), only such grade marks as are required under the *Commerce (Trade Descriptions) Acts*, 1905 *to* 1930, will be applied.

Regulation 14 provides for compulsory refund of price paid for any pig whose carcass is subsequently slaughtered and condemned within thirty days of sale by Government inspectors as unfit for the food of man. Many pigs are purchased in Queensland and are paid for prior to slaughter. All such pigs come within the ambit of this Regulation and thus are brought into line with those consigned direct to factories and not paid for until slaughter and inspection is complete. The Regulation makes it compulsory for the purchaser to demand the refund, and for the vendor to pay within a stated period. This clause will, it is believed, be of inestimable benefit to the industry in this State.

Regulation 15 has reference to a similar subject, but deals with the purchase of live pigs by dealers who thereafter consign to factories for slaughter within thirty days. In this case the dealer is placed on the same footing as the farmer, and will be compelled to refund in case of condemnation. This clause will apply to every such transaction between a dealer and an owner of a factory.

Regulation 16 requires the owner of a factory to supply to the Minister a list of trade marks used, &c.

Regulation 17 requires the owner of a factory to supply to the Minister a list of all products manufactured or sold by such factory.

Regulation 18 provides for the use of more than one trade mark where so desired by the owner of a factory.

Edible products shall be identified with a different trade mark from inedible products such as fertilizer.

Regulation 19 makes it an offence to beat a pig with a whip, stick, or other weapon capable of bruising or damaging the carcass of such pig. Similarly, it will be an offence to ill-treat a pig in any way, penalty being such as is provided for in the Act.

Regulation 20 indicates the scope of the Regulations and is largely administrative.

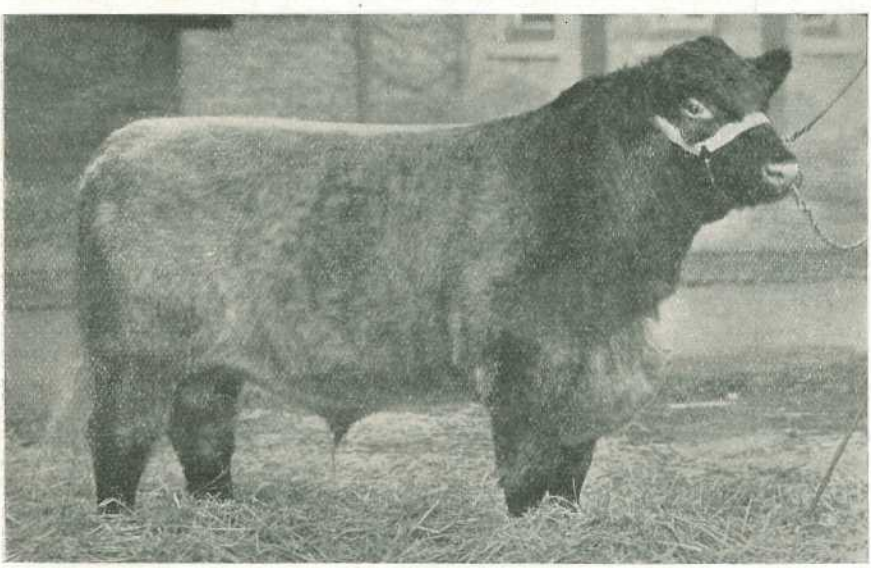


Plate 315.—Champion Polled Shorthorn Bull—a Recent Importation.

[*Photo. by courtesy of Queensland Meat Industry Board.*

Fruit Market Notes.

By JAS. H. GREGORY, Instructor in Fruit Packing.

Apples.

IT is at this period of the year we often find consignments of so-called cookers which, as a rule, consist of small, immature, green fruit. Fruit of this description always has a detrimental effect of a lingering nature on market values from which it takes a long period for prices to recover. If sending early apples to market as cookers, growers should take care to see that the size of the fruit is not less than 2⅝ in. in diameter. Fruit of this size and larger will sell as cookers where smaller fruit is unsaleable. At the present time—late November—some splendidly-packed lines of Yates and Sturmers of good quality from Victoria and Tasmania are arriving and realising up to 12s. per case. Green fruit could not compete successfully with this fruit.

Stone Fruits.

Plums, apricots, and cherries, with lines of local peaches, are now arriving in quantities. Good, well-packed lines are meeting with a ready sale. Some consignments of Stanthorpe fruit have shown traces of fruit fly. This should serve all growers as a warning to take all precautions possible to prevent a spread of the pest. The rainy weather towards the end of November did not assist in helping to make a good early-season beginning. The humid conditions hastened considerably the breakdown of some of the riper lines. Care must be taken by growers to ensure that no wet or damp fruit is packed for market. Only dry and well-cooled-before-packing stone fruits will carry and open up to perfection. Again a warning is given to pay strict attention to packing-shed cleanliness if brown rot is to be kept in check.

Citrus.

The Queensland citrus season is now drawing to a close. It has not been a successful season. Small-sized fruit has been the cause of low prices during the greater part of the year. Serious attention will have to be given in the future to the elimination of fruit of this description, which has all along helped to create glut conditions. Two-inch mandarins and 2¼-inch oranges have proved particularly unsaleable throughout the season, and if the percentage of this quality had been eliminated an almost normally-supplied market would have resulted.

Tomatoes.

The quality of tomatoes during November has been one of the best ever produced in the State. Some splendid consignments have gone to Southern markets. The standard of maturity of the fruit this season has been raised far ahead of previous years. It would appear that this has had a stabilising effect on the markets, preventing speculators from buying at green prices and holding for a rise. As the warmer weather is with us, care must be shown in not sending fruit too far advanced in colour to distant markets. Packing has also shown improvement; the benefit of the school packing classes of previous seasons is now being felt.

Papaws.

Prices for papaws have increased considerably on the local market. Quality should still be the keynote of papaw marketing, all spotted or fungus affected fruit being carefully rejected. Although Melbourne weather has remained cool through November, warmer conditions can soon be expected, when papaws will need to be carefully selected to avoid the risk of their arriving over-ripe on the Southern market.

Pineapples.

With the winter crop over, pines generally are scarcer on the market. The shortage of pines and citrus on the markets is offset by the increased supplies of stone fruits arriving on the market. Medium-sized pines are selling readily at fair prices, but buyers are not keen to operate on small fruit. Growers sending South are gradually changing over to woodwool packing, which opens up in a much sweeter and less musty smelling condition than blady grass.

Miscellaneous.

Attention is drawn to the publication of a packing chart for apples in the standard export case. A packing chart for the Australian dump case is in course of preparation, and advice will be given in these notes when it is completed. Packing charts may be obtained free on application to the Under Secretary, Department of Agriculture and Stock, William street, Brisbane.

Charts for both the dump and standard cases are now available for oranges. A lemon-packing chart is in course of preparation.

Intending apple exporters should watch for the appearance of the new grade standards for the exporting of apples, which will be published as soon as they come to hand.

The attention of growers marketing locally and using second-hand cases for packing is drawn to the fact that in many cases old brands are not removed from cases and replaced with the grower's name, address, variety of fruit, and grade. Growers have had to be dealt with for infringements of this kind which, it is hoped, will soon cease.

DEHORNING DAIRY CATTLE.

The dehorning operation should be performed while the animals are young. The dehorning of calves is best accomplished by the application of caustic to the horn "buttons"—the two small protuberances which can be felt when the animal is a few days old on either side of the poll where the horns emerge. The skin immediately surrounding each button should first be protected by smearing it with vaseline, and the button itself then carefully rubbed with the caustic pencil. Should the caustic touch the skin severe burning will occur, and areas of skin will slough off. For the same reason the caustic must not be handled with the fingers, but slipped for use into some metal holder, such as an ordinary pencil-holder. Four applications are usually sufficient, when the buttons will peel off, this marking the completion of the treatment.

The operation is thus performed without any pain to the animal, and the method is quite the most effective and humane. Adult cattle are sometimes dehorned by use of a special instrument, several kinds of which are upon the market, but it is a painful operation and is not recommended.

If cattle prove troublesome in the yard by horning others, much damage can be prevented by sawing off the ends of their horns, leaving them quite blunt. Care should be taken not to remove too much of the horn, and the sawn ends should not be filed round.

Crown Land for Selection.

TOCAL SHEEP COUNTRY.

Approval has been given for the opening for Grazing Homestead Selection of a subdivision of Tocal Resumption at the Land Office, Longreach, on Thursday, 17th January.

The block contains an area of about 30,000 acres, and is situated on the south side of the Thomson River, about 55 miles south-west from Longreach. The term of lease will be twenty-eight years, and the annual rental 2½d. per acre for the first seven years of the term.

The block embraces an area of very open downs, with a small area of fairly well-shaded gidyea and boree country. The remainder is open boree downs country, pebbly in places, and well shaded in patches.

Grasses consist of Mitchell, blue, water couch, &c., and the country is fattening. Fair woolgrowing and suitable for breeding.

Improvements consist of tanks, sheep yards, boundary and intersecting fencing. The present water supplies are sufficient.

The valuation of the improvements is £1,821.

The selection must be stocked to its reasonable carrying capacity with the applicant's own sheep within a period of three years, and proof must be furnished of the financial standing and pastoral or land experience of the applicants.

Free lithographs and full particulars are obtainable from the Land Agent, Longreach, the Land Settlement Inquiry Office, Brisbane, and the Government Intelligence Bureaux, Sydney and Melbourne.

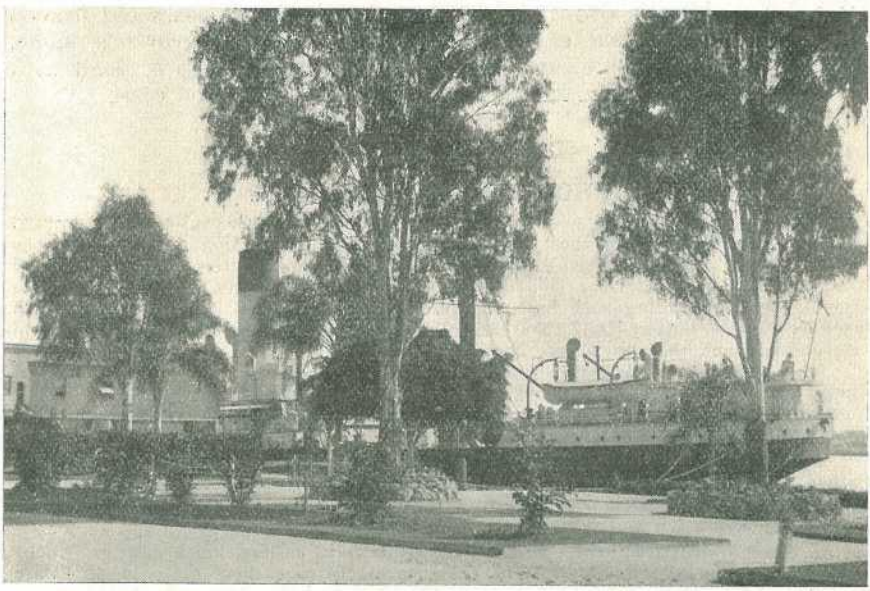


PLATE 316.—M.V. "IDOMENEUS" LOADING FIRST EXPERIMENTAL SHIPMENT OF CHILLED BEEF AT THE BRISBANE ABATTOIR.

[Photo. by courtesy of Queensland Meat Industry Board.

The White Man in the Tropics.

The following addresses by Professor A. GRENFELL PRICE, C.M.G., D.Litt., F.R.G.S., of the University of Adelaide, were broadcast over the National Network from Stations 5CL and 5CK on the 11th and 18th July, 1934.

I HAVE been asked to speak to you on the very important and unsolved problem of whether the white man, and particularly the Nordic white man, can settle permanently as a worker in the tropics. So this evening I will tell you about the question in general and what has happened in other lands, and next Wednesday I will deal with an aspect that is so vital to Australians—the problem of whether we, as a white people, can hope to live in and develop the vast, but almost empty, areas of tropical Australia—a region of nearly 1,150,000 square miles. I need hardly emphasise how vital is this question to the Commonwealth. Again and again other nations have called us "dogs in the manger," because of our "White Australia" policy as regards these empty tropics, and only recently the Dean of Canterbury voiced a very usual opinion that we should give North Australia to the Japanese.

But we are not the only white people who are involved in the tropics. Britain, France, and the United States have great tropical possessions, and I found American scientists intensely interested in their own tropical problems in Florida, Panama, and Puerto Rico, and most anxious to hear Australian views.

The truth is that throughout the world leading scientists are disputing over this question of the ability of white people to settle the tropics. Some Americans, such as the well-known Professor Ellsworth Huntington, believe that whites cannot live there permanently, because they are destroyed by the climate. Other scientists, like General Gorgas, of Panama fame, and the Australian Dr. Ray Cilento, consider from the records of Panama and Queensland that the whites can colonise the tropics if they overcome disease. A very great authority, the late Sir Andrew Balfour, took a mid-way position, but at his death he seemed to be swinging towards Cilento's views.

Definitions.

Let us begin by defining White, Settlement, and Tropics. By White we mean people who are white, or nearly white, such as the Europeans, the people of Canada, the United States, and Australia, and the near white peoples of Costa Rica or Cuba. By Settlers we mean people who live, work, and have families for generations in the tropics, and we exclude officials, missionaries, soldiers, and traders who go to the tropics only for a time. By Tropics we mean the earth's surface roughly between 23½ Lat. N. and S., but this covers regions of very varied heat, rainfall, and humidity, and some areas will be far more suitable than others for the whites. We can exclude from our study many regions such as the African or Australian deserts, where no one can live, and many countries such as India or Java, where the whites will never form a working population as the coloured people and their cheap labour are overwhelmingly competitive. Thus we can narrow our inquiry to a few possible areas. The most important of these are North Australia, parts of North, Central, and South America, and the West Indies.

There are three ways in which scientists are attempting to examine the question —the methods of history, of statistics, and of the laboratory. Unfortunately, history is not a very accurate guide, as the progress of medical science has completely changed white prospects in the last few years. The statistical method is not wholly reliable.

It is difficult to secure absolutely satisfactory figures of climate, heredity, &c., even in civilised countries. The laboratory method is also uncertain, for when you test people under artificial conditions of heat or moisture in a laboratory you cannot reproduce the exact conditions which face them when they have to undergo acclimatisation in a tropical zone. By combining the three methods, however, one can find out a great deal about whether the whites are really making progress.

The White Man's Conquest.

The history of the white man in the tropics is very fascinating. From 1500 onwards European nations carried out a great pre-scientific conquest of the tropics. The Portuguese, Spaniards, English, Dutch, French, and other nations poured into tropical Asia, Africa, America, and Australia, and either conquered or destroyed the native coloured peoples. Before very long, however, the tropical diseases and the tropical peoples began to regain their own. In India, Java, Africa, or Mexico the whites continued to hold sway as governors or traders, but each generation returned home, for if they remained they were absorbed like a river flowing into an ocean. In sparsely-inhabited countries, such as the West Indies, the whites destroyed the natives, but, instead of working themselves, the whites brought in negro slaves, and these negroes increased so rapidly that the white masters were soon absorbed. In India, the Portuguese tried the interesting experiment of deliberately breeding a half-caste people, but even this proved impossible, and ultimately the half-castes will be absorbed. Nevertheless, this white pre-scientific wave left some interesting flotsam and jetsam, and many fascinating books have been written on the little communities which have survived. Central America and the West Indies are full of such groups of white people, and, perhaps, we might even call the settlement at Darwin one. In 1932 and 1933 I was lucky enough to examine a number of such communities—Costa Rica in the Central American highlands, where an almost pure Spanish community has survived for 400 years; Jamaica, where a German community came about the same time as the German pioneers of South Australia; and the little and almost unknown island of Saba, where an English-Dutch community has kept almost pure white since the days of the English buccaneers and first Dutch planters—a period of 250 years.

Without going into scientific details, I will simply say that the evidence shows that white men can live and work for generations in the more favourable tropics, provided that they are protected both from disease and from the presence of coloured races, who are usually unhealthy, and are far more dangerous to the white man than any tropical climate. In Costa Rica one found a white Spanish community—artistic and educated—which had kept pure white because the people had been isolated on the plateaux, and because the negro had been excluded until comparatively recent days. This exclusion of the negro is of the utmost importance. Only this week a letter came from an American scientist in Costa Rica to say that the Government so fears the rapid increase of the negro population that it is completely prohibiting negro immigration. It is the same in Saba. There one found a very fair type of pure white English-speaking people who had always done a great deal of their own hard work, but are now in danger, like the Costa Ricans, of being absorbed by negroes.

Control of Tropical Diseases.

After the old pre-scientific invasion of the tropics by the whites had failed, a new and far more promising invasion occurred. From 1890 onwards the British and American scientists learned the control of hookworm, yellow fever, malaria, and many other tropical diseases, and the worst enemies of the whites were partly subdued. On the Panama Canal, for example, "the pest hole of the world," the Americans showed that it was possible to secure a lower death rate than in the most healthy cool temperate countries, and the white death rate to-day is lower than even that of Australia or New Zealand. I spent some three weeks with American scientists in Panama, and saw white Americans who, with very few

vacations in the United States, had carried out the hardest physical labour in the workshops for nearly thirty years. One also saw whites of the second generation who were doing the hard work perfectly well. As for the tropics injuring children, an exhaustive examination in 1930 showed that white children in Panama were, on the average and right up to the end of their high school days, of higher standard than similar white children in the United States. The same thing is going on in Southern Florida, where white fruitgrowers are working in a climate that is truly tropical—and the same type of evidence is now coming from the white sugar growers on the Queensland coast, who are actually doing work that the Americans think no white man can possibly perform. We could, however, copy much from the Americans at Panama, for their control of disease, hygiene, and sanitation, and their methods of housing, clothing, and diet are unequalled anywhere in the tropical world. Our figures in Queensland would be even better if we would follow some of their ideas.

We must not, however, be too optimistic because of these successes. What is really happening in Florida and Queensland is that the white man, in particularly favourable regions where economic factors are particularly suitable, is beginning to penetrate the margins of the tropical zone. The great American doctor, General Gorgas—who conquered yellow fever in Cuba and Panama—made the mistake of being over-optimistic because of his successes, and thought quite wrongly that the whites would be able to colonise any part of the tropics. In reality, we are just beginning to understand that we are facing a huge and complex scientific problem, and that the future progress of white people in the tropics depends on a large number of geographic and economic controls. To take only one example, even a small region like Panama has great local varieties of climate, and there are probably in the climate, as affecting white people, a number of factors that are as yet unknown. Similarly, one race is more suited to the tropics than another, and even in a single race there are some individuals who are suited to the tropics, and others who can never acclimatise. This point was strongly emphasised by Dr. Sunstroem, when working in tropical Australia. The Americans are now talking about establishing in Panama a Research Institute to study the process of acclimatisation in various individuals, and a branch of such an institute would be of extraordinary value if founded to study thoroughly the effect of climate on white workers on the Queensland coast.

Soil.

Another vital control is soil. The world is gradually abandoning the old fallacy that almost all tropical soils are fertile. Australia, for example, would have saved a vast wastage in lives and expense had she realised that her Northern Territory soils are some of the poorest anywhere.

Housing.

Isolation is also important. We are beginning to realise that loneliness and inter-breeding have harmed many white communities more than tropical climates, and that small scattered settlements, such as some of those in North Australia, have little chance of meeting with success. Comfort is also of vital importance, particularly for women. One of the greatest hopes for white settlement in the tropics lies in air conditioning the houses. Very soon the white man in the tropics may be able to control the temperature of his dwelling as easily and effectively as the American controls the winter temperature by central heating. Then again, there is the importance of social habits and of food and drink. Many failures in the tropics, particularly British failures, have been partly due to ridiculous clothing, heavy unsuitable diets, and alcoholic excess. Again and again when a young man died of drink in the West Indies, his parents were charitably informed that he had died of fever, and that good old whipping post—the tropical climate—took the blame. Again, we are beginning to realise how dependent the white peoples of the tropics are on temperate policies and markets. The Americans turned

Puerto Rico and Cuba into lands of one crop industry—dependent on the cool temperate sugar markets. Now the United States is refusing to pay a profitable price for sugar, and when the unhappy, starving Cubans explode in riot and revolution, the supposed instability of a tropical people is blamed.

