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QUEENSLAND AGRICULTURAL JOURNAL

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Event and Comment.

The Current Issue.

A valuable paper on the influence of the composition of foods on the health of live stock by Mr. Brünnich is an important feature of this issue. Mr. McGrath's notes on separation and the separator will be appreciated by dairymen. Passion fruit and strawberry culture are discussed by Mr. Benson, and Mr. Girault has added some notes on insects infesting fruit in Western Queensland. Ear Rot is the subject of a memoir by Mr. Tryon, and which has already been published in pamphlet form. The Bunchy Top Investigation Committee supplies a description of the disease with some finely reproduced illustrations. Results of South Burnett wheat trials are noted by Mr. Gibson. An interesting plant, a species of Gomphrena, is described by Mr. White, who also has a note on the weeds of Queensland. Mr. Rumball has a useful paper on worms in poultry. Mr. Shelton's contribution this month covers the several methods of administering medicine to pigs. Regular features are well supplied, and the March Journal is up to the high standard set in preceding numbers.

"Bunchy Top" in Bananas—Alarmist Statements Deprecated.

The Deputy Premier and Minister for Agriculture (Hon. W. Forgan Smith) discussing various matters affecting the banana industry with representatives of the Metropolitan Press recently, called particular attention to the fact that the "bunchy top" disease had been occupying the serious attention of the departmental officers for some time past. Full and complete investigations had been made and

experiments conducted with a view to (1) determining the cause of the disease; and (2) devising measures to combat it with a view to its complete eradication. No undue publicity, however, had been given to the matter, and the Minister deplored the panicky references to it in some quarters which must affect the banana industry prejudicially.

In 1920, the disease in New South Wales was investigated by officers of the Queensland Department, and its course in that State was subsequently closely watched. In 1922, departmental officers, conjointly with their confreres in New South Wales, furnished a report on the matter and recommended the carrying out of joint investigations covering the causation, prevention, and cure of the disease.

Following on this, the Queensland Government secured the appointment of a joint committee consisting of Professor H. D. Watt, the Professor of Agriculture of the Sydney University, representing New South Wales, Professor T. G. B. Osborne, of the University of Adelaide, representing the Commonwealth Government, and Professor E. J. Goddard, of the Queensland University, representing Queensland. This committee submitted certain recommendations in February, 1924, and, as a consequence, a campaign against the disease was planned. A Bunchy Top Investigation Committee was appointed and an Experiment Station established at Tweed Heads to discover if possible the cause and remedy for the disease. Professor Goddard was appointed supervisor of the investigations. In July, 1924, Mr. H. Collard, of the Fruit Staff of the Queensland Department, was sent to Fiji to observe conditions in those islands, so that anything that might be gleaned there might be applied to the benefit of the industry in Australia. The final report of the operations at the Tweed River Station and the recommendations arising therefrom had only just been submitted, but in the meantime every action possible had been taken to prevent the spread of the disease in Queensland, and any districts where "bunchy top" had been discovered had been quarantined immediately and traffic in suckers from those areas prohibited absolutely.

For some time past seven plant inspectors of the department had been exclusively engaged on "bunchy top" investigation work, while two officers in the far North had been specially brought to Brisbane to gain field knowledge of the disease.

In the course of the past two years the Queensland Department had expended over £2,000 on "bunchy top" investigation alone. Other diseases of the banana are receiving similar attention, and an entomologist had been devoting his whole time for over five years to the banana beetle borer. Another disease of the banana, thrips, is also engaging the special attention of another entomologist.

In addition, Professor Goddard's services as a consultant in these matters have been retained specially by the Department. The Cabinet has since approved of the continuation of the "bunchy top" investigation, the cost being provided in equal contributions from the Commonwealth, New South Wales, and Queensland Governments. Although the investigation has advanced to such a stage that it is possible to submit recommendations for the control of "bunchy top," there are two aspects of the work in connection with which it is considered further inquiry is warranted. These relate to certain entomological and pathological problems which it is hoped to soon elucidate. The further investigation will involve a contribution of £250 a year from each contracting Government who has agreed to the payment of its quota.

The Queensland Government, added Mr. Smith, has also approved of the conduct of an investigation into the cause and control of the obscure disease in bananas known as "squirter." The co-operation of the Commonwealth Institute of Science and Industry has been secured, and that Institute is giving a guarantee of £500 towards the cost of the investigation, conditional that Queensland provides a similar amount. To this the Cabinet has agreed.

Checking "Bunchy Top"—Departmental Activity

In the course of a recent Press announcement the Deputy Premier and Minister for Agriculture and Stock (Mr. W. Forgan Smith) stated that the intimation that "bunchy top" had been discovered in a Northern district had been confirmed by the local inspector. On one plantation two infested stools were found and on another one infested stool was discovered. All were destroyed immediately. In both cases the suckers had been obtained from a Southern district towards the end of last year. The fact that these suckers had been sent to the Northern area had been known since the discovery of the outbreak near Brisbane, and, anticipating that "bunchy top" would make its appearance in the North, the Director of Fruit Culture (Mr. A. H. Benson) took every precaution to meet the situation by bringing the two Northern inspectors to Brisbane and instructing them in the symptoms of "bunchy top" and the methods of procedure as recommended by the Bunchy Top Investigation Committee. These officers visited the Tweed for practical field experience, and were afterwards enabled to study closely the disease in all its stages in the districts in which it has occurred. In addition to this, the Department, with the aid of the Railway Commissioner and certain growers and agents, endeavoured energetically to trace to their destination the suckers distributed from infected areas. Unfortunately, continued Mr. Smith, efforts in this direction had not been supported by all growers and agents, but, nevertheless, the Department was now able to appreciate the exact position in respect to the possibility of "bunchy top" appearing in Northern banana areas, and in order that every person to whom suckers had been sent in these localities might identify the disease a copy of the recommendations of the Bunchy Top Investigation Committee embodied in its pamphlet, and which is reproduced in this issue of the Journal, was despatched to each. Other practical measures of confining the outbreak to areas in which the disease has made its appearance and towards ultimate eradication are being energetically applied.

Imported Maize—A Shipping Anomaly.

The Minister for Agriculture (Hon. W. Forgan Smith) stated recently in the course of a Press announcement that for some years past the Government had been in direct communication with the Federal Authorities urging the necessity for the imposition of an import duty of 3s. per cental on maize imported into Australia from South Africa, because of the serious position accruing from the dumping of such maize on Australian markets. Under the 1921 tariff, the duty on maize was fixed at 1s. 6d., 2s. 6d., and 3s., but South African maize was admitted at 1s. under "*The South African Preference Act of* 1906." The Commonwealth Government advised that an increased duty could only be imposed by Act of Parliament and as duty on South African maize involved the question of reciprocal tariff arrangements between the Commonwealth and South Africa, there was a difficulty in giving effect to the requests of the Queensland Government.

At a later date the Queensland Council of Agriculture agitated for an increased duty on maize from South Africa, and its action was supported by the Queensland Government. As a result of combined efforts, an anti-dumping duty of 7d. per cental was imposed on maize. With the suspension of the anti-dumping duty, an endeavour to have an import duty of 3s. per cental imposed on all maize introduced to the Commonwealth had and was still, being vigorously prosecuted. A case was presented before the Tariff Board, which reported to the Federal Government on the subject. Mr. Smith was of the opinion, apart from the question of duty altogether, that there should be a complete embargo against the importation of maize grown by coloured labour either in South Africa or elsewhere. Queensland growers of maize should not be expected to compete with the cheap labour conditions obtaining in South Africa.

In the course of last season the anomaly was presented in the case of the ship that carried Queensland maize to England and on its return brought a cargo of South African maize to Townsville. That was a state of affairs, continued Mr. Smith, which should not be allowed to continue. Queensland has large areas of land suitable for the cultivation of maize and everything possible should be done to protect and foster our own Australian resources.

Bureau of Sugar Experiment Stations.

CANE PEST COMBAT AND CONTROL.

The Director of the Bureau of Sugar Experiment Stations (Mr. H. T. Easterby) has received from the Acting Entomologist at Meringa, near Cairns (Mr. A. N. Burns) the following report (23rd January, 1926):—

NOTES ON CANE BEETLES.

Grey-back Cane Beetle (*Lepidoderma albohirtum* Waterh.).

As anticipated the welcome rains which fell over the period 28th December and 3rd January brought forth another—and most likely the final—emergence of these beetles. Following the first two days of this rain, when 1 inch was recorded, a marked increase in the evening flight was noted, and large numbers were to be found on the feeding trees.

A good many of these beetles still remain (12th January), but a rapid daily decrease now occurs. Further rains in the near future may bring out a few more of these insects. Occasional stragglers will probably continue to emerge even on into February.

First, and even second stage grubs (two of the latter were found under one stool at Meringa, 9th January), are now to be found feeding at cane roots. These are undoubtedly the offspring of beetles that emerged during the emergence that occurred after the rains in November. With over a month's time between each emergence of the beetles, the resulting grubs will continue to hatch from the eggs well on into February, so that grub attack this season will most probably be extended until late in the autumn. Fumigation should therefore be carried out at such a time as to catch grubs from the present emergence as well as those from the November one.

Frenchi Cane Beetle (*Lepidiota frenchi* Blackb.).

The first emergence of this cane pest took place following the recent rains, and for about a week every evening moderately large numbers of these beetles were noted flying about half an hour or so before the grey-backs in their mating flight. After flying about for a few minutes in great agitation they settle on convenient low objects, bushes, fences, &c., and mate, the females resting first and being quickly surrounded with males. When a female has found a mate the other males fly round again seeking other females. During the act of mating the male hangs head downwards from the female and reversed with his mate, sustained only by the genitalia.

Another, and very likely the general emergence of this insect will in all probability take place after the next soaking rains.

Rothei Cane Beetle (*Lepidiota rothei* Blackb.).

In company with the emergence of "frenchi" beetles, a small number of these insects was observed, and late each evening specimens flew into light. Mating pairs were found on a few bushes, usually in situations at a greater elevation than *L. frenchi*. According to Dodd, in Bulletin No. 16 of this office, 1921, page 56, this species appears to be somewhat local in its occurrence, appearing to be found mostly in the area around and near Gordonvale and district.

As with *L. frenchi*, the main emergence of this beetle has yet to take place. Its mating habits much resemble those of the preceding species, but the act of mating only occupies at longest a period of about two minutes, quite unlike any other species of its genus.

Anomala Beetle (*Anomala australasiae* Blackb.).

The recent rains have also been responsible for a fairly large emergence of this, so far, comparatively minor pest of cane. Numbers have been noticed every evening flying in company with *L. frenchi* and *L. rothei*, and mating chiefly on lantana bushes and fence posts. It is a well-known fact that this beetle favours lantana bushes, resorting chiefly to the terminal branches bearing the flower clusters. It is on the latter that the beetles feed, eating the corolla out of the flowers. Already the numbers of these insects are diminishing rapidly, so that it seems that this last emergence is the final one.

Christmas Beetle (*Anoplognathus boisduvali* Boisd.).

Very few specimens of this ordinarily plentiful cane pest have so far been observed, even immediately following the rains. Occasional beetles have flown to light at Meringa, and whilst collecting grey-backs from feeding trees a search has frequently been made to determine the prevalence of the former species in its feeding trees—namely, poplar gum (*Eucalyptus platyphylla*), bluegum (*Eucalyptus tereticornis*), and box (*Eucalyptus leptophleba*), with the result in each case of only an odd specimen being found. The main emergence, therefore, of this species may still be pending after further rains, for in 1920 (also a very late season) the main emergence occurred from the 10th to the 15th of January.

Isodon Beetle (*Isodon puncticollis* MacLeay).

Moderately large numbers of this insect have been in evidence during the last three weeks, a good many flying in to light every evening. This beetle does not occur in "flights" or "swarms" like the grey-back or frenchi beetles, the only evidence of its emergence being shown by those flying in to light.

The damage done to sugar-cane by the grubs of this species is apparently almost negligible. Although they are to be found in isolated patches, their occurrence there is mainly due to there being manure or humus in the soil. Grubs have been previously recorded from heavily manured soil.

Species of Histeridæ (*Platysoma* sp.) associated with Tachinid Fly Pupæ (*Ceromasia sphenophori* Vill.).

On 10th November, 1925, whilst cutting out Tachinid fly pupæ (*Ceromasia sphenophori* Vill.) from beetle borer infested first ratoon cane on Mr. James's property, on the banks of the Russell River, near Mirriwinni, a borer cocoon was found with several empty fly pupæ inside it, and from all of which Tachinid flies had apparently emerged, with the exception of one. This pupa seemed quite normal from a rough inspection with the naked eye, and close investigation was immediately proceeded with to ascertain the cause why this one remained in this state, whilst the others appeared to have yielded flies.

The pupa was therefore opened, and within the shell was found a Histerid beetle (*Platysoma* sp., No. C. 381, now in the office collection). This beetle must have recently transformed from the pupal stage, for its elytra and other body parts were still of a reddish-brown colour, having not yet properly hardened and deepened in colour. Other beetles of the same species found later were of a jet black colour, and judging from the fact that this pupa was found intact it was concluded that the beetle transformed within the pupa and probably lived at the expense of the stored up fatty products of the fly pupa, if not in its primary larval existence then in the latter period of this stage. However, it is possible that one Tachinid fly pupa contained enough nourishment for the complete development of the Histerid.

No similar case was found to bear out this discovery, but later, on the same farm, several more of this same species associated with the beetle borer and fly pupæ were found, and as if to add further weight to this theory regarding its predaceous nature, it was noticed that wherever this Histerid was intimately associated with Tachinid fly pupæ in borer tunnels in sticks of cane, no living fly pupæ were found. This supposed predatory habit therefore still needs confirmation.

Fumigating Grey-back Cane Beetle Grubs.

Examination of cane stools in areas usually grub-infested has shown that the time for applying grub fumigants to the soil is now approaching, as indicated by the appearance of young grubs. The recent rains have created vigorous growth in the canefields, and in general the cane looks healthy and green, there being at present certainly no indications to denote the advancing attack from grubs, with the exception of the isolated patches where the cane has already wilted through the ravages of the "frenchi" grub.

This healthy looking cane will not, however, begin to show the effects of grey-back grub attack until about early March, when by that time the grubs will be in the third stage, and the root systems of the cane stools almost eaten out.

Arrangements are therefore being made for the carrying out of extensive field experiments embodying the uses of various solid and liquid fumigants to be used against these formidable pests. These experiments are to be carried out as soon as the grubs are all feeding, and the weather still favourable for getting best results from fumigation.

The Director of the Bureau of Sugar Experiment Stations has received the following report (20th February, 1926) from the Acting Entomologist at Meringa, Mr. A. N. Burns:—

Attacks by Army-worms.

Reports have come to this station from different farmers in the district, the chief centres being Highleigh and Edmonton, of extensive damage to cane through the attacks of caterpillars. Inspection of each attacked area showed in each instance that the injury was caused by the same species of larva—one of the "army-worms," but not either of the two species that are usually responsible for "army-worm" damage to cane in Northern districts.

The insect in question is probably *Prodenia exempta* (Walker)—we have not yet had specimens of the adults determined—one of the Noctuidæ, a family of moths which contains many species that are responsible for an enormous amount of damage to economic crops.

In each of these attacks the damage extended over areas of from 3 and 4 up to 20 acres. In one instance the larvæ had eaten to ground level a field of about 20 acres of young corn in three days, and were then moving *en masse* into canefields which bounded the eaten corn on three sides. At noon the day after the larvæ had left the corn the first seven rows of one of these areas of cane were very badly damaged; the larvæ were at this stage slightly over half-grown, so that the greatest amount of damage had still to come. They were steadily advancing, and it is quite probable that before evening another six or eight rows of cane would have been attacked. On another side of the eaten-out cornfield a narrow road had to be crossed by the larvæ before they could reach the cane; every blade of grass (crowsfoot) on this track had been eaten, and the larvæ were pouring into the cane in numbers so great that it was impossible to walk without destroying probably as many as fifty at each step.

Several species of Tachinid fly parasites were observed in fairly large numbers flying about amongst the larvæ and ovipositing on some. In one instance a fly was watched; it deposited ten eggs in a space of less than half a minute on ten different hosts. The fly would hover over a larva, touch the body with its ovipositor, and then fly off to another host. The larva in each case fell to the ground immediately after the fly had laid its egg.

The natural control measures exerted by these flies would not affect the present generation, for larvæ when parasitised by Dipterous parasites (Tachinid flies) almost invariably attain their full size and feed up till pupation, the parasite larva leaving its host shortly after the latter has pupated.

Control Measures.—If the larvæ are centred over a given area an efficient control measure may be resorted to by digging a trench or running a deep plough furrow between the infested and clean fields, taking care to have the vertical face of the furrow opposite the advance of the larvæ. Poison bait made up of Paris Green, bran, and molasses in the following proportions will be found effective:—

Paris Green, 1 lb.; bran, 2 lb.; molasses, 2 quarts. Add enough water to reduce this mixture to a thick mass which will break up easily, and sprinkle it thinly in the bottom of the trench.

Should the larvæ have already gained access to clean cane, a good control method to employ is to spray two or three rows of the cane just in front of the advancing larvæ with an arsenate of lead solution spray. Two pounds of arsenate to 50 gallons of water is sufficiently strong, and the ready-made arsenate of lead compound is the easiest and best to use. The affected rows may also be sprayed after this with good result.

Description.

Larva.—Length, when fully extended, 1¼ inch. Colour, pale-green, dorsal line dark-green to green, broad, longitudinally halved by three whitish undulating thin lines. Sub-dorsal stripe yellowish-green, fairly broad, divided almost centrally by a metamerically broken green line; below this sub-dorsal stripe and parallel to it runs another broad green stripe distinctly streaked with white. Lateral stripe very dark-green, almost black, moderately broad. In this stripe at the centre of each segment after the third from the head is a round white spot. On the lower margin of the stripe in front of each of the spots are situated the spiracles, which are jet black. Below this stripe again occur two white narrow stripes separated by a greenish-yellow line regularly marked with brown. Ventral area, including claspers, pale-green, pro-legs yellow. In the region below the lateral stripe is an irregular shaped patch of whitish spots on each segment. Head brown, with a white V-shaped marking, with its apex directed backwards. On the first segment behind the head, dorsally, is a jet black collar extending to the sub-dorsal area on each side of the body.

Pupa.—Length, approximately five-eighths of an inch. Colour, reddish-brown, at junction of abdominal segments darker brown. Wing covers lighter brown. Before emergence the eyes darken. Pupation takes place in the soil, generally from 1 to 2 inches below the surface.

Moth.—Width across the expanded wings, from 1 to 1¼ inch. Antennæ filiform, two-thirds length of costa. Forewing very variable, usually some shade of dark-brown, a black spot at end of cell, a zig-zag black line running from costa to hind margin beyond end of cell. This is bordered on the outer side by a similar whitish marking which does not extend as far as the hind margin, but terminates in an irregular ovate black marking about half way to the hind margin. A radulate black marking runs along termen from apex to angle, cilia grey. Hindwing light-fawn coloured, suffused dark-brown to black towards costa and termen, veins dark-brown, cilia pale silvery grey.

The larval stage occupies from twelve to fourteen days, pupal period nine to eleven days.

Notes on Cane Grubs.

Recent examination of cane stools in areas which usually are grub-infested has revealed the presence of grubs of the grey-back cane beetle (*Lepidoderma albohirtum* Waterh.) in all three stages, the greatest number at present being in the second stage. Grubs of the "frenchi" cane beetle (*Lepidiota frenchi* Blackb.) are still feeding in the third stage, and will continue to do so till about April, when they will cease feeding and tunnel deeper into the soil to pupate. Young grubs (first stage) of the Christmas beetle (*Anoplognathus boisduvali* Boisd.), the Anomala beetle (*Anomala australasiæ* Blackb.), and *Dasygnathus australis* Boisd. are also to be found in isolated patches feeding at cane roots.

Paradichlorobenzene.

Two plots, each one-tenth of an acre, of grub-infested cane have been treated with this fumigant, using doses of ¼ ounce placed about 15 inches apart on each side of the rows of cane. Injection was carried out by means of a Massey-Harris corn planter fitted with improvements and alterations for the injection of paradichlor. Control plots of equal size were established beside the treated area. Another similar experiment has still to be carried out with this fumigant in another part of the district.

Calcium Cyanide (Flake Form).

In conjunction with Mr. Wolstenholme, a plot of grub-infested cane embodying six rows each 50 feet long was treated with ½-oz. doses, four to a stool, of the flake form of this fumigant. A control plot of equal size was left adjacent. Results will be given later after the final digging which is to take place three weeks after the time of injection. Another experiment of one-eighth of an acre in extent, also using flake form of the fumigant, is being put down this month.

See-Kay.

Two blocks of grub-infested cane, each 130 by 45 feet, have been treated with 1 drachm and 2 drachm doses respectively of this fumigant. Control plots of equal size have been marked out adjoining the treated areas.

Chlorocide "A."

Two plots of grub-infested cane, each one-tenth acre in extent, are being treated with Chlorocide "A." The fumigant is being sprinkled in a drill opened up a few inches away from the stools on each side of the rows of cane and the material sprinkled in at the rate of 4.26 drachms per yard (1 cwt. per acre) in one plot and 6.39 drachms per yard (1½ cwt. per acre) in the other plot. Control plots of equal size are established alongside the treated cane.

Dehydrated Tar Repellant.

Five rows each 125 feet long have been planted with Badila cane sets having their ends dipped in dehydrated tar before planting. Another row of equal length was planted having the sets wholly immersed in the tar before planting. In each case the sets were well drained before planting, and were planted in land infested with grubs of the grey-back cane beetle (*Lepidoderma albohirtum* Waterh.) and "frenchi" cane beetle (*Lepidiota frenchi* Blackb.). A control block planted with undipped sets was put in beside the treated plots.

FIELD REPORTS.

The Director of Sugar Experiment Stations (Mr. H. T. Easterby) has received the following report (22nd January, 1926) from Mr. R. S. Mungomery, Southern Assistant Entomologist:—

Since my transfer to the southern sugar districts from the Meringa laboratory, I have spent the time in commencing an inspection of the Isis district for cane pests, and during this period work has been confined mainly to the Childers and Doolbi cane areas.