The Colour Barrier.

Most important of all we are beginning to realise that the greatest barrier to white settlement in the tropics is neither climate nor sickness, but the presence of vast masses of coloured peoples, who, as we know from the history of the Kanakas in Queensland, lower the standard of living, create reservoirs of disease, and form the means by which the whites can shirk doing the essential physical work.

From Washington to the Equator, every American scientist I encountered said "You Australians are the wisest people on earth with your 'White Australia Policy'," and this dictum rests on indisputable facts. The health of white people in the Southern United States suffers appallingly from the presence of millions of negroes, while the West Indies and Central America are steadily going black. Jamaica, for instance, which once had thousands of white settlers, is now coloured to 96 per cent.

In this address I have tried to explain the general controls which govern white settlement in the tropics, and I have attempted to give you some idea of the great question in other parts of the globe. Next Wednesday, I will apply some of these principles to our own great problem, and will deal with our strange record of success and failure in the northern tropics, and the difficulties that confront Australians—or any other people—white or coloured—who attempt to settle the North of this great continent.

THE PROBLEM OF NORTH AUSTRALIA.

In my address last week I told you about the general question of white settlement in the tropics. I explained why the white invasion of the tropics failed in the days before modern science, and why the new and scientific invasion of the marginal tropics was meeting with some success. Finally, I tried to show that the future progress of white settlement would depend not merely on the successful combating of tropical climate and disease, but upon many other factors, such as soils, communications, housing, food, and drink, the exclusion of coloured peoples, and economics. To-night, I will apply these general principles to the history and prospects of white settlement in tropical Australia, and will deal with the pre-scientific invasion which failed, the new scientific invasion which appears to be making some headway in Queensland, and the factors which will determine whether any nation, white or coloured, can settle the North of this great continent.

As the Spanish say, "There are tropics and tropics," and we cannot begin to understand the problem of our North unless we realise that we keep a variety of tropics in North Australia. While we possess no equatorial lowlands, like the Congo or Amazon Basins, we have four other kinds of tropics: the tropical trade wind coast of Queensland; the tropical plateaux; the interior deserts of Western Australia, Queensland, and the Northern Territory; and the wet-dry region, that great belt of country, with a monsoonal rainfall in summer and a drought in winter, which runs right around the Australian North and North-West coast. Throughout the world the high plateaux with their cooler climates are the most suitable parts of the tropics for white settlement, but in Australia, out of 46,000 square miles of tropical plateaux over 2,000 feet in elevation, only 14,000 square miles of Queensland plateaux have rainfall and soils sufficiently good to support many whites. Also, we can eliminate completely from the viewpoint of any close white settlement (except, perhaps, for a few temporary mining camps) the whole of the desert or arid regions which have less than 15 inches of rainfall—regions which comprise not less than 700,000 square miles. Thus, we need consider only

the Queensland coastal margin backed by its comparatively small plateaux, and the wet-dry belt of monsoonal country running inland from the North and North-west coast. Australians should never forget that these two regions are of entirely different character. The Queensland coast and plateaux are really promising, for they possess patches of excellent soil and a good and well-distributed rainfall from the monsoons and south-east trades. The Northern and North-western coastlands are entirely different. Most of the soils are poor, leached, and deficient in plant food. During six to eight months the country is almost drought-stricken. In summer, much of it is flooded by terrific rains, some of the rivers rising 50 or 60 feet.

Development of Our Tropical Territories.

Last time I explained how in the days before modern science the whites invaded the tropics, and how in almost every region their penetration failed. From 1824 onwards the whites entered the Australian tropics, partly as squatters and partly as agriculturists on the Queensland and Northern Territory coasts. From 1824 to 1849 the British planted small stations, such as Port Essington in North Australia, and South Australia founded and maintained the Northern Territory as a dependency from 1868 until in 1911, when the Commonwealth took control. From the sixties onwards Australia also saw the development of Northern Queensland by pasturing, agriculture and mines.

This tropical invasion took the usual course. The whites believed that it was impossible for them to work in the tropical climate, and they imported various coloured races which proved hotbeds for diseases that affected the whites in turn. From 1863 to 1891 Australians brought 46,000 Kanakas to Queensland, and from 1874 onwards the Northern Territory permitted the entrance of thousands of Chinese. Few people now realise that in 1876-7 the Japanese Government emphatically refused an official offer by South Australia for an extensive Japanese settlement in the Northern Territory, including free transport for the first 200 Japanese.

A Lost Opportunity.

This influx of coloured people to our continent had the same tragic results as in the West Indies and other parts of the world. We Australians, who had entered into possession of what might have been a marvellous biological laboratory of continental magnitude and free from the worst kinds of tropical sickness, brought in unhealthy types of coloured people who riddled the country and its white inhabitants with tropical disease. In the Northern Territory, during the seventies, white men and Chinese coolies died like flies, while in Queensland the "dreadful eighties" saw a Kanaka death rate four times as great as that of the white inhabitants, and a white mortality that became 50 per cent. greater than that of any other State. Yet, even in these circumstances, events showed the fundamental difference between Queensland and North Australia. In both regions pasturing and mining made progress, but while in Queensland the whites and Kanakas established sugar, cotton, fruit, and other tropical industries, in the Northern Territory with its seasonal rainfall, poor soil, isolation and pests, such as the white ant and rat, the whites and Chinese met with no success. The close of the century saw North Australia stagnant save for cattle, mining, and pearling, and for a plantation system of agriculture—as usual unhealthy—established on the Queensland coast.

A Scientific Invasion.

Yet, while the pre-scientific invasion failed in Australia as in other countries, a scientific invasion from 1900 onwards has made progress, as is the case in Panama and in Southern Florida, which latter is a moderately tropical region very like the Queensland coast. Under the much-criticised White Australia Policy the nation deported the Kanakas, and by a health campaign against hookworm, leprosy, malaria, and other diseases, made the health and vital statistics of Queensland as good, or better, than those of any other State. To the utter astonishment of the

scientists of all nations, we established a working population of 150,000 white people in North-Eastern Queensland—the largest population of working Nordics in any part of the tropics. There is, of course, the question of alien Italian penetration in the most northern sugar districts, and it is very significant that in these areas foreigners or naturalised subjects number no less than 43 per cent. The Sugar Committee of 1931 reported, however, that the flow of alien immigration had declined; that the problem was passing through a transitory stage; and that satisfactory communities would be evolved out of the communities in the far North. White Australians of British extraction have shown that they can do all the heavy labour in sugar and other industries, and before the depression they were bringing the costs of sugar production down towards the cost of production in coloured labour countries. In this respect, mechanical improvements will be of vast importance. In Florida and Jamaica I saw machinery which will eliminate almost all the hard manual labour in the sugar industry. While, however, this machinery will improve the prospects for white workers, it will spell stark naked tragedy for the wretched coloured peoples whom the white man has forced into one-crop industries.

Remarkable Physical Phenomena.

In 1924 a scientific investigation of certain Queensland towns disclosed remarkable phenomena. Contrary to all previous beliefs, white residents, even of the second and third generations, seemed to be healthy and strong. Tropical-born women averaged larger families than immigrant women from the cool temperate zone, and the most healthy people were those who did hard manual work. There remain two dangers in Queensland. First, the experiment is very new, and we are by no means certain of the continued effects of climate. Dr. Cilento considers that there is beginning to be a very definite type of North Queenslander or tropical-born Australian who moves slowly and conserves his muscular heat-producing energy in every possible way, but that this type is not lacking in muscular strength, while his endurance is equal in his own circumstances to that of the temperate dweller in his. Sir George Buchanan, in his great report on the Northern Territory, produced evidence to the effect that white labour there was from 10 per cent. to 35 per cent. inferior to that in the temperate zone.

The second danger in Queensland is that the white industries are uneconomic in the sense that their costs of production are far above world average, and that Australia is being forced to pay inordinately high prices for such products as sugar and bananas to allow the white population that standard of living which is essential if whites are to survive in the tropics. Yet, Queenslanders can justly argue that their industries are now no more uneconomic than most of the tariff-propped industries of temperate Australia. As Keynes and other economists confess, the tariff-mad and nationalistic nations are boxing themselves in water-tight economic compartments, and we must all face artificial industries and a lower standard of life.

Cattle-raising—A Probable Solution.

While the whites have succeeded in tropical Queensland, in the rest of North Australia, save in cattle, they have met with practically no success. It is a matter of sympathy that in the Northern Territory, for example, the figures of deaths, illegitimate births, serious crime, suicides, and drunkenness are far higher than those for any other division of the continent. Such figures are not necessarily due to the tropical climate, for isolation, a mixed population, poor diet, and frontier conditions take their toll from the unfortunate people. Nevertheless, it is significant that South Australia and the Commonwealth fruitlessly expended enormous sums of money in vain efforts to develop a huge area which now contains less than 4,000 whites. From 1911 to 1930 the Federal Government spent over £11,000,000, and in 1928-29 alone made a loss of £576,000, or about £150 per white person, while under Federal control the costs of working the Northern and Central railways

have exceeded the revenue by nearly 100 per cent. It is small wonder that American scientists, in a recent world survey, have pointed out the utter futility of Australia wasting vast sums in attempting to develop agriculture and close settlement in her North Coast lands of poor soil and uncertain monsoonal rains. The only real hope lies in the cattle country which runs across the continent from Queensland to Western Australia between the central deserts and the coastal regions. Here, on stock routes and water supplies, we should spend as much as we possibly can, and it is splendid to know that the motor transport unit, which the Federal Government is subsidising, may solve the railway problem, and is already reducing costs by 50 per cent.

Segregation of the Native Race.

Outstanding questions of North Australia are the aboriginal and half-caste problems. It is now generally recognised that we should try to segregate the blacks, where it is possible, for example, in Melville Island and Arnheim Land. As regards the thousands of aboriginals who have access to settled country, the best we can hope is to absorb them as the Americans have absorbed the Red Indians. It is interesting to note that a recent Vice-President of the United States was legally an Indian—a ward of the State. The Australian half-castes are now increasing at the rate of 800 per annum, and one believes that the Protector at Darwin is right in trying to marry these half-castes to one another, and the surplus girls to white people, rather than to force them back to the aboriginal camps.

Successful Tropical Settlement.

In conclusion, one would say that history and science provide the answer to those who ignorantly criticise our empty North and the policy of White Australia. The only parts of our tropics which any nation—white or coloured—can hope to settle closely are the coasts and highlands of Eastern Queensland, and here we have already planted successful white industries and a white population which is apparently teaching the most extraordinary and unexpected lessons to the whole world. The remainder of North Australia is at best a cattle country. We have poured out £17,000,000 in unsuccessful attempts to settle one portion—the Northern Territory. Agriculture, with coloured Chinese labour, has been an utter failure, and the Japanese very wisely refused our invitations when we invited them in. If, despite such a record, the Dean of Canterbury, or Dean Inge, or Mr. Beverley Nicholls continue their criticisms of our supposed selfishness, Australians might humbly ask them to visit the West Indies, and study, as I did recently, the tragic problems of race, health, and economics, which were created by the importation of negro slaves.

Scientific Research Demanded.

What is the practical lesson of these two addresses? It is that the Australian Governments of all parties should face their problems in the tropics, not as questions of politics, but of science, and that before more money is lost in attempts to plant white settlers and tropical industries they should prepare the way by careful scientific research. To take only one problem—that of agriculture in the Northern Territory—almost every one of the few soil analyses have been disappointing, and even black soil which I brought down from the Adelaide river flood plains proved deficient in potash. Yet, despite the advice of Sir George Buchanan, the Government, only a few years back, again attempted to foster by subsidy a one-crop peanut industry on soils which a later soil analysis proved unsatisfactory. We now know that adequate scientific work in the Northern Territory could have saved the nation a loss of millions of pounds, and the people of Australia have the right to ask that no more money be wasted without the most careful and impartial examination by highly-trained scientists.

PRODUCTION RECORDING.

List of cows and heifers officially tested by officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Book of the Australian Illawarra Shorthorn Society, the Jersey Cattle Society, and the Friesian Cattle Society, production charts for which were compiled for the month of October, 1934 (273 days period unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORN.				
MATURE COW (OVER 5 YEARS), STANDARD 350 LB.				
Lucky II. of Windella	J. Phillips, Wondai	14,152·58	592·29	Daisy's Westbridge of Glenthorn
SENIOR, 4 YEARS (OVER 4½ YEARS), STANDARD 330 LB.				
Springleigh Primrose 2nd	Moller Bros., Boonah	9,647·9	388·203	Red Knight of the Cedars
SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD 290 LB.				
Champion 12th of Oakvilla (365 days)	H. Marquardt, Wondai	14,717·15	595·498	Victory of Greyleigh
JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD 270 LB.				
Springleigh Buttercup 2nd	Moller Bros., Boonah	8,310·35	316·64	Red Knight of the Cedars
SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD, 250 LB.				
Euroa Carnation	H. L. Lindenmayer, Binjour	7,272·5	265·244	Swagman of Clonogan
College Granny 4th	Queensland Agricultural High School and College, Gatton	6,500·22	253·936	Duplex of Greyleigh
JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD, 230 LB.				
Lady Primrose 2nd of Blacklands	A. Pickels, Wondai	10,278·55	350·834	Fussy's Monarch of Hillview
College Buttercup 2nd	Queensland Agricultural High School and College, Gatton	6,475·18	333·449	Fussy's Kitchener of Hillview
Euroa Clorine	H. L. Lindenmayer, Binjour	7,174·75	265·599	Swagman of Clonogan
College Mayflower	Queensland Agricultural High School and College, Gatton	6,961·17	253·436	Premier of Hillview
Euroa Remona	H. L. Lindenmayer, Binjour	7,012·75	240·232	Swagman of Clonogan
College Molly 2nd	Queensland Agricultural High School and College, Gatton	5,543·99	237·021	Duplex of Greyleigh

JERSEY.

Mature (over 5 Years), Standard, 350 lb.

G. N. Diva	Cox Bros., Maleny	6,876·6	433·551	Retford Mendels Noble

Senior, 4 Years (over 4½ Years), Standard, 330 lb.

Langside Quip (365 days)	G. W. Young, Inverlaw	8,335·75	512·856	Masterpiece Yeribee of Brucevale
Kelvinside Idol Tidy	J. & R. Williams, Crawford	6,353·75	428·403	Kelvinside Fleurs Benedictine

Junior, 3 Years (under 3½ Years), Standard, 270 lb.

Oxford High Girl	E. Burton & Sons, Wanora	6,086·76	324·005	Trinity Ambassador
Trecarne Rosette 3rd	T. A. Petherick, Lockyer	4,839·47	270·558	Trecarne Golden King

Junior, 2 Years (under 2½ Years), Standard, 250 lb.

Langside Pattibelle	G. W. Young, Inverlaw	5,365·65	279·754	Masterpiece Yeribee of Brucevale
Brooklands Forward Lillian	Wallace Bishop, Kenmore	5,546·5	271·443	Forward of Brooklands
College Rhoda	Queensland Agricultural High School and College, Gatton	4,443·02	255·286	College Silverside
Langside Thelma	G. W. Young, Inverlaw	4,968·1	248·957	Masterpiece Yeribee of Brucevale
College Florette 2nd	Queensland Agricultural High School and College, Gatton	4,141·3	241·826	Burnside Renown

FRIESIAN.

Senior, 4 Years (over 4½ Years), Standard, 330 lb.

Ryfield Maggie 2nd	J. P. Larson, Miriam Vale	9,868·25	383·988	Ryfield Butterman 3rd
Ryfield Dinah 4th	J. P. Larson, Miriam Vale	8,832·	379·446	Ryfield Butterman 3rd

Senior, 3 Years (over 3½ Years), Standard, 290 lb.

St. Athans Honeysuckle	W. H. Grams, Upper Tent Hill, Gatton	8,637·98	326·6	Glenvale Dutch Oak

Junior, 3 Years (under 3½ Years), Standard, 270 lb.

Rockview Hope	J. P. Larson, Miriam Vale	6,576·	283·854	Noreens Dekol

Senior, 2 Years (over 2½ Years), Standard 250 lb.

St. Athans Double Dutch	W. H. Grams, Upper Tent Hill, Gatton	7,205·33	254·410	Glenvale Dutch Oak

AGRICULTURE ON THE AIR.

Radio Lectures on Rural Subjects.

Arrangements have been completed with the Australian Broadcasting Commission for the regular delivery of further radio lectures from Station 4QG, Brisbane, by officers of the Department of Agriculture and Stock.

On Tuesdays and Thursdays of each week, as from 3rd January, 1935, a fifteen minutes' talk, commencing at 7.15 p.m., will be given on subjects of especial interest to farmers.

Following is the list of lectures for January, February, and March, 1935:—

SCHEDULE OF LECTURES

BY OFFICERS OF THE DEPARTMENT OF AGRICULTURE AND STOCK, RADIO STATION 4QG, BRISBANE (AUSTRALIAN BROADCASTING COMMISSION).

Thursday, 3rd January, 1935—"Rose Culture," by H. Barnes, Director of Fruit Culture.

Tuesday, 8th January, 1935—"Some Notes of a Travelling Scholar in Plant Breeding," by Dr. L. G. Miles, Plant Breeder.

Thursday, 10th January, 1935—"Improving the Quality and Productiveness of Fruit and Fruit Trees," by H. Barnes, Director of Fruit Culture.

Tuesday, 15th January, 1935—"The Place of Plant Breeding in Agriculture," by Dr. L. G. Miles, Plant Breeder.

Thursday, 17th January, 1935—"The Trend of Agricultural Economics," by Hon. Frank W. Bulcock, M.L.A., Secretary for Agriculture and Stock.

Tuesday, 22nd January, 1935—"The Problem of Youth—The Call of the Land," by J. F. F. Reid, Editor of Publications.

Thursday, 24th January, 1935—"A New Deal for the Farmer," by J. F. F. Reid, Editor of Publications.

Tuesday, 29th January, 1935—"Frost Prevention by Orchard Heating," by H. Barnes, Director of Fruit Culture.

Thursday, 31st January, 1935—"Wheat in Queensland," by H. W. Ball, Assistant Experimentalist.

Tuesday, 5th February, 1935—"The Rural Revival in Britain—What it Means to the Australian Producer," by J. F. F. Reid, Editor of Publications.

Thursday, 7th February, 1935—"Grading Cotton," by R. W. Peters, Cotton Experimentalist.

Tuesday, 12th February, 1935—"Winter Legumes and other Fodders," by C. T. White, Government Botanist.

Thursday, 14th February, 1935—"Some Notes on Our Inland Pastures," by S. L. Everist.

Tuesday, 19th February, 1935—"Management of Paspalum Pastures," by C. W. Winders, B.Sc. (Agric.).

Thursday, 21st February, 1935—"The Cultivation of Lucerne," by A. E. Gibson, Director of Agriculture.

Tuesday, 26th February, 1935—"The Effects of Fertilizers on the Quality of Tobacco Leaf," by W. J. Cartmill, B.Sc.

Thursday, 28th February, 1935—"Snapping Cotton," by R. W. Peters, Cotton Experimentalist.

Tuesday, 5th March, 1935—"The Activities of Sheep and Wool Branch with Special Mention of the Farmers' Wool Scheme," by J. L. Hodge, Instructor in Sheep and Wool.

Thursday, 7th March, 1935—"Sheep Licks," by J. L. Hodge, Instructor in Sheep and Wool.

Tuesday, 12th March, 1935—"Winter Pastures," by C. W. Winders, B.Sc. (Agric.).

Thursday, 14th March, 1935—"Grape Culture," by H. Barnes, Director of Fruit Culture.

Tuesday, 19th March, 1935—"Some Remarks on Animal Nutrition," Part I., by E. H. Gurney, Agricultural Chemist.

Thursday, 21st March, 1935—"Some Remarks on Animal Nutrition," Part II., by E. H. Gurney, Agricultural Chemist.

Tuesday, 26th March, 1935—"Observations on Tobacco Fertilizer Trials," by W. J. Cartmill, B.Sc.

Thursday, 28th March, 1935—"Expanding our Export Trade," by J. F. F. Reid, Editor of Publications.

NOTICE TO SUBSCRIBERS.

SPECIAL AND IMPORTANT.

Under the Commonwealth Postal Regulations it is NO LONGER PERMISSIBLE to indicate the expiry of subscriptions with a BLUE CROSS on the first page of the Journal. So in the future that reminder will NOT appear.

The need for the strictest economy makes any other form of reminder at present impracticable. THE ONUS OF REMEMBERING THE DATE OF EXPIRY OF, AND RENEWING THE SUBSCRIPTION PROMPTLY IS, THEREFORE, PLACED ON EACH SUBSCRIBER.

As about 1,000 subscriptions expire each month, the cost of a postal reminder is, in present circumstances, prohibitive. Readers will, therefore, appreciate that fact, and will, no doubt, help us to retain their names on our mailing list by kindly noting the date of payment of their subscriptions and, on expiry, sending in their renewals at once.

Instead of just sending the annual subscription—one shilling—along, it is suggested that, when renewing, they do so for two or three years, or even a longer term. For instance, FIVE SHILLINGS would keep a name on our subscribers' register for FIVE YEARS.

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Readers renewing their subscriptions should USE THE ORDER FORM on another page, which should be filled in FULLY and CORRECTLY. Renewals by letter do not as a rule give the essential information, thereby causing unnecessary waste of time and much inconvenience. The Form is also our record, and orders which come by letter require special handling to adapt them to our card recording system.

When an address on the Order Form is not that to which the Journal has hitherto been sent, attention should be called to the new address, and the former address given. This assists us to identify subscribers, of whom we have many of the same name, often in the same district, as well as in different parts of the State.

Women subscribers should add to their names the word "Mrs." or "Miss," as the case may be. This is a constantly recurring omission, and its correction causes a lot of unnecessary labour in checking electoral rolls and other references. Wives and children of subscribers should apply in the subscriber's name, and so facilitate registration.

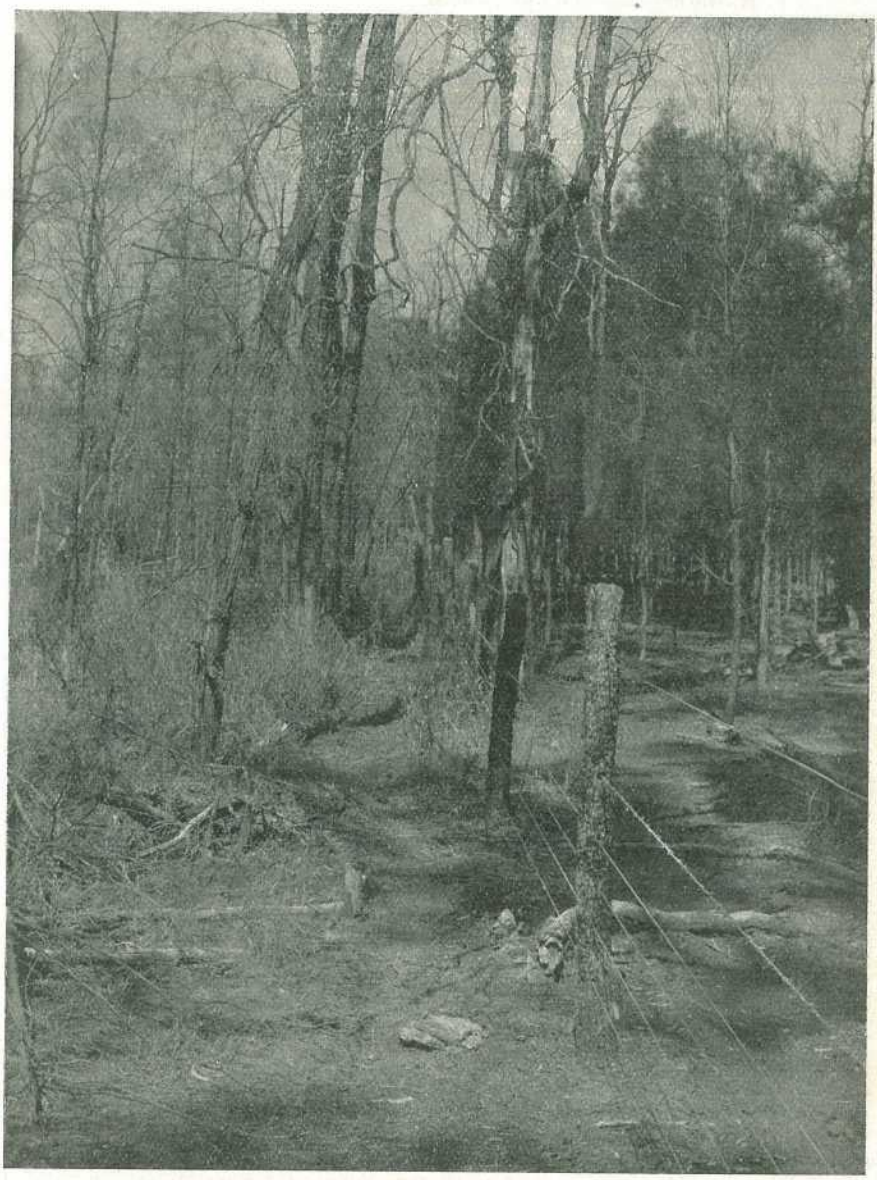

PLATE 317.
Stock-proof Fence and Ringbarking on a Selection in the Roma District.
[*Photo., J. A. Lunn.*

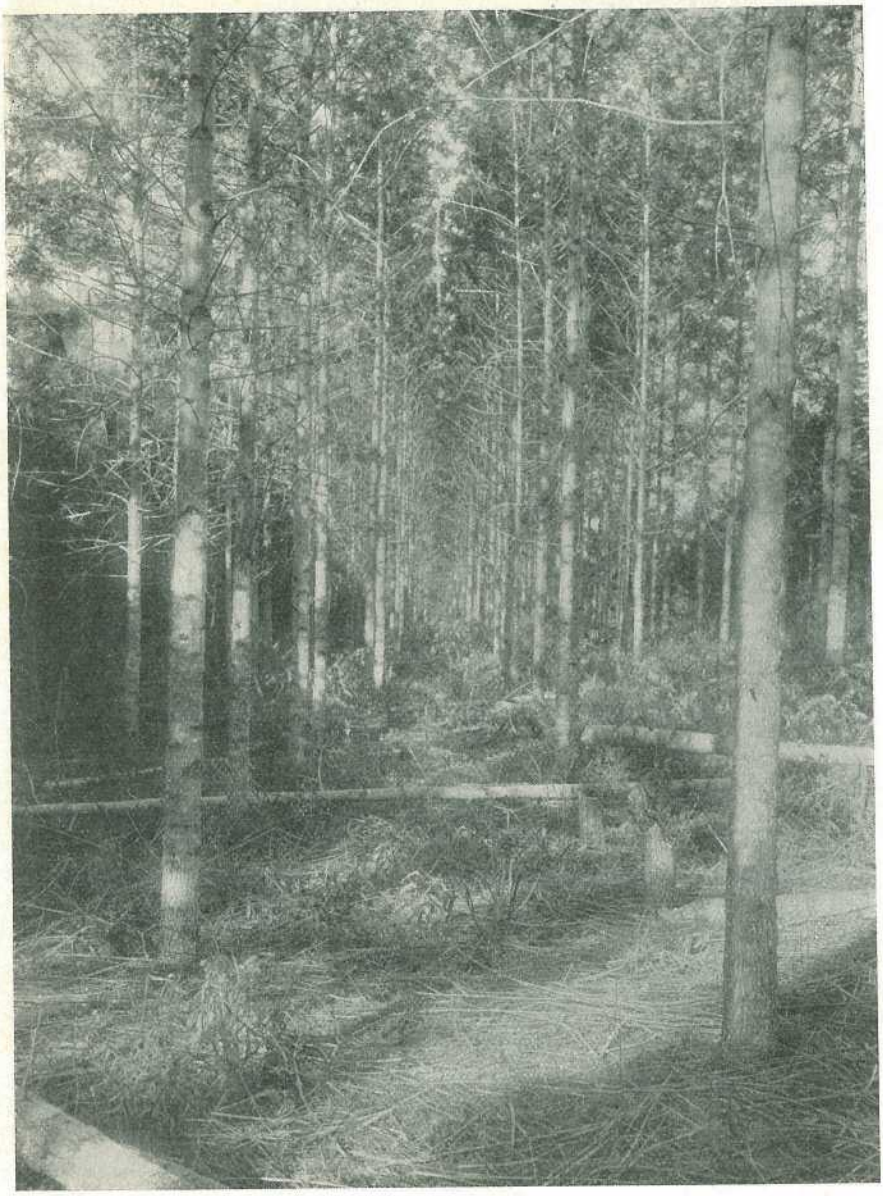

Plate 318.

Silky Oak in Plantation, showing First Thinning. Trees ten years from planting.

[*Photo., J. A. Lunn.*

PLATE 319.

A Queensland Kauri Pine Plantation, seventeen years old. This species makes a good plantation tree, and is used to the greatest extent permitted by seed supplies, which are difficult to obtain.

[*Photo., J. A. Lunn.*

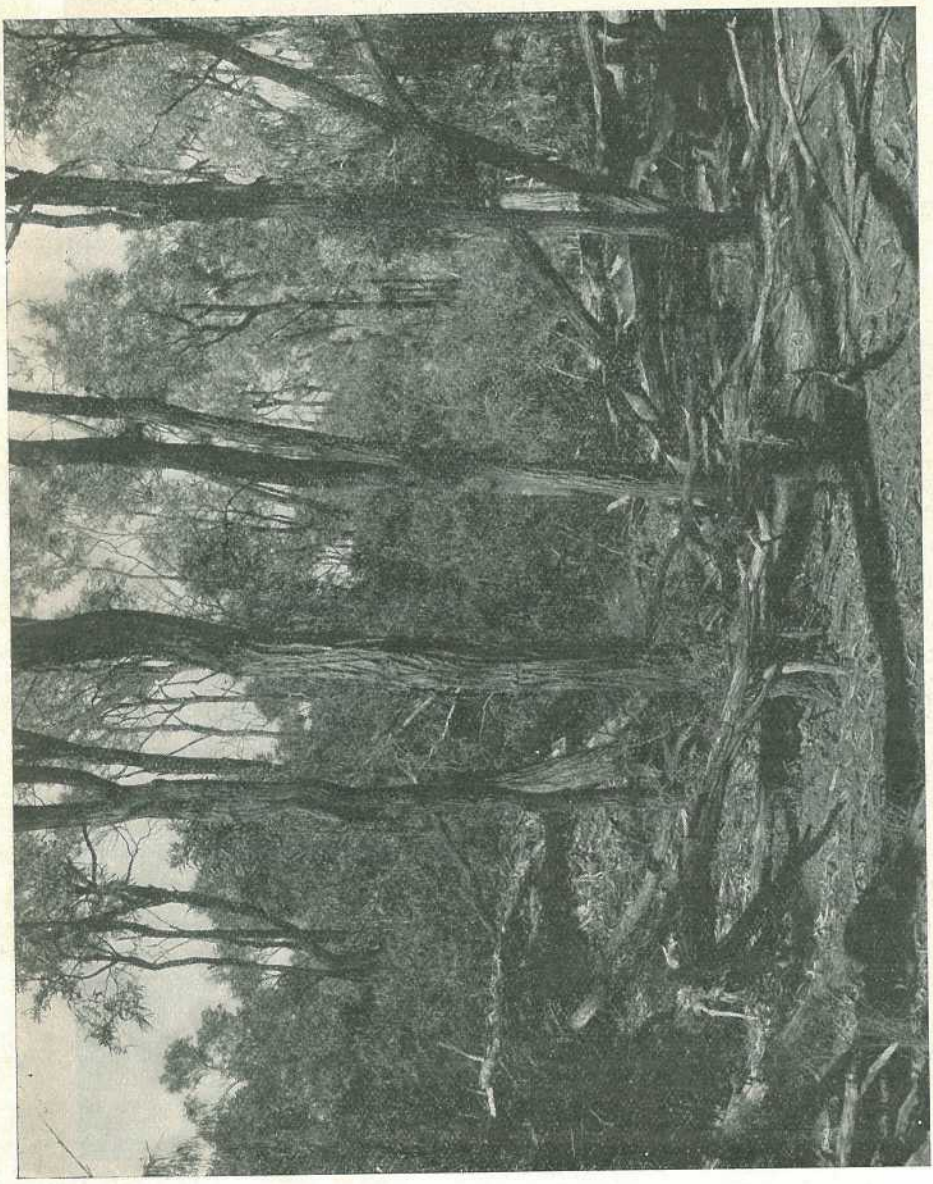

PLATE 320.—GREEN BRIGALOW AND BELAH COUNTRY, SOUTH-WESTERN QUEENSLAND.
[*Photo., J. A. Lunn.*

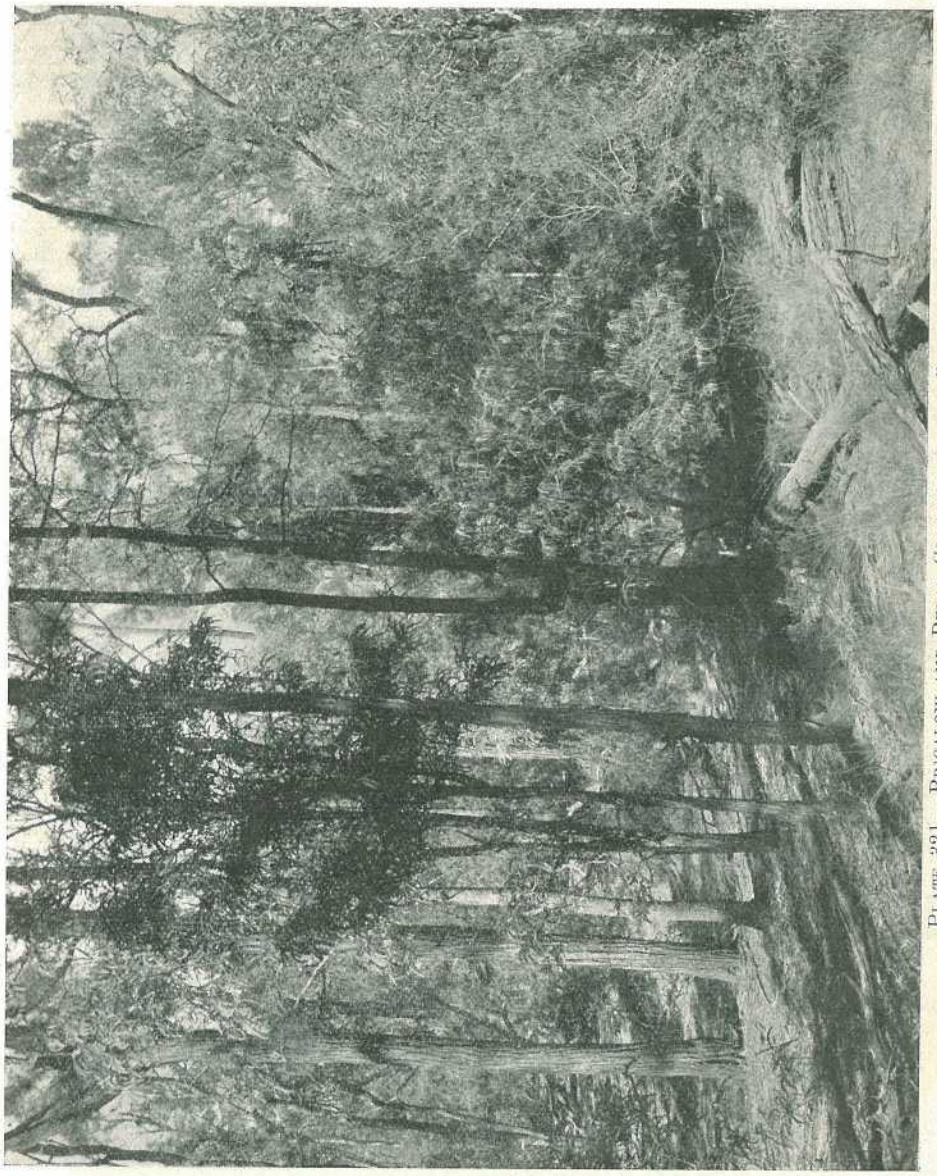

PLATE 321.—BRIGALOW AND BELAH COUNTRY, BEFORE RINGBARKING. [*Photo., J. A. Lunn.*

PLATE 322.—HEAVY COATING OF GRASS ON COUNTRY RINGBARKED TWO YEARS AGO, MARANOA DISTRICT.

[*Photo. by J. A. Lunn.*

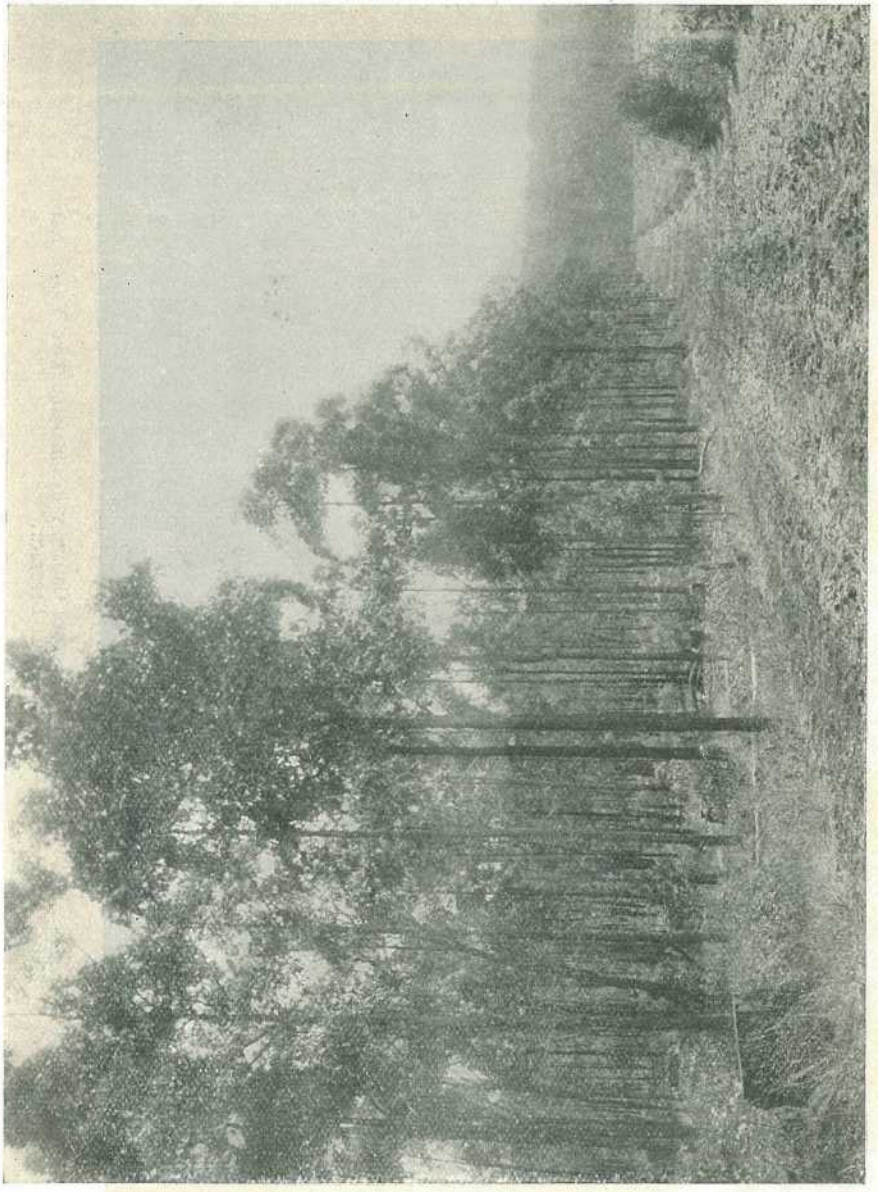

PLATE 323.—NATURAL REGENERATION OF IRONBARK (*E. paniculata*), SHOWING FIREBREAK.