These areas at present are looking particularly well, due to the timely fall of 3 inches of rain about the middle of the month, followed by a similar amount towards the end of the month. Though there had been a minor emergence of beetles in November, this fall of rain on the 13th December heralded the general emergence of the common cane beetle (*Pseudoholophylla furfuracea* Burm.), and some of the older residents consider this to have been one of the largest flights of beetles in the Isis district for many years. It is gratifying to know that growers are fully awake to the seriousness of the depredations of this formidable pest, and through the Pest Fund of the Isis Shire Council payment at the rate of 1s. and 1s. 6d. per quart for grubs and beetles respectively is being made. In this manner upwards of £500 has this year been disbursed, of which almost £100 went towards the collection of beetles, which accounted for approximately 830,000 specimens, and the remainder in the collection of cane grubs, several millions of which must have been destroyed.

Though this must necessarily exercise a great control on their natural increase, still grubs are very plentiful in the localities visited, and have occasioned a great amount of damage both to young plant cane and to ratoon crops. So severe has been the injury in certain cases that young plant cane has had to be ploughed out and replanted three times before a successful "strike" has been obtained. Most farmers follow the wise practice of picking up the grubs in the furrow when ploughing, and if this be done at any time excepting during the winter months, when the grubs burrow deep down into the soil, their land can be made reasonably free from grubs and ensure a good plant crop.

With ratoon crops a different aspect is presented, and there are instances of "grubby patches" developing and remaining almost exactly in the same place year after year, and in this case fumigation must be resorted to. It will then be possible to ratoon a third and fourth time, whereas at present many growers seldom carry their crops further than to second ratoons, and cases are many in which first ratoons have been absolute failures through grub attack.

Fumigation of the soil with paradichlor against "white grubs" has not been tried very extensively in the Isis district, and growers for the most part are unfamiliar with this chemical, also the method of injection, so I propose to lay out as soon as possible a few test plots to demonstrate its effect.

A small species of termite (white ant) has been found on various farms affecting ratoons, and also eating into the "sets" which had recently been planted; in one instance as many as twelve consecutive "sets" had been destroyed. In all these cases there was evidence of infestation from wood, such as old stumps or fence posts in the immediate vicinity, and farmers were advised to burn all surplus wood and to poison infested fence posts with the arsenic-caustic soda-molasses solution.

The Director of the Bureau of Sugar Experiment Stations has received (25th January, 1926) from Mr. A. P. Gibson, the Northern Field Assistant, a report as under:—

Innisfail.

The rainfall for the greater part of December was scanty; only 18 points had fallen up to the 30th. The last two weeks of the month many hopeful storms appeared, some looked threatening, but they passed away rainless until the aforesaid date, when 131 points fell in good time and temporarily relieved the situation. The grand total rainfall for the year (1925) was 143.80 inches, and was quite up to the average; 75 inches of this were precipitated during the months of February and March.

The thermometer climbed up over the 100 degrees mark three days in succession, 102 degrees being the maximum on Christmas day, and at the same time having a wet bulb reading of 80 degrees.

The prevailing dry and hot condition greatly benefited harvesting and cultural operations, but were not conducive for continuous crop growth. It dried up the surface water and compelled many residents to buy water, costing 10s. 6d. per 100 gallons.

Harvesting and Grinding Operations.

The grinding season is speedily drawing to a close. Goondi completed its crop of 168,000 tons on the 14th December; South Johnstone expected to finalise its crop of 200,000 tons on the 15th January; Mourilyan Mill is still going its hardest. It has no chance of fully treating its record tonnage; 126,000 tons had passed through the rollers up to the 9th instant. The average mill quality of cane to date was 13.35, but is now declining. The management still hoped to extend grinding operations to middle of February (weather permitting), when perhaps 150,000 tons would be treated, leaving 20,000 tons approximately to stand over. This is less than first of all expected, due to the fact that some thousands of tons of burnt cane had to be condemned.

The mills have been fortunate in having favourable weather. This has permitted a good cane supply and delayed the new crop growth, thereby preventing a rapid decline in the sugar content. Ideal conditions enabled the many harvesters to work continuously, thereby making big cheques. On the whole the harvesting work appeared satisfactory; in a few instances too high ground cutting was noted. This is detrimental to subsequent ratoons. The carrying on of grinding operations into the month of January and February is not desired for many reasons. The principal are as follow:—(1) Great decline in the commercial cane sugar; (2) harvesting and subsequent husbandry are often delayed by prolonged wetness; and (3) the late cut canes are not sufficiently advanced for the following grinding season.

Manuring.

This month great quantities of fertilisers have been applied, and since the rains of recent date had worked wonders. When surface dressings of manure are applied it is imperative that the cane rows are at least clean.

Green Manuring.

The indispensable organic matter in the soil is derived almost entirely from decayed vegetable matter. Farmers do not grow leguminous crops to the extent that they should. The importance of this is being realised too slowly; the practice is carried on to a greater degree here than elsewhere. It is not recommended to interplant corn and cowpea on the grounds that the former mentioned harbours Mosaic; this disease was noticed where corn and cowpea were growing conjointly.

Patches of cowpea were found wilting and dying; a minute creamy to brown borer was located in affected stems and branches.

Pests and Diseases.

The notorious rat and weevil borer (*Rhabdocnemis obscurus*) still are causing havoc in the yet unharvested cane paddocks. They are responsible for increased harvesting rates, reduction of cane tonnages and c.c.s., and the injured portions of the stem serve as inlets for destructive pests and diseases. Thousands of pounds are lost annually to the grower. Farmers and millers should co-operate and tackle this dreaded field rat in a systematic manner, otherwise extended losses may ensue. The Pest Board and some of the mills during the past have done good work in this particular branch. The curling of the leaf is just one of Nature's little ways of conserving moisture when the soil supply is becoming low, by so doing the leaf surface exposed to the fierce rays of the sun and drying winds is minimised and evaporation reduced. At this stage it is difficult to detect the primary stages of the various diseases. Many English and native bees were observed resting on the young cane leaves affected by the aphis sacchari, the punctured leaves evidently yielding some sweet substance desired by them.

Dead Cane.

Standing condemned, burnt cane should be cut at the earliest convenience and placed in the convenient interspaces, or, better still, removed off the paddock. This operation is costly, but if left interferes with subsequent harvesting, and may cause serious damage to the stubble or prove a breeding-ground for pests.

Cane Culture.

Cane culture is perhaps the worthiest and most profitable pursuit in the North. It is certainly one of the most useful. To-day a cloud of depression has fallen heavily upon it, resulting in a low price, and it is clear that only by judicious management and reducing the cost of production can we all hope to make it pay.

Crop Prospects.

The 1926 crop growth at the end of the year was backward and perishing, due to the absence of moisture, but timely rain storms came along and have caused a transformation. The leaves were washed clean, and they immediately uncurled, and the fast-growing crop is speedily painting over the bare patches of cultivation. The present prospects are favourable for another good crop, but there appears to be little chance of it overshadowing in tonnage the past record season. There are people of many nations interested in cane-growing here. One requires to be a linguist to make oneself understood. As a rule, the foreigners are industrious and keen agriculturists. Those who do understand seem deeply interested in things pertaining to cane culture. The average cane price for the district is to be about 32s.

Tully.

The Tully, Queensland's newest sugar-producing district, was again briefly visited. Some people are already gazing into the district's future and seeing greatness.

Stormy rains had fallen since my last visit. This, in conjunction with the prevailing sweltering heat, had decidedly improved next year's prospects, but even so the cane was backward.

Crushing.

The mill had worked better the last few weeks, and was expected to complete its maiden crop of 30,000 tons on the 12th January. Practically all the cane crushed was burnt. Much Badila had been burnt and harvested too long before being treated, therefore being highly fermented. Great activity prevailed. Huge silky oaks, monarchs of the scrubs, were being tumbled for their valuable timber, and the dense tropical jungle, the home of beautiful birds, is fast giving way to the ever-extending sugar areas. Cane-growing is a new venture for many here; some, in consequence, were paying dearly for their experience.

Scrub Felling and Burning.

A good fire improves the soil condition and considerably reduces subsequent logging costs. Various things influence this important operation, such as time of cutting and judicious falling, the complete severing of all trees from their respective stumps, otherwise they are slow in drying. Firing with the assistance of a gentle breeze during the heat of the day is preferable to night burning.

My visit was confined to the new perpetual leaseholders situated some three miles north from the mill and connected thereto by a tramline. There are some sixty-six farms, ranging from 55 to 75 acres. Of this number fifty-six are occupied, and it is computed that 200 acres had been planted with cane.

The all-scrub soil is composed of the usual fine to coarse grey to reddish-brown decomposed granite, and lying adjacent to the ranges. It is level for the greater part, and drained by the Bookle Bookle and Bulgan Creeks.

Planting.

Planting the virgin scrubland was in progress. It is a common and good practice to make the cane holes by spade, for which 4s. per 100 holes is paid. Farmers had hazy ideas regarding spacing of plants and width of drills. This, as a rule, is dependent on the fertility of soil, the variety to plant, and the interspace most convenient for cultural operations. Five feet drills and about 2 feet spacing for Badila should suit the Tully lands. Some growers have planted too shallow. The cane at present looks well. There is the probability of the resulting crop tumbling badly when the soil becomes very wet, owing to insufficient and surface root anchorage.

Pests and Diseases.

Damaging cane sets underground: (1) Termites (white ants), of which there appeared to be a small and a medium sized ant. The damage would probably be reduced when the wet season sets in. (2) Minute, active, black beetles, found mostly boring through the nodes of plants. This seemed to be the soft wood borer. Brown Rot was located on three farms, in N.G. 15 (Badila) virgin scrub land. The growth of the stools affected was quite equal to the surrounding one, and the root system was considered normal, but dead and pulpy. When the stool is attacked it quickly dies.

Red Rot was located in canes being used for plants. Several fields previously planted from this area carried on the disease.

Some growers in ploughed areas are unwisely depositing the fully-grown canes into drills and cutting same into plants as they lie. This is not plant selection, and the tendency is to extend pests and diseases.

The ratoons appear to be doing better than plant cane here. The probable reason is that the soil, since freed of its dense jungle, is gradually being sweetened by the process of aeration and direct sunlight.

It is computed that about 5,000 acres will be cut for the Tully Mill next season. This should yield approximately 100,000 tons.

The Director of the Bureau of Sugar Experiment Stations (Mr. H. T. Easterby) has received the following report (29th January, 1926) from the Central Field Assistant, Mr. E. H. Osborn:—

Burdekin District.

Unfortunately, the excessively dry conditions that had been experienced upon the Burdekin so long were still prevailing, and right throughout the district the effects of such a prolonged dry spell were very apparent. In the middle of December great hopes were entertained of a good fall; but, unfortunately, only some 90 points were the result of much wind and thunder. Intense heat accompanied this dry spell, and, although the irrigation plants were pumping to their full capacity, the crops in general were below the usual standard of the Burdekin cane at this period of the year. With so many set-backs it is no wonder that opinions were locally expressed that, in view of the present sugar market, profitable cane-growing in an extra dry season in this area will be very hard, the salvation of which may probably be smaller areas requiring no outside labour, very careful cultivation, and growing only the most suitable cane for each particular farm.

As regards harvesting costs, although high considering the present average grower's return, yet the contract system ensures that the amount paid is commensurate with the work carried out, and as a class the local cutters are a reliable and hard-working body of men, in many cases having harvested the same farms for many years.

Cane Varieties.

When writing of above in last month's report, mention was made of very satisfactory returns having been obtained from E.K. 28, both as regards tonnage and density. As these results were obtained upon medium forest soil, it appears that such soils are more suitable for this cane than the heavier and deeper soils adjoining the creek and river banks. In fact, the experience of several growers of the cane in question upon such soils is that, although the crops are heavy, the density returns are only medium.

Diseases.

Owing to the climatic conditions being very unfavourable for disease detection, very little of such was noticed. Leaf Stripe or "Downy Mildew" that had been noticed in a large block of plant B. 208, now showed marked effects of same in the ratoons, but possibly the very dry conditions have a good deal to do with such. In relation to this disease, Mr. B. Parker, of Airedale, upon whose farm the disease was noticed some eighteen months or so ago in B. 208 and N.G. 24 (Goru) ratoons, mentioned that after harvesting he ploughed the crop out, not replanting until the following spring with the same variety (B. 208), but obtaining seed from another farm where the disease had not been seen. So far the cane looks clean, although it may be premature to say that the disease has been eradicated, as it may yet appear in the ratoons.

Mosaic was noticed upon several farms in the Airedale locality. In one in particular where it has been seen in plant H.Q. 426 (Clark's Seedling), it was not so apparent (just then) in the first ratoons now to be ploughed out, but, as already mentioned, weather conditions made disease detection very hard. Upon another farm the disease was seen in plant B. 208 adjoining some diseased H.Q. 426. Mentioning such, it is not surprising that secondary infection should be observed in this locality, for numbers of little corn aphides were noticed upon the corn and sorghum growing in close proximity to the cane on several farms.

It has been frequently pointed out that to grow such crops where Mosaic is likely to occur is creating a potential danger, and the grower cannot be too careful, especially in these hard times.

Top Rot.—Easily the cause of most loss to the growers of Badila upon the Burdekin; is now being investigated through a series of inoculation experiments by an officer of this Department. Such experiments may lead to a different view being taken of the direct cause of this very serious disease.

White Ant (Giant).—This pest did not seem to be as bad as formerly at Jarvisfield, and several growers, where the pest was at its worst, credit the following mixture with giving good results:—

Arsenic, 2 lb. by weight.

Caustic soda, ¼ lb. by weight.

Cover mixture with water, causing soda to boil and dissolve arsenic, then add to above molasses 4 gallons, thoroughly mixing up. To obtain best results all adjoining timber, such as stumps, fencing, posts, &c., require poisoning.

Ingham Railway Line.

Along this line recent showers had freshened the pasturage and cane up wonderfully, contrasting forcibly with the Burdekin in its dry state. The area from Rollingstone to Helen's Hill seems to have fared better than that further north, even Tobanna did not have as much as Helen's Hill. Although these showers have been useful, they have only partially relieved the situation, and at this juncture rain is urgently required to ensure a decent crop for 1926.

Harvesting operations were very active. Railway wagons then being as plentiful as they had been scarce in the earlier part of the season, unfortunately in the hottest period of the year, and at a time when the density is generally very low.

Early in the season the estimated tonnage was placed at 20,000 tons, but probably 17,000 tons will be about the harvest. Of this quantity Tobanna, with seventeen suppliers, is the largest supplier, and should supply some 9,000 tons. At this particular siding several large plantings of young cane were noticed, but in general the appearance and growth of same was very backward, the early plant looking far better in proportion than that put under later on. Some of the land is low lying, and should be very wet in a heavy wet season. Draining such places is very necessary.

Good density returns were obtained. Mr. J. C. Heard, mentioning that cutting right throughout the season to date, his figures were only once under 15 c.c.s. Badila was the cane. At Helen's Hill some uncommonly good N.G. 15 (Badila) was coming in, and here again some fair-sized paddocks of young cane, mostly N.G. 15, was remarked upon.

At Yuruga, Mutarnee, Meongabulla, Bambaroo, and Rollingstone the crops were looking green and healthy, considering what a dry time they had gone through. The ratoons except in a few places were, however, rather backward, and have a lot of leeway to make up.

Motor Transport

Is much in evidence upon this line, five power trucks pulling into one siding. Everywhere the users of these trucks are very keen upon them, especially the light style of truck, and aver that there is no comparison between them and horses for such work, both for economy and quickness.

CANE PEST COMBAT AND CONTROL.

The Director of the Bureau of Sugar Experiment Stations has received the following report (15*th February*, 1926) *from Mr. R. Mungomery, Assistant Entomologist:*—

Isis District.

Here I was able to complete a survey of the whole district for insect pests, and found that grub attack represented by far the greatest damage, and, judging from the extent of the injury and the degree of infestation, this species (*Pseudholophylla furfuracea* Burm.) is only rivalled by the notorious "grey-back" (*L. albohirtum* Waterh.) in its ravages in the cane areas this year.

Although individual grubs can be found outside these limits, the farms showing the greatest damage lie in a line from Cordalba to Childers, thence branching to

Horton and South Isis, and following very closely to the railway line. As the railway line tapped the centre of the Isis scrub lands, it will be seen from this that grub infestation is confined chiefly to the rich red volcanic soils, while those lands situated nearer to the forest are little troubled. Notwithstanding that grub damage is most noticeable in the red volcanics, odd cases have been met with in which yellow and white friable soils have been seriously infested, but in no instance have I found them to be present in any alarming degree in the low black alluvials or white forest lands. Of course, the losses incurred by this pest vary directly as the infestation, but individual losses can best be estimated when many growers give as a moderately reckoned amount the sum of £100 to £200 as their annual loss, and maintain they suffer a worse gruelling from grubs than from the periodical dry spells to which the district is subject.

It is an easy matter to find as many as thirty specimens under a single stool of cane, but as many as sixty have been found, and one can imagine what little chance cane has of actually surviving, without thought of its producing an average tonnage, against such adverse conditions.

Though those to which reference has been made as occasioning all this damage are mostly large third stage grubs, several small first stage grubs are now to be found, and these will be responsible for the injury in the coming spring, so where farmers know these grubs to occur they should fumigate with either carbon bisulphide or paradichlor. as soon as possible, and so avoid this coming evil.

Experiment Plots.

With a view to familiarising farmers with the use of paradichlor. and the method of injecting with the "Jarvis" injector, and also to find out the effects of this fumigant on first and third stage grubs of *P. furfuracea*, plots were laid out on the farms of four growers in the district in young August plant cane and first ratoons, all of which were badly grub smitten.

Doses of ½ oz. of paradichlor. were injected on each side of the stool, and 1 foot apart in the case of large stools, and the growers in each case are kindly co-operating with me in observing any changes or results during my absence.

Parasites.

Too much cannot be expected from natural parasites, and these are remarkably few in numerical strength at present. The parasitism from scoliidæ (digger wasps) is very small, and, although I had ample opportunity for observation during this month when so much land is under the plough, only a few parasitised grubs were found. The hyperparasites, Hyperalonia sp. of the family Bombylidæ (bee-flies), are very numerous all over the Isis district, and must have an appreciable effect in curtailing the activities of the digger wasps. While dissecting a beetle which I had dug up, to determine its egg-laying capacity, I found inside it five maggots which had almost completely eaten out the abdominal contents, and these maggots I successfully introduced into another beetle of the same species, where they completed their development, pupated, and about a week later emerged as perfect flies (Tachinidæ sp. unidentified). It is difficult to arrive at the extent of this parasitism, for the beetles are usually hidden far underground, and so escape notice, but they must doubtless effect a fair check in destroying the ovaries of the female beetles with consequently no production of eggs.

Several predaceous Asilid (robber-fly) larvæ have been found closely associated with cane grubs, and as many as seven out of nine from under one stool of cane have fallen victims to these voracious feeders.

Moth Borer (*Phragmatiphila truncata*).

Injury from this insect is not very pronounced now, but occasionally standover cane and young cane growing near paddocks full of "natal" and "guinea" grass suffer considerable damage, often making a block of cane very wasteful when it is left with the intention of cutting a supply of plants from it.

Mealy Bugs (*Pseudococcus* sp.).

These are common around the leaf sheaths of older cane, and are well distributed throughout the district. Their effects are not noticeable, since they are kept in check by various natural enemies, the chief of which at this time was an entomogenous fungus which had developed during the wet weather and which I found had killed several.

Bundaberg District.

Only a week was spent in the Bundaberg district, and during this period work was confined to a few of the sub-districts.

P. furfuracea was found on several of the red soil farms in the Woongarra and Qunaba areas, but it remains of minor importance and does not inflict the same damage that it is responsible for in the Isis district.

Lepidiota grata.—Grubs of this beetle have been found to be doing damage in the South Kalkie district, and have eaten out small patches of cane, and the injury very much resembles that due to *L. frenchi* and *P. furfuracea*, and the method of combating it with fumigants is similar.

Caterpillars.—A species of caterpillar was found on the Fairymead Estate, and was eating the cane leaves and generally stripping the plant, the injury very much resembling that due to "army worms." These caterpillars had been feeding previously on the "summer" and nut grass, and when these grasses had been cleaned up in cultivating operations they had directed their activities towards the cane. Having no facilities for breeding these, I was unable to connect them with the moth responsible for their appearance, but as several were feeding openly throughout the day they were subject to attack from numerous birds, and others again were parasitised by Tachinid flies, so it is improbable that the following generation will do any appreciable harm.

FIELD REPORTS.

The Director of the Bureau of Sugar Experiment Stations (Mr. H. T. Easterby) has received the following report (16th February, 1926) from Mr. E. H. Osborn, Central Field Assistant:—

Herbert River.

That this area must be a fairly solid one is shown by the rapid strides taking place in building and general improvements, for at present four new and up-to-date concrete or brick hotels are going up in the town (Ingham) area, whilst licenses have been granted for one each at Trebonne and Long Pocket. Great improvements were also noticed in the roads, more especially in that being constructed by the Main Roads Board to Halifax. At the latter place a Traffic Bridge is being built that will connect the North Coast Line at Beamerside with Halifax direct, and which should greatly benefit Halifax.

Again, in Ingham the Colonial Sugar Refining Company are intending to remove their cane tram line that now runs down the centre of its two main streets to a less conspicuous portion of the town's activities. Also, upon the outskirts of Ingham, very many new and substantial residences are going up in places that were cattle paddocks only a very few years ago. All this prosperity is solely due to the sugar industry, and any one conversant with Northern conditions must view with concern a curtailment of cane areas, more so when it is remembered that during the season just closed some 445,000 tons of cane (*i.e.*, Macknade 230,000 tons and Victoria 215,000 tons) were crushed.