[*Photo. by J. A. Lunn.*

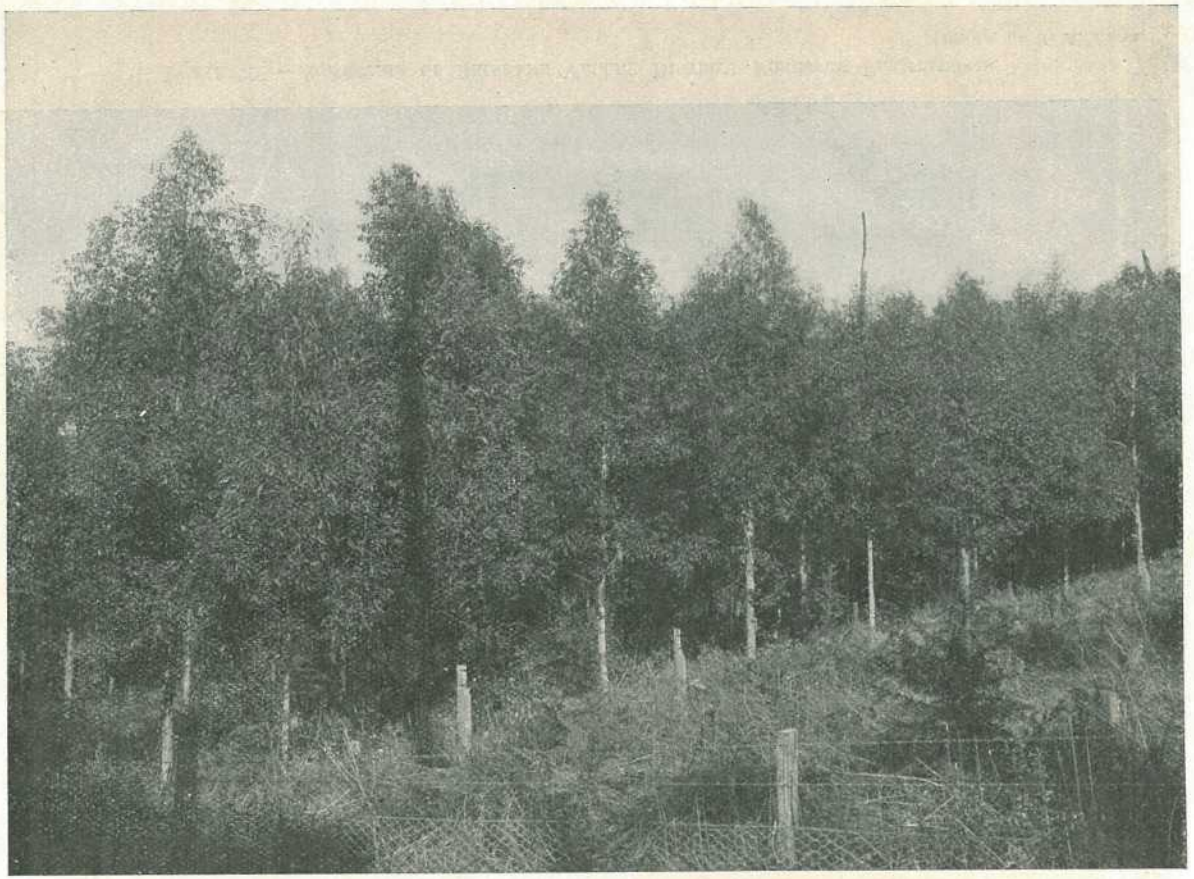

PLATE 324.—FORESTRY IN QUEENSLAND—PLANTATION OF TALLOWWOOD (*Euc. microcorys*) FOUR YEARS OLD.

[*Photo. by J. A. Lunn.*

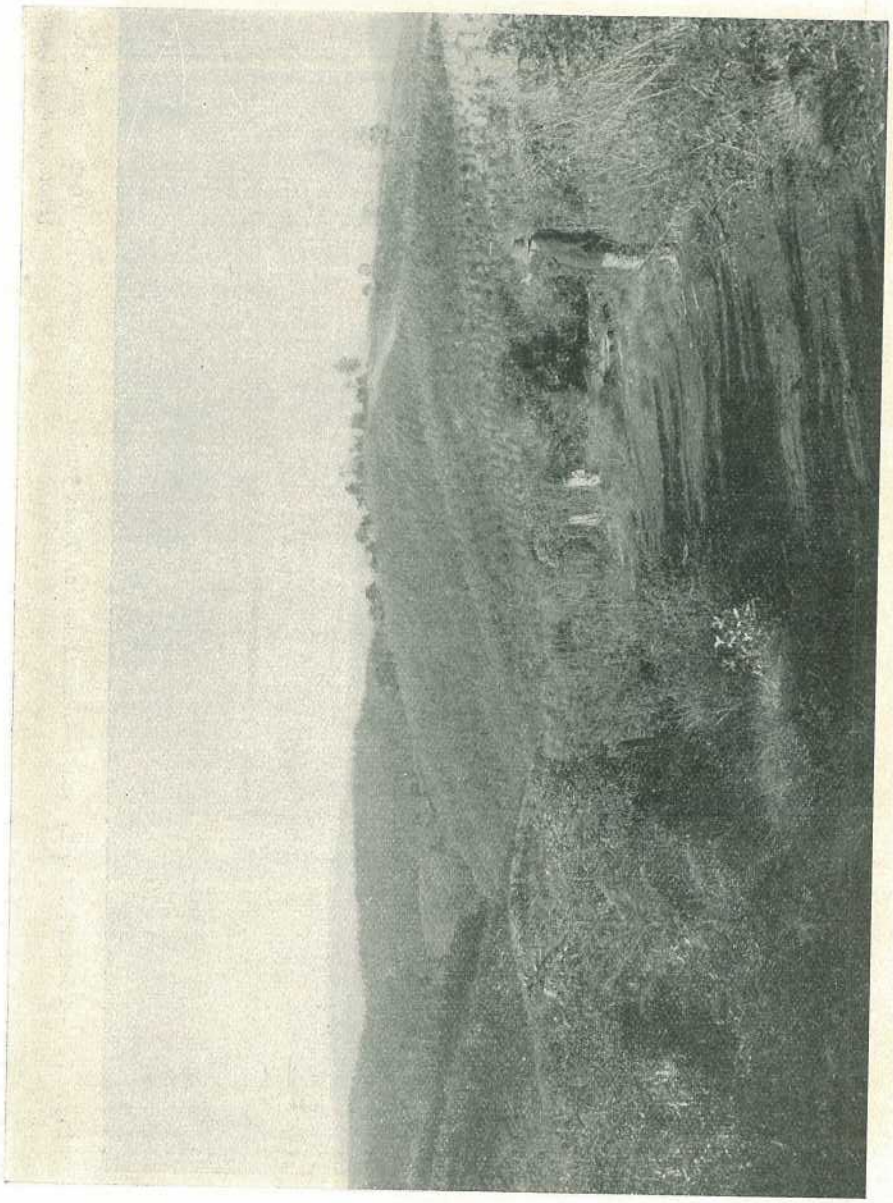

PLATE 325.—A SECTION OF BRISBANE VALLEY DISTRICT FORESTRY PLANTATIONS.
[Photo. by J. A. Lunn.

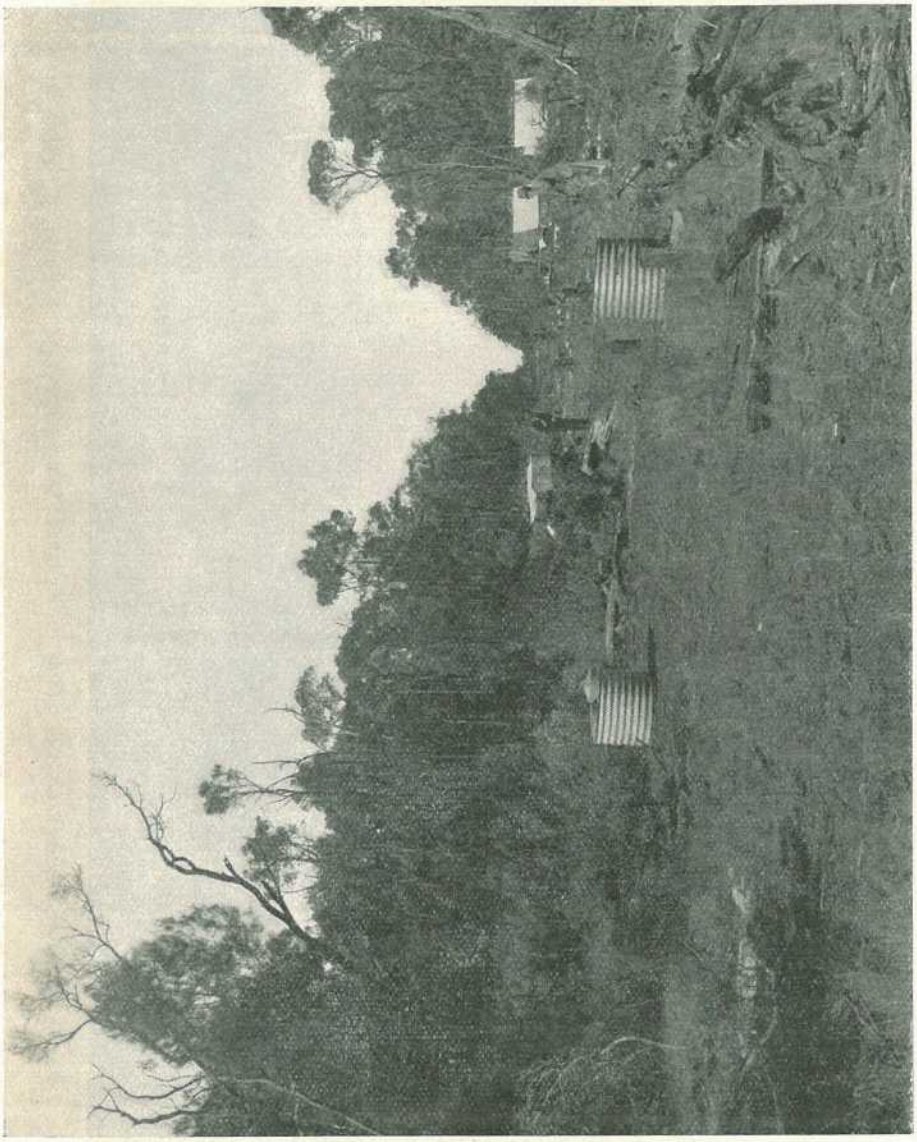

PLATE 326.—CLEARING LINE FOR A MARSUPIAL-PROOF FENCE THROUGH BRIGALOW AND BELAH SCRUB IN THE TARA DISTRICT. [*Photo. by J. A. Lunn.*

PLATE 327.—HOOP PINE PLANTING STOCK IN NURSERY, SUB-DEPARTMENT OF FORESTRY, QUEENSLAND.
[Photo. by J. A. Lunn.

PLATE 328.—YOUNG HOOP PINE PLANTATION, SEVEN YEARS OLD. [*Photo., J. A. Lunn.*

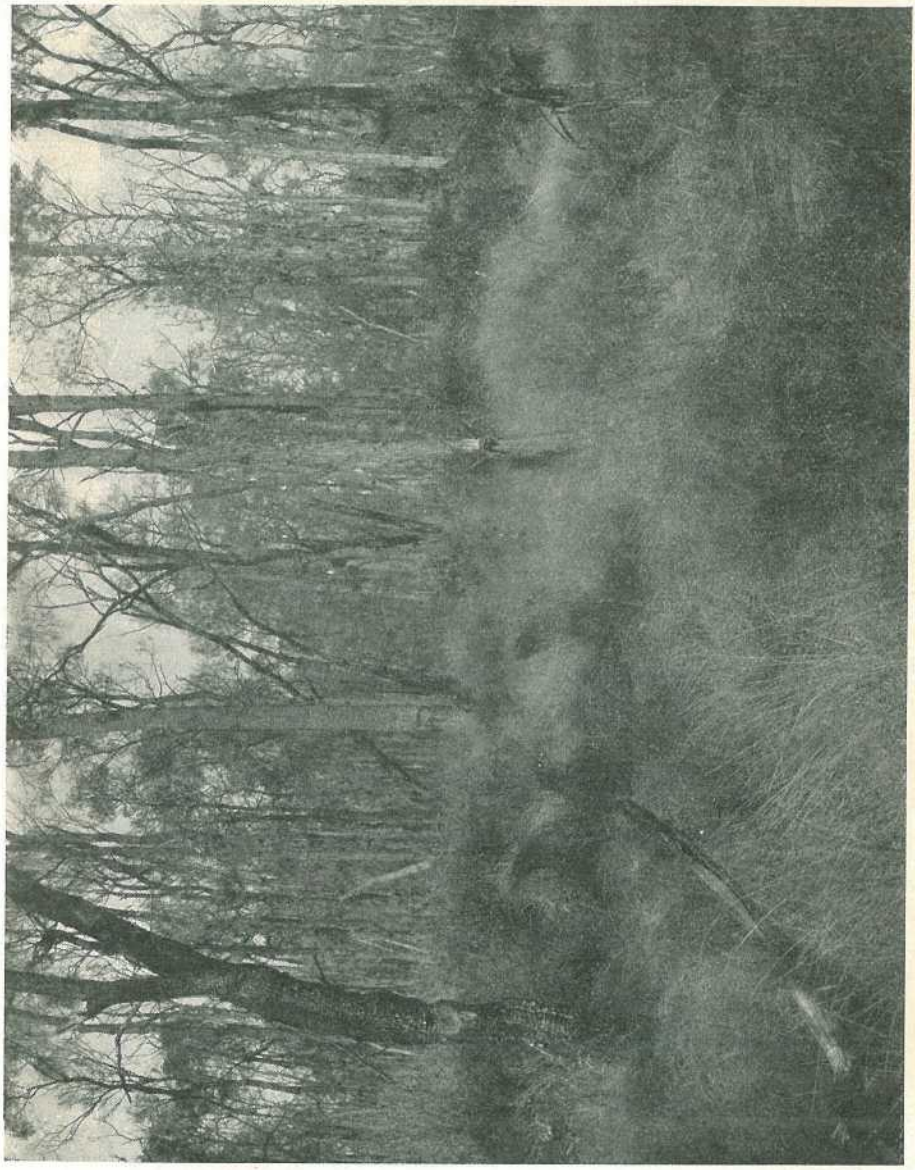

PLATE 329.—BRIGALOW AND BELAH SCRUB RINGBARKED EIGHTEEN MONTHS AGO NOW CARRYING A HEAVY COATING OF NATURAL AND NUTRITIOUS GRASSES.

[Photo., J. A. Lunn.

Answers to Correspondents.

BOTANY.

Replies selected from the outward mail of the Government Botanist, Mr. Cyril White, F.L.S.

Poisonous Plants Identified.

H.C. (Mackay)—Your specimens have been determined as follows:—

1. *Crotalaria* sp., a species of Rattlepod. All these plants are to be looked on with suspicion, although, generally speaking, our experience in Queensland is that stock rarely touch them in sufficient quantities to cause trouble.
2. *Lantana camara* var. *sanguinea*, the Red Lantana. Very abundant in parts of Queensland, and causes the trouble known as "Pink Nose," no doubt familiar to you.
3. *Trema orientalis*, a close ally of the Poison Peach or Peach-leaved Poison Bush. The present form grows into a medium-sized tree, and is very common in coastal localities. We have not heard of it causing trouble in any way, therefore do not think this plant can be looked on as the cause of the trouble in this case.
4. *Asclepias curassavica*, Red Head or Milky Cotton-bush. A very common weed in many parts of Queensland. It is poisonous, though, on the whole, our experience has been that stock rarely eat it in sufficient quantities to cause trouble.
5. *Clerodendron floribundum*. A shrub or small tree common in parts of coastal Queensland. We have not heard a common name applied to it. It is not known to be poisonous or harmful in any way.
6. *Glochidion Ferdinandi*. A small tree very common in coastal Queensland, particularly as second growth in paddocks. It is not known to be poisonous or harmful in any way. We have not heard a very distinctive local name for it.

Of the above plants Nos. 1, 2, and 4 come under suspicion, and, if possible, should be eradicated from the property.

"The Tree of Heaven."

C.B. (Pine Mountain)—

The shrub contained neither flowers nor seeds, but we think there is no doubt it represents *Ailanthus glandulosus*, the "Tree of Heaven." The bark and roots contain a poisonous principle and this probably extends to the leaves; although the tree is very common in cultivation and has run out in some places, we can find no reference, either in Australia or abroad, to the leaves having proved harmful or poisonous to cattle. In view, however, of the known poisonous character of the plant it would be just as well to eradicate it from places to which cattle have access. The poisonous properties of the plant are said to be a cause to a great extent of chronic gastritis. Vomiting, pains in the back, difficult urination, and persistent constipation are said to be features of Ailanthus poisoning.

Flame Tree.

E.H. (Childers)—

The specimen represents the Flame Tree (*Sterculia acerifolia*), a native of Northern New South Wales and coastal Queensland. It is moderately common in come coastal rain forests or vine scrubs, and when one is at a height such as Tamborine Mountain and the McPherson Range, looking down on the valleys at this time of the year one can see bright patches of colour where this tree is in flower. It is certainly an exceedingly handsome tree, but it varies a lot in its flowering qualities. Some trees at the present time of the year are one mass of flowers, others have somewhere about an equal proportion of flowers and leaves, and others are bearing practically all leaves and very few flowers.

Wild Verbena.

INQUIRER (Brisbane)—

Your specimen represents *Verbena venosa*, commonly known in Queensland as the Wild Verbena, a native of the Argentine, now a common naturalised weed in many parts of Queensland and New South Wales. It seems to have been much on the increase in Queensland during the last two or three years, and along many roadsides and railway lines we have seen it crowding out other plants and grasses. If it is invading the native pasture in the Burnett district it is certainly serious, as it is a very dominant weed and would eventually run out the grasses and pasture plants—practically speaking, ruining the paddocks.

Plants from Winton District Identified.