State of Crops.—Unfortunately, this district at the time of my visit was suffering from extremely dry conditions, for although splendid rain fell during the early part of 1925, October and November were very dry, December was rather better, but January was one of the very driest Januarys known for many years. The following are the registrations:—

	Halifax.	Ingham.
January, 1925	23.05	14.48
February, 1925	16.75	15.06
March, 1925	28.39	24.13
April, 1925	2.81	2.96
May, 1925	.6	.25
June, 1925	1.30	1.49
July, 1925	.15	.33
August, 1925	1.82	1.96
September, 1925	1.43	1.71
October, 1925	—	.12
November, 1925	.5	.43
December, 1925	2.17	1.99
	78.97	64.91

Whilst up to the third week in January 1.99 inches represented Halifax, and only .96 inches Ingham. Naturally such a dry period has had a very bad effect upon the crops in general, and throughout the district, early and late plant cane and also ratoons are decidedly backward; in fact, so much so that in many cases hardly any cane had formed. It seems that the average early plant did not strike too well, and the moderate area of late plant, although better in proportion, is very backward indeed, being far below the usual standard of cane upon the river at this period of the year. This factor will undoubtedly affect next year's crop too, for it will be very hard to get sufficient early plants for this year's planting. Fortunately, good rains have since been experienced.

Cane Varieties.—N.G. 15 (Badila), Q. 813, H.Q. 409, Goru (mainly N.G. 24 B), Korpi, Nanemo, and Oramboo are the principal canes grown, and some fine crops of each have been harvested this year. Of these H.Q. 409 certainly requires early planting—early in March, if practical, or failing that, well after the cold weather has ceased. One experienced grower mentioned that his best results were due to his making it a practice to relieve the soil covering about a fortnight after planting, which he said seemed to give the young stuff a great "kick" along. In his particular farm (medium ground) he generally harvested a 35 to 40 ton crop, followed by, say, a 25-ton of first ratoons, using manure, of course.

Q. 813 is now a popular cane in this area upon old and medium lands on account of its good striking and ratooning qualities, several growers speaking of from a 35 to 40 ton crop for plant twelve months old.

Unfortunately, as young plant being a shallow rooter, it does not stand up too well to such dry conditions as have lately been experienced here, but it responds well to good weather conditions, although very wilted looking, and so far it has shown no signs of gum.

Green Goru (N.G. 24 B) has a certain percentage of favour, for in light sandy soil under dry conditions it has done rather better than other canes.

Green Manure.—Dry conditions probably account for the fact that the area under crop this year seems far less than usual.

Fertilisers.—Howe's Mixture, B_2, dried blood and meatworks manures are all popular here, whilst sulphate of ammonia as a top dressing is also favoured.

Implements.—Ploughing in trash is always strongly advised, and to expediate this operation the D. 1 disc plough in use in Fiji for some time is now also to be seen upon the Herbert, and is favourably reported upon, quite a few being in use. An Athens plough attached to a Fordson was also doing very good work in breaking up a fairly solid and hard grass paddock.

Diseases.—Due to so much dry weather it was hard to detect symptoms of gumming, and it looks as if the restrictions placed upon H.Q. 426 (Clark's Seedling) have already started to show improvement. Top Rot was seen in first ratoon Badila and first ratoon Q. 813, growing in an experimental plot alongside each other. I understand that it also showed up in the cane in its plant crop.

Invicta Mill (Giru).

When this area was inspected early in February the cane and pasturage looked particularly green and healthy, in pleasing contrast to the dry conditions of the Herbert. Last year's rainfall figures were:—

January	14.53	July	—
February	21.17	August	2.79
March	5.00	September	2.76
April	—	October	—
May	—	November	.06
June	2.00	December	2.03

or a total of 50.34 inches, whilst 3.95 inches were registered for January. Considering that no rain fell for April, May, July, and October, and only six points in November, the crops look surprisingly well, for although there are a number of irrigation plants in the area they are in most cases upon the small size, and only in use when conditions are extremely dry.

During my visit a number of farms situated at the "Mountain" and adjoining a beautiful lagoon known as Healey's Lagoon—distance some 4½ miles from Giru—were seen. This lagoon is said to be some 3½ miles long and from about 70 to 80 yards wide, and varying in depth from 15 to 25 feet, and certainly presents splendid irrigating possibilities, for it has never been known to go dry. Upon its banks are some very good farms, capable of growing good and heavy crops of cane for many years.

Although the cane, as mentioned already, looked very green and healthy, it was upon the backward side, and in too many cases showed too much weed growth.

One farm that was noticed after leaving the Mountain was that of Mr. L. Horton, who is trying out several varieties of cane in rather a larger way than usual. H.Q. 409 and Q. 813 each looked well here, and had responded to the freedom from weeds.

Cane Varieties.—Amongst these, Q. 813 is still giving excellent results in poor or medium soil, one local grower mentioned having cut an acre for 36 tons, with an average c.c.s. of 17.2, whilst several growers spoke of their satisfactory returns, too. H.Q. 409 was noticed to be growing in several small patches, but had struck very erratically, having been planted too late, and bears out the views expressed by the Herbert growers about the most suitable time of planting. A few lines of E.K. 28 were noticed here and there, and I understand that there will be a larger proportion of this variety for next year.

Diseases.—Giru has so far been fairly free from disease, but growers must still be careful and use careful seed selection.

Leaf Stripe or Downey Mildew was seen in two places in plant B. 208, and in some first ratoon Imperial where formerly it was seen in the plant, whilst Mosaic was also seen upon two farms in plant B. 208. As all these were only a few infected stools in each case, they were rooted out by the owner.

H. 458 in a plant crop showed peculiar dry streaks in some of the outer leaves, but the grower intends ploughing out, as the density figures are not too good.

Top Rot was noticed for the first time here upon three different farms, all of which consisted of very fair soil, *i.e.*, upon the northern side of the Haughton River in plant and ratoon Badila, and upon the southern side of the river in plant and first ratoon Badila. Portion of these plants came from the Ingham line, the rest being local seed. In this case where the disease was noted the ground was of a very good type, whilst right alongside some cane grown under exactly similar conditions, but in an inferior class of soil, was then free as far as one could see.

In connection with this disease the Bureau has been carrying out some inoculation experiments upon the Burdekin, which may prove of much value in providing data to work upon in connection with control of its activities.

Progress of District.—Giru is rapidly expanding, and within a few weeks the public will be catered for by the opening of two hotels. As regards the mill it had just finished a remarkably good season, having crushed some 78,333 tons of cane for an average c.c.s. of 14.15, all mill records, both as to mill work and value of same being broken, and the manager and staff are to be congratulated.

When it is remembered that of the above 78,333 tons, some 19,500 tons came from the Ingham Railway Line suppliers, and 7,046 tons from the Lower Burdekin, with 1,607 tons from Woodstock upon the Towers Railway line, it will be seen how difficult it was to keep up a regular cane supply at a time when all available Government rolling-stock was taxed to the utmost, and it is to be regretted that some growers do not take these factors more into consideration before blaming the unfortunate cane inspector for any truck shortage.

The Director of the Bureau of Sugar Experiment Stations has received (17*th February*, 1926) *from the Southern Field Assistant, Mr. J. C. Murray, the following report*:—

Bundaberg District.

Since last reporting on cane conditions in this locality there has been a small fall of rain, but not nearly enough. There has been no regular rainy season.

The mills have closed down and cultivation is now in full swing. All classes of ploughs are going from the single furrow disc to the big steam ploughs. There is a general striving towards increased agricultural efficiency and lowering incidental expenditure. Practically all the growers are unanimous with regard to the value of potash as a fertiliser for the red volcanic soils. No negative results have so far been reported where weather conditions were favourable after using this fertiliser as a predominant ingredient.

Regarding fertilising generally, it could be mentioned that the Bureau officers have now fairly complete data as to the requirements of the various types of soils, compiled chiefly from the most reliable source of all—results of local experiments. Analyses have also been made by the Bureau of about every class of soil in the sugar belt.

Growers in the Bundaberg district are recommended to seriously deal with the Mosaic disease in the district this coming planting.

Regarding varieties in the Bundaberg district, farmers are extending their areas of Q. 813. Those on the river are strongly recommended to plant more of this cane.

A disease destroying a considerable number of stools was brought under the writer's notice, but as the same malady was encountered at Beenleigh a more detailed description will follow.

Beenleigh District.

The farmers in this fertile district did fairly well with their cane last year and should have good crops for the coming season, judging by the appearance of the cane at present. One noticeable feature was the number of farmers who are planting the variety Q. 813. The bulk of the growers supplying Mr. Heck's Mill, of Rocky Point, are now planting this cane. It is not only high in sugar, but shows considerable disease resistance. Some farmers have small areas of H.Q. 285. Other local names for this valuable cane are "Early Maturing," "Nerang," and "Milton's."

Regarding pests and diseases, no serious losses were reported by the growers from these, although as mentioned above, what the writer takes to be an infection that may prove serious if not watched, was located. The following is a description:—

The diseased shoots will grow a foot or so and will have a number of healthy looking leaves when suddenly they will lose their capacity to grow normal leaves, and throw out a few bent and twisted ones. Some of the eyes may shoot, but they soon become twisted like those on the main stem. An examination of the leaves will show a number of long galls on the underneath side of the leaf. On splitting the cane small galls can be found on the vascular bundles. Practically all the leaves bear these galls.

The farmers are recommended to plough out and burn the affected stools and get plants from an absolutely unaffected area. No time should be lost in destroying affected stools. No plants should be sent from these areas to others, until the disease has completely disappeared.

A new cane pest has been discovered—the fox. One grower pointed out where it had gnawed several sticks.

The Use of Potash on the Woongarra Red Soils at Bundaberg.

Following the successful experiments with potash on the red soils of the Sugar Experiment Station at Bundaberg, in the Woongarra sub-district, further trials were made last year with this fertiliser.

The application of potash alone was continued on a third ratoon crop, the heaviest dressings being at the rate of 300 lb. of muriate and sulphate of potash per acre. The cost of the fertiliser and its application was £2 5s. per acre.

The increase in the tonnage of cane per acre for this application amounted to 6.57 tons. This was not so high as in the second ratoon crop, but the climatic conditions were not too favourable. This return, however, was highly remunerative.

From a mixed manure, containing a fairly heavy dressing of potash, applied to first ratoons, and consisting of 100 lb. sulphate of ammonia, 100 lb. of muriate of soda, 200 lb. sulphate of potash, and 200 lb. of meatworks fertiliser, an increase of 10.42 tons of cane per acre was secured over the cane which received no manure.

It was evident from analyses of these red soils that the potash content was low, and the use of this element warranted, although it is not contended that dressings of potash alone will always give higher results than mixed fertilisers, upon the red soils, but it is believed they will do so at first, and proof of this is found in its successful use on many farms in the Woongarra district, latterly.

On the Northern alluvial soils where the available potash is higher, potash alone would not give such an increase in yield.

The Northern Field Assistant, Mr. A. P. Gibson, reports 23rd February, 1926:—

MOSSMAN.

The mill and its dependent township is situated some four miles in a direct line from what is now left of the old but one time important town of Port Douglas.

The sugar land is somewhat broken, is purely coastal, and is bounded on one side by a rugged, densely wooded high range. Proximity of this to the sea generally ensures a beneficial rainfall. The soil is mostly scrub or forest alluvial deposits; as a rule it is not deep, and varies in texture from light silt to a coarse decomposed granite.

Rainfall.

The annual rainfall is over 86 inches; last year the average was exceeded by fully 21 inches. This fine rainfall, coupled with suitable humid conditions, is most conducive for rapid crop growth, hence a satisfactory tonnage of cane having a good quality is raised. The four centres from which the factory receives its supply, with their respective areas harvested and tonnages, are:—

Centre.	Acreage Harvested.	Tons Crushed.
Mossman	2,421	39,658
Miallo	1,533	16,604
Mowbray	638	13,025
Cassowary	884	10,989
Total	5,476	80,276

Unfortunately, these lands are scattered, necessitating the construction of many bridges, lengthy 2-feet permanent tram lines, miles of which pass through stretches of non-producing sugar land. Such districts require more rolling-stock, greater supervision, and maintenance, all of which naturally increases the cost of transportation and manufacture. The mill had its maiden run twenty-nine years ago. In the year 1906 it treated 103,291 tons, its greatest cane tonnage, making 10,421 tons of sugar. Cane was then grown on the steep virgin hillsides. Now it is wholly confined to the lower levels.

Year.	Tons Cane per Ton Sugar.	C.C.S.	Extraction.	Tons Cane per Hour.
1906	9·91	12·25	89·7	27·4
1925	7·64	14·20	94·7	32·1

The extraction would have been better, but owing to a mishap two sets of mills instead of three were in use for a time. The increased recovery is due to installation of more modern machinery, superior cane varieties, and better husbandry. Further improvements are under way.

Mossman is the only Northern mill that has not had a sufficient supply of cane, nor does there appear land convenient enough to raise the much desired seasonal requirements of some 130,000 tons. When Australia was called upon "to produce"—Mossman did its best. The price offered at the time made it worth while to bring in the poorer land as well as the richer. Tramways were extended, the factory was modernised and its capacity increased to meet the expected additional supply. A change has taken place, sugar and cane prices have declined, and in consequence the inferior and distant lands will again be placed out of bounds for profitable cane culture, less fertilizers will be used, all of which must result in a reduced seasonal tonnage. It is said the one remaining hope of insuring a profitable crop on the present face of things, and for which the management is agitating, is the extension of the tram line about 13 miles to the Daintree River area.

Cane Varieties.

Many varieties are raised, the principal with particulars are as follow:—

Varieties of Cane.	Area under Crop.	Percentage.	Percentage c.c.s.
H.Q. 426 (Clark's Seedling)	1,241	22·66	14·84
Q. 813	45	·82	14·72
N.G. 15 (Badila)	1,125	20·55	14·66
M.Q. 1 (Badila Seedling)	98	1·79	14·60
B. 147	667	12·18	13·82
Goru	211	3·85	13·64
D. 1135	1,635	29·86	13·62
M. 189 (Black Innis)	85	1·55	13·31
Mixed	369	6·74	13·62

Others which are grown on a small scale show the following analyses:—Q. 903—14.65 c.c.s.; H. 109—14.40; E.K. 28—14.15; Q. 855—13.66.

Planting.

Some growers still deposit whole canes in the drills and cut them into sets as they lie before covering. This is unsatisfactory as pests and diseases escape notice. Apparent lack of supervision at time of planting is most marked, unfortunately resulting in the wide distribution of the diseases known as Leaf Stripe and Leaf Scald. It is highly probable that the former has been aided by (1) the widespread custom of growing the same stock variety continuously in the same soil; (2) careless selection of plants and subsequent inferior cultivation, the foregoing weakening the variety to such a degree that it simply cannot survive the attack of the organism connected with the disease. Soaking sets prior to planting is common here; this develops the eyes rapidly and speeds up germination, more especially if the water is warm. The time of immersion varies from twelve to twenty-four hours. When the soil is moist and in good mechanical order this operation is hardly necessary. Too great a time in the water is harmful, one farmer tried dipping in salt water and reports success. Some growers are transplanting stools of cane into empty spaces in plant cane in preference to planting sets; when the weather is favourable it is a good plan.

Great care should be exercised when planting B. 147 and M.Q. 1. They are badly infected with Leaf Stripe disease. D. 1135 and H.Q. 426 are good and suitable canes for medium soils, but the latter is very susceptible to disease. N.G. 15 (Badila), although having Leaf Scald disease seems at present to be one of the freest varieties from disease in the district. Where the soil is rich and deep this should be grown.

Q. 813 and E.K. 28.—The growing of these canes on the poorer soils should be extended; when grown on too fertile soil the former grows rapidly and lodges, resulting in a reduced c.c.s., higher harvesting rates, and light trucks. 7 R. 428 (Pompey) probably would do well on the poorer soils.

Pests and Diseases

Rats, grubs, wild pigs, and wire-worms have been responsible for great crop destruction. The banks of the many ever-flowing creeks and depressions intersecting the farms contain much undergrowth and prolific crops of Panicum and other grasses and are jumping off places for the rat, besides protecting them from their natural enemies. The controlling of this pest is of immense importance. We can only hope to bring this about by the hearty co-operation of those concerned in (1) systematic poisoning; (2) clean farms, more especially headlands; (3) fencing off where possible the non-producing areas, thereby permitting the ingress of stock.

Fully grown "frenchi" grubs had destroyed some 10 acres of D. 1135 plant cane on the Bri Bri Estate.

Wild pigs raid the cane fields in isolated patches and are quite capable of causing much damage in a short time.

Wire-worms are sometimes responsible for sets not germinating. Depoliated patches of cane were observed when passing through the Mowbray area by rail motor; this appeared to be the result of grasshoppers.

Small patches of Aphis Sacchari and Sooty Fungus were seen. There is little cane stem showing yet, in consequence borers were not noticed.

Leaf Stripe (Downy Mildew) and Leaf Scald are widely distributed, more especially in ratoon paddocks having the varieties B. 147 and M.Q. 1. The more seriously affected fields should be ploughed out and subsequently limed. Unfortunately, lime is scarce and the price delivered makes it almost prohibitive. Farmers are advised to watch plant crops closely and to remove any affected diseased stools that may appear.

Leaf Scald was located, more especially in H.Q. 426 and N.G. 15.

Fertilisers.

The value of the various manures purchased by the mill for the farmers last year was £17,087. This consisted principally of meatworks, B_3, and ammonia. The manure is applied at various rates per acre, some prefer placing it in cane drills at time of planting; others delay the operation until the cane is established. Surface dressings unfortunately are too often applied to grassy cane lands; in such instances the grass not the cane derives the benefit.

Green Manuring.

Cowpea and Mauritius bean are grown in a small way. Corn, where grown, was badly affected with Mosaic disease.

The 1926 Crop.

At the beginning of the present growing period, dry weather prevailed, followed by many light showers which only revived the cane but promoted weed growth to such a degree that it temporarily overmastered the cane growth. Later, splendid rains fell when the cane soon outgrew the intruding weeds, but still leaving many of the paddocks dirty.

The prospects for the coming season are promising, parts of Saltwater and the Mowbray are backward. However, it is at present thought that last year's tonnage will be overshadowed.

The mill is capable of treating a greater tonnage of cane than it has been receiving and the management is out to acquire it if possible.

Extension of Railways.

The line is to be extended another 46 chains in the recently opened up Whyanbul Creek area before the season commences. The formation is completed and the rails are lying alongside in readiness for placing.

SEPARATION AND THE SEPARATOR.

BY CHARLES McGRATH, Supervisor of Dairying.

The variations of the butter fat content of the cream forwarded to butter factories is frequently a cause of dissatisfaction to the producer. Many cream suppliers state that their method of cream production does not allow of fluctuations in the butter fat content of the cream. Such fluctuations do arise from various causes. Producers can control to a great extent the conditions that ensure the production of a cream of a uniform composition and character.

The separator must have a solid rigid foundation and be quite level to ensure satisfactory creaming results, and to prevent the machine getting out of repair owing to the wearing of the spindle and bearing on one side.

The separator must be in good running order and properly lubricated with approved oils. A separator is not doing efficient work, unless it is running smoothly.

When the separator bowl revolves at the correct speed and is not vibrating or jarring, the cream is separated by the centrifugal force and is delivered into the cream pan.

When the separator bowl vibrates a portion of the cream becomes remixed with the separated milk, and is then carried away with the skim milk.

The speed of the separator bowl has a direct influence on the butter fat content of the cream. By increasing the speed of the separator bowl the fat content of the cream delivered is raised.

If the separator bowl is run below normal speed the fat content of the cream delivered is lowered, the separation of the butter fat is not thorough, and a loss occurs owing to an amount of fat being left in the skim milk.

When belt-driven separators are used, see that the belt adjustment is correct. When the belt is too loose slipping takes place, causing irregularity in the speed of the bowl and unsatisfactory skimming. If the belt is too tight the separator bearings become heated with resultant injury to the machine.

The position in which the cream screw is set influences the fat content of the cream. A slight turn of the screw will cause a variation of the cream test.

The cream screw should grip firmly in the thread of the bowl so as to prevent any movement in the screw owing to vibration.

The fat content of the cream must always be regulated by adjusting the cream screw. Do not endeavour to vary the fat content of the cream by running the separator faster or slower, or by decreasing or increasing the supply of milk to the separator bowl. Such practices prove most unsatisfactory, and result in loss of fat into the skim milk or injury to the machine.

Always run the separator at the correct speed and provide for a regular supply of milk in accordance with the stated capacity of the machine.

The use of the float ensures a regularity in the flow of milk into the bowl, an essential condition in securing efficient skimming. When the supply of milk to the separator bowl is delivered by a float process from a correct feed adjusting tap, the regularity is affected in a small degree, by the change of pressure due to the varying quantity of milk held in the supply vat, and by varying temperature of the milk treated. The higher the temperature of the milk, all other conditions being the same, the greater quantity will flow through the delivery tap.

The temperature of the milk at the time of separation has a decided influence on the fat content of the cream produced.

A suitable temperature for the separation of milk is approximately 90 degrees Fahr. If the milk is below 75 degrees Fahr. at the time of separation, the process is not complete, and a high percentage of fat is left in the skim milk.

It is advisable to separate the milk as soon as possible after it is drawn from the cows at a temperature approximately 90 degrees Fahr.

If milk is separated when at the lower temperatures the cream produced will have a higher fat content than if the milk was treated at the suitable temperature of 90 degrees Fahr., and there will be an increase of fat in the skim milk.

During the winter months the milk cools quickly, and in the process of separating enters a cold bowl which chills the first of the milk and cream. The bowl may be warmed by running some warm water through previous to use.

Variation in the fat content of milk at different periods of the season causes a variation in the fat content of the cream produced. The cream from the higher testing milk will have a higher fat reading than cream from milk of a lower fat content when separation takes place under exactly similar conditions.

The physical condition of the milk treated has an influence on the efficiency of the process.

Viscous, slimy, ropey, fermented, and partial coagulated condition of the milk gives unsatisfactory skimming results, causes a loss of fat in the skim, and delivers a low grade cream.

The capacity of the separator bowl in relation to the quantity of milk separated during the one operation has a direct influence on the fat content of the cream, and the general efficiency of the process of separation.

When a large quantity of milk is treated by a machine of a relative small capacity the gradual accumulation of bowl slime fills up the space between the discs within the bowl, and the space between the bowl and the discs reducing the bowl's holding and separating capacity.

The inflow of milk is gradually becoming greater than the skimming capacity of the slime-clogged bowl, resulting in the delivery of cream with a lower fat content, and causes a loss of fat which is carried away in the skim milk.

When a large quantity of milk has passed through a bowl it is at times noticeable that the flow of cream becomes irregular.

The separator should be stopped and the slime removed from the bowl, when the work can be resumed with satisfactory results.

When the whole milk is not properly strained before separation the amount of bowl slime is greatly increased. A separator of a large capacity will last longer than one of a small capacity. The larger machine will work for the shorter period in treatment of a similar quantity of milk.

Some years ago the hand separators of larger capacity were heavy to turn, but the large capacity hand machines of to-day are as easy to turn as the smaller machines on the market a few years ago.

The amount of water used in flushing the bowl influences the cream test. Too liberal a supply lowers the fat content of the cream.

The condition physical and otherwise of the cream delivered at the factory has an influence on the accuracy of the determination of the butter fat content.

The sampling and testing of cream is unsatisfactory, and the grade is generally low—

1. When the undesirable practice is followed of separating the cream into a can or receptacle containing the cream from a previous separation.
2. When cream is not stirred thoroughly after separation and at subsequent intervals.
3. When cream of varying temperatures is mixed and the blending is incomplete, the body of the mixed cream showing clots or lumps.
4. When cream is fermented owing to the presence of yeasts.
5. When cream is partly churned in transit.
6. When cream is viscous, slimy, ropey, or curdled.

During the winter months cream containing 40 per cent. butter fat and over delays the sampling owing to its heavy body.

Cream properly separated and handled and having a butter fat content of 40 per cent. to 42 per cent. in the summer period, October to March, and 36 per cent. of butter fat during the winter months, April to September, if properly handled on the farm and regularly delivered, will generally reach the factory in a condition that facilitates sampling and testing. It will be of a higher grade than cream produced under conditions that make for varying butter fat content, which is frequently associated with irregular and uncertain grades.

INFLUENCE OF COMPOSITION OF FOODS ON THE HEALTH OF STOCK.

By J. C. BRÜNNICH, Agricultural Chemist.

The Cloncurry and Winton District Branches of the United Graziers' Association suggested investigations on the following questions:—

(*a*) Why stock thrive so much better in some localities than in others;

(*b*) Why the lambing and calving are so much more prolific in some localities compared with others;

(*c*) Why stock thrive so much better on green food than they do on similar dry food;

(*d*) To determine if it is commercially possible to artificially supply the absent—or nearly so—soluble mineral matters; and

(*e*) The most profitable method of supplying same.

The proposed investigations are undoubtedly of the greatest importance to all our stockowners, but do not apply to Queensland alone, but to the whole world.

The same problem is now seriously taken up by the Committee of Civil Research in England, and a questionaire in connection with the mineral contents of pastures has been sent quite recently to all the Dominions. The problem is intimately connected with our own, and a copy of the preliminary report of the sub-committee is appended.*

In connection with this subject a valuable and interesting paper was read at the 1921 meeting of the Australasian Association for the Advancement of Science, by E. Murphy, Dairy Supervisor, Victoria, entitled "The Health of Live Stock. Notes on soils and pastures." Many interesting facts and suggestions are mentioned in this paper, of which the following are quoted:—

"I do not underrate the baneful effects of over-stocking, but wish to stress the fact that the killing out of the deep-rooting grasses throws the burden of stock carrying upon the superficial layers of the soil, which quickly become depleted."

Again, in the above paper, mention is made of a farm which forty-five years ago was free from disease, and that then the surrounding district was covered with white clover, and that there is now no white clover to be found, and the farm in question has become very unhealthy.

"Heavy losses have occurred on this farm and throughout the district from cripples and paralysis in cows and in sheep, &c."

"The Department of Agriculture conducted some manurial trials on portion of the dairy farm mentioned above. Lime and superphosphate gave the best results. Ten hundredweight of lime and 2 cwt. of superphosphate were applied per acre in 1918 and again in 1919. Samples of the manured and unmanured vegetation were analysed. The results throw a flood of light upon the necessity for maintaining an adequate supply of mineral nutrients in the pasturage for lactating animals. On the food supply grown on the manured land the animals thrive, on the other they die.

CHEMIST'S REPORT.

	No. 1. Area untreated. Per cent.	No. 2. Area treated with lime and super. Per cent.
Total ash	7.19	7.17
Protein	5.55	10.25
Crude fibre	32.37	28.36
Carbohydrate	52.21	51.37
Fat	2.68	2.85
Analysis of the Ash.		
Phosphoric acid	0.14	0.33
Potash	0.84	1.70
Lime	0.42	1.06
Magnesia	0.18	0.27"

*Copy of this report will appear in our next month's issue.

The problem is also dealt with in a most exhaustive manner by the Chief Veterinary Surgeon of New South Wales, Mr. Max. Henry, M.R.C.V.S., in an article, "The Influence of the Mineral Constituents of Food on Animal Health," which appeared in the "Agricultural Gazette" of New South Wales, December, 1925, and in which several curative measures were suggested.

The following well known facts have a fundamental bearing on the questions raised:—

1. Under primeval conditions, nature maintains, by working in everlasting cycles, aided by the external forces of light and heat supplied by the sun, an exact balance between soil, vegetable, and animal life, which is liable to an exceedingly slow change during æons.

2. Man's interference with nature's laws, by increasing production in any direction, removing the products and even destroying some of the factors, upsets the balance of nature to the detriment and exhaustion of the soil.

3. The nutrient value of foods shows very wide variations, according to soil, seasons, and locality.

4. The food value of the crop also varies with the age—it generally increases towards the flowering stage and decreases with ripening.

5. There are five classes of nutrient constituents in foods, every one of which much be supplied in necessary adequate amounts. Each nutrient has certain functions, which, however, to some extent overlap with those of others:—

(*a*) Proteins, nitrogenous organic compounds which produce animal tissue, flesh, and muscles;

(*b*) Fats; and

(*c*) Carbohydrates, organic compounds composed practically of carbon and water, which build up fatty tissues, and produce and maintain the animal heat;

(*d*) Mineral salts, entirely obtained from the soil, are absolutely necessary for the formation of bone, they aid in the building up of all animal tissues, production of milk, wool, &c., and are indispensable aids in the process of digestion;

(*e*) Vitamines, or accessory foodstuffs, present in minute quantities, but absolutely necessary for the maintenance of health and normal development of all the higher animals.

6. Lack or deficiency of any one of the nutrient constituents causes starvation or malnutrition, ill health, and predisposes the animal to a large number of diseases, and more particularly is fatal in the stages of reproduction.

The most abundant constituent of all stock foods are the carbohydrates, which are produced in the leaves of plants from the carbonic acid in the air by the aid of sunlight. In this process of assimilation or carbon fixation, the presence of minute amounts of mineral salts, particularly lime, magnesia, and potash are also absolutely necessary. Well known carbohydrates are starch, sugars, gums, cellulose or fibre, fats, oils, and waxes.

The most valuable nutrients are the proteins which are most complex organic compounds containing carbon, oxygen, hydrogen, nitrogen, and sulphur. Protein is the essential constituent of the protoplasm, a peculiar slimy jelly-like substance found in the plant cells, and in solution in the plant sap, and nearly always associated with small amounts of phosphoric acid in form of phosphates. Proteins are largely stored up in the seeds of plants, more particularly in the seed of cereals (wheat, rye, barley, &c.), of legumes (peas, beans, &c.), and oily seeds (nuts, cottonseed, linseed, &c.). In the fodder plants the amount of protein varies very largely, not only the amount is very different in the various classes of fodder plants, but in each species the amount varies according to stage of maturity, classes of soil, climatic conditions, &c.

For years numerous fodder analyses have been carried out in our Agricultural Laboratory, and in the yearly reports of 1909, 1912, 1914, analyses of all kinds of fodders, grown in many localities and cut at various stages of growth, have been reported and are of great interest. For instance, our celebrated Mitchell grass shows a variation in the protein content, calculated on the water free material, from 3.33 per cent. to 8.76 per cent. The highest amount was always found in mid-growth, and the lowest in the mature grass. In Rhodes grass we find an even greater variation from 3.45 per cent. to 12.12 per cent., and in Prairie grass, unquestionably our most valuable winter grass, amounts from 10.05 per cent. to 25.90 per cent.

Quite recently we received a sample of Mitchell grass hay from a locality in the Longreach district, where very heavy losses of lambs and sheep were experienced. On analysis we found only 2.1 per cent. of proteins, which is lower than found in

the poorest of bush hays, and one of the causes of the losses is without doubt protein starvation.

In all our natural pastures edible herbs and shrubs are a valuable addition to the grasses, and the analyses of such edible plants found in the Maranoa district, which were published in the annual report, 1918, show the great nutritive value of a large number of these plants. Many of these herbs and bushes, more particularly those belonging to the leguminous plants, contain very fair amounts of proteins, or flesh forming nutrients.

It is, however, not only the composition of the fodder which determines its value as a food, but of equal importance is the digestibility of the various nutrient constituents, and furthermore the palatableness of the fodder must also be taken into consideration. The digestibility of any fodder is influenced by the age of the crop, the conditions of growth, the treatment of crop at the time of harvesting, and lastly depends to a large extent on the animal itself consuming the food.

Succulent green fodders are not only more palatable, but are more easily digested. The process of hay-making, and also making of ensilage, always lowers the digestibility of the nutrients, combined with losses of vitamine.

The mineral constituent of foods, although generally present only in small amounts, are of the most vital influence for the normal development of the animals and maintainance of animal health.

The actual chemical elements forming these mineral constituents are absolutely necessary to the animals, in order of the required amounts, are:—Calcium (Ca.), Phosphorus (P), Sulphur (S), Chlorine (Cl), Potassium (K), Sodium (Na), Iron (Fe), Magnesium (Mg), Fluorine (F), and traces of Silicicum (Si), Manganese (Mn), and Iodine (I).

The first two more important elements, calcium and phosphorous, exist in combination as calcium phosphate, the chief component of the bones. Chlorine and sodium form the well known common salt, sodium chloride. Sulphur is always found in small amounts in proteins; wool fibre, for instance, contains 17 to 19 per cent. of nitrogen and 3 to 5 per cent. of sulphur. Potash again is of particular importance to sheep, as in 1,000 lb. of raw wool we find 90 lb. of potassium carbonate and 6 lb. of potassium chloride.

All the mineral constituents must be supplied by the soil in a readily available form to the fodder plants, and naturally if the soil is deficient in any of them, the fodder plant must be also lacking the same constituents. Very much larger amounts of the mineral constituents, than actually required, must be consumed by the animal, as only a comparatively small amount of the mineral constituents is utilised and the remainder is voided with the excreta.

Phosphate of lime is not only necessary for the bone formation, but is necessary for the building up of all animal tissues, and production of meat, milk, and wool. The female animals, particularly during the periods of pregnancy and lactation, require large amounts of phosphate of lime. If a pregnant animal gets only food lacking in phosphate of lime, the phosphates necessary for the fœtus are drawn from the animal's own bones, which become more and more porous and brittle.

In all vital processes, the mineral salts play an important part, and deficiencies cause malformation of bones, digestive troubles, sterility, general decrease in health and vigour, predisposition to worm infestation, and other diseases. Full details on these matters are given in the papers already referred to.

Before the effects of malnutrition, like bone chewing, depraved appetite, malformation, paralysis, digestive troubles, &c., become too pronounced, curative measures must be taken.

The addition of bran and pollard, oil cakes, and lucerne to the ration will be found beneficial. A supply of green fodder, grown on a richer or a well manured soil, will be useful, as it not only supplies the mineral salts, but the necessary vitamines.

The supply of licks containing salt and bonemeal, or the addition of such in small amounts to the rations of hand-fed animals, gives good results, and the effects become noticeable in a very short time. One part of fine bonemeal mixed with one to two parts of coarse salt makes a good lick. The bonemeal must be specially prepared and sterilised for this purpose, and ordinary bonemeal used as fertiliser should not be used. An excellent substitute for bonemeal is finely crushed Nauru phosphate, as it contains much larger amounts of phosphoric acid and lime than bonemeal and is just as easily digested by the animal, and cannot carry disease germs like bonemeal. Excellent results by the use of Nauru phosphate have been reported from many of the dairying districts in New Zealand, and already good reports have been received from some of our sheep owners who have used it in form of a lick on our recommendation.

Wherever practical, the top-dressing of the pasture with phosphatic manures, practised very largely in many parts of the world, gives excellent results, and cattle pasturing in such paddocks instinctively rush for the portions on which phosphates have been applied. If it is not possible to fertilise the whole grazing areas, smaller paddocks may be treated and used as nursery paddocks for sick stock.

The actual amounts of mineral matter required by sheep are very small, a full-grown wether 2 years old, with about ½ lb. of potash in the wool, 1 lb. each of lime and phosphoric acid in carcass, and about 2 lb. of nitrogen in carcass and wool, requires annually in the food about 7½ oz. of lime and ½ oz. of phosphoric acid. A breeding ewe naturally requires more, but these amounts of mineral matter should be easily supplied even by the poorest of pasture.

I cannot help remarking that I consider the trouble of malnutrition to be more a protein starvation than lack of mineral salts, or more likely a combination of the two, and due to the inherent poverty of the soils in those districts where the trouble exists.

It is of interest to repeat here a table of the mineral constituents found in the soil in some of the districts already reported elsewhere, and state that the amounts of mineral constituents given are the actual total amounts, of which only a very small proportion is actually readily available to plant life, which will easily account for the difference in the value of these places for sheep-breeding. We find in the soils from:—

——	Lime.	Phosphoric Acid.	Potash.
	Per Cent.	Per Cent.	Per Cent.
Comet Downs	·23	·05	·17
Cunnamulla	·21 to 1·5	·04 to ·06	·03 to ·76
Mount Windsor Tableland	·10 to ·40	·06 to ·12	·07 to ·22
Winton	·58	·09	·35
Emerald	·20 to 1·3	·04 to ·10	·20 to ·40
Longreach	1·20	·10	·30
Blackall (Isis Downs)	4·00	·10	·46
Peak Downs	4·40	·40	·40
Barcaldine	·08 to 1·0	·02 to ·04	·14 to ·27

In a previous paper on the problem of closer settlement in the Maranoa district, by combining sheep-breeding with wheat culture, I made the following calculations:—

As a basis for such a scheme, we will take a well-established farm of 1,280 acres, on which it is recommended to have always about 200 acres under wheat, 200 acres fallow, and breaking up new ground as required every year, so that every acre of the land will only be once every five years under wheat. On the farm a flock of 600 merino sheep could be pastured, of which annually 200 head are sold as store sheep and lambs, and also a yearly wool clip of about 8 lb. of wool per head should be obtained.

——	Nitrogen. N.	Potash. K_2O.	Phosphoric Acid. P_2O_5.	Lime. CaO.
15 bushels of wheat, remove per acre lb.	19	5	7·5	·8
Wheat removes from 200 acres lb.	3,800	1,000	1,500	160
200 Merino sheep, at 70 lb. live weight, remove lb.	333	24	167	185
4,800 lb. of wool from 600 sheep remove lb.	260	271	3	9
Total constituents removed annually lb.	4,393	1,295	1,670	354
Removed per acre (for whole 1,280 acres) lb.	3·43	1·01	1·30	·28
Sheep excreta supply per acre lb.	3·6	3·7	1·2	1·0
An average rainfall of 26 in. supplies lb.	3·7	..	..	..
If *wheaten hay* or straw is sold :				
35 cwt. of hay remove per acre lb.	67	69	16	10
Wheat straw, 25 cwt. per acre, remove per acre lb.	11	35	3	6

From this table we learn that the sheep remove only very small amounts of mineral matters per acre, on such lightly-stocked farms, and only when the wheat grain, wheaten hay or straw or other crops are sold, much larger amounts of mineral matters are taken from the soil. Sheep must, of course, receive in their rations much more mineral matters than theoretically required, and, therefore, with coarse, poor food, deficient in proteins and mineral matters, they could not consume sufficiently in a day's feed to supply the necessary amounts. How much more of the constituents are consumed is clearly shown by the large amount returned to the soil by the excreta per acre.

It is a well known fact that sheep-grazing on fallowed lands, improve the land, by returning large amounts of easily available plant-foods in the dung, which is spread fairly evenly over the land, and well trampled in by the sheep. With a light stocking with only one sheep for two or more acres, the amounts removed are practically negligible, and only on soils originally very poor in lime, phosphoric acid, and potash, a depletion may become apparent and appreciable in the course of time.

Intimately connected with the subject is the problem of the renovation of paspalum pastures, as in practically all our coastal districts it is becoming more and more apparent every year, that there is a serious falling off in the food obtained from such pastures, both in quality and quantity.

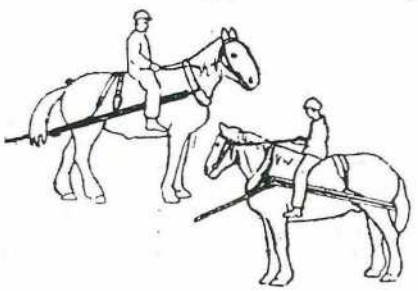
Experiments dealing with this problem have been started by the Department of Agriculture and Stock in several localities: Maleny, Cooroy, and Runcorn. Naturally some considerable time must elapse before such experiments can reach finality, but already there are strong indications that a good breaking up of the paspalum sod by ploughing and harrowing, combined with the application of artificial fertilisers will yield wonderful results.

With regard to our Western pastures, the investigation started over twelve years ago should again be seriously taken up and the co-operation of stock inspectors and stock-owners in securing good average samples of pasture crops from normal and abnormal localities, at various periods of growth, and submitting the air-dried samples for analysis, is necessary for the scheme. Of course such sampling must be done for several years in order to allow for local and seasonal variation in the crops already alluded to in this paper.

In conclusion I must state that the perusal of the foregoing remarks shows distinctly the influence of food on the health of stock, and it is therefore the duty of all stock-owners who experience any trouble, to make experiments on a small scale, not only by using additional concentrated foods when urgently required, and giving a liberal supply of licks recommended, but to make trials, if only on a few acres, for the improvement of the pastures by top-dressing with artificial fertilisers.

A CONVENIENT HITCH.

A convenient hitching arrangement for pulling up the hay fork when stacking hay or hoisting bags of wheat or hoppers of maize is shown in the illustration from "Popular Mechanics." It consists of a U-shaped rig, made from two round iron bars, and held in place by the collar and a hip strap. The rope to the hay fork is looped on the lower branch of the rig, and slides readily around it when the



horse turns. There is no swingletree to bump against the horse's heels, nor anything for the driver to hold up on the return trip. The left-hand illustration shows the horse going out with a load, and the right-hand one shows him starting back for another trip.

PASSION FRUIT CULTURE.

By ALBERT H. BENSON, M.R.A.C., Director of Fruit Culture.

No recent publication dealing with the culture of this fruit having been issued by this Department, it is considered desirable to bring out a new pamphlet dealing not only with the well-known passion fruit *Passiflora edulis*, but with the less known fruits, varieties of the same natural order "Passifloreæ," that can be grown here, such as the Granadilla, *P. quadrangularis;* the "Bell Apple," *P. laurifolia;* the Meixcan Passion Fruit, *P. ligularis;* and the Banana Passion Fruit, *Tacsonia mollissima*. Other varieties of the same natural order are grown for the sake of their flowers and foliage, and the papaw, "Carica papaya," is a very near relative.

All passion fruits are climbers, and the varieties above referred to are either semi-tropical or tropical, and require a well-drained, friable, rich sandy loam soil to be grown to the best advantage; but the common passion fruit can be grown on comparatively poor soils that are naturally well drained, provided they are systematically manured, well cultivated, and are not subject to severe frosts. Stagnant water at the roots is fatal and very heavy soils should not be selected.

As with all other fruits the land should be thoroughly prepared prior to planting, so as to reduce it to a state of perfect tilth, and provide the right soil conditions in which to start the young plants. This is a matter of very great importance, and one that does not receive the attention it should, as not only passion fruit but all other fruits are frequently planted in land that is very far from being in good order, and which should have received much more care and attention in order to enable it to produce healthy vigorous plants that will yield payable returns. Slovenly work is never a success in any branch of fruit culture; and nothing is "good enough" except the best; in fact, as far as the fruit itself is concerned, the only fruit in which there is any profit is "the best."

Passiflora edulis—Purple Passion Fruit.

This variety is the one that is most commonly grown, not only in Queensland but throughout Australia. There are at least two types, the large fruited or "giant" passion fruit, sometimes called "Mexican," which attains a size of over two inches in diameter, and the common type which averages about 1¾ inches in diameter. The former, though a larger and more showy fruit, is somewhat disappointing, as it is frequently a shy bearer and the fruit does not contain as large a percentage of pulp as the common type, which is the best all-round commercial fruit. The best fruit has a very dark purple skin, which is filled with an orange-coloured pulp in which the seeds are imbedded. The pulp is slightly sub-acid and possesses a very distinctive agreeable flavour, so that when used as an ingredient of a fruit salad it imparts its characteristic flavour to it, and the salad is greatly improved thereby.

The plant is easily propagated from seed, all that is necessary being to select perfect fruit, fully mature, from a perfectly healthy plant that is free from leaf, root, vine, or fruit affection of any kind. The pulp, when removed from the fruit, should be placed in a tub or suitable vessel, and be covered with water, the mass being then allowed to ferment long enough to free the seeds from the pulp, when they should be strained off, well washed, and dried. If early spring ripened fruit is selected and the seed is planted as soon as ready, good strong plants will be available for summer planting, but if plants are wanted for early spring planting the seed must be sown the previous autumn. The seed should be sown in a specially prepared seed bed in soil of a light, free nature, containing a quantity of leaf mould or humus—a good potting soil—and the young plants should be sheltered from the sun and judiciously watered should the soil become dry. When the seedlings are about one foot high or larger they should be planted out in the permanent position, taking care to keep them moist so that they will not dry out.