R.C. (Winton)—

1. *Sporobolus actinocladus*, a common grass in parts of Western Queensland. We have not heard a common name applied to it.
2. *Goodenia glauca* (?). Better material required to be certain. Species of Goodenia are quite common in Queensland, both on the coast and inland. They are probably quite useful herbs in the mixed native pasture, though we cannot say we have actually seen stock eating them to any extent.
3. *Chloris scariosa*. One of the Star grasses or Windmill grasses. A very pretty species, though we have not heard a distinctive name given to it.
4. *Capsella Bursa-pastoris*, Shepherd's Purse. We note you say that this plant has just appeared in your locality. It is very common in Queensland, but mostly occurs as a farm weed. It belongs to the family Cruciferae which contains the Turnips and Mustards, and like other members of that family, if eaten in quantity by dairy cattle, it taints milk very badly.
5. *Abutilon* sp., a plant of the Mallow family. The genus Abutilon is a fairly large one in Queensland, and the members are rather difficult to determine except with very complete material. The genus, we think, is rather in need of revision.
6. *Bassia* sp., Gidgee Prickly Saltbush.
7. *Euphorbia Stevenii*, Bottle Tree Caustic. This is generally regarded as poisonous, though so far as we know actual feeding tests have not be carried out with it. The characters of Euphorbia poisoning as recorded by practical stockmen, both in Queensland some of the other States, are that the head and neck of affected animals swell very considerably, and if this swelling is pierced an amber-coloured fluid exudes. If pierced in time the life of the animal is usually saved.
8. *Helichrysum podolepideum*. A fairly common weed in parts of Western and Central Queensland. It is not known to be poisonous or harmful in any way.
9. *Ptcrigeron adscendens*. This and an allied plant have been suspected of poisoning stock, but no feeding tests have been carried out with them. Chemical analysis in most of these cases yields very little result, and the only way of finding out whether these plants are poisonous or not is by means of feeding tests.
10. *Capparis nummularia*, a plant of the Caper family. It is not known to be poisonous or harmful in any way. I have never heard it called Fuchsia Bush. It is a pity to call it Fuchsia Bush as this confuses it with another plant—namely, *Eremophila maculata*, with red, or more rarely yellow, spotted flowers. This latter is probably familiar to you. It is undoubtedly poisonous, containing a prussic acid yielding glucoside, but like other prussic acid yielding plants it is sometimes eaten in large quantities without any ill effects following. The effects of plants of this character are most marked on tired or travelling stock.
11. *Scaevola* sp. Could you send better material of this species, pressed if possible? We do not seem to have it in our collections.
12. *Swainsona Burkei*, Ladies' Pockets. Another interesting plant. Would it be possible to send fruiting material of this?
13. *Trichodesma zeylanicum*, Kangaroo Bush. We have never seen stock eat this, although they may nibble at it at times. The plant has been suspected of being poisonous, but we think on insufficient evidence.

Chaff Burr.

INQUIRER (Winton)—

The specimen represents *Achyranthes aspera*, the Chaff Burr or Prickly Chaff Flower, a weed widely spread over tropical and sub-tropical parts of India, the Malayan region, Australia, and the islands of the Pacific. It is quite common in parts of Queensland and ranges from the sea beach to the far interior. Though its prickly fruits seem to lend themselves to distribution, we cannot say that we have seen the plant anywhere as a serious pest. In India the plant is looked upon as highly medicinal, being used in the treatment of various diseases. The leaves, like those of other members of the Amaranth family (Amarantaceæ) in the East, are sometimes used as greens. The plant does not possess any poisonous properties and would probably be eaten by stock, although we have had no experience with it in this direction.

Plants from Cairns District Identified.

J.A.H. (Cairns, N.Q.)—Your specimens have been determined as follows:—

Flannel Weed, *Pterocaulon cylindrostachyum*. The name Flannel Weed is mostly applied in North Queensland to a rather different plant—a species of Sida, namely *Sida cordifolia*. We know of no economic uses for either of them except that the Sida plant is said to be readily eaten by stock, although the numerous hairs with which it is covered might cause digestive troubles.

Scented Weed, *Pterocaulon glandulosum*. We note what you say about this plant being a possible repellent for insects. See notes under next specimen.

Camphor Weed, *Hyptis suaveolens*. A very common weed in North Queensland, a native of tropical America. It was first noticed about Townsville some twelve years or so ago, but is now very abundant through the whole of the North. The stems and leaves are sometimes strewn around themselves by fishermen, who state that the plant has a definite value for keeping away the attacks of sand flies, mosquitoes, and other insects. If the oil were distilled from this plant, it would probably have somewhat the effect of citronella and be merely a repellent. We do not know that it would have any definite lethal properties; this could only be tried by experiment.

Native tree, said to be quite ornamental and good for bees, is *Persoonia falcata*, one of the Geebungs.

Corky Bark, *Coelospermum reticulatum*, a native tree very common in many places, widely distributed in Queensland, but for which we have not heard a definite local name.

Yam, *Dioscorea bulbifera* var. This we think is the common ornamental yam grown in Queensland. Have you ever tried eating them? We once wrote to Mr. Burkill, when he was Director of the Botanic Gardens at Singapore. He is a great authority on yams and we asked him about the varieties of *Dioscorea bulbifera*. He said they varied very considerably in regard to their edible qualities from pleasant to dangerous. Cutting the yams open and seeing if they turn brown quickly or not he regarded as quite a good sign. When in doubt his advice was to cook in small quantities and taste discreetly.

Perennial Rye.

J.M.C. (Condamine)—

The specimen has been determined as the Perennial Rye (*Lolium perenne*). This, we think, is undoubtedly the best of the Rye Grasses owing to its perennial character. So far as our experience in Queensland goes, however, it does not seem to have succeeded outside of cultivated areas. However, we think it well worth trying with the Burr Trefoil and White Clover on your box and sandalwood country. The addition of the superphosphate you are using should certainly increase the clover and trefoil content of the pasture. Did the grass grow through last summer with you or did it die out and come again this year? Even the true perennial strains of Rye Grass, we are inclined to think, may die out in the Queensland summer, particularly when the plants are pastured, although they may come again the following season. Have you tried the perennial strain of Prairie Grass (*Bromus marginatus*)? Seeds of this and the Rye Grass are best sown during the autumn months.

Gympie District Plants Identified.

E.R.L. (Lagoon Pocket, via Gympie)—

Your specimens have been identified as follows:—

1. *Medicago denticulata,* the Burr Trefoil, a very valuable winter and early spring fodder. Stock seem to prefer the plant when it is dying off rather than when it is green and luxuriant, but even the dried plant covered with its little seed-pods is quite nutritious. The burrs that follow the seed-pod are rather objectionable in the belly wool of sheep, but the good qualities outweigh the bad.
2. *Solanum nigrum,* the Black Nightshade, called "Blackberries" by children. The plant, however, is not related in any way to the true Blackberry. The green fruits contain a poisonous alkaloid, solanin, which tends to disappear as the fruits ripen up. Hence the ripe fruits are freely eaten by children without any ill-effects following.
3. *Stachys arvensis,* commonly known as Stagger Weed or Wild Mint. It is not to be confused with the Wild Mint that has attracted so much attention in the Press of recent years, and is a bad weed on parts of the Darling Downs. The present plant, as its name indicates, causes "staggers" or "shivers" in working stock. Ordinary paddock or resting stock, however, feed on the plant with impunity, and for dairy cattle, calves, &c., it is quite a good fodder.
4. *Silene gallica,* French Catch-fly, a native of Southern Europe, now a common naturalised weed in most warm temperate countries.
5. *Erythræa australis,* Centaury, a plant of the Gentian Family (*Gentianæ*); used by many people as a tonic.
6. *Euphorbia peplis,* Spurge. The milky sap that this plant contains is sometimes used for drying up sores, and is said to have curative properties.
7. *Trifolium procumbens,* Hop Clover. An annual Clover; a native of Southern Europe now naturalised in most warm temperate countries. It is moderately common in Southern Queensland during the winter and spring months, dying out on the approach of summer.
8. *Striga parviflora.* Plants of this genus are mostly parasitic on grasses. Some of the species are quite common in Queensland as parasites of sugar-cane.
9. *Trifolium glomeratum,* Cluster Clover. One of the best of the annual Clovers and worth encouraging.

W.G.B. (Amamoor, Mary Valley Line)—

1. *Fumaria officinalis,* Fumitory. A common European weed now common as a naturalised alien in most temperate countries.
2. *Chenopodium triangulare,* Fish Weed, a native plant of the Saltbush Family. It is a very common weed in many places. Stock seem to eat it readily enough when it is dying off and made into hay, though they do not eat the growing plant very much as a rule. It is said to be quite good fodder, but gives a peculiar fishy flavour to milk and cream; hence the local name.
3. *Richardsonia brasiliensis,* a native of South America. It is sometimes called Mexican Clover, though it does not belong to the Clover Family, and is indeed botanically far removed from them. In other countries it has been highly spoken of as a fodder, but our experience in Queensland is that stock practically never touch it. It is rather a bad weed in some of the fruit farms on the North Coast Line.
4. *Rumex Brownii,* Native Dock.
5. *Apium leptophyllum,* commonly called Wild Carrot or Carrot Weed. It is eaten by stock, but gives a strong flavour to milk and cream.
6. *Chenopodium carinatum,* a strong-smelling weed for which we have not heard a common name.
7. *Anagallis arvensis,* the Scarlet Pimpernel, a common European weed now abundant in Queensland and the southern States. It is recorded as poisonous, but is mostly left untouched by stock. Some years ago, however, we received a number of seeds from the paunch of a cow that had been poisoned at Buderim Mountain, evidently through eating this plant. Dr. Gilruth has also recorded poisoning of sheep in Victoria through it.
8. *Stellaria media,* Chick Weed.

Galvanised Burr.

A.E.G. (Brisbane)—

Galvanised Burr (*Bassia Birchii*) is a native of Western Queensland and Western New South Wales. It is not an introduction, but has spread of recent years to an alarming extent especially along stock routes and in heavily stocked country. This is due to the grasses and more palatable herbage being eaten out, leaving this burr to reproduce freely. It sets an enormous quantity of seed, starting to seed at a very early stage and continuing till the end of its life. A plant probably lasts for two years, perhaps a little more. The burrs are spiny, a burr is borne in practically every leaf axil, and each contains a single seed.

The only method of eradication that has been practised successfully so far as we know is the costly one of hoe chipping. We are rather doubtful as to whether arsenical and other sprays would have very much effect on the plant, and their use in ordinary pastoral country is always attended with some risk. The plants, we think, are very brittle; perhaps if you are acquainted with them you could think of some mechanical means of control.

Plants and Shrubs Suitable for the Hughenden District.

H.C. (Brisbane)—

Following is a list of shrubs and other garden plants suitable for the Hughenden district:—

Most of the summer annuals, provided water is available, should do very well there, particularly hardy plants such as zinnias; in fact, the only ones that would probably be difficult to grow are asters, and unless unlimited attention can be given to these, their cultivation, we think, would be hardly worth worrying about. Of perennial flowers, probably the best to grow would be gerberas. The perennial calliopsis or coreopsis would be excellent, and would probably grow almost like a weed.

Of shrubs, the best type to grow is something subtropical. The various sorts of acalyphas should do quite well, although, unless in protected situations, they might be a bit tender during the winter months. Here is a list:—

Abutilon; any varieties.

Franciscea; flowers blue, turning white.

Crotalaria (Bird Flower).

Hibiscus. There is a multiplicity of varieties of these, and they are probably about the best things to grow as shrubs in the Hughenden district.

Jasminum. Several Jasminums would do. Probably the best would be *Jasminum grandiflorum.*

Lagerstræmia; any of these would do.

Lasiandra; worth trying.

Murraya.

Oleanders. A great range of these in bright colours can be obtained. They are among the best of the flowering shrubs for the Hughenden district.

Ochna; yellow flowers followed by black fruits seated on a bright red receptacle.

Frangipanni; both the red and white varieties would do well there.

Rhaphiolepis; Indian Hawthorn.

As regards climbers, the best plants would probably be the Bougainvilleas. If your friend has time in passing through it would pay him to visit the Botanic Gardens at Townsville, and have a talk with the Curator of the Gardens, Mr. Johnson, who might be able to supply him with some of the plants.

Milk Thistle.

H.A.J. (Ayr, N.Q.)—

The specimen represents the Sow Thistle or Milk Thistle (*Sonchus oleraceus*), a species of thistle widely distributed over the warm temperate and tropical regions of the world. In Java the thistle is commonly used as a herb, the leaves being steamed and eaten with rice. In Queensland the milk thistle is much prized as green feed for caged birds. It is also said to have valuable tonic properties for horses, and is commonly much sought after by trainers on this account.

The Date Palm.

INQUIRER (Brisbane)—

Date Palms can be propagated either from seeds or suckers. Seedling plants come up quite freely in Queensland, often accidentally, and in some cases produce quite good dates. The male and female flowers in the date, however, are borne on distinct plants, and if you want to be certain of the sex, propagation must be from suckers. Unfortunately, the suckers do not root too readily, and even with a good deal of care there is always a certain number of losses; in fact, some authorities state that it is impossible to grow dates from suckers without a 50 per cent. loss. One could render the planting more satisfactory by banking up the earth around the sucker and inducing it to form roots while still on the parent plant. To ensure the best dates, the female flowers must be hand-fertilized, or at least partly hand-fertilized. This is usually done by opening the nearly ready male spathe, taking out a few male flowers, hanging them among the females, allowing them to open and the wind to scatter the pollen.

Shelter Trees.

J.L. (Goomeri)—

Some of the pines are good trees to plant as shelter for the cattle. Some of the true pines such as the Insignus Pine (*Pinus radiata*) or Long-leaved Pine (*Pinus longifolia*) should suit your purpose. Both these species are stocked by leading nurserymen. A pine that the Forestry Department is planting extensively at the present time, and which they say is giving good results, is *Pinus tæda*, the Loblolly Pine. Another tree that would do well is the Torulosa Pine (*Cupressus torulosa*). These may be purchased from nurserymen, either as seedling plants or plants raised from cuttings. The latter are more expensive, and for your purpose the seedling trees would suffice. This pine varies a little in shape, and if trees of a uniform character are desired it is better to get them raised from cuttings. The plants could be put in at the present time, although it is rather late. Get in touch with the Secretary, Sub-department of Forestry, Department of Public Lands, Brisbane, who might be in a position to supply you at a reasonable rate with Tæda or Loblolly Pines from their nearest nursery.

Button Burr.

A.C.W. (Capella, C.Q.)—

The specimen is the Button Burr (*Sida platycalyx*), a native of the Northern Territory, Central Australia, and parts of Western Queensland. We have from time to time received samples of this disc-like burr taken from wool received from Western Queensland. So far as we know, the burr is not growing naturally in your district, but if it were introduced it might become a bad weed. Fortunately, however, so far it has not shown any great tendency to spread, because, though it must be present in the wool of sheep from the far West, it does not seem to have spread east of the far western parts of the Warrego and Maranoa districts.

Ellangowan Poison Bush.

C. (Wandoan, Q.)—

The specimen has been identified as *Myoporum deserti*, the Ellangowan Poison Bush, a very common shrub in parts of Queensland. It was suspected for many years as a plant poisonous to stock, and recent feeding tests carried out at the Glenfield Veterinary Research Station, New South Wales, proved definitely the poisonous nature of the plant. Acute constipation and inflammation of the digestive tract are features of Myoporum poisoning. Most of the cases of trouble from this plant that come under our notice occur in travelling stock.

Shepherd's Purse.

C.McG. (Brisbane)—

The specimen forwarded represents *Capsella Bursa-pastoris*, the Shepherd's Purse, a common European weed now naturalised in most temperate countries. It is a very common weed in Southern Queensland. It is not known to be poisonous or harmful in any way, but like most members of the family *Cruciferæ* would taint milk very badly if eaten by dairy cattle to any extent.

General Notes.

Staff Changes and Appointments.

Constables W. Borghardt (Tewantin) and J. Kann (Kilkivan) have been appointed also Inspectors under the Slaughtering Act.

Messrs. W. Miller and W. Irwin, gatekeepers at the Buchan's Point Toll Gate and Third Beach Toll Gate, Cairns-Port Douglas road, have been appointed Honorary Rangers under the Native Plants Protection Act.

Miss M. A. Lyle has been appointed Assistant Cane Tester at the Kalamia sugar Mill as from 30th October, vice Mr. H. McAntee, resigned.

The Officer in Charge of Police, Malanda, has been appointed also an Acting Stock Inspector at that place.

Messrs. F. C. Coleman (Dairy Inspector, Pittsworth) and W. Dixon and H. J. D. McBean (Stock Inspectors at Goondiwindi and Millmerran) have been appointed also Inspectors under the Diseases in Plants Acts.

Sergeant W. Peters, Thursday Island, has been appointed also an Inspector under the Slaughtering Act.

Mr. J. A. Murray, Police Magistrate, Maryborough, has been appointed Chairman of the Mount Bauple and Maryborough Local Sugar Cane Prices Board, vice Mr. J. M. Bracewell, Police Magistrate, Gympie.

Acting Sergeant A. B. Brown (Biggenden) and Police Constables P. Byrne (Adavale), W. J. Crohau (Coomera), J. E. Wilson (Port Douglas), F. R. Nolan (Miriam Vale) have been appointed also Inspectors under the Slaughtering Act.

The Officer in Charge of Police at Cooyar has been appointed also an Acting Inspector of Stock at that place.

Messrs. H. Valentine (Bourbon Estate, South Bundaberg), W. G. Smith (Millbank, West Bundaberg), and A. Howe (Perry street, North Bundaberg) have been appointed Honorary Rangers under the Animals and Birds Acts.

Mr. A. P. Donnelly has been appointed Canegrowers' Representative on the Farleigh Local Sugar Cane Prices Board, vice Mr. H. G. Mulherin, resigned.

Messrs. A. R. Betts (Boonah) and R. J. O'Sullivan (Albion, Brisbane) successful candidates at the recent examination for Stock, Slaughtering, and Dairy Inspectors, have been appointed Inspectors under the Diseases in Stocks Acts, the Slaughtering Act, and the Dairy Produce Acts, Department of Agriculture and Stock.

Acting Sergeant W. R. Hennessy (Goombungee) has also been appointed an Inspector under the Slaughtering Act.

Messrs. Ross Nott (North Adelaide) and A. L. Clay (Bondi, N.S.W.) have been appointed Government Veterinary Surgeons, Department of Agriculture and Stock.

The Price of Bananas.

Queensland banana-growers are acutely conscious of the low prices prevailing for their fruit on the local and Southern markets, remarked the Minister for Agriculture and Stock (Hon. F. W. Bulcock, M.L.A.) recently. He had asked for a report on the matter, and it appeared that the large area which had been planted up in New South Wales and now in bearing, was chiefly responsible for such a big increase in production. It did not appear likely there would be any improvement in prices in the immediate future, for we were about to enter our season of heaviest production. A study of the daily market reports in recent weeks showed that while reasonable prices were being returned for the higher grades prices for the minimum grade were very poor. One solution of the difficulty was for growers to concentrate on the production of higher grades. The Director of Fruit Culture (Mr. H. Barnes) had advised that if growers adopted a more intense system of pruning of bunches by removing the bottom two or three hands soon after the bunches were thrown, the size of the remainder of the fruit on the bunches would be correspondingly increased.

At present growers discarded the bottom first, and sometimes the second hands of most bunches at the packing-shed, because the fruit on such hands did not come up to the minimum size permitted to be marketed. It was sound cultural practice to prune any fruit tree with the object of getting better fruit, and at the present time particularly there was every reason why this rule should be applied also to bananas and the useless bottom hands cut away from the bunches at an early stage of growth, and the plant food which would ordinarily be used in the development of small fruit which would later be discarded directed into the upper hands of the bunches to produce larger fruit there.

In Memoriam.

CHARLES ROSS, F.R.H.S.