Prior to planting, the land is marked off in rows not less than ten feet apart. A trellis consisting of good fencing posts, placed fifteen feet apart in the row, is erected along the row, the posts being set with their width across, not in the direction of the row. The posts should be about 8 inches wide by 3 inches thick by 6 feet 6 inches long, and be set 18 inches in the ground and 5 feet out of the ground. The end posts must be much heavier and be well strutted as they have to act as strainers, and prevent the wires that are attached to the top of the posts from sagging when they have to carry a heavy growth of vines. Two No. 8 galvanised

wires are firmly fixed to the top of the posts, one on each side, so that when in position they form two parallel lines, 8 inches apart, on which the vines are trained. The young plants are planted midway between the posts, right under the wires, and are tied to a light stick or other temporary support till they reach the height of the wires, when they are topped and two main lateral stems are allowed to develop, all other lateral growths on the main stem from the ground to the wire being removed. The two main laterals are then trained on to the wires, and when they meet those of the adjacent plants their growth is stopped by pinching back the terminal growth, which causes secondary laterals on which furit is borne to be thrown out all along the main lateral. These secondary laterals, if left alone, throw out further laterals and these again in turn make more lateral growth, with the result that a very dense and tangled growth of vines is produced from which it is hard to separate the primary and secondary laterals and which, owing to its dense habit of growth, is frequently prone to be attacked by disease. Systematic pruning is therefore desirable—first to keep the plants healthy, secondly to produce strong new lateral growth on which good fruit will be grown, and thirdly to bring in the crop at different periods of the year, so as to get a better distribution of the crop instead of a glut at one time and a scarcity at another. When an autumn or winter crop is desired the main summer crop must be sacrificed. This is done by pruning the vines right back to the secondary laterals when they are showing their blossoms for the summer crop, and this will have the effect of throwing out a new growth which will blossom at a later period. A word of warning is, however, necessary; don't prune hard back in dry weather—you will probably kill the plants if you do so—but wait till the ground has had a good soaking, when the plants will throw out a fresh growth very quickly and will not be permanently injured. A good dressing of quick-acting manure at this time will be found beneficial and materially increase the following crop.

Mr. Brünnich, in his last edition of "Complete Fertilisers for Farm and Orchards," recommends the following manure for passion fruit:—

> "Use per acre, in accordance with the richness of the soil, a mixture of—1 to 2 cwt., nitrate of soda; 4 to 8 cwt., blood and bone manure; 1 to 2 cwt., superphosphate; 1 to 2 cwt., sulphate of potash. A top dressing of 1 cwt. of nitrate of soda in spring will be found beneficial."

This is a complete manure rich in organic and inorganic nitrogen, citrate and water soluble phosphoric acid as well as potash, and should not only act quickly but be fairly lasting in its effect.

The passion fruit is liable to be attacked by several different pests of which the leaf disease is by far the most serious. This disease has only made its presence felt during recent years, and so far no remedial measures have been found very efficacious. The disease is of an obscure nature and attacks every part of the plant above ground—the flowers, leaves, and laterals. The latter are killed by a small portion of the stem becoming affected to such an extent that it dies and all the rest of the lateral that is beyond the part attacked shrivels and dies, frequently when it is covered with fully grown but immature fruit which shrivels up. The affection is receiving the careful attention of the Vegetable Pathologist, and it is hoped that the result of his investigation will throw some light on the best means to be adopted to keep it in control, if not do away with it altogether. Red spiders and spinning mites frequently injure the leaves and young laterals. These pests can be kept in check by spraying with sulphide washes or dusting with finely-ground sulphur.

Scale insects of various kinds also attack the wood, leaves, and fruit. These may be kept in check by systematic spraying, but this can only be effectual when the vines are systematically pruned, as when grown in a dense mass the spraying material used has little chance to come in contact with the majority of the insects.

Nematodes injure the roots, and here the use of materials that can be injected into the soil such as paradichlorobenzene are well worth taking. Fruit fly also attacks the fruit, as does also a sucking bug. The latter sometimes causes a heavy loss, as the punctured fruit either drops or if it remains on the vine becomes hard and woody. This bug is very fond of the red prickly cucumber, commonly known as the "Cape or African Cucumber," and if this is used as a trap, a large number of the bugs can be caught and destroyed.

When fruit fly is troublesome, trapping with Harvey's (B) fruit fly lure as soon as the first sign of the fly's presence is seen and systematically attending to the

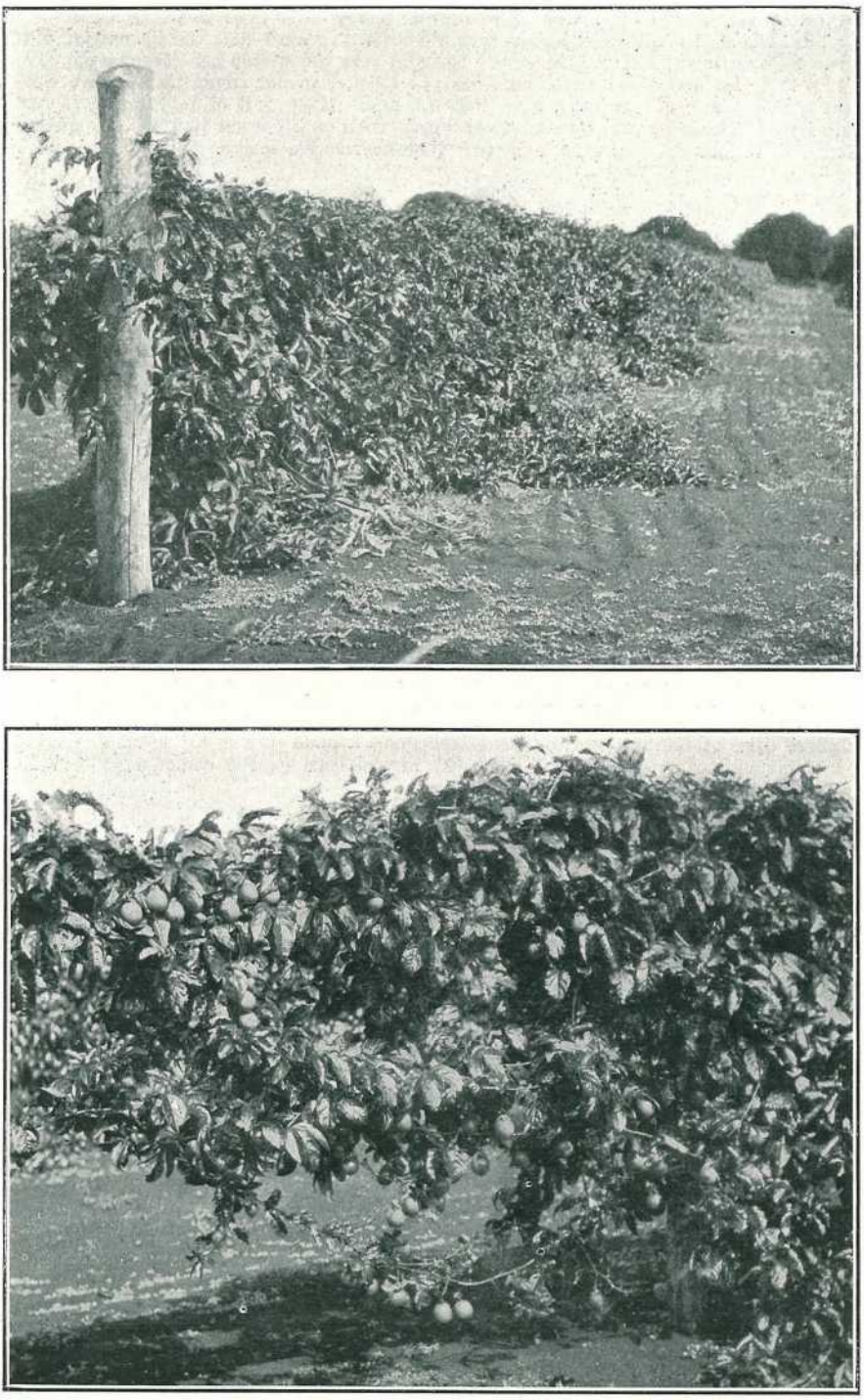


Plate 38.—Passion Fruit, Redland Bay, showing Method of Culture and Part of a Vine in Fruit.

traps will result in the destruction of large numbers of female flies, and thus reduce the loss they would cause were they allowed to lay their eggs in the immature fruit whilst the skin is still soft and before it becomes so hard that the fly cannot pierce it. As showing the attractiveness of the (B) lure the writer has recently caught no less than 1,200 Queensland Fruit Flies (*C. tryoni*) in one glass trap in five weeks, of which nearly 80 per cent. were females, many being full of matured eggs ready to be deposited; so that systematic trapping with an effectual lure will undoubtedly tend to reduce the loss caused by this very destructive insect.

***Passiflora quadrangularis*—Granadilla.**

The Granadilla is a tropical fruit that is better suited to the northern than to the southern part of this State, though excellent examples of the larger type of granadilla—"*Macrocarpa*"—can be produced in the coastal districts both to the south and north of Brisbane, provided the situation is a warm one, free from frost and well protected. The *macrocarpa*, as its name signifies, is a very large type of granadilla, the fruit frequently weighing several pounds. The seed cavity is small for the size of the fruit, and is surrounded by a thick layer of whitish flesh which has no distinctive flavour, but which, when flavoured with lemon or other suitable flavouring, is used for pies. It is not as a rule a heavy bearer, and must be grown on a horizontal (not lateral) trellis.

The Northern Granadilla—*quadrangularis*—is a smaller fruit of a somewhat irregular, oblong shape, about 4 to 4½ inches in diameter. The pulp cavity is large and is filled with large seeds surrounded with a pale yellow pulp of exceptionally high flavour when the fruit is fully ripe, which is known by the outer fleshy covering becoming soft, and the skin, instead of being a pale green, turns a dull yellowish-green colour. This variety when fully ripe is one of the highest flavoured tropical fruits, and eaten either alone or used in combination with the papaw, pineapple, banana, and the juice of a lemon or lime to form a fruit salad, it is very hard to beat. Unfortunately, it does not carry well and consequently can only be obtained in perfect condition where grown. The granadilla requires a deep, well-drained, rich loamy soil to be grown to perfection, and it does best when trained on an overhead trellis (as shown in illustration herewith, which was taken some years since at Kuranda, near Cairns, and gives a good idea of its habit of growth). Similar manuring to that recommended in the case of the common passion fruit will be found beneficial.

***Passiflora laurifolia*, "Bell Apple."**

The Bell Apple is not grown to any extent in this State as its fruit is not equal to that of the previously mentioned varieties. It is a handsome and vigorous climber, and is more valuable for covering unsightly edifices or for ornamental purposes than for fruit production, and its cultivation for the latter purpose is not recommended.

***Passiflora ligularis*, Mexican Passion Fruit.**

This variety is very highly spoken of by Mr. Wilson Popenoe, the Agricultural Explorer of the Bureau of Plant Industry, Department of Agriculture, Washington, U.S.A., and I am in hopes that we will be able to establish it in this State, but so far we have not succeeded in doing so. I merely mention this fruit as it is the true Mexican passion fruit, and is quite distinct from the large purple or giant passion fruit which sometimes goes under this name. It requires a climate similar to that suitable for growing the granadilla.

***Tacsonia mollissima*, the Banana-shaped Passion Fruit.**

Although this fruit has been seen in fruit shops of the Southern States for some years, it is only recently that it has been met with in our local markets. During last spring a quantity of fruit was offered for sale locally, and met with a good demand at a very satisfactory price. It is not, however, advisable at the present time to plant this variety extensively, despite the attractive appearance of the fruit, as a taste for it will have to be acquired and a demand created before there will be a market for any large quantity of the fruit. Its culture is similar to that of other passion fruits and it is more hardy than the more tropical varieties.

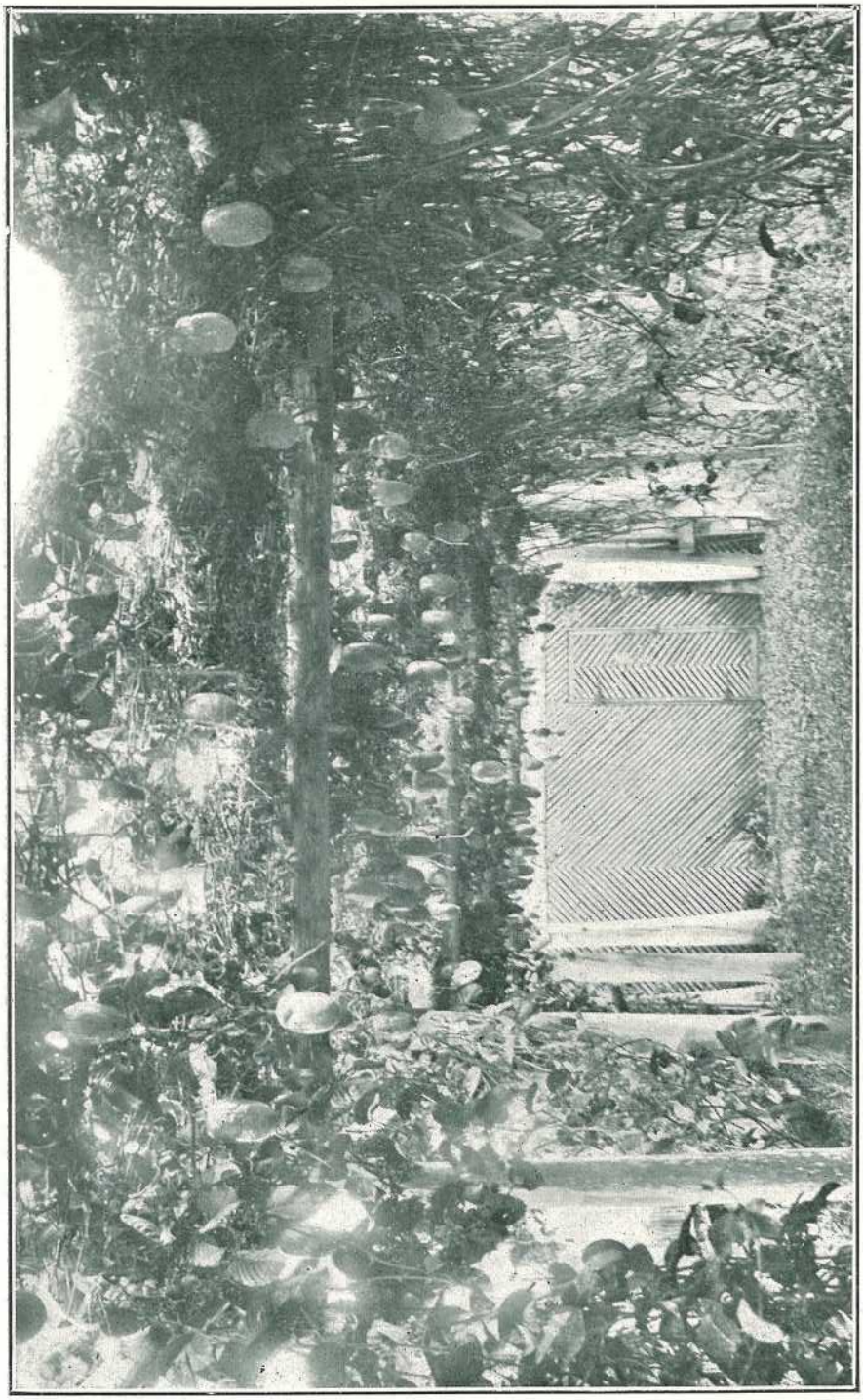


PLATE 39.—GRANADILLA VINE AT KURANDA, CAIRNS DISTRICT.

STRAWBERRY CULTURE.

By ALBERT H. BENSON, M.R.A.C., Director of Fruit Culture.

Although the strawberry is commonly considered to be better adapted to the climate of the temperate zones than to that of the semi-tropics, it is, nevertheless, the one berry fruit which can be grown to perfection in this State. Excellent fruit is produced in our Southern coastal districts and even under tropical conditions such as those existing at Townsville, when the plants are grown on alluvial soil and are well irrigated, very good fruit is produced. This shows that the strawberry has a wide range in this State and that it can be grown successfully over the greater portion of our Eastern coastline and the tableland country adjacent thereto, provided there is either an adequate rainfall or, failing that, a supply of water for irrigation.

The commercial cultivation of the strawberry is, however, confined mainly to those districts possessing a regular rainfall, and extends from the Redlands Area in the South to Bundaberg in the North. When grown under suitable conditions in this district, the strawberry has proved itself to be an early and prolific bearer, able to stand a fair amount of hardship, in the shape of dry weather, and to resist the attack of insect and fungus pests to a greater or less extent.

There is a good demand for the fruit, either for immediate consumption in this and the Southern States or for conversion into jam, and, as few crops yield a quicker return, it frequently enables a beginner to make a living whilst more slowly maturing fruit crops are coming into bearing. Many a pioneer fruitgrower has to thank the strawberry for his start, as it enabled him to make a living where he would, in all probability, have failed otherwise, and what applied in the case of our pioneers still holds good with the beginners of to-day.

Our strawberries are of excellent quality and carry well, so that they reach their destination in the Southern States in good order when carefully handled and packed, provided the weather is not excessively warm or the fruit over soft on account of excessive rainfall. The fruit is very suitable for jam, and the product of some of our local factories is not excelled elsewhere in the Commonwealth; further, the demand for strawberry jam exceeds the supply, so much so indeed that, for a considerable period of the year, it is not procurable. There is therefore room for the extension of the industry as the price realised for good strawberry jam in the Commonwealth should enable both producers and manufacturers to obtain a satisfactory return.

Soils for Strawberries.

Given suitable climatic conditions, strawberries will thrive in most soils, but the ideal soil for this fruit is a rich loam of medium texture, well supplied with humus, possessing perfect natural drainage, and capable of retaining moisture during dry spells—and the nearer one can get the soil to this ideal the better the results. Heavy, cold, badly-drained soils are not suitable, but any good loam or sandy loam, whether of scrub or forest origin, can be made to produce good berries if properly treated.

Preparation of the Soil.

There is only one way to prepare soil for strawberry culture, and that is, *thoroughly*. Nothing else will do. In the case of virgin scrub or forest land, which is, as a rule, fairly rich in humus, the land, after it is cleared, should be broken up deeply and brought into a state of as nearly perfect tilth as possible. On virgin soil, except it is of the poorest nature, it is not necessary to apply any manure for the first crop, as there is usually an ample supply of available plant-food and humus present in such soil, but for subsequent crops, or old land, systematic manuring is very important. Old land that is at all deficient in humus should have that deficiency made good, either by the application of a heavy dressing of farmyard or stable manure, such as a load to every 4 perches, or if this cannot be obtained, then by growing a green crop such as cowpeas or other legume which has been well manured with phosphatic and potassic manures and ploughing it in. The green crop so ploughed in should be allowed to rot and, when rotten, the land should be reploughed and worked down fine. If the green crop has received a generous dressing of phosphatic and potassic manure, then there will be no need to apply any further fertilising material to the land, as a complete manuring has been given; but if not, then the soil should be treated as recommended later on.

The surface of the land should be kept as even and level as possible, and, as already stated, it should be worked down fine, so that when the young plants are set out they will take hold of the soil at once and become firmly established.

Planting strawberries on raw land, sour land, or land that has been indifferently prepared, is only courting failure, whereas, when the planting is carried out as advised, there is every chance of success.

Selection of Plants.

Always obtain strong runners from healthy, prolific plants. The first runners next to the parent plants are to be preferred, as they are usually the most vigorous and best rooted, and, further, they come into bearing earlier; but, failing these, any well-rooted, strong, well-grown runners can be used, and although they will not fruit as soon as the first runners they will give a good yield later on, and frequently continue to bear when the earlier fruiting plants have ceased.

Planting.

Having secured suitable plants, trim the straggling roots with a sharp knife; take care not to let them dry out, and plant as shown in the illustrations herewith,

No. 1.

No. 2.

No. 3.

No. 4.

which are self-explanatory. Careless planting is responsible for many failures, especially too deep planting, as no strawberry will thrive if its crown is buried under the soil.

The distance at which to set out the plants varies somewhat in different districts, but it is not advisable in any case to overcrowd the plants, but to allow plenty of room. Personally, I favour planting strong plants at from 20 in. to 2 ft. apart each way, so that when planted the land can be worked all round the plant; or if row planting is desired, then the rows should be about 30 in. apart and the plants set out at from 15 to 18 in. apart in the row. The illustration of a strawberry garden at Mooloolah, taken some years since, shows the manner of planting adopted by one of the most successful growers of his day, and it will be noted that the plants have plenty of room and are in no way overcrowded.

Cultivation.

Strawberry plants must only be surface-worked whilst growing or bearing fruit. The object is to keep down weed growth and to prevent the surface of the soil caking; but the cultivation must never be so deep that it will injure the roots. The best implement to use is the Planet Junior hand cultivator or similar machine; or, failing that, a good Dutch hoe of any type that may be preferred.

Weed growth must be kept down and the surface of the soil must not be allowed to become hard and set, as if it does the evaporation of moisture from the soil will be greatly increased, and it will dry out rapidly.

If the plants are to be kept over for a second or third year, then the whole of the runners, other than those required to make good any losses in the original plants, must be removed, and the ground between the original plants must be well broken up and manured in late summer or early autumn, so that the plants will be in good nick for producing a crop of fruit the following season.

If the plants have been badly attacked by leaf blight it is a good plan to cut off all the leave and burn them prior to working and manuring the land, as numerous fungus spores are destroyed thereby. The burning off is best done by scattering a little loose dry straw over the plants when the leaves have been cut off and have dried, and then setting fire to the lot. A light burning does not injure the plants, but is decidedly beneficial.