Mr. Charles Ross, one of the best known identities in the agricultural and horticultural life of the State, died on 2nd November. Mr. Ross, who was seventy-nine years of age, first learned the principles of horticulture in Yorkshire, England. He made further studies in temperate fruit culture in the open, and in tropical subjects under glass at leading establishments in the British Isles. When he landed in Brisbane, in 1878, he was engaged by the late Mr. Walter Hill, curator of the Botanic Gardens, as plant propagator. He later proceeded to the Darling Downs, where he designed, planted, and conducted extensive improvements in the orchards and pleasure grounds at Canning Downs and Strath Elbess, and was in charge of the first wheat experiments by the late Professor Shelton, at the former place. When the Government acquired the Hermitage State Farm, he was appointed the first manager in 1897, and during the first four years over 400 varieties of cereals were under observation. He was probably the first to discover canary grass (*Phalaris bulbosa*) growing on the Darling Downs. This grass is now recognised as among our best pasture plants, and extensive swards of it have been established, especially in the Southern States, where it has won a high reputation among stock owners. In 1901 he became manager of the Westbrook State Farm, where special features were made of fruit and vegetable culture. Mr. Ross commenced his last appointment in the Government service as Instructor in Fruit Culture in 1910, from which position he retired in 1921, having reached the age limit. In his capacity as Instructor in Fruit Culture his duties brought him into close contact with people throughout the State, and as his visits to the country frequently synchronised with the holding of local shows, at which his services as judge were eagerly sought, he became one of the best known experts of the Agricultural Department. For many years he also officiated as judge in the fruit and vegetable sections of the Royal National Exhibitions, Brisbane. In his younger days Mr. Ross was a familiar figure in the cricket fields of the Darling Downs. He was a member of the old Zingari Club in Warwick in the eighties and early nineties, and was then regarded as one of the finest wicketkeepers in the State. His passing is deeply regretted.

Vegetables for Export—New Bags must be Used.

Advice has been received from the authorities in New South Wales that vegetables exported from other States to New South Wales markets must be packed in new containers. The previous practice has largely been to use second-hand bags for vegetables such as pumpkins, carrots, parsnips, &c., but the use of such containers is now prohibited.

Another Tully Sanctuary.

Bellenden, the property of Messrs. Henry Brothers, near Tully, has been declared a sanctuary for the protection of native animals and birds.

Broom Millet Board.

An Order in Council has been approved under the Primary Producers' Organisation and Marketing Acts formerly extending the operations of the Broom Millet Board from 1st November, 1934, to 31st October, 1937.

An Order in Council giving notice of intention to extend the operations of the Board for a further term of three years was issued on 23rd August last, and a petition invited from growers on the question of continuance. No such petition was received.

Canegrowers' Roll.

For the purpose of Local and Central Sugar Cane Prices Boards elections, the electors' roll of canegrowers is compiled from lists of canegrowers furnished to the Central Board by millowners each season. It is now proposed to use an up-to-date list of assigned lands prepared by the Central Board in lieu of the roll as furnished by the millowners, and accordingly the Regulations under "*The Regulation of Sugar Cane Prices Acts*, 1915 *to* 1933," have been amended to make provision for the new form of canegrowers' roll.

Egg Board Election.

The following nominations for the annual election of five growers' representatives to the Egg Board for the year 1935 have been received:—

District No. 1 (Caboolture-Bundaberg)—
Ronald Benjamin Corbett (Woombye). Returned unopposed.

District No. 2 (Brisbane North-Redcliffe)—
Matthew Hale Campbell (Albany Creek).
Robert Auburn Chapman (The Gap, via Ashgrove).
Raymond Harrison (The Gap, via Ashgrove).

District No. 3 (Brisbane South-Cleveland)—
Christian Gisler (Wynnum).
Tom Hallick (Wynnum).

District No. 4 (Moreton)—
Johannes De Vries (Rosewood).
Heinrich Jacob Jurgensen (Moogerah).
Alexander McLauchlan (Boonah).

District No. 5 (Darling Downs)—
Walter Thos. Hughes (Middle Ridge, Toowoomba). Returned unopposed.

The present members are Messrs. Corbett, Hallick, McLauchlan, and Hughes. The position for District No. 2 was rendered vacant by the recent death of Mr. A. A. Cousner.

The date fixed for the return of the ballot-papers to the department is on or before the 29th December next.

Control of Grasshopper Plague.

The Executive Council has approved of a Proclamation and a Regulation under the Diseases in Plants Acts dealing with the control of the plague grasshopper. These prescribe the manner in which the pest shall be dealt with by the application of insecticidal mixtures, and provide for the appointment of supervisory committees in the shires to which the Proclamation and Regulation at present apply—namely, Waggamba, Inglewood, Pittsworth, and Millmerran. The occupier, or if there is no occupier, then the owner, of land in these shires is obliged to apply an insecticidal mixture in a prescribed manner on land infested with larval plague grasshoppers. A breach of the Regulation renders the person committing the breach liable to a penalty not exceeding £20, a similar penalty being prescribed for a false statement made in an application for the supply by the Department of Agriculture and Stock of the requisite insecticidal materials.

The Minister for Agriculture and Stock, Hon. F. W. Bulcock, pointed out that during the incidence of the first generation of grasshoppers much valuable control work was done by farmers and pastoralists. It was essential, however, that the grasshopper plague be fought on every holding on which it appeared; hence it had been considered desirable to acquire powers to deal with any member of the community who might not yet be alive to his responsibilities in this important matter.

The State Government was making very considerable quantities of the necessary insecticidal materials available free of charge, and stocks had been or were being established at Goondiwindi, Yelarbon, Whetstone, Inglewood, Texas, Pittsworth, Millmerran, Kooroongarra, Rocky Creek, and Mount Emlyn. Persons requiring to control the grasshoppers on infested properties could make application for insecticidal materials on the prescribed form, the application to be lodged with the officer, committee, or individual controlling the local stock of materials.

The Minister stated that the second generation of hoppers would commence emerging during the next week or two, and all farmers and pastoralists were urged to keep a very careful watch for such emergencies. Furthermore, they should realise that it was essential to apply the control measures during the early stages of the larval grasshopper's life while the pest was still concentrated in large numbers on or near the sites on which the hoppers had emerged from the eggs.

Covered Smut of Barley—A Correction.

It has been brought under notice that in the article on covered smut in barley in the Journal for March, 1934, the omission of the figure "0" from the fourth line of the first column of the table on page 239 makes it appear that Abavit B, 2 oz. per bus., was not tried in 1932. Actually it was included in the experiment, with very good results, the resultant infection being nil.

Rural Topics.

Fat Lamb Raising.

The scheme inaugurated by the Minister for Agriculture and Stock (Hon. F. W. Bulcock) last January is already giving results.

The first batch of lambs to come forward for open competition at the Abattoir were the property of Mr. R. Taylor, of Felton East. These lambs were sold on Thursday, 1st November, and it is gratifying to be able to state that the Southdown Cross lambs by the Department's loan rams topped the market. Lambs out of identical ewes by Dorset Horn rams and dropped under similar conditions came a very meritorious second. Experienced judges are of the opinion that the Dorset Cross lambs in this consignment were the heavier. This goes to prove the fashion at the present time existing for the Southdown Cross.

Officers of the Sheep and Wool Branch of this Department have lately inspected the greater number of farmers' flocks coming under the scheme, and from now on a steady stream of prime export lambs may be looked for up until January next.

Everywhere visited the lambs give promise of early development, and the figures compiled after the end of the selling season should prove valuable to the Department and highly instructive to the farmers.

The scheme has created a wide interest amongst farmers and, in addition to those farmers who already have rams, there is a waiting list of others desirous of getting rams should the scheme be extended.

It is not possible at this date to indicate the most successful crosses. Figures and conditions under which lambs were grown will have to be carefully studied subsequent to the end of the experiment.

It may, however, be stated that the experiment has proved highly successful, and in many cases farmers have already expressed their preference for certain of the British breeds.

Potato-growing as Part of a Mixed Farming Proposition.

Under the present economic conditions it was necessary that the unit cost of production be as low as possible, and the motto of potato growers should therefore, be, "not more acres, but more yield per acre," observed a special instructor in vegetable production of the New South Wales, Department of Agriculture, in the course of a recent address. It would perhaps be wise if potato-growing was considered more in the light of a mixed farming undertaking, particularly in conjunction with stock-raising, than as a one-crop farming venture.

The growing of fodder and grazing crops would be found of great advantage in improving the quality of the land for future potato crops. The maintaining of a satisfactory organic content in the soil was a matter of vital importance on potato areas, since the decomposed organic matter in the soil imparted a desirable texture. On many areas the lack of organic matter was very apparent, and such soils quickly compacted; should this happen shortly after planting of the potatoes low yields were certain. From recent United States experiments it would appear that the growing and turning under of maize crops the season previous to the potato crop was receiving increased attention. Maize had become popular owing to the large bulk of organic matter supplied to the soil. Full benefits from artificial fertilizers could only be expected in a soil which had a relatively high moisture-holding capacity, such as was imparted to the soil by the incorporation of organic matter, in conjunction with proper cultivation methods.

Imported Berkshires.

It is of interest in reviewing the progress of the Berkshire breed to note that recent importations of selected stock in this breed have quite remarkable overseas records. The Berkshire sows imported last year by Mr. Frank Bach, of Oakey, are typical. The champion Berkshire boar at the English Royal Show in 1934 is from the same stud as that from which Mr. Bach selected his champion sow, "Lenton Patience," and also the reserve champion at the English Royal is from the herd where his younger sow came from.

It is understood with a view to further strengthening his herd, Mr. Bach is now importing another animal, a specially selected Berkshire boar from one of the most noted studs in England. Such importations are of great value to the Berkshire breed in this country.

An Australian Harvester-Thresher.

Following is an interesting extract from the "London Morning Post," 23rd August, 1934:—A new harvester thresher has been introduced into England by Mr. Scott, of Knighton Manor, near Salisbury. It is called the Sunshine harvester, and is of Australian origin. It pushes its way into the crop by its own power. It does not require a tractor to pull it, and so avoids the necessity of mowing round the field, or running over the grain from the outside.

The Average Cow—"Better Fed than Bred."

Discussing the feeding of dairy cattle before the recent Illawarra and South Coast Agricultural Bureau Conference, Mr. H. Cox, of Kangaroo Valley, said that the average dairy cow was much better bred than fed, or, in other words, was not fed well enough to enable her to yield her potential production.

The ration should not only be sufficient and correctly balanced, but should also have variety, succulence, and palatability. A nutritive ratio of 1:6.3 (1 part of protein to 6.3 parts of carbohydrates and fats) was considered ideal. In these days of low prices of dairy products it was necessary to consider carefully all the costs of production. If the dairy farmer could grow lucerne and maize his farm should be self-supporting as far as fodder was concerned. If it was necessary to buy concentrates, then extra fodder should be grown for sale to compensate for the expense.

By the improvement of pastures a ration nearly balanced could be provided and one which would keep the cows in good health.

Mr. Cox suggested the following daily rations:—

Maize silage, 30 lb.; lucerne chaff, 16 lb.; maize meal, 5 lb.; nutritive ratio, 1:6.3.

Maize silage, 35 lb.; lucerne chaff, 8 lb.; maize meal, 5 lb.; bran, 6 lb.; nutritive ratio, 1:5.6.

Maize silage, 30 lb.; maize meal, 5 lb.; bran, 7 lb.; wheaten chaff, 10 lb.; nutritive ratio, 1:6.9.

Lucerne chaff, 15 lb.; wheaten chaff, 5 lb.; bran 6 lb.; maize meal, 2 lb.; nutritive ratio, 1:5.9.

How to Maintain Quality in Cream.

Absolute cleanliness is the first law in profitable dairying, and a substantial proportion of the remedies for common cream faults come under this heading. Following are some hints on other aspects of prevention:—

Cool all cream promptly after separating.

Do not expose cream or cans to the direct rays of the sun.

Deliver to the factory frequently—not less than four times weekly. Deliver daily in summer time.

If possible, send all the cream in the dairy on days of delivery; any left over should be kept as cool as possible.

Do not mix fresh cream with older cream until the former has been cooled. Give the whole an occasional stir to make the mass uniform, and stir at least four times daily.

Prevent cows from wading in stagnant water; udders of cows should be washed and wiped before milking.

At least once a day remove all cow droppings 100 feet from dairy, yards, and bails.

Never use milk from sick cows, or from cows too soon after calving.

Use clean, sound brushware only in cleaning utensils—never use cloths.

Use only smooth, well-tinned tinware and cans, with all seams soldered flush.

If possible keep cows away from rank or objectionably flavoured weeds. Feed cows at least two hours prior to milking—better still, feed just after milking.

Do not send a very small quantity of cream to the factory in a can of large capacity if any distance is to be travelled.

Have the engine outside the separating room, and extend the engine exhaust to blow clear of the building. Keep smoke away from the dairy, and all strong-smelling material out of the dairy. On no account use water that has been heated in the engine jacket for washing.

Do not use strong-smelling disinfectants in water for washing.

Young or Old Boars?—How Long may Service be Extended.

Replies from prominent pig breeders to a questionnaire by the "Pig Breeders' Gazette" were made as follows:—

"Does an old boar produce as large and as strong litters as a young boar? If not, at about what age does he cease to do so?"

The general opinion seems to be that a boar is never too old so long as he is prolific and can produce constitutionally strong litters. The following were some of the replies received:—

"Really, it depends on constitution; some boars never seem tired. I castrated one nine years of age, four years ago, and am still regretting it and wishing him back. Others pack up at three years, or even earlier.

"As long as conception results from the service, my opinion is that the number and strength of the litter depend almost entirely on the dam."

"Much depends on the individual sire and his management. Some sires seem to go on for years—up to seven and eight—and to get vigorous, healthy litters, while others fail when three to four years old.

"A boar becoming bad-tempered may shorten his useful life, but a boar too young and too hard at the start of his work has the greatest limiting effect, while running him on free range with a bunch of sows is extremely wasteful.

"Between the litters of young, vigorous boars and old, vigorous boars there seems comparatively little to choose, the variations usually being attributable to factors other than age. It has been found that the use of a suitable service crate will often improve the size and strength of litters from an old boar."

"I do not think that it is either a question of age or the strength and size of his get that determines the usefulness of a boar; one thing that I am certain of, however, is the fact that it is impossible to lay down a hard and fast rule as to a limit of age at which he ceases to get good litters, also that anyone who makes a definite statement in regard to it is either lacking in experience or observation.

"One of the greatest factors in keeping a boar fit is to give him plenty of work, after he is mature; by plenty, I do not imply that it is wise to let him run with sows. His services should be controlled, and, if he is big and heavy, a crate should be used for him; and provided he is well fed with a suitable ration, containing a fair amount of protein, there is no reason why his litters should diminish in size or strength, even though he may be eight or nine years of age, whereas there are many boars, whether from mismanagement or from some constitutional weakness, which seem to lose their usefulness at half this age, or even less.

"I am confident that periods of rest from service are not conducive to the length of useful life of a boar, neither are they with regard to the size and strength of litters. It is owing to this fact, I am inclined to think, that we breeders so often get rid of our second string stock boar before he has had a real chance to prove his worth."

A Travesty of North Queensland.

The writer of a recent work of fiction has chosen the surroundings of a North Queensland sugar mill as the venue of his story of the life of an Australian born of Italian parents. With the quality of the book as a whole we are not here concerned; but what needs emphatically to be stated is that as a picture of life in any part of Queensland, north or south, it is distinctly and dangerously misleading. One of its Melbourne reviewers has hailed it as "an accurate picture of a typical small town in the Queensland sugar belt," and "as showing us a glimpse of a hitherto unfamiliar country"—so unfamiliar is it that such a place is unknown to Queenslanders themselves, nor is it discoverable outside the pages of what in more senses than one is, as we have said, "a work of fiction." It has never been denied that North Queensland, in certain parts, has become the home of numbers of Continental Europeans, amongst whom, as amongst every race, there are a proportion of undesirables; but the unrelieved squalor and undiluted foreignisation described by the writer are certainly non-existent, whilst the miseries of the wet season are grossly exaggerated. The low death-rate of the population and the bright vigour of the children attending the schools, so consistently remarked upon by visitors from the South, are evidence of a very different state of things. "Eulaville," the name adopted by the author for his visionary sugar town, is represented as occupied almost solely by a polyglot crowd, amongst whom the strong self-respecting

Australian is absent. The legislation by which the sugar industry in Queensland is studiously regulated and organised is unknown in that fabled region. The mill itself, so far as it enters into the story, is different from all others—as, for example, the existence of open pans of boiling sugar, a trap for unwary feet, is unknown in modern practice, and an operating factory, remaining in the dead of night with a venal watchman as the sole occupant, is an absurdity. The writer apparently is unacquainted with the fact that the labour in the sugar mills is almost exclusively of "British" nationality. But perhaps the most misleading incident of all is that in which the whole of the "foreigners" band together to defeat a waterside strike, in which they are in no way interested, by forcefully and illegally attempting to load the steamers, in spite of police and shipping officials. This is really a travesty of what occurred some years ago in a port very much further south, when the farmers, almost exclusively Australians, went down to the wharf in orderly and lawful combination and thus secured the shipment of the raw sugar which the striking waterside workers had refused to handle. The foreign-born elements in this country have never been responsible for any approach to such conduct as that described by the writer of this book, nor are they ever at all likely to be. The brief quotation from a review which we give above is an example of the mischief likely to be wrought in unreflecting and prejudiced minds, already predisposed to think evil of a remote part of their own country.

In connection with the above, an interesting article appears in the "Launceston Examiner" of 23rd August. In the light of what is stated in the book, and of the recent articles by a special investigator commissioned by the Brisbane "Telegraph" to inquire into the state of affairs in the North Queensland sugar district, the Tasmanian journal gives a very judicial summing up of the position, as follows:—"The weight of evidence would seem to suggest that the Italian is by way of becoming a useful member of the community of the North, and of becoming ultimately a good, if somewhat emotional, Australian."—"The Australian Sugar Journal" for September.

Good Feeding Means Profitable Dairying.

Great improvement had been made in the class of stock bred in the Manning River district during the past twenty years, said Mr. J. A. Grant, manager of Wingham Butter Factory, N.S.W., addressing a recent gathering of local dairy farmers, but many farmers had failed to realise how much depended on the proper feeding of their stock. He predicted, however, that more attention would be given this aspect of dairying in the near future, as farmers were beginning to realise how uneconomical it was to keep even a champion milker if she were only half fed. Under these conditions such a large proportion of the feed went to keep the cow warm and to supply energy, that little was left for the production of milk.

Quoting as an example the operations of one particularly successful farmer he had observed for very many years, Mr. Grant stated that this man only reared sufficient calves to replace any cows that had passed their best, and the calf was only retained after careful examination of the breeding and production records of dam and sire, and after a check-up on its size, conformation, and health. The culled cows were spayed, and in a few months were fat enough to sell to the butcher. This was only possible because there was always an abundance of feed for the cattle. He was best able to judge as to the efficiency of this farmer's methods by the surprisingly regular amount of his monthly cheque.

This farm was not on rich country, but was rather steep and hilly. As a consequence of rearing so few calves, a comparatively large number of pigs were reared and fattened. The young pigs and breeding stock were grazed on rape in the winter and lucerne in the summer, with a very small quantity of milk and an abundance of water. When the young pigs were grown sufficiently they were fattened as rapidly as possible on maize and milk, which constituted an excellent ration. It had frequently happened that during a more or less dry year this farmer had made more money from his pigs alone than his neighbour, with a better farm, had made from his cows and pigs combined.

The explanation was to be found in better feeding as a result of better general management of the farm.

The Home and the Garden.

OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

Summer Diarrhœa.

It is not many years since diarrhœa was the most frequent cause of death among babies. Diarrhœa was then most prevalent during the hot summer months, partly because milk rapidly becomes unwholesome when exposed to summer heat, but chiefly owing to the infection of milk from the growth of disease germs, which are always more or less prevalent during that season. Of recent years there has been an amazing lessening of the number of deaths caused by diarrhœal infections among babies. But some deaths from this cause still occur annually, and only by an intelligent use of our knowledge of their causes can these dangerous diseases be prevented.

Diarrhœa is the passage of frequent loose or watery motions. It is caused by the presence of some irritating material in the bowels. The bowels are trying to expel this, and so the motions are frequent. The contents of the bowel are being hurried through, and so they are watery. According to their cause, we may divide diarrhœas into food diarrhœas and infectious diarrhœas.

Food Diarrhœas.

These may be caused by simple overfeeding with food that is quite suitable, when not given in excess. This may occur at any time of year, but is more likely in summer, because babies are then often thirsty. Mothers sometimes fail to distinguish between hunger and thirst in babies, and yet it is easy. Thirst is satisfied by plain boiled water, and the baby should be given as much of this as he wants between feeds. Milk is a food, and thirst may induce an infant to take too much of it when he is not hungry, and so he gets upset.

Unsuitable foods may cause diarrhœa. There are so many kinds of unsuitable foods given to children and babies, that we shall not attempt any list of them. We may divide them into those which the mother gives, because she knows no better, and those which the babe, who has reached the crawling stage, finds for himself on the floor or elsewhere.

In hot weather milk rapidly becomes unwholesome from the growth of putrefactive organisms, unless the milk is kept cold. Especially is this likely to happen quickly if the milk has been obtained or handled in a dirty manner. If we remember these three causes of food diarrhœa in babies, their prevention is simple.

Treatment of Food Diarrhœas.

This also is simple. It is usually wise to give a teaspoonful of castor oil at the beginning to clear out the irritating material. At the same time we completely cease giving the babe any milk. He may drink as much very weak barley water, which may be slightly sweetened, as he likes. After twenty-four hours he should be distinctly better, but should

be kept on the barley water for another day if necessary until the motions begin to improve. He may then be given whey made with junket tablets. The whey is allowed to drip through cheese-cloth without any squeezing. Give nothing else to the babe under nine months. The babe over nine months may, if he is hungry, have some water-sago, or water-arrowroot, perhaps flavoured with a trace of marmite, or if he has teeth, a small piece of baked bread. No cow's milk must be given until the motions are much improved, and then only a small spoonful or two with each feed. If this is well digested, the quantity must be gradually increased. If the baby is breast-fed it is not necessary to diet him so strictly, and small feeds of breast milk may be given once or twice daily as the baby improves, instead of giving whey.

Infectious Diarrhœas.

These are much more serious. The infant may be very ill at the beginning, and medical advice should be sought at once. Sometimes the disease is deceitfully mild at first, but does not improve with simple treatment. Therefore, if the treatment for food diarrhœa is not followed by improvement within twenty-four hours, to seek medical advice is the only safe course. Especially is this necessary when the passage of blood and slime with straining shows that it is a case of dysentery.

The Prevention of Infectious Diarrhœas.

The responsibility for this rests with the mother. Breast-fed babies are much safer than those on the bottle. Therefore, we do not wean babies during the hottest months, if we can help it. The infection may be conveyed to the baby's food by dirty fingers, but more commonly is conveyed by flies. All milk should be scalded, unless pasteurised and in sealed vessels. It must be kept cool and most carefully protected from flies. The bottles and teats used by artifically-fed infants must be boiled, and afterwards most carefully shielded from flies. Flies are fond of alighting on the baby's dummy—we regret to say that these horrible things are still used by some mothers. The best safeguard for these babies is to burn the dummy.

ILL-NOURISHED CHILDREN.

THE skilled observer may see poorly-nourished children wherever he goes. Fortunately, they are usually fewer in number than the well-nourished children, but there are many of them. Their number varies in different places and at different times, but they are always present. There are many causes of poor nutrition, but in all but a few the cause is simply defective diets. By this we do not mean that the children do not get enough food. They probably get as much as they will eat; they may even get expensive foods, but they do not get the right sort of food. Their mothers have never received a right education and are not to be blamed for want of knowledge which no one has taught them. They are not to be blamed, but their children suffer all the same.

There is a widespread belief that the important foods are meat, white bread, butter, and sugar, and that all other foods are extras. Of the five necessary vitamins, meat contains only one, while bread and sugar contain none, and butter, which is valuable for its vitamins,

is expensive and is being replaced by margarine. So long as times are good most people take a large variety of foods, and these often supply all that is needed in the diet; but when times are bad and thousands are on relief wages, it is only natural that mothers should concentrate on what they think the important foods. They satisfy their children's appetites with foods on which really good health is impossible. There is no starvation, but much bad feeding. Poverty is not the cause. The cause is want of knowledge, the evil effects of which are made more dangerous by want of money. The foods that are essential to children's health are only too often cut out because the mother thinks they are not important, and therefore she cannot afford to buy them. Meanwhile she spends money unnecessarily on foods of inferior value.

Milk the Most Important Food.

The most important of foods for children is milk, and this is often the first to be cut out. In some places poorly-nourished children have become very numerous. It is sad to see so many of the next generation being spoilt in the making—so many that will never grow strong men and women, but will help to fill our hospitals, when in later life they fall victims to all kinds of diseases—so many that will fall easy victims to tuberculosis, or become hopelessly crippled with chronic rheumatism. The condition of their teeth will be such that all the dentists in Queensland working overtime, Sundays and holidays included, will not be able to do what is necessary. Every child under six should have a pint of good milk in some form or another daily. Every child over six should have at least half a pint, but a whole pint would be better. As it is, many families are given only a little condensed milk, or some powdered skimmed milk, in large quantities of water—a mere pretence of proper nourishment.

What can we propose for this great evil? Firstly, we must dispel this want of knowledge. Out Infant Welfare Service is responsible for all children under school age, and is doing its best to help their mothers. This work is difficult and slow, and we cannot reach mothers not within easy distance of our centres. A large number of new branch clinics are much needed. The next generation of mothers will, we hope, have been better educated before they leave school. Secondly, there are ways in which we can directly encourage the increased consumption of milk. These will be explained in our next article.

SIMPLE COOKERY.

BAKED ORANGE PUDDING.

Materials—1 slice bread; 2 eggs; 1 pint milk; 1 dessertspoonful butter; 1 dessertspoonful sugar; 2 oranges.

Utensils—Pie dish; basin; saucepan; whisk.

Method—

1. Look to the oven and grease pie dish.
2. Place milk on to boil.
3. Put bread into pie dish and pour boiling milk over it.
4. Beat egg and sugar together.
5. Add grated orange rind and juice to egg.
6. Pour over the soaked bread.
7. Add a little butter.
8. Bake in moderate oven. Place dish in cold water.
9. Serve cold.

STEAMED GINGER PUDDING.

Materials—½ lb. flour; 3 oz. dripping; 3 oz. sugar; ½ cup milk; ½ cup treacle; 1 tablespoonful ginger; 1 dessertspoonful each of cinnamon and spice; 1 teaspoonful soda.

Utensils—Bowl; sieve; wooden spoon; basin; paper; steamer.

Method—

1. Cream dripping and sugar; add milk and treacle; mix well.
2. Add flour sifted with spice, ginger, salt, and soda.
3. Pour into a greased basin; cover with greased paper.
4. Steam for 3 hours; turn out; serve with sweet, white sauce.

STEAMED URNEY PUDDING.

Materials—¼ lb. flour; 3 oz. butter or dripping; 2 oz. sugar; 2 eggs; ½ teaspoonful carbonate soda; 1 tablespoonful seeded jam.

Utensils—Steamer; basin; greased paper; wooden spoon; whisk.

Method—

1. Put water on to boil.
2. Beat butter and sugar together.
3. Add egg well beaten with jam.
4. Sift in flour and baking soda.
5. Steam 1½ hours.
6. Serve with white sauce or jam.

TAPIOCA (BOILED).

Materials—2 tablespoonfuls tapioca; ½ pint milk; ½ pint water; 1 dessertspoonful sugar.

Utensils—Basin; saucepan.

Method—

1. Wash tapioca well; cover with water.
2. Soak it 1 hour.
3. Put it into a saucepan; add milk and sugar.
4. Cook till clear and tender; serve with milk or cream.

TAPIOCA CREAM.

Materials—¼ cup tapioca; 1 pint milk; 2 eggs; 2 tablespoonsful sugar; essence of vanilla.

Utensils—Basin; saucepan; wooden spoon; whisk.

Method—

1. Soak the tapioca in milk or water over night.
2. Place over the fire and boil till clear.
3. Beat yolks of eggs and sugar well together.
4. Add to the tapioca; allow to thicken, but do not boil; whisk whites to a stiff froth; add half to the mixture when cold; beat well.
5. Turn into glass dish; decorate with coloured cocoanut and remaining white of egg; serve with stewed fruit.

COCOANUT BISCUITS.

Materials for Biscuit.—¼ lb. butter; ¼ lb. sugar; essence or grated lemon rind; yolks 2 eggs; ½ lb. flour.

Materials for Top—Whites 2 eggs; ¼ lb. icing sugar; ¼ lb. cocoanut.

Utensils—Bowl; wooden spoon; sieve; cutter, baking tin.

Method—

1. Cream butter and sugar together; add essence and yolks of eggs; beat well.
2. Sift in flour; turn out on floured board and knead.
3. Roll out and cut into biscuits with a round cutter.
4. Spread cocoanut mixture on top and bake on a greased tin in a moderate oven half an hour.

Cocoanut Mixture—Whip whites of eggs until stiff; add cocoanut and icing sugar until a thick paste is formed.

GINGERBREAD.

Materials—¾ lb. flour; pinch of salt; ¼ lb. butter or dripping; ¼ lb. sugar; 2 teaspoonfuls ginger; 1 teaspoonful mixed spice; ½ cup treacle; ½ teaspoonful soda; 2 eggs; ¾ cup milk.

Utensils—Sieve; bowl; saucepan; basin; whisk; cup; wooden spoon; baking tin.

Method—

1. Sift flour, salt, ginger, and spice into a bowl.
2. Heat the butter or dripping, sugar, and treacle, stirring until the mixture is smooth.
3. Beat eggs well; slightly heat the milk; dissolve soda in it.
4. Mix all wet ingredients together.
5. Add to the dry ingredients; stir until smooth.
6. Pour into a greased tin; bake in a moderate oven for about 1¼ hours.

LEMON BUNS.

Materials—2 oz. butter; 2 oz. sugar; 1 egg; ½ cup milk; lemon essence or grated rind; ½ lb. flour; 1 teaspoonful cream of tartar; ½ teaspoonful soda.

Utensils—Bowl; wooden spoon; cup; grater; sieve; baking tin.

Method—

1. Beat butter and sugar to a cream; add essence or rind, and egg.
2. Beat well; add milk and flour sifted with cream of tartar and soda.
3. Take pieces of mixture and form into balls; brush over with egg and milk, and sprinkle with pink sugar.
4. Put on greased tin; bake till slightly browned.

NUT FINGER BISCUITS.

Materials—¼ lb. butter; 2 oz. sugar; ½ lb. flour; 1 small teaspoonful baking powder; 1 egg; ¼ lb. icing sugar; 1 oz. nuts.

Utensils—Bowl; rolling-pin; knife; pastry board; plate; wooden spoon.

Method—

1. Attend to the oven.
2. Beat butter and sugar to a cream.
3. Add yolk of egg and beat well.
4. Sift in flour and making powder.
5. Mix all well together until crumbly.
6. Add 1 or more tablespoonfuls of boiling water to blend mixture into a stiff dough.
7. Beat icing sugar and white of egg together.
8. Chop nuts up finely.
9. Roll out paste to less than ¼-inch thickness; cut into a square.
10. Spread over icing and sprinkle with nuts.
11. Cut into finger lengths 1 inch by 3 inches.
12. Bake on greased tray in moderate oven.

SHORTBREAD.

Materials—4 oz. butter; 2 oz. icing sugar; ½ lb. flour.

Utensils—Bowl; sieve; rolling-pin; baking dish.

Method—

1. Cream sugar and butter together till white.
2. Add sifted flour.
3. Turn out on floured board; knead; cut into halves; roll out; pinch edges; put on baking dish.
4. Bake in a slow oven for 1 hour.

Note.—The amount of flour may be reduced slightly.

SPONGE ROLL.

Materials—3 eggs; ½ cup sugar; 1 cup flour; 1 teaspoonful baking-powder; 2 tablespoonfuls jam; 1 tablespoonful water; icing sugar; dripping or butter for greasing tin.

Utensils—Bowl; whisk; sieve; jam-roll tin; cloth.

Method—

1. Break eggs into a bowl.
2. Add sugar; whisk till thick; add water.
3. Add flour mixed with baking-powder.
4. Bake in greased jam-roll tin.
5. When cooked turn out on clean cloth; roll up quickly; unroll; spread with jam; roll up; sprinkle with icing sugar.

BREADMAKING.

To make Yeast.

Materials—1 potato; 2 tablespoonfuls loose hops; 1 tablespoonful sugar; 1 tablespoonful flour; 3 cups of water.

Utensils—Saucepan; basin; cup; strainer; bottle.

Method—

1. Wash potato; slice it into a saucepan.
2. Cover with water; boil till soft.
3. Put hops into a basin; add 1 cup of boiling water.
4. Cover; let cool.
5. Mix sugar and flour together with water.
6. Add hops, potatoes, and remainder of water.
7. Strain; bottle; tie cork down securely.

To make Bread.

Materials—1 lb. flour; ¼ cup yeast; ½ pint tepid water; ½ teaspoonful salt.

Utensils—Bowl; tin; knife.

Method—

1. Sift flour into a bowl.
2. Mix yeast and half water together.
3. Make a well in centre of flour.
4. Pour in yeast and rest of water.
5. Mix into dough; cover with a cloth.
6. Let stand in a warm place for 6 hours; add salt.
7. Knead for 30 minutes; form into loaves; let stand to rise.
8. Bake in hot oven 40 minutes.

WHOLEMEAL BREAD.

Materials—1 lb. wholemeal; ¼ cup yeast; ½ cup lukewarm water; ¼ teaspoonful salt.

Utensils—Bowl; cup; knife; tins.

Method—

1. Put whole meal into a bowl.
2. Mix into a smooth, soft dough, with yeast and water.
3. Stand aside in a warm place for 3 hours; add salt.
4. Turn out on a board; knead; divide into pieces; form into loaves.
5. Place in greased tins; stand for an hour.
6. Bake in a moderate oven.

Compressed Yeast.

Compressed yeast, a putty-like mass of yeast plants, may be purchased; it will only keep for two or three days; if it is not possible to use it at once, it should be kept in a cool, dry place.

BREAD MADE WITH COMPRESSED YEAST.

Materials—1 lb. flour; ½ oz. compressed yeast; ½ teaspoonful salt; ½ teaspoonful sugar; about ½ cup of warm water.

Utensils—Sieve; basin; wooden spoon; board; knife; tin.

Method—

1. Sift flour into a warmed basin; crumble yeast into middle of flour.
2. Sprinkle sugar over yeast; add 2 tablespoonfuls of lukewarm water.
3. Stir until the centre of the flour is like batter; stand in a warm place for 10 to 12 minutes.
4. Sprinkle salt over dough; mix well, adding sufficient warm water to form dough.
5. Turn out on a floured board; knead well.
6. Return to warmed basin; cut across surface with a floured knife.
7. Cover and let stand in a warm place for 35 to 40 minutes.
8. Turn out on a floured board; knead it into shape; put into a greased tin, leaving about one-third of the space for rising; stand in a warm place for 10 minutes.
9. Put into a hot oven for 5 to 10 minutes; decrease heat; allow 30 to 40 minutes to complete the baking.

Note—The whole process takes from 1¾ to 2 hours.

BILLY BREAD.

Materials—1 cup flour; 1 cup wheatmeal; 2 teaspoonfuls baking powder; ½ teaspoonful salt; 1 dessertspoonful butter or dripping; 1 dessertspoonful sugar; ½ cup treacle; ½ cup milk; dripping to grease tins.

Utensils—Bowl; cup; fork; board; groats or other tins with lids or billy can; skewer.

Method—

1. Put wheatmeal and flour sifted with baking powder and salt into a bowl.
2. Add sugar; work butter or dripping in with the tips of the fingers.
3. Make a well in the dry ingredients; pour in the milk and treacle well mixed together.
4. Work into a damp dough with a fork; turn out on a slightly floured board; knead for 1 minute.
5. If necessary divide the dough; put into well-greased tins or billy can, leaving not less than one-third of the space for rising.
6. Put lids on; bake in a moderate oven for 1 to 1½ hour; the time will depend on the size of the tin or billy can; test with a skewer.

Note—Nuts, shelled and cut up, sultanas, dates, or other dried fruit may be used with this mixture to make nut loaf, date loaf, &c.

NUT BREAD.

Materials—2 cups self-raising flour; 1 cup brown sugar; 1 cup milk; 1 egg; ½ cup chopped nuts; 1 teaspoonful salt.

Utensils—Bowl; wooden spoon; baking tin with lid.

Method—

1. Grease tin and look to the oven.
2. Sift flour and salt into a bowl.
3. Add sugar and nuts.
4. Make well in centre; break in the egg and add milk.
5. Mix all together quickly.
6. Half fill coffee tin and bake with lid on for 1 hour in moderate oven.

Orchard Notes for January.

THE COASTAL DISTRICTS.

ALL orchards, plantations, and vineyards should be kept well cultivated and free from weed growth; in the first place, to conserve the moisture in the soil, so necessary for the proper development of all fruit trees and vines; and, secondly, to have any weed growth well in hand before the regular wet season commences. This advice is especially applicable to citrus orchards, which frequently suffer from lack of moisture at this period of the year if the weather is at all dry, and the young crop of fruit on the trees is injured to a greater or less extent in consequence.

Pineapple plantations must also be kept well worked and free from weeds, as when the harvesting of the main summer crop takes place later on, there is little time to devote to cultivation. If this important work has been neglected, not only does the actual crop of fruit on the plants suffer, but the plants themselves receive a setback.

Banana plantations should be kept well worked, and where the soil is likely to wash badly, or there is a deficiency of humus, a green crop for manuring may be planted. Should the normal wet season set in, it will then soon cover the ground without injury to the banana plants. When necessary, banana plantations should be manured now, using a complete manure rich in potash and nitrogen. Pineapples may also be manured, using a composition rich in potash and nitrogen, but containing no acid phosphate (superphosphate) and only a small percentage of bonemeal, ground phosphatic rock, or other material containing phosphoric acid in a slowly available form.

Bananas and pineapples may still be planted, though it is somewhat late for the former in the more southern parts of the State. Keep a good lookout for pests of all kinds, such as Maori on citrus trees, scale insects of all kinds, all leaf-eating insects, borers, and fungus pests generally, using the remedies recommended in Departmental publications.

Fruit fly should receive special attention, and on no account should infested fruit of any kind be allowed to lie about on the ground to become the means of breeding this serious pest. If this is neglected, when the main mango crop in the South and the early-ripening citrus fruits are ready, there will be an army of flies waiting to destroy them.

Be very careful in handling and marketing of all kinds of fruit, as it soon spoils in hot weather, even when given the most careful treatment. Further, as during January there is generally more or less of a glut of fresh fruit, only the best will meet with a ready sale at a satisfactory price.

Grapes are in full season, and in order that they may be sold to advantage they must be very carefully handled, graded, and packed, as their value depends very much on the condition in which they reach the market and open up for sale. Well-coloured fruit, with the bloom on and without a blemish, always sells well, whereas badly coloured, immature, or bruised fruit is hard to quit.

One of the greatest mistakes in marketing grapes is to send the fruit to market before it is properly ripe, and there is no better way to spoil its sale than to try and force it on the general public when it is sour and unfit to eat.

Bananas for sending to the Southern States require to be cut on the green side, but not when they are so immature as to be only partially filled. The fruit must be well filled but show no sign of ripening; it must be carefully graded and packed and the cases marked in accordance with the regulations under the Fruit Cases Acts and forwarded to its destination with as little delay as possible.