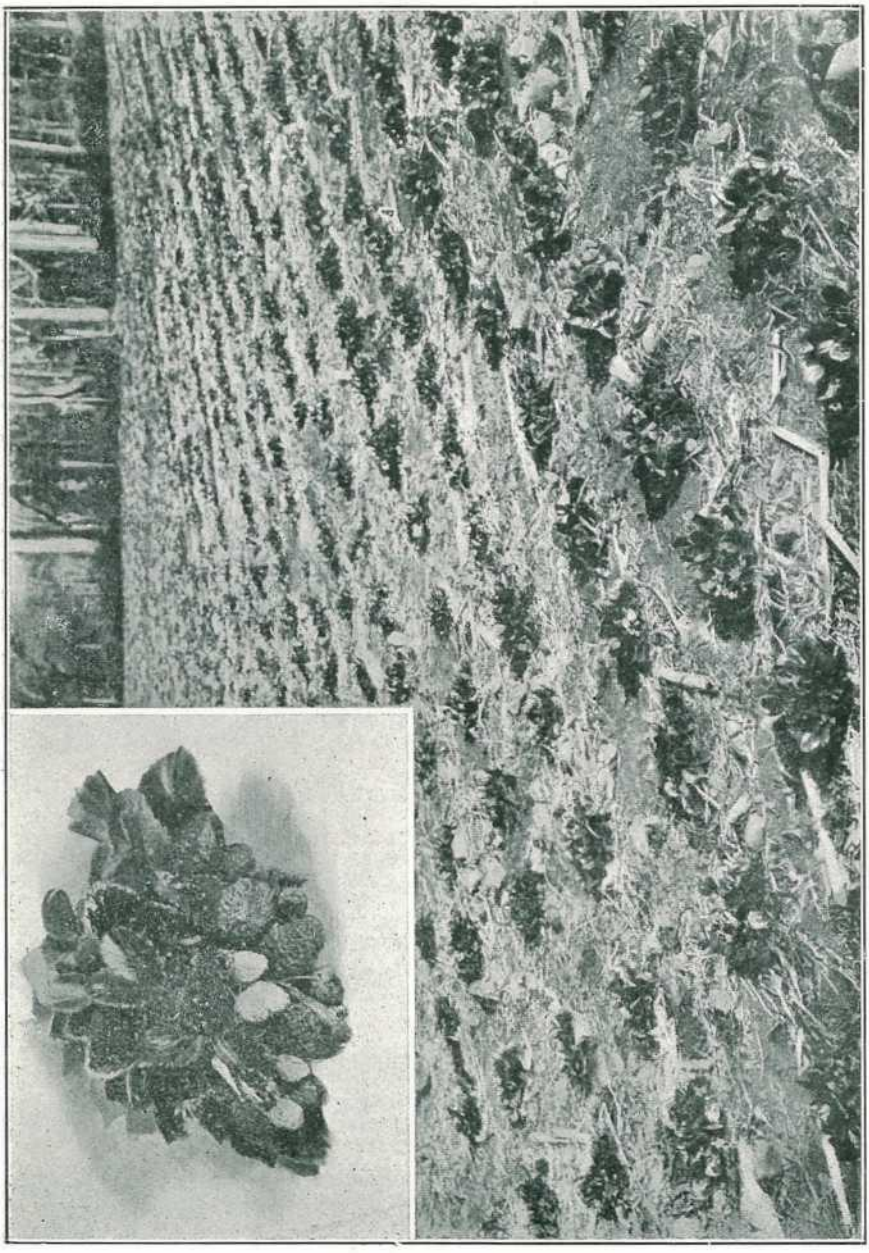


PLATE 40.—A STRAWBERRY GARDEN AT MOOLOOLAH.

Mulching.

Mulching is seldom practised in this State, probably owing to the fact that a really good material for mulching is not readily obtainable, and therefore a light soil mulch produced by the surface working of the soil by means of a Dutch hoe, Planet Junior, or similar hand cultivator is all that is necessary. The use of a paper mulch has, however, much to recommend it, as it would certainly keep down weed growth and tend to maintain even soil conditions. A strip of paper mulch 18 inches wide would be all that is necessary, and the plants should be set through the paper at from 15 to 18 inches apart in the row. A further advantage to be derived by the use of paper mulch is that the fruit would be kept much cleaner as it would not be so liable to be covered with dirt as frequently happens if heavy rain falls or the watering is not very carefully applied.

Irrigation.

Where water is obtainable it should always be available for the plants' use during dry weather, as the ability to maintain an adequate supply of moisture in the soil at all times and thus maintain an even growth will result in larger and better fruit, and a heavy increase in yield. Strawberries pay well for intensive culture, and the money expended in providing a good system of overhead or other method of spray irrigation will be found to be a very profitable investment. A combination of paper mulching and spray irrigation will enable a grower to maintain a regular supply throughout the season of first class table fruit for which there is always a ready market.

Manuring.

The strawberry is a fruit that requires an abundance of readily available plant-food, and one that pays well for systematic and judicious manuring. In the 1924 edition of his pamphlet, "Complete Fertilisers for Farm and Orchard," the Agricultural Chemist to this Department gives the following advice, which it will pay to follow:—

"Some of our coastal country, between the 26th and 28th degrees south latitude, is particularly suitable for strawberry culture, frequently producing quite phenomenal crops. Some of our rich loamy soils found in our coastal scrub lands give the best results. In poorer sandy soils the improvement effected by artificial fertilisers, particularly such containing potash, is very marked, and a light dressing of 5 to 10 tons of stable manure per acre is very beneficial.

"A complete fertiliser for strawberries of the formula 4-8-10 should be used at the rate of 5 to 9 cwt. per acre.

"The following fertiliser mixture may be found useful:—

1 to 1½ cwt. sulphate of ammonia, or nitrate of soda
3 to 5 cwt. basic or ordinary superphosphate
1½ to 2 cwt. sulphate of potash
} per acre;

or,

1½ to 2 cwt. nitrate of soda
1 cwt. fine bonemeal
4 cwt. superphosphate or Nauru phosphate
2 cwt. sulphate of potash
} per acre;

the latter applied by two or three top-dressings, at the rate of 1 cwt. per acre, when fruit is first forming, and thereafter at intervals of two weeks."

Green Crop Manuring.

When dealing with the preparation of the soil, the importance of providing an adequate supply of humus was referred to, and the statement made that where a sufficient quantity of farmyard manure was not available to supply this essential ingredient to the soil, green crop manuring should be used to make good the deficiency. Humus plays a very important part in the composition of soils, and especially so in those devoted to strawberry culture, as its presence in the soil enables it to retain a much larger percentage of moisture than it would do were it deficient in humus. The power to retain moisture is of the greatest importance in a soil devoted to strawberry culture, as the strawberry is a shallow-rooted plant that soon suffers when there is any lack of moisture.

Moisture in the soil also enables the artificial fertilisers applied to become available, as they are of no use whatever to the crop unless their plant-food is capable of being dissolved by the soil moisture, and can thus be obtained therefrom by the roots of plants. When leguminous crops are grown as a green manure they should be manured with a fertiliser containing lime, citrate-soluble phosphoric acid, and potash; such as a mixture of finely-ground island phosphate and a potash salt, used in the proportion of four of the former to one of the latter. No nitrogen need be applied, as the plants will obtain their own from the atmosphere; and when they are ploughed into the soil it will not only be enriched by the plant foods contained in the fertiliser applied to the soil to produce the green crop, but also by the nitrogen that has been produced by the green crop itself; the whole forming a complete fertiliser, as it contains all the essential plant-foods in an available form. Green crop manuring is the cheapest way in which to apply nitrogen to the soil, so that, taking into consideration its value as a supplier of humus, it is of the greatest value when intensive cultivation is intended; and as the strawberry is a crop that demands intensive cultivation, its importance cannot be over-estimated, especially in soils that are deficient in humus. Cowpeas, vetch beans, small Mauritius beans, and the large black Mauritius beans are the best legumes for summer growth and vetches or tares and the grey or partridge field pea for winter.

Marketing.

Fruit for immediate consumption should be gathered whilst still quite firm. It should be carefully handled, graded for size and colour, and packed in boxes or trays containing a single layer of fruit. The use of punnets is not so satisfactory, as the fruit is more likely to be bruised, and it is doubtful if the methods of marketing the fruit in single layers can well be improved upon. Fruit for factory use is stemmed, placed in casks or other suitable receptacles, and forwarded as quickly as possible to the factory. Care in handling, picking, grading, or packing, always pays.

Diseases.

The most serious diseases of the strawberry in this State are those of fungus origin—viz., leaf blight and mildew.

The former can be controlled by the use of Bordeaux or Burgundy mixture applied as a spray, combined with the burning off of affected leaves, as previously mentioned; and the latter can be kept in check by means of sulphur applied in a similar manner to that employed for the treatment of oidium in grapes, or by spraying with sodium or potassium sulphide or a weak solution of lime sulphur. Insect pests seldom do any very serious injury, but when leaf-eating beetles or other leaf-eating insects are present they can easily be destroyed by spraying with arsenate of lead; or in the case of cut-worms these insects can be kept in check by the use of poisoned baits.

Varieties.

Although most of the standard varieties of strawberries have been grown in Queensland at one time or another, experience has shown that no one variety has proved permanent, but that it has been necessary to either raise new kinds from seed or to introduce them from elsewhere. Varieties producing perfect flowers have proved more profitable than pistillate sorts and are therefore most commonly met with.

After being grown in this State for a few years most varieties become weaker in growth, more liable to disease, and less prolific, so that they have to be discarded. The introduction of new sorts is thus essential, and there is no better way of doing this than by raising local seedlings. Some of the best sorts ever grown in the State have been locally raised seedlings, of which the *Aurie*, *Anetta*, and *Phenomenal* are good examples, and there is no reason why sorts equal or even superior to these should not be produced. The raising of seedling strawberries is now being carried out at the Nursery, Bribie Island. A large number of young plants grown both from local and imported seed are being tested, and there is good reason to believe that amongst them we will get one or more varieties that will prove to be suitable to our climate and that will be prolific bearers of commercially valuable fruit. Of the well-known standard varieties, such as *Marguerite*, *Trollop's Victoria*, *British Queen*, *Pink's Prolific*, *Federation*, *Melba*, and *Edith*, and several others that have been grown from time to time in this State, few are now planted. *Phenomenal* (a Gympie raised seedling) is now the variety most commonly met with; other new varieties are being tested and some of them may prove to be adapted to our local conditions. The type of strawberry best suited to this State is a vigorous healthy grower—that is, a good bearer and producer of good coloured fruit of good, firm texture and fine flavour; a fruit that keeps and carries well, and that meets the requirements of both the fresh fruit trade and of the jam maker.

SOME NOTES ON WESTERN QUEENSLAND FRUIT INSECTS.

By A. A. GIRAULT, B.Sc., Assistant Entomologist.

In order to obtain some definite information regarding the general character of the insect pests of fruits in a Western Queensland locality, as compared with the coast, a visit was paid to several orchards near Roma, with the object of obtaining specimens and making observations.

The large orchard at Red Hill, 5 miles from Roma, now owned by Mr. A. H. Hickson, and that at the State Farm at Bungeworgorai were the two main places at which collections and observations were made; but, in addition, several small plantings near the former were inspected as were also some vineyards.

As a whole, the orchards were clean; the vineyards were remarkably so, and bore very heavy crops of clean fruit. For the purpose in view, it was not considered necessary to extend the scope of the work. The time occupied was 2nd and 3rd December, 1925.

The orchard at Red Hill, being irrigated, was in better health and the trees were of greater stature than on the State farm, where the trees showed the results of a dearth of water; and I was informed by Mr. Soutter that, in the absence of irrigation, citrus trees did not do well on the latter place on account of the scanty rainfall.

Citrus Insects.

With the exception of the grape, citrus varieties were the principal fruits in the localities visited and as the grapes were free of pests, practically the whole of the collections and observations were made from citrus trees. The fact that no fruit flies were seen nor did any person report them is worthy of mention.

The destructive insects observed were as follows and attention is directed to the fact that all the species dealt with occur in the coastal fruit districts.

1. *Aspidiotus aurantii.* The Red Scale.—This was the most serious citrus pest found in the district, but at Red Hill it was held in control, although nearly every tree was infested. At the State farm, this serious pest was less in evidence on citrus, but it occurred occasionally upon other fruits and upon every part of the orange except the roots.

2. *Aspidiotus perniciosus* Comstock.—The presence of this highly destructive species was suspected in several instances, but its actual occurrence could not be demonstrated. Discolorations were the main symptoms present, but the insect causing these had perished and disappeared.

3. *Biprorulus bibax* Breddin. The Spiny Orange Bug.—This is, perhaps, the second most serious pest of citrus occurring in the orchards visited. It was more abundant at Red Hill than on the State farm, but is at present doing little damage. All stages of the insect were found and eggs were being laid at the time of my visit. In the warm parts of the day the adults fly, making a loud buzzing noise in doing so. On the trees they were usually seen in twos and threes, sucking a fruit (ripe grape fruit or small green oranges) or a blossom. When disturbed they eject a malodorous liquid, from glands upon the ventral thorax. The egg masses observed were always upon the upper surface of the leaf and when first deposited the eggs are whitish. From one discoloured egg mass, parasites were seen to have emerged from large jagged holes through the operculum. Upon dissecting a few of the eggs in this mass, the dead remains of a Proctotrypid (probably a *Telenomus*) and of a Chalcidid (probably a male *Eupelmus*) were disclosed. Later, four distinct parasites were obtained from these eggs.

The recently hatched young, after coloration is established, are glossy black, the abdomen salmon pink bordered narrowly first with white, then a broken black edge, the disc bearing a large spherical black spot which is transversely divided into four parts by narrow lines of white (of the areas thus marked off the second and third are thickest). In later stages, the whole body is dull green, the discal spot of the abdomen disappears and the margin of the abdomen bears only a black spot at the caudal end of each segment (as in the adult). The "horn" is not developed until the adult stage. The thorax above is finely pin-punctate in both larva and adult.

After hatching, the young of this species have the habit of squatting over the egg mass for several days.

In regard to the latter, observation revealed that the number of eggs per mass varied as follows in six egg masses counted:—12, 11, 11, 12, 12, 13, the latter being in a single line along and upon the midrib; usually, however, the eggs in the mass form an elongate figure of twos or threes or these in alternation. They are similar to those of the Bronzy Orange Bug (*Oncoscelis sulciventris*), but are decidedly smaller and instead of being globular are of greater height than width; the surface sculpture is not quite so dense, and in *Oncoscelis* it appears to be formed by minute papillae instead of by minute punctuation.

Of the fourteen adults captured and examined nine were males; this sex is somewhat smaller than the other and differs externally from the female in that the external genitalia are formed of one piece whereas in the female they are divided into a number of selerites.

4. The Orange Butterflies.—Two species were observed in flight through the orchards at Red Hill—*Papilio aegeus* and *P. anactus*. A pair of the latter were captured, but upon the main orchards no other stages were observed. However, upon young trees elsewhere the eggs, always deposited upon the tip of a young leaf of the new growth, were commonly observed, as were also the solitary caterpillars in several stages of growth. Specimens were obtained and preserved.

The injury done by the larvæ of these butterflies is usually confined to the new growth of young trees, and Mr. Hickson informed me that this damage is occasionally sufficient to stunt growth. Spraying with arsenicals is an easily applied remedy.

5. Locusts.—A pair of large grasshoppers were captured from the foliage and were observed to be common in the citrus orchard. The species proved to be *Acridium irregulare*, and is of great size and power. I was shown fruit which bore large whitish scars said to have been caused by the bites of this insect. The young of a katydid was also taken from the foliage.

6. Borer—*Uracanthus cryptophagus* Olliff.—An adult of this species was given to me by Mr. Hickson. Later, the burrow of a larva, full grown or nearly so, was located and secured. The larva had travelled more or less spirally about 3 feet of the branch, the latter an inch in diameter. This and other borers were scarce.

7. Plant Bug—*Amorbus robustus* (?).—A single adult of this species was captured and I was informed that it sucked the tender growth. The specimen was placed among the accessions in the insect collection (Het. No. 2174). Its identity is more or less uncertain.

8. The Orange Siphanta.—An occasional specimen and egg-mass were observed.

9. *Lecanium hemisphaericum* Targioni.—Occasionally observed upon orange twigs. The larvae were hatching.

10. *Siphonophora citrifolii* Ashmead.—Noticed upon new growth at Bungeworgorai.

Other Fruit Pests.

Upon grape I found nothing but lady-birds and upon other fruits no more than the Red Scale and a Chrysomelid beetle (Coleop No. 8525) feeding upon the tender foliage of plum and apricot. The larvae were not present.

An Olive Insect Heretofore Little Known in Queensland.

Upon cultivated olives my attention was drawn by Mr. Soutter, of the State farm, to what he thought was a thrips occurring upon the under side of the foliage and disfiguring it with oily spots of what appeared to be excrementitious matter. These insects were abundant in patches, but aside from the disfigurement did not seem to be doing much injury. However, they discoloured the foliage also. The adult and several larval stages were present, but no eggs were found.

The species turned out to be a Tingitid, *Froggattia olivinia*, described by Horvath from specimens sent to him by W. W. Froggatt, who found it in several localities in New South Wales.

The larvae are flat forms with the margins of the body covered with semi-erect spines, these regularly disposed around the abdomen; two or three of the spines project forward from the front end of the head. The disc of the body is usually sordid, the antennae being white with a black club.

In 1916 Tryon recorded this species from a native shrub in Queensland, one not related to olive, this being the first record of its occurrence within the State.

EAR ROT OF MAIZE.*

(*Diplodia Zeæ* (Schwein.) Lév.)

BY HENRY TRYON, Vegetable Pathologist.

FOREWORD.

THIS Memoir—"Ear Rot of Maize—*Diplodia Zeæ* (Schwein.) Lév."—by Henry Tryon, Vegetable Pathologist, based primarily on two cobs of Maize referred to him for examination and report, indicates that what hitherto in Queensland has been regarded by the farmer as a form of deterioration of the mature maize-grain, signified in the general terms "Mouldy Corn" or "Mildewed Corn" applied to it, is really a parasitic disease proper to the growing plant, one that, whilst under ordinary cultural treatment in maize-growing in any district wherein it occurs may be both augmented and perpetuated with more or less prejudicial results on yield. The disease may, on the other hand, under modified procedure that its presence involves, be largely checked and considerably reduced. It is therefore published for general information as having an interest far beyond the immediate purpose that occasioned it.

E. GRAHAM, Under Secretary.

26th November, 1925.

INTRODUCTORY.

On 11th August, 1925, two maize cobs were received, accompanied by a letter from "The Atherton Tableland Maize Board" to L. R. Macgregor, Council of Agriculture, dated Atherton, 25th July, 1925, and signed R. Day, secretary, in which they are thus referred to:—

"Two cobs of corn which are totally comprised of white dead grain. There is a great quantity of maize of this nature, included in crops on the Tableland, and at present it is being discarded by growers as of no value; or, if any is included in their crops, when delivering to the silos, it is marked against them in grading."

Further the secretary invited the prosecution of inquiries—"with a view to informing us if possible of, firstly, the cause of the dead grain; secondly, any suggestive remedy to prevent same; and, thirdly, as to whether maize of this nature has any feeding value," since the results of such "would be of much interest to growers here."

These cobs of corn when delivered to me, without cover, were found to be much "rubbed and broken and not in a fit condition for examination."

Accordingly, I at once approached Mr. F. B. Coleman, Inspector, Stock Foods Act, who was visiting the Atherton district, suggesting he take the necessary steps for "obtaining specimens direct from the grower" and "bring them with him to Brisbane in returning."

The officer in question, as the outcome of this, obligingly furnished me, on 15th September, with a series of carefully selected corn-cobs illustrative of the injured condition referred to, together with carefully collated information bearing on the circumstances under which the

*Published also in pamphlet form.

specimens exhibiting it were met with, and facts relating to the occurrence generally—derived from his own observations, and the testimonies of representative maize-growers who had had personal experience of its incidence. Data bearing on the rainfall of district in question were also furnished.

OCCURRENCE.

Mr. Coleman's statement, that had reference to the Kairi, Tolga, and Atherton districts of the Atherton Tableland, was to the effect that "this blight or mould occurred practically in every field, irrespective, apparently, of the various methods of cultivation employed, and of the different kinds of soil" in which the crop was grown; also that "it seriously affects in quality of maize" throughout the area. Also that in fields from which the samples furnished were derived "the percentage of (ears in) crops damaged ranged from 12 to 45 per cent. by count"

The testimony elicited from individual growers, summarised, was that the maize trouble was not a new occurrence, that it was worse when the field was subject to wet weather following on "dry spell," and the old lands—the areas longest devoted to maize-growing—were those worse affected.

SELECTION OF SAMPLES.

The officer mentioned thus described his procedure in examining the corn-cobs for evidence of this maize affection, when securing the specimens submitted:—The husks, covering the cobs, were separated at the tips of the ears, so as to expose the grain and silk, and if, in doing so, these presented characteristic outward symptoms of the "disease" they were replaced and confined in position by use of string, and the individual cob reserved.

GENERAL APPEARANCES.

(*Note.*—The samples were all derived from maize of which the stalks had long since died in the ordinary course of growth, the cobs having been left on the plants exposed to the weather, for the purpose of field-drying-out, for longer than would be necessary in the southern cornfields of the State, where other meteorological conditions obtain than those characterising the Atherton Plateau, and thus the husks presented outwardly an unusually dark appearance due to the ordinary moulds (Cladosporium sp., &c.) that live on dead plant tissue.)

Possibly the first feature that will present itself will be the exceedingly light weight, relatively speaking, that characterises the affected ears. On removing the husk piece by piece, and on rejecting the outermost ones, especially those springing lowest from the "shank" and exhibiting the effects of prolonged weather exposure (*vid.* Note), it will be noticed that they are unusually pale-coloured, and, especially when the trouble is pronounced, of a thin and somewhat delicate texture. Also that their surfaces are more or less covered with a very thin "skin" or film of white mildewed-like substance, that may be in patches or occupy them entirely, with the result that they have become very closely coherent, the fungus film occupying continuously apposite faces, and in fact may be quite difficult to separate without their being torn; these features being more and more pronounced as in this process of detachment the grain is being reached. (Plate 41, fig 2.) Then it may be found that the delicate innermost bracts have been impressed or indented with the crowns of the grains, lacking the ordinary turgour to

prevent this happening. What too remains of the "silk" is now also discoloured, mildewy, and more or less adherent to the grain.