Pineapples should be packed when they are fully developed, which means that they contain sufficient sugar to enable the fruit to mature properly. Immature fruit must not be marketed, and if an attempt is made to do so the fruit is liable to seizure and the sender of the fruit to prosecution under the abovenamed regulations. Further, the fruit must be graded to size and the number of fruit contained in a case must be marked thereon. Immature fruit must not be sent. For canning, the fruit should be partly coloured; immature fruit is useless; and over-ripe fruit is just as bad. The former is deficient in colour and flavour and the latter is "winey" and of poor texture, so that it will not stand the necessary preparation and cooking.

Should there be a glut of bananas, growers are advised to try and convert any thoroughly ripe fruit into banana figs.

The fruit must be thoroughly ripe, so that it will peel easily, and it should be laid in a single layer on wooden trays and placed in the sun to dry. If the weather is settled, there is little trouble, but if there is any sign of rain the trays must be stacked till the weather is again fine, and the top of the stack protected from the rain. To facilitate drying, the fruit may be cut in half lengthways. It should be dried till a small portion rubbed between the finger and thumb shows no sign of moisture. It can be placed in a suitable box to sweat for a few days, after which it can be dipped in boiling water to destroy any moth or insect eggs that may have been laid on it during the process of drying and sweating. It is then placed in the sun to dry off any moisture, and when quite dry it should be at once packed into boxes lined with clean white paper. It must be firmly packed, when, if it has been properly dried, it will keep a considerable time. It can be used in many ways, and forms an excellent substitute for raisins, sultanas, currants, or other dried fruits used in making fruit cakes and other comestibles. Banana figs will be found useful for home consumption, and it is possible that a trade may be built up that will absorb a quantity of fruit that would otherwise go to waste.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

JANUARY is a busy month in the Granite Belt, and orchardists are fully occupied gathering, packing, and marketing the crop of midseason fruits, consisting of plums of several kinds, peaches, nectarines, pears, and apples. The majority of these fruits are better keepers and carriers than those that ripen earlier in the season; at the same time, the period of usefulness of any particular fruit is very limited, and it must be marketed and disposed of with as little delay as possible.

With the great increase in production, owing to the large area of new orchards coming into bearing and the increasing yields of those orchards that have not come into full profit, there is not likely to be any market for immature or inferior fruit. There will be ample good fruit to fully supply the markets that are available and accessible. Much of the fruit will not carry far beyond the metropolitan market, but firm-fleshed plums, clingstone peaches, and good firm apples should stand the journey to the Central District, and, if they are very carefully selected, handled in a manner to prevent any bruising, and properly graded and packed, they should carry as far as Townsville. Growers must remember that, given a market fully supplied with fruit, only such fruit as reaches that market in first-class condition is likely to bring a price that will pay them; consequently the grower who takes the trouble to send nothing but perfect fruit, to grade it for size and colour, to pack it carefully and honestly, placing only one-sized fruit, of even quality and even colour, in a case and packing it so that it will carry without bruising, and, when opened up for sale, will show to the best advantage, is pretty certain of making good. On the other hand, the careless grower who sends inferior badly graded, or badly packed fruit is very likely to find when the returns for the sale of this fruit are to hand that after paying expenses there is little, if anything, left. The expense of marketing the fruit is practically the same in both cases.

Then why "spoil the ship for a ha'p'orth of tar" after you have gone to the expense of pruning, spraying, manuring, and cultivating your orchard? Why not try and get a maximum return for your labour by marketing your fruit properly? The packing of all kinds of fruit is a fairly simple matter, provided you will remember—

(1) That the fruit must be fully developed, but yet quite firm when gathered.

(2) That it must be handled like eggs, as a bruised fruit is a spoilt fruit, and, when packed with sound fruit, spoils them also.

(3) That only one-sized fruit, of an even degree of ripeness and colour, must be packed in a case.

(4) That the fruit must be so packed that it will not shift, for if it is loosely packed it will be so bruised when it reaches its destination that it will be of little value. At the same time, it must not be packed so tightly as to crush the fruit.

If these simple rules are borne in mind, growers will find that much of the blame they frequently attribute to the fruit merchants or middlemen is actually the result of their own lack of care. Fruit that opens up in the pink of condition sells itself, whereas any fruit that opens up indifferently is hard to sell on any except a bare market, and on a glutted market is either unsaleable or realises such a poor price that the grower is frequently out of pocket and would have been better off had he not attempted to market it.

If spraying with arsenate of lead and systematic bandaging has been properly carried out, there will be comparatively few codlin moths to destroy the later ripening pip fruits; but if these essential operations have been neglected or carelessly carried out a number of moths will hatch out and the eggs laid by them will turn to larvæ that will do much damage, in some cases even more than that caused by the first broods that attack the fruit as soon as it is formed. Where there is any likelihood, therefore, of a late crop of moths, spraying with arsenate of lead must be continued if the late crop of pip fruits is to be kept free from this serious pest.

Fruit fly must be systematically fought, and on no account must any fly-infected fruit be allowed to lie about on the ground and breed this pest, to do further damage to the later ripening fruits.

Citrus orchards will need to be kept well cultivated in the drier and warmer parts of the State, and, where necessary, the trees should be irrigated. If scale insects are present, the trees should be either sprayed or, better still, treated with hydrocyanic acid gas.

Western grapes are in full season, and if they are to be sent long distances by rail then they are all the better to be cut some hours before they are packed, as this tends to wilt the stems and keep the berries from falling off in transit. The fruit must be perfectly dry when packed, and should be as cool as possible. It must be firmly packed, as a slack-packed case always carries badly and the fruit opens up in a more or less bruised condition.

Farm Notes for January.

FIELD.—The main business of the field during this month will be ploughing and preparing the land for the potato and other future crops, and keeping all growing crops clean. Great care must be exercised in the selection of seed potatoes to ensure their not being affected by the Irish blight. Never allow weeds to seed. This may be unavoidable in the event of long-continued heavy rains, but every effort should be made to prevent the weeds coming to maturity. A little maize may still be sown for a late crop. Sow sorghum, imphee, Cape barley, veteches, panicum, teosinte, rye, and cowpeas. In some very early localities potatoes may be sown but there is considerable risk in sowing during this month and it may be looked upon merely as an experiment. Plant potatoes whole. Early-sown cotton will be in bloom.

On coastal and intercoastal scrub districts, where recently burnt-off scrub lands are ready for the reception of seed of summer-growing grasses, sowing may commence as soon as suitable weather is experienced. Much disappointment may be saved, and subsequent expenditure obviated, by ensuring that only good germinable grass seed is sown, of kinds and in quantities to suit local conditions, the circumstances being kept in mind that a good stand of grass is the principal factor in keeping down weeds and undergrowth.

In all districts where wheat, barley, oats, canary seed, and similar crops have recently been harvested, the practice of breaking up the surface soil on the cropped areas should invariably be adopted. Soil put into fit condition in this way will "trap" moisture and admit of the rains percolating into the subsoil, where the moisture necessary for the production of a succeeding crop can be held, provided attention is given to the maintenance of a surface mulch, and to the removal, by regular cultivation, of volunteer growths of all kinds. If not already seen to, all harvesting machinery should be put under cover, overhauled, and the woodwork painted where required.

Where maize and all summer-growing "hoed" crops are not too far advanced for the purpose, they should be kept in a well-cultivated condition with the horse hoe. Young maize and sorghum crops will derive much benefit by harrowing them, in the same direction as the rows are running, using light lever harrows with the tines set back at an angle to obviate dragging out of plants, but the work should not be done in the heat of the day.

Quick-maturing varieties of maize and sorghum may still be sown in the early part of the month in coastal areas where early frosts are not expected.

Succession sowings may be made of a number of quick-growing summer fodder crops—Sudan grass, Japanese and French millet, white panicum, and liberty millet (panicum). In favourable situations, both "grain" and "saccharine" sorghums may still be grown; also maize, for fodder purposes.

Fodder conservation should be the aim of everyone who derives a living from stock, particularly the dairyman; the present is an important period to plan cropping arrangements. Exclusive of the main crops for feeding-off (when fodder is suitable for this purpose), ample provision should be made for ensilage crops to be conserved in silo or stack. As natural and summer-growing artificial grasses may be expected to lose some of their succulence in autumn, and more of it in winter and early spring, the cropping "lay-out" to provide a continuity of succulent green fodder throughout the season calls for thorough and deep cultivation and the building up of the fertility and moisture-holding capacity of the soil. Planter's friend (sorghum) may be sown as a broadcast crop at the latter end of the month for cutting and feeding to cattle in the autumn and early winter. Strips of land should be prepared also for a succession sowing about the second week in February, and for winter-growing fodder crops.

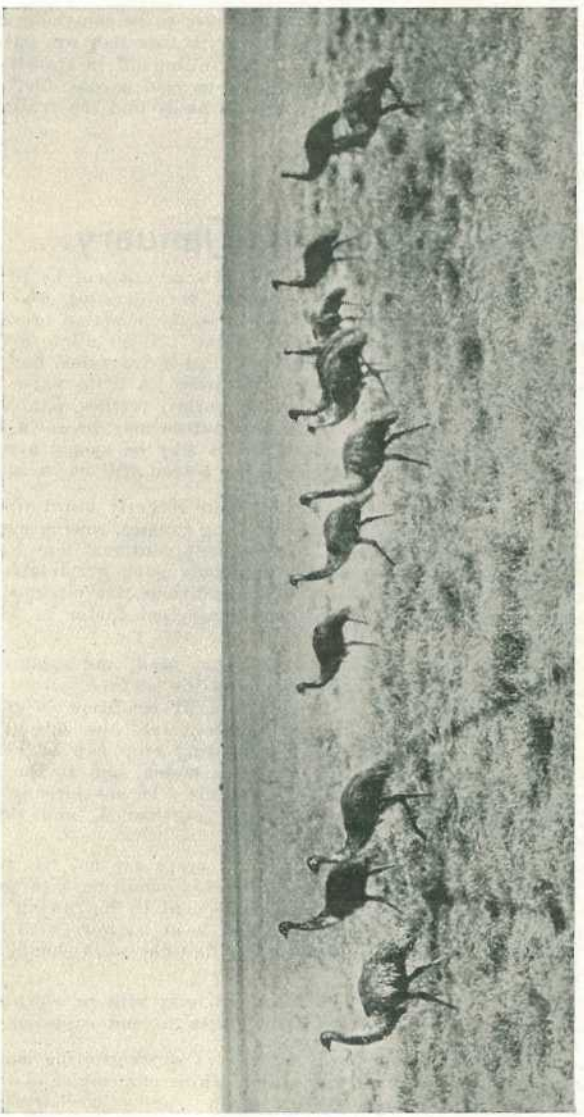

PLATE 330.—EMUS ON DOWNS COUNTRY, HUGHENDEN DISTRICT.

[Photo. by courtesy of Lands Department.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF OCTOBER, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING OCTOBER, 1934, AND 1933, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Oct..	No. of Years' Records.	Oct., 1934.	Oct., 1933.		Oct..	No. of Years' Records.	Oct., 1934.	Oct., 1933.
North Coast.	In.		In.	In.	*Central Highlands.*	In.		In.	In.
Atherton	0·92	33	0·91	1·86	Clermont	1·32	63	2·09	2·15
Cairns	2·13	52	1·26	2·40	Gindie	1·36	35	3·11	2·10
Cardwell	2·07	62	2·10	2·58	Springsure ..	1·64	65	2·74	2·69
Cooktown	1·05	58	1·37	1·03					
Herberton	0·99	48	0·58	1·86					
Ingham	1·95	42	1·99	2·84					
Innisfail	3·21	53	3·03	15·14					
Mossman Mill ..	3·01	21	3·62	2·09	*Darling Downs.*				
Townsville	1·38	63	0·40	1·20	Dalby	2·08	64	1·45	5·73
Central Coast.					Emu Vale ..	2·19	38	2·98	2·91
					Hermitage ..	1·90	28	2·26	1·77
Ayr	0·98	47	0·30	0·85	Jimbour	1·90	46	1·33	2·45
Bowen	1·05	63	0·44	2·02	Miles	2·03	49	2·62	5·67
Charters Towers ..	0·72	52	0·91	1·92	Stanthorpe	2·55	61	3·98	3·18
Mackay	1·66	63	3·65	1·45	Toowoomba ..	2·55	62	3·12	2·67
Proserpine	1·72	31	0·89	2·76	Warwick	2·30	69	2·53	2·62
St. Lawrence ..	1·77	63	2·06	4·66					
South Coast.									
					Maranoa.				
Biggenden	2·40	35	3·39	7·52					
Bundaberg	2·11	51	2·89	4·48	Roma	1·75	60	2·64	3·35
Brisbane	2·54	83	1·34	3·82					
Caboolture	2·52	47	1·94	4·36					
Childers	2·69	39	3·87	8·18					
Crohamhurst ..	3·29	41	..	5·99					
Esk	2·53	47	1·76	1·77					
Gayndah	2·40	63	3·26	4·87					
Gympie	2·72	64	2·66	5·33	*State Farms, &c.*				
Kilkivan	2·62	55	3·55	3·76					
Maryborough ..	2·78	63	3·88	8·28	Bungeworgorai ..	1·44	20	2·75	3·09
Nambour	3·01	38	4·81	6·53	Gatton College ..	1·99	35	1·95	1·56
Nanango	2·25	52	1·47	1·45	Kairi	1·04	20	..	1·82
Rockhampton ..	1·78	63	3·21	4·07	Mackay Sugar Experiment Station	1·39	37	2·14	1·29
Woodford	2·56	47	1·60	3·72					

J. H. HARTSHORN, Acting Divisional Meteorologist.

CLIMATOLOGICAL TABLE—OCTOBER, 1934.

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	29·95	85	69	87	17,18,25	59	1	112	3
Herberton	..	79	59	85	17	50	2	58	2
Rockhampton	30·08	83	63	89	5, 28	55	5	321	9
Brisbane	30·13	76	59	85	28	50	23	134	8
Darling Downs.									
Dalby	30·10	79	53	87	23	37	2	145	7
Stanthorpe	..	69	47	78	7, 23	29	2	398	11
Toowoomba	..	71	52	78	28	37	2	312	8
Mid-Interior.									
Georgetown	29·94	96	70	99	9,13,14, 15, 16, 17, 18, 19, 20, 26	61	8, 18	16	2
Longreach	30·00	91	61	100	14	44	2	55	3
Mitchell	30·05	81	54	91	24	34	2, 3	326	7
Western.									
Burketown	29·94	92	72	99	28	60	4	7	1
Boulia	29·98	91	63	107	24	46	2	17	2
Thargomindah	30·02	83	59	99	23	43	2	117	6

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	December. 1934.		January. 1935.		Dec., 1934.	Jan., 1935.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					a.m.	a.m.
1	4·49	6·33	5·0	6·50	12·42	12·50
2	4·49	6·33	5·1	6·50	1·14	1·31
3	4·49	6·34	5·1	6·50	1·44	2·26
4	4·49	6·35	5·2	6·51	2·20	3·28
5	4·50	6·36	5·2	6·51	2·59	4·35
6	4·50	6·36	5·3	6·51	3·48	5·41
7	4·50	6·37	5·3	6·51	4·46	6·52
8	4·50	6·38	5·4	6·52	5·49	8·3
9	4·50	6·38	5·4	6·52	6·56	9·6
10	4·51	6·39	5·5	6·52	8·4	10·13
11	4·51	6·39	5·6	6·52	9·13	11·15
					p.m.	p.m.
12	4·51	6·40	5·7	6·52	10·19	12·17
13	4·51	6·40	5·8	6·52	11·24	1·18
					p.m.	
14	4·52	6·41	5·9	6·51	12·24	2·20
15	4·52	6·41	5·10	6·51	1·26	3·18
16	4·52	6·42	5·10	6·51	2·26	4·14
17	4·52	6·43	5·11	6·51	3·27	5·5
18	4·53	6·44	5·12	6·51	4 28	5·54
19	4·53	6·44	5·13	6·51	5·28	6·37
20	4·53	6·45	5·14	6·50	6'22	7·14
21	4·54	6·45	5·15	6·50	7'12	7·47
22	4·54	6·46	5·16	6·50	7·59	8·18
23	4·55	6·46	5·17	6·50	8·39	8·44
24	4·55	6·47	5·18	6·50	9·13	9·13
25	4·56	6·47	5·18	6·49	9·46	9·42
26	4·56	6·48	5·19	6·49	10·15	10·13
27	4·57	6·48	5·20	6·48	10·43	10·46
28	4·58	6·49	5·21	6·48	11·10	11·26
29	4·59	6·49	5·22	6·47	11·40	a.m.
30	4·59	6·50	5·23	6·47	a.m.	12·12
31	5·0	6·50	5·24	6·46	12·13	1·6

Phases of the Moon, Occultations, &c.

7 Dec.,	●	New Moon	3 25 a.m.
13 ,,	☾	First Quarter	8 52 p.m.
21 ,,	○	Full Moon	6 53 a.m.
29 ,,	☽	Last Quarter	12 8 p.m.

Perigee, 9th December, at 6 p.m.

Apogee, 25th December, at 7.36 p.m.

Mercury will be in conjunction with the Moon at 5 a.m. on the 6th, 1 hour 12 minutes after rising.

Venus will be in conjunction with the Moon at midday on the 7th, but being only about 4 degrees east of the Sun will be unobservable to amateurs.

Saturn will be in conjunction with the Moon on the 11th, an hour and a-half after setting. Earlier in the evening the crescent Moon and the planet will form an interesting spectacle apparently amongst the stars near the eastern border of Capricornus.

On the 31st Mercury will be in superior conjunction with the Sun, but being 1 degree 44 minutes southward will not get actually behind it. Mercury will then be at a distance of about 36 million miles beyond the Sun.

The Moon's path in December will be as follows :—Commencing at 8 p.m. on the 1st, it will be apparently amongst the stars of Virgo about 5 degrees south of the celestial equator; at midday on the 3rd it will be passing Spica, about 3 degrees south of it, and at 8 p.m. the waning Moon will be a little further to the south-east. About midday on the 4th it will pass into Libra and be in it till an early hour on the 6th ; about 11 p.m. on the 7th it will pass into Sagittarius, but being new will be unobservable ; about 8 a.m. on the 10th it will pass into Capricornus ; at 11 p.m. on the 11th into Aquarius; at 9 p.m. on the 13th into Pisces; at 4 p.m. on the 16th into Aries ; before noon on the 18th into Taurus ; before midday on the 21st into Gemini ; at 5 p.m. on the 23rd into Cancer ; at 10 a.m. on the 25th into Leo, passing about 2 degrees south of Regulus at 10 a.m. on the 26th. It will pass again into Virgo at 4 p.m. on the 28th.

Mercury rises at 3.54 a.m. on 1st December and only 38 minutes before the Sun on the 15th.

Venus rises 12 minutes after the Sun and sets 14 minutes after it on the 1st ; on the 15th it rises 26 minutes after the Sun and sets 29 minutes after it.

Mars rises at 1.4 a.m. and sets at 12.54 p.m. on the 1st ; on the 15th it rises at 12.30 a.m. and sets at 12.31 p.m.

Jupiter rises at 3.15 a.m. and sets at 4.27 p.m. on the 1st ; on the 15th it rises at 2.27 a.m. and sets at 3.45 p.m.

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5 Jan.	●	New Moon	3 20 p.m
12 ,,	☾	First Quarter	6 55 a.m.
20 ,,	○	Full Moon	1 44 a.m.
28 ,,	☽	Last Quarter	5 59 a.m.

Perigee, 6th January, at 9.42 p.m.

Apogee, 22nd January, at 8.0 a.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.