The grain may occur as usual in uninterrupted rows, but manifest a somewhat shrunken appearance, apart from the crown-depression usual in Dent corn. It has, however, now entirely lost its polish and lustre, and is not only dull-hued but bleached, its ordinary deep amber colour giving place to a pale creamy yellow. Again, it may be more or less clouded or blotched at the sides with brown. Moreover, it appears to have been dusted over outwardly with very fine, white meal; and, in the narrow sutures between grain and grain, this substance is packed so as to outline the individual grains with what is really the exposed edge of a film or crust of mildew, that separates more or less continuously one from another. The grain again is very readily detachable, its stem being apparently decayed; and the cob to which it is attached has a whitish colour and is much more fragile than in ordinarily sound maize-ears. In fact, generally speaking, the cob is white mildewy right through, without presenting the common features of rottenness. (Plate 41, fig. 1.)

This dry condition of apparent decay is again further suggested when one cuts through an affected grain. (Plate 42, fig. 3.) This is not only white like flour within, the "germ" alone excepted—a remark that applies to both the starchy and horny (yellow) endosperm—but has become so altered in its consistency that it is now even more yielding to the knife than would be ordinary chalk. Moreover, like chalk again, it is readily broken up and reduced to powder on receiving the slightest impact; only the pericarp or hull, that remains apparently unaltered although weakened, securing its intactness. In fact, when such grain finds its way into the silo, much of it must either be reduced to fragments or even to powder, that, like so much flour, will subside to the bottom of this container; the fact that this profoundly altered grain is now, too, unusually dry contributing to this event. In short, a condition is realised that has won for the alteration brought about the term "Dry Rot," although it is not such as one ordinarily associates with this term, denotive of decay.

From a consideration of the features presented generally by affected corn-cobs, it is evident that the destructive changes alluded to have not proceeded from the husk inwards, but *vice versâ*. Also that the cob proper is not the first part to be affected, but on the other hand the grain. Again it is usual, when this is so, that every grain has participated in the alteration described. Further, that the shank, and in turn the stem, perhaps, may become successively involved in injury, after the cob; as may be seen on cutting longitudinally downwards through them, from the point of union of the former with the affected cob, and noting the progressive brown discolouration one or both have undergone.

THE CAUSE.

This is undoubtedly a parasitic fungus possessing all the characters of the one named *Diplodia Zeæ* (Schwein.) Lév. The following facts are connected with it and its occurrence:—

(1) Vegetative Growth—Occurrence and Description.

The most obvious feature of this parasite is its vegetative form or mycelial growth (mycelium), that develops both externally and internally in close association with its host-plant, the maize. The fine, white,

felt-like film occurring on apposite faces of the glumes constituting the husk, as well as the denser patches of the same material that intervene between grain and grain on the cob, illustrates this growth, and are really in each case an intricately interwoven mass of slender septate threads or fungus hyphæ. (Plate 44, fig. 2.) These, the mycelial threads, also penetrate through and through the tissues of the husk, whereon outwardly, as the result of this, they occur so conspicuously; so also with respect to the grain itself. And, again, they traverse thoroughly in all directions the cob to which this is attached, and then in turn pass through the tissue from the cob to the shank.

With respect to the grain, the circumstances characterising the presence of these mycelial threads within it are noteworthy. When this is suitably prepared, so as to admit of thin sections being made, and on doing this, and the starch being removed, it will be found that all the tissues possess the very finest of colourless fungus—hyphæ—traversing their component cells; also that the walls of those cells composing the starch-tissue—always thin—have almost disappeared, and that the starch-grains themselves, that should be of even circular outline, although often somewhat angular by compression, are now very irregularly shaped, having their surfaces evidently considerably eroded or dissolved away. (Plate 42, fig. 5.) These internal grain-tissues have in fact evidently undergone a process of degradation, as the growth of the parasitic fungus has proceeded within them; such as might be effected by the action of diastase, an amylolytic enzyme; that, as has been elsewhere shown, this parasitic fungus produces, during its vegetative growth, at the expense of the plant organism that sustains it. (*Note.*—The actual loss of substance brought about by this agency may be concluded from the fact that, as I am informed by Mr. Coleman, on comparing the weights of a large number of affected grains and sound grains, the two being otherwise as far as possible identical, a reduction of 22 per cent. was found.)

The fungus mycelium, that is quite colourless—although white when viewed *en masse*—is not always composed of "hyphal threads" of even calibre, as there are often curious thickenings in its course, as especially happens when it is traversing the tissues composing the central cob. That within the grain, however, is of special tenuity. (Plate 44, fig. 4.)

The parasite again vigorously attacks the germs so that a fungus-affected grain rarely sprouts, if at all, and then generally the plantlet is too weak to survive.

(2) THE REPRODUCTIVE GROWTH—OCCURRENCE AND DESCRIPTION.

The reproductive phase of the parasite's organisation is shown in the occurrence of minute black, point-like bodies. These we have found (1) on the inner surfaces of the husks embodied in the white mycelium, and occurring here singly or in little groups; (2) on the shanks to which the ears are attached and on the portions of the stems from which these have sprung, and in these cases they have been met with emerging through the hard epidermis from within; (3) on the affected grain itself, on this having been kept in a moist chamber, their appearance following (commonly) that of a Penicillium (evidently an accidental occurrence) emerging through the white mycelium that meanwhile had produced a flocculent development of growth entirely covering it. In the latter case, occurring often in large numbers on each single maize-grain. (Plate 43.)

(*Note.*—These occurrences were afforded by the samples of ears of corn available for examination, and must not be regarded as embracing all the circumstances under which the small black bodies might have been met with in the course of field observations. Soaking in water the dry maize tissues of affected parts, as a preliminary course, again will cause them to appear under sustained damp conditions more commonly.)

Omitting technical details, these small black bodies—that microscopical examination indicates spring from the mycelial threads and within the subjacent tissue in each case—are, it may be said, little pear-shaped sub-spherical or ellipsoidal bodies named "pycnidia," whose thick walls of cellular tissue contain a cavity enclosing fungus spores or seeds. Generally they are simple and arise isolatedly, but two or more may be merged together in a common connecting also dark-coloured substance—a stroma. But still they are mere points or specks only in size, although their structure suggests, as is actually the case, that they are well adapted to maintain the vitality of the spores they contain. Plate 44, figs. 5, 6, and 7.)

They are eventually broadly flask-shaped, being now each endowed with a single broad conical protuberance (osticlum) that, as the spores within them mature, is thrust outwards through the epidermis within which it is at first developed, and, if present, through the white fungus mycelium encrusting it.

Within the interiors of these conceptacles are formed the characteristic relatively large spores of the parasite, that are elongated and cylindrical with rounded and elliptical ends. They are straight or slightly curved, and with a septum dividing them into two nearly equal lengths (bilocular). In colour they are very dark smoke-brown (fuliginous), and in length are from 20 μ to 30 μ having a width of 5 μ to 6 μ (μ = ·001 mm.). These spores are sprung each from a short stalk that in their early lives, being not divided off, is not easy to discern. Again, these fungus-seeds, as they develop within the pycnidia, seem to radiate from a central point, rosette fashion. (Plate 44, figs. 1, 6A, and 8.)

HISTORICAL.

The fungus is evidently, as above stated, one originally named by Schweinitz in 1822, *Sphæria Zeæ*, its features detailed corresponding with his description of it. However, it has, during the hundred years that have elapsed since this event, received several other generic names—amongst them Dothiorella, for instance. It is now termed technically *Diplodia Zeæ*, the former word alluding to its 2-celled spores, and the latter to its host the maize—*Zea Mays*.

Notwithstanding this early recognition in 1822, it was not until 1908 that it was definitely recognised as being a parasite of the maize plant, by the American writer J. T. Barrett. He too, in association with T. J. Burrill, published in 1909 a full account of it, and its life-history, including a description of its parasitic habit, in his "Ear Rots of Corn." Prior to this period, in fact, it was included as one of the micro-fungi that occur exclusively in various parts of the dead and decaying corn-plant only.

Further, until 1922, it was considered to develop as a parasite, only on and within the ears and the stems or shanks to which they

are attached, and on no other parts of the growing or living plants; but during this year L. W. Durrell, of Iowa, U.S.A., reports, as the outcome of his observations in that State, that infection may spontaneously occur on the roots and stems also; the most common parts of attack under the circumstances being the stem-joints or nodes where one would expect to find lodged spores. Only so, however, under conditions of extreme moisture and high temperatures. All infection in any case is only a topical one, no general systemic pathological changes ensuing.

The Australian occurrence of this disease appears to have been first made known—but in a very general way—by Dr. Darnell Smith, when dealing with the "Fungus Diseases of the Maize" in March 1918. Then he describes it as a New South Wales maize malady under the terms—"Ear Rot of Maize" *Diplodia Zeæ* (Schw.) Lév.; "Maize Culture," Farmers' Bulletin 116, N.S.W. Dep. Agr., Mar. 1918; "Fungus Disease of Maize," *op. cit.* p. 33-37). He, however, omits reference to locality of occurrence, but states that the "disease is a serious one and appears to be spreading" (p. 33). Shortly subsequent to this (1919) the present writer recorded its existence in Queensland also, under the name "Cob Rot," caused by *Dothiorella Zeæ* (Report of the Entomologist and Vegetable Pathologist for 1918-19, separate, p. 9, Brisbane, 1919).

This related to its presence in a small area of maize in the Eudlo district, where it was occasioning noteworthy damage already in June 1919; whilst a further instance of its presence in Southern Queensland was afforded by an incident near Samford reported on 20th July of the same year.

(*Note.*—The former of these instances of occurrence of the disease in question in Queensland is thus alluded to by the writer in the report cited, and may be of historical interest):—

> "*Maize.*—(1.) 'Cob Rot,' caused by *Dothiorella Zeæ* (a synonym of *Diplodia Zeæ* (Schwein.) Lév.) or a related organism. As its name implies, it firstly affects the cob of the maize plant; the ensheathing bracts have an appearance suggestive of mildew, and the grains being dull and brownish-coloured in patches of greater or less extent with an intervening felted, often pinkish coloured, mass of fungus mycelium. The individual grains are darker-hued on their opposing faces on the cob, and on sections reveal an abundance of mycelial threads intervening between the epidermis and aleurone layers which here and there form stromata that ultimately rupture the cuticle forming at the same time isolated cavities in their midst that become filled with spores.
>
> "In one instance of the occurrence (Eudlo district, South Queensland) of this disease brought under notice, 15 per cent. of a small area of maize had become affected by the presence of this form of Cob Rot, but it had been subject to heavy rains. In another inquiry was instituted as to whether such maize would be injurious to stock if incorporated in their ration. With the knowledge of what serious ill-health has been attributed to the consumption of mouldy corn (although we have not here a case of mouldy corn as ordinarily understood), the farmer is ill-advised who ventures to feed his stock with any maize that contains so-called 'dead grains,' such as we have here."—*Tryon, H., l.c.*

THE PARASITE IN LIFE.

Should the portion of disease-affected maize plant (husks, grain, cob, shank, stem, &c.) on which the spore-cases (pycnidia) with their contents have formed be maintained in a dry atmosphere, or in one in which the humidity falls well short of its saturation point, they will persist without alteration for considerable periods—many months, in fact.

This influence of dryness in effecting a condition of dormancy and acting on the parasite directly, or through the medium of the tissues of the plant—those of husks, cobs, grain, stem, &c.—extends to the mycelial threads, although their destruction may at times be earlier brought about by its not only affecting their growth but also their development of pycnidia; so, too, the growth also and liberation of spores by these fruit-organs. And, again, the sprouting or issue of spawn-threads by the spores themselves, whose structure and colour even suggest this possibility of endurance occurring.

The writer's observations have related to the persistent vitality of the mycelium and to its failure to produce pycnidia (a production that, as after events indicated, had evidently been delayed). This he estimates has, in the case of Diplodia-attacked corn, extended this season to about three months, including July, August, September, 1925, at least.

Messrs. Burrill and Barrett proved that spores taken from a culture at the expiration of 51 days germinated; although at the hand of Dr. Van Bijl, when twelve months old and of similar origin, no germination took place (*op. cit.* p. 291). There have, however, apparently been no very definite experiments conducted, bearing on this question regarding the longevity of spores isolated from the pycnidia, in which they may be long retained without detriment to, although without evidence meanwhile of, their vitality.

It has been observed that Diplodia spores from portions of maize plant that had lain exposed for five months, have readily germinated in 48 hours 10-12 per cent., and in 96 hours 15 per cent. (Burrill and Barrett, p. 81). and that others taken from two old, diseased cornstalks that had been kept indoors for six months germinated to the extent of 90 per cent. and 92 per cent. respectively (*Ib., l.c.*).

The influences of soil conditions on vitality must not, too, be lost sight of; but these again do not appear to have been fully inquired into, although Dr. Van Bijl found in two instances, after burying cultures in which the mycelium and pycnidia of *Diplodia Zeæ* occurred, and then removing them at the expiration of a period of twelve months, there was no germination.

Again, since corn, in areas where this disease occurs, must be often consumed in feeding stock, and the resulting droppings may find their way into the field, the question may be raised—Do *Diplodia Zeæ* spores under these circumstances retain their viability? Here we have only experiments on mice to guide us. These were conducted, again, by Dr. Van Bijl. As the result of two experiments in feeding these animals with cultures in which spore-containing pycnidia had been crushed, he found that, although the spores had been retained in their alimentary tracts for 14 hours, they germinated after being passed out with the fæces but that evidently the growth was only weak. So much with regard to this important matter of continued life in the parasite.

Now, when the above-mentioned parts of Diplodia-infested maize containing the spore-cases have been subjected to moist conditions,

especially if already they have or purposely have been soaked with water (rain, &c.), a slender, long, twisted, tendril-like, black body will issue from the emerged summit or ostiolum of each, and this on examination will be found to be composed entirely of the elongated 2-celled spores—already described—agglutinated together, although easily separable, especially in water. In fact, under these circumstances, these peculiar filaments originating in this manner may now be met with quite numerously, where previously there was only a delicate film or encrustation of white fungus mycelium on the surface, or even none at all.

These spores in ordinary water, or preferably in suitable nutrient fluids, will commence within 5 to 8 hours to germinate, the period being delayed even for 2 to 3 days with certain, and in the case of some media with all, of them. A delicate, colourless germ-tube results from germination of each spore, and this as it grows becomes septate and branched; and the several such germ-tubes arising together soon form with their further growth an intricate mycelium.

This marks the extent of our present inquiry; but investigators in the United States (Illinois) and in South Africa have further tested their growth both in these nutrient fluids and on many solid media also, noting especially that when the mycelial threads (vegetative phase of fungus-life) have continued growing for a few days, more or less according to the medium for growth employed, pycnidia and spores are formed in connection with them similar to those that arise when they have been formed in or on the maize-plant tissue. In fact, it was found by J. Burrill and J. T. Barrett that an extract of corn-meal with agar was the best medium, of those employed in the laboratory, for securing this free growth of the fungus organism to its spore-bearing (reproductive) stage.

The Illinois workers above referred to, Messrs. J. Burrill and J. T. Barrett (1909), obtained positive results in this way in no less than nineteen out of twenty tests, in which different substances of immediate plant origin served as media; whilst Dr. Paul A. Van der Bijl, of Natal, to whose graduation thesis—"A Study in Dry Rot Disease of Maize caused by *Diplodia Zeæ* (Schw.) Lév." 1916—the writer is largely beholden for information, tested no less than thirty different cultures with regard to the growth of the Diplodia fungus up to the pycnidia stage, and obtained positive results with all but six. These culture tests were at a temperature of 25 deg. C. (*op. cit.* p. 26-29).

The foregoing facts are of interest, since they go to show that the *Diplodia Zeæ* is not always dependent on the living maize plant for its existence and continuous growth, when once present.

Van der Bijl's memoir also records the results of experiments under test conditions in ascertaining the effects of specific alkalies, acids, and carbohydrates in influencing the growth of the Diplodia.

When the spores of the fungus, on issuing from the pycnidia as described—an event that takes place under special weather conditions, as may be now inferred—in turn drop to the ground, either on having become dry where they originate, or on having been washed down into it and having done so, then, as Burrill and Barrett in the course of their experiments discovered, they may be taken up into the air and transported by the wind ("Ear Rots of Corn, 1909," pp. 81-83). As proving this they used pieces of glass that had been smeared with glycerine, or glycerine and alcohol, fixed to stakes in the ground to detain if perchance any spores that came in contact with them, on their being so exposed near affected stands of corn, or near ground in which

a diseased crop had formerly been grown. These were thus displayed for several days; in one experiment the glasses being exposed even near land in which diseased corn had been raised, but that had been later devoted to the growth as a successive crop of either lucerne or clover, and where, too, pieces of the old corn-stalks still remained on the ground; and in each of eight tests the spores of the Diplodia fungus were captured from the air, from 2 to 400 being obtained on individual pieces of glass.

Similarly, like tests were carried out in order to ascertain if the fungus spores were conveyed over long distances from where they originated. These involved distances of from 50 to 350 yards, but notwithstanding, in all cases, covering the employment of fifteen smeared glass slides, the characteristic Diplodia spores were secured.

The foregoing facts narrated, indicate whence individual maize plants may become infested, and whence the infective agent may emanate too, and reach corn-plants previously free from the disease.

ACT OF INFECTION.

The facts of maize plant infestation, and how it is brought about, has too been ascertained by the three investigators mentioned; also experimentally Messrs. Burrill and Barrett in 1907 made numerous tests with corn that had cobbed, and that was in different stages of growth—just silking out well, or the silk well developed, already commencing to dry. They made wounds with a knife in different plants and then inserted spores in these. They also placed spores under the outer husks, or well down into the silk. Positive results—effective inoculation—were thereby secured; but most of them were to be explained as the action of wound parasitism. However, spraying the ears with a fluid medium in which the spores were suspended, when the grain was in the "hard milk stage," gave the best results: "80 per cent. of silk-inoculated ears produced (thus) the disease"—in fact, thereupon. When the cobs were first silking out well and showed no signs of drying whatever, spraying only gave 3·3 positive infections.

"A number of inoculations made on stalks and leaf-sheaths by merely applying spores to the uninjured surface of each, and in slight wounds made by scratching with a needle, were entirely unsuccessful" (p. 85).

Dr. Van der Bijl, in the course of his Inoculation Experiments (pp. 15-17), using spores in suspension in water, produced infection by puncturing the green ear through the husks; by squirting the fluid into the silks that had reached a stage of growth just fit for pollination; and by watering the silks with it at this period also, placing at the same time a little of the fungus mycelium on the silks; and by pollinating and applying the spore water-suspension, at the same time. Summing up his positive results in these terms:—"The inoculation experiments already referred to (pp. 15-16) clearly show that maize in the field readily becomes infected through wind-borne spores (*vid.* p. 10) which find their way on to the silks of the maize plant, at or about the time of pollination" (p. 17).

The so-far limited observations of the present writer suggest this method of infection also. Thus, when a maize grain or kernel is only slightly infested—a fact perhaps only to be discovered by microscopical examination of its tissues—the Diplodia mycelium has been found to

be restricted in its occurrence to the tissue (testa) intervening between the outer hull (pericarp) and the aleurone layer; in other words, occupying just such a position as might be expected—when one realises the process of development of the ovary—with mycelium entering through the stylar cavity that of the "silk" filament (style), connected with each individual maturing grain.

A recent writer, L. W. Durrell ("Nodal Infection of Corn by *Diplodia Zeæ*," Iowa, U.S.A. Agr. Station, Research Bull. 77, 1923), considers, as we have previously stated, that the most common points of attack are the nodes or stem-joints and ear-shanks; and that all his observations and experiments emphasize the fact that *D. Zeæ* infects locally the maize plant at any point where blown spores lodge, moisture and temperature being of course essential to this act.

Notwithstanding the ultimate pernicious results from the free growth of *Diplodia Zeæ* in the grain, the writer does not consider it as being a vigorous parasite of the growing plant. Thus (*vid.* succeeding paragraph), with regard to this generally, its attacks are so ineffective that previous to 1923 they had been overlooked; and with respect even to the kernels, their development, in spite of its presence within them, can still proceed almost to the stage of maturity; until in fact, in the case of the Dent corn varieties, therefore, the characteristic depression (dent) in the crowns has arisen.

SOURCE OF INFECTION.

Probably always, as our observations appear to show, the maize grain or kernels when occupied by the fungus to the fullest extent, as commonly happens, yield the seed-bearing conceptacles, or pycnidia, to a relatively larger extent than does any other part of the maize plant; yet it is considered by us that the part they play in infection is not one of an immediate procedure, owing to the fact that they furnish viable spores to both soil and air, and so only indirectly effect it.

The South African observations indeed show that "in the maize inoculated in the field, no instance was found where the disease spread from ear to ear in the same season."

Dr. Van der Bijl, in the 1913-14 Natal mealie season, planted "kernels" from typically infected cobs, but, though many of them failed to germinate, not one of the plants raised had infected ears. This also applied to maize plants raised from clean seed in the same soil in which this experiment had been carried out, during the ensuing season—an indication, he adds, "that the malady is not carried over in the seeds" (*op. cit.* p. 16).

So with regard to apparent inability of soil, &c., harbouring the fungus spores to infect, through seed planted therein, maize plants grown therefrom. Thus Van der Bijl states that, notwithstanding some maize kernels soaked in water containing Diplodia spores grew, the plants afterwards showed no trace of the fungus upon them (*op. cit.* p. 17).

SYMPTOMS AND OCCURRENCE OF ATTACK.

In the field, soon after the fertilisation or pollination has taken place, a premature yellowing of the husks, on plants otherwise healthy, is described as illustrating its diseased condition. Or in other words,

with the Diplodia infection "these husks have a dried appearance," somewhat difficult to define, "whilst healthy ears still retain their normal colour." Again, at the same time, too, a growth of white mildew within the leaves of the husks and on the surface of the cob becomes manifest, "the number of ears thus shown to be infected increasing more or less through the season." This progressive increase must not, however, be necessarily regarded as implying successive infections covering the same period of time, but as reflecting a variation in the dates arrived at by the plants in attaining a definite stage of growth—tasselling, for example. This may be concluded from the circumstances governing these infections, in which more than a single factor operates; and in the common observation, that infection between the ears of one plant and the ears of another occurs only slightly if at all, for the disease is not systemic as regards its plant-host, but almost confined to definite parts of it—the ears; and moreover there appears to be a more or less uniform period in which all the plants in a maize area are first affected by its presence.

MODE OF INJURY.

CHANGES EFFECTED.

This is obviously conditioned by incidents connected with the growth of the Diplodia fungus in its parasitic relations, and probably only to a very small extent by any factor otherwise directly affecting this—e.g., the essential composition of the maize plant itself generally. This growth implies nutriment and its occurrence in a form in which it can be assimilated; and, if not immediately forthcoming in the parts of the plant in which the parasite is growing, then its preparation from bodies therein from which it can be made.

It might be suggested, in accordance with what takes place with other plant parasites, that final injury might also be brought about by some toxic principle, formed in the tissues invaded, excreted by the Diplodia as it grows. We have not, however, in its case any evidence of the formation, or suggestion of the operation of any such generally injurious principle, to account for the changes brought about.

So, again, we must dismiss the suggestion that it is an instance of mechanical injury, due to the occurrence of such added material in the tissue that the presence of the fungus mycelium constitutes, much less to any diversion of growth energy to form other tissues, as we find may attend the growth with other parasites in other plants.

The alterations that take place, however, can be precisely ascertained in two ways—(1) by direct observation of the Diplodia-infested maize plant and the interpretation of the facts observed; and (2) by investigation of the facts occurring when the organism is grown under exact control conditions.

Direct observation indicates that there is a loss of substance, indicated by loss of weight found on comparing disease-affected with normal portions of the maize plants; a remark that applies, for instance, to the entire ears, to the grain or kernel, to the cob proper, and again to the grain or kernels attached to it.

Dr. Van der Bijl, in the course of his investigations, inoculated eight ears on growing maize with *Diplodia Zeæ* spores through the silk, and on gathering them 56 days afterwards found, as compared with

a similar number of inoculated ears, that there was an average loss in the weight of ears, after the removal of the husks, of 24·8, and that with respect to the grain the loss in weight in the different inoculated ears varied from 6·7 to 38 per cent., averaging 27·8 per cent. (*vid. op cit.* p. 19, table II.).

Take the grain, for instance, we have previously (*vid.* p. 5) mentioned, that of an Atherton Tableland sample not especially selected, that had experienced a loss in weight of 22 per cent. Now, looking for an explanation of this simple phenomenon of change, microscopically examining the grain in question to this end, we note how this loss has been brought about. In fact, the cell-walls of the fungus-invaded tissues have almost disappeared, and the starch-grains that usually fill the cells themselves, although as numerous apparently as usual, have been partly dissolved and eroded away; both of which changes point to the action of a starch and cellulose-reducing agent of the nature of an enzyme or unorganised ferment diastase. Similarly it has been found that the oil component of affected maize is reduced, suggesting the action of a lipase. (*Note.*—This oil, as we know, is principally yielded by the "germ," a part especially favoured with fatal effects by the parasite; and, as bearing on our statement, the results of an investigation on the part of the Agricultural Chemist, Mr. J. C. Brünnich, of the oil-content of the grain of the original Atherton cobs submitted to us as disease-affected, are of interest. He found, in fact, that its oil-content was only 2·48 per cent., as compared with a yield of 4·2 per cent. by sound maize from the same district, that had yielded it.)

Now, with regard to the bodies formed by the *Diplodia Zeæ* during growth, Dr. Van der Bijl (*op. cit.* p. 54-56), examining the mycelium produced by the fungus when grown under control conditions, has definitely proved by special chemical tests, not only such enzymes as invertase, oxidase, and catalase in the culture medium, but also especially diastase and an oil-destroying (lipoid-destroying) one, lipase. He also ascertained the production, amongst various other bodies, of both glycerine and a special sugar, mannitol. In fact, as derived from the medium for growth by the Diplodia hyphæ or mycelial threads, we must infer the production of liquids and of bodies capable of being taken up by liquids, that, being lost through evaporation when these plant-tissue-contained hyphæ perish and dry up, account for any reduction in weight of affected grain observed (*vid.* p. 5 and this page as above.)

As bearing on this discussion regarding the nature of injury due to *Diplodia Zeæ*, it may be further remarked that the bodies such as are, as is above stated, formed by the progressive degradation of starch and cellulose by enzymes—maltose, galctose, cane sugar, and glucose—constitute when added, in 5 per cent. solution for example, to the fungus grown in a medium of cornmeal, again, about the optimum conditions for its successful growth: "the cultures containing them producing by far the most pycnidia, when compared with other media employed, in cultivating the organism." (Burrill, T. J., and Barrett, J. T., 1909, p. 79.) Thus the researchers of the United States and of South Africa—alike physiological—botanists confirm each other's findings.

SOIL COMPONENTS AND "EAR ROT."

It may be suggested that a deficiency in phosphorus in Atherton soils may be the explanation of Dry Rot disease prevalence there.

However, this question appears to have been disposed of by Dr. Van der Bijl's researches, that have been so often cited here (*cf. op cit.* pp. 30-32), although not directed to one of the kind. In fact, in the course of a series of definite tests regarding the action on the growth and spore-production of *Diplodia Zeæ* of (*a*) various groups of chemical bodies and (*b*) of single ones, he found what may be regarded apparently as a reverse generally of any restraining action of phosphorus, actually occurring in certain cases.

In the tests of more than one in conjunction, he used an approved medium containing 1·5 per cent. Again, with 5 per cent. dextrose, and in testing the single ones, he employed the agar medium alone, with one gramme in 50 c.c. water, of each of the several bodies, entering into the test, as an addition.

His tabulated statements relating to those conditions, as regards chemicals present, that produced the better growth of fungus indicate that when the culture included either ammonium hydrogen phosphate or potassium hydrogen phosphate a vigorous growth ensued—except when potassium chloride was omitted—after 7 days, but that it was very feeble indeed when calcium triphosphate plus potassium chloride was used. On the other hand, without any phosphorus salt whatsoever in the mixture, a growth of only 0·8 as compared with 1 was secured.

Using single chemicals only, the growth when potassium biphosphate was used was equally good to that produced when either potassium sulphate or potassium nitrate was employed. This growth, however, was less when calcium triphosphate was used, and reduced still when ammonium phosphate was the salt employed, in the latter case the growth being very feeble.

INGESTION OF MAIZE AFFECTED BY DRY ROT.

The question of the food value of maize affected by Dry Rot is not a matter for our consideration. However, sickness, and even fatality, in farm animals having been so often apparently traced to their having fed on mouldy corn, or such as has been suspected of being so, the question has arisen, if this, when occurring, be directly traceable to the occurrence of changes brought about by the fungus under consideration, *Diplodia Zeæ* (Schwein.) Lév.

Some years since a fatal epizootic in horses in the Bundaberg-Isis district having, as the outcome of applying the principle of exclusion, caused corn in the form of grain to be inculpated in this connection, several samples of maize grain, at the time of this occurrence and thus under suspicion, were examined by the writer, but in no instance was the parasite in question met with, associated with them. In another, afforded by fatality in coach-horses also, in the Western district, that he too inquired into, death was evidently to be attributed to Ricin yielded by castor-oil seed meal, that was detected by him, as an evidently accidental inclusion.

As immediately bearing on this question, and the possible toxic action of *Diplodia Zeæ*, special researches have been recorded that have not led to positive results.

Dr. P. A. Van Bijl informs us (*op. cit.* p. 5) that in 1914, having prepared in quantity a special culture of the fungus on crushed maize, a definite portion of it was fed to a heifer each day for 8 days, the total quantity consumed being 28 lb., with the result that no signs of illness resulted. This experiment was carried out under the direction of Sir A. Thieler, Director of Veterinary Research, Union of South Africa.

Further, that feeding experiments were conducted, also under the Veterinary Research Division, in which infected mealie cobs, with or without their being first soaked, were fed to calves, sheep, and goats daily during a period of 11 days, but meanwhile the animals remained healthy. Similarly a mule was fed during a like period, until it had consumed 170 lb. of this material, with the same negative results. In fact, in neither case was there even temperature disturbance (*op. cit.* p. 25).

Again, an extract prepared from a pure culture on flour-paste was used to inoculate a white mouse, but no noticeable ill-effects followed (*op. cit.* p. 26). Further, this mouse and two rats were fed with Diplodia-infected maize kernels, but the animals appeared none the worse (*l.c.*). And, further, on making cultures in which several different media were used, the products due to the fungus growth resulting did not include animal toxic principles (*op. cit.* pp. 48-58).

Subsequent to these investigations (1914), and in the light of the fact that cattle in South Africa were still becoming poisoned on feeding in areas devoted to mealie (maize) cultivation, the Union veterinary surgeon, D. T. Mitchell, inquiring into the matter in 1920, apparently arrived at the conclusion that the afore-mentioned findings were to be set aside. Thus, summarising further investigations, he concluded as follows:—"Experimental evidence has shown that cultures of *Diplodia Zeæ* on sterile mealies, when fed to animals, can set up clinical symptoms which are similar to those shown in animals contracting the disease naturally, and further experiments indicate that the results are produced by *a substance of at-present unknown composition* during the growth of the fungus in the maize grain." In this investigation, Mitchell, starting with pure cultures of *Diplodia Zeæ* provided by Dr. Van der Bijl, inoculated sterile crushed maize, and then allowed the growth to proceed for *two months in (open) jars* prior to feeding it to the animals. (Mitchell, D. T., M.R.C.V.S., Acting Director of Veterinary Research, "Poisoning of Cattle in Mealie Lands," Journ. Depar. Agr. Un. S.A., 1, No. 2, 1920, pp. 138-143.)

Further, on endeavouring to find out if the Diplodia organism cultivated simply on a cellulose medium would give rise to a similar condition of poisoning as did Diplodia-infected maize-cobs, he arrived at a negative result. (Mitchell, D. T., "Poisoning of Cattle by Diplodia-infected Maize," South African Jnl. of Sc. 16 (1920), No. 5, pp. 446-452.)

Now, in the course of the present writer's limited observations, he, as have other workers, has found other fungus organisms besides *D. Zeæ* associated with it in these disease-affected maize ears when taken from the field, notably a species of Fusarium; and, moreover, has met with others, e.g. Penicillium sp. and Aspergillus sp., upon the maize kernels harbouring the Diplodia, that have been taken from ears exposed after they have been husked; and there can be no doubt that maize, in the general condition described as mouldy, has in abundant instances in other countries occasioned sickness, even fatal sickness, to animals

feeding on it, without this being the invariable result. There is in fact an abundance of literature upon the subject; and since *Diplodia Zeæ* itself does not appear to be directly implicated in producing this result, and the chemico-biological reactions, on organic media, of the several associated organisms referred to, so far as they have been prosecuted to the extent of obtaining final results, also apparently are not, it is unnecessary now to further dwell upon the subject, except to add that, generally speaking, the use of all mouldy fodder, and mouldy maize especially, should be avoided.

EXTERNAL CONDITIONS AND THE DISEASE.

Meteorological.

According to statements made by farmers to Mr. F. B. Coleman, that had reference to the parts of the Atherton Tableland in which they were respectively interested, the disease was more active in those areas of maize grown in what were denominated wet seasons.

Further, according to the explicit testimony of one, a resident of Kairi, this special virulence appeared to be dependent on another factor co-operating—i.e., the stage of growth that the maize plant has attained when this favouring condition occurs. Thus he stated: "This season, November-planted maize had much rain during March and April when the grain was ripening, while December-planted had the same rain when the crop required it. The November crop gave a very much greater amount of damaged grain." (In the section dealing with Mode of Infection this incident would appear to find its explanation.)

Again, J. J. McDonald, member of the Maize Pool Board, Tolga, is alleged to have stated with regard to the relative incidence of the disease on two areas of forest land, both of which had been long cropped with maize and were seeded with maize from a single source, as follows:—"On 14 acres sown on 3rd November, 1924, there was a crop of 3 to 4 tons of good maize in addition to many damaged cobs present. On 31 acres sown on 19th November, 1924, there was a crop of 21 tons of good maize, in addition to a few damaged cobs present." (*Note.*—In the former case, at the latter rate of yield of good maize, the return should have been 9·6 to 10·6 tons.) The explanation as above may apply here also, but there was another factor to take into consideration: the former area of the two had for a far longer period been devoted to maize-growing.

Soil.

The soil of the areas devoted to maize-growing on the Atherton Tableland is described as red volanic soil, and apparently therefore it is primarily of a general uniform character; although originally some of the country so used was described as forest land, other as scrub (rain forest) land, accordingly any difference in the incidence of the disease in the various areas must find its explanation in other factors than yielded by fundamental difference in soil—e.g., depletion of plant nutrients. (*Vid.* "Soil Components and Ear Rot," p. 14.) However, its occurrence in both "new land" and "old land" would appear to indicate that the matter of depletion has no determining influence on its presence—a conclusion also based on other considerations that need not now be advanced.

There was, however, a consensus of opinion that the disease was most prevalent in old land that had been continuously devoted to maize-growing, and on this the disease occurrence was apparently a continuous incident—an experience that finds its ready explanation in the fact that, with the mode followed of handling the crop in the Tableland area, the soils must *cæteribus paribus* be becoming yearly endowed with the infective agent, the *Diplodia Zeæ*, in increasing amount.

RECOMMENDATIONS.

It is difficult, with the limitations of our present knowledge, that lacks the guidance or control of full experience of Atherton Tableland maize-growing conditions, to propound a satisfactory course to be pursued in meeting the situation arising from the local prevalence of *Diplodia Zeæ*. The following general principles may, however, be enunciated:—

1. To prevent its continuous presence in yearly increasing amount there should be an intermission in maize growth. This to apply successively, at least, to circumscribed areas that can be regarded as isolated, whether individual fields or more comprehensive areas, as regards spontaneous spread of the disease; but, at one and the same time, to all areas that are accessible to a common source of infection, owing to their contiguity or nighness thereto. This intermission to be brought about (1) by clean-fallowing of the land; (2) raising a cover-crop on it, e.g., cowpea or other plant that may have like value; or (3) alternating with some crop that, like maize, itself yields a merchantable commodity.

2. As subsidiary to the foregoing, the amount of infective material occurring in or on the maize fields should be reduced as nearly as possible to a vanishing point, by in the first place lessening the time occupied in the field with the maize plant for each crop after the cobs are mature, by from two-thirds to three-fourths of that now devoted to "field curing" or "drying off." (*Note.*—At present, owing to the climatic conditions as regards rainfall—drizzle and humidity obtaining on the Tableland—this reduction will probably be found to bring the period into correspondence with that which characterises conditions of maize-growing in certain other districts.) This procedure to involve taking off the crop soon after the grain is mature, transferring the cobs for their drying-out to special "bins" constructed for the purpose, such as are not unknown in handling it elsewhere where corn is grown; the added cost being probably recoverable from an alternate crop with a single year other than maize. Under procedures now in vogue in the district that involve the presence of the crop on the land three or four months after it has matured, it may be anticipated, apart from the occurrence of *Diplodia Zeæ* immediately associated with the cobs already, by the time that the maize crop is removed from the field, every part of the plant already dying, or long since dead, has become the site of secondary infection, or harbours now the spores of the

parasite fungus, whereby its vigorous temporary existence as a saprophytic organism is ensured. Moreover, apart from the advantage accruing to the system contemplated to prevent this, this innovation would meet an important requirement of another character, as obviating an occurrence—as serious in some instances, as a source of loss, possibly, as this "Dry Ear Rot"—for abundant evidence has come under my notice that, in consequence of the present method of handling the harvest in the field, the maize is in many cases already infested with grain weevils, if not already seriously damaged by them, when brought in to be held in store.

3. Arising out of the presence of this infective material on the land, follows the necessity of getting rid of it, and this will not be effected by breaking down the old stalks after removing the ears and cutting them up, and ploughing them under with the farm implements; since, as is elsewhere shown in the report, every piece of old dead maize plant may, if left on the land, prove a source of infection to the succeeding crop of corn, this being even so when cowpea, earth nuts, or some other plant is grown in alternation with succeeding ones, and the land has not been cleaned as recommended.

4. There is no evidence, at present, of any particular kind of maize being immune from or resistant to the attacks of the fungus associated with Ear Rot; but, notwithstanding, there is a pressing obligation, on other grounds, to maintain a high quality in the seed used in planting. There is little outwardly, with but slight infection occurring, to distinguish infected from disease-free seed, and obviously "dead seed" is probably always a carrier of *Diplodia Zeæ* in its tissue, when derived from a crop in which the disease, that it occasions, occurs. This "tainted" seed will not, should it germinate, as only happens when the infection is light, directly give rise to a plant in whose system, consequently, the disease will develop; but, failing to do so, it may, when placed under circumstances favourable to growth of the fungus, yield the Diplodia spores that may prove a source of eventually infecting many other maize plants that otherwise would remain healthy: and "dead seed" will, with utmost likelihood, do so. (*Note.*—Probably this explains how this "Ear Rot" originated in the Atherton Tableland.)

5. There are the best grounds for concluding that the maize plant becomes infected with the *Diplodia Zeæ* when it is silking; also, that this incident is contemporaneous with, or immediately follows, a period of rainfall; also, that the persistence of humid conditions promotes it. An effort should therefore be made to grow the crop to avoid these concurrences.

6. The obligation to consider the occurrence of this disease as a common misfortune in the district, and to regard it, therefore, as one for a common attitude in the prosecution of control measures.

DESCRIPTION OF PLATES 41-44.*

PLATE 41.—Maize Cobs as harvested, showing outward occurrence of *Diplodia Zeæ* (Schwein.) Lév.

Fig. 1.—The husks removed, "White Mildew" involving entirely grain and core.

Fig. 2.—Outer husks alone detached; "White Mildew" involving surfaces of those remaining.

PLATE 42.—Maize Grain or "Kernels" as harvested, showing changes effected by *Diplodia Zeæ* (Schwein.) Lév.

Fig. 1.—Outward appearances, dark patches and "White Mildew." x 2.

Fig. 2.—Sound grain for comparison with Fig. 1. x 2.

Fig. 3.—Internal appearance. Section through disease-affected grain. x 2.

Fig. 4.—Sound grain. Section for comparison with 3. x 2.

Fig. 5.—Starch from disease-affected grain; surface erosion; magnified.

Fig. 6.—Starch from sound grain for comparison with 5; magnified.

PLATE 43.—*Diplodia Zeæ.*—The organism on maize, under moist (field) conditions.

Figs. 1-4.—Fruiting bodies (Pycnidia) emerging or emerged through "White Mildew" (mycelium) covering grain surface, as seen when disease-affected grain is exposed to moisture in field or elsewhere. (Note spore filaments, &c.) x 2.

Fig. 5.—The same on leaf sheath. Natural size.

Fig. 6.—The same on "shank" (stem) of maize-cob. Natural size.

PLATE 44.—*Diplodia Zeæ.*—The organism and its maize-tissue relations.

Infective Agent.

Fig. 1.—Spores (*vid.* Fig. 8).

Vegetative Growth.

Fig. 2.—Mycelial threads (external) or "White Mildew."

Fig. 3.—Mycelial threads traversing tissue cells of husks.

Fig. 4.—Mycelial threads traversing tissue of seed "germ."
(Note thickenings and irregular contour.)

Reproductive Growth.

Fig. 5.—Pycnidium (spore-case) still covered by "White Mildew" or external vegetative form, its spore filament being extended.

Fig. 6.—Pycnidium (spore-case), longitudinal section showing stroma composing pycnidium, and spore containing cavity.

Fig 6A. Spores: successive stages in formation on sporophenes on inner surface (hymenium) of pycnidium cavity. Pycnidium (spore-case), longitudinal section. More advanced stage of growth, the spores being extended.

Fig. 8.—Spores, from spore filaments germinating in moisture; omitting delicate germ-tubes.

(*Note.*—Figs. 1-8 all highly magnified.)

* Prepared, from specimens provided by the writer, by I. W. Helmsing, Artist Assistant.

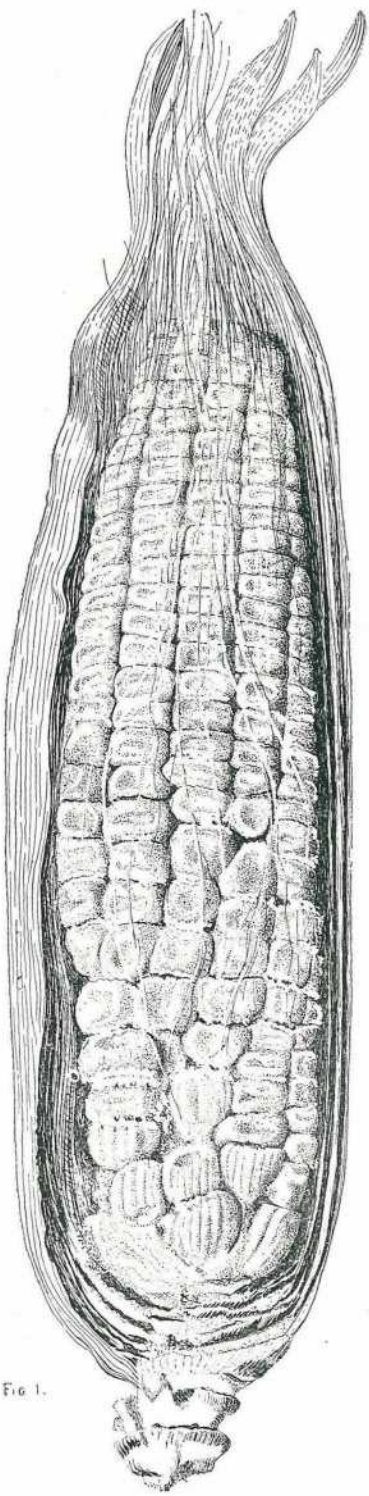


Fig 1.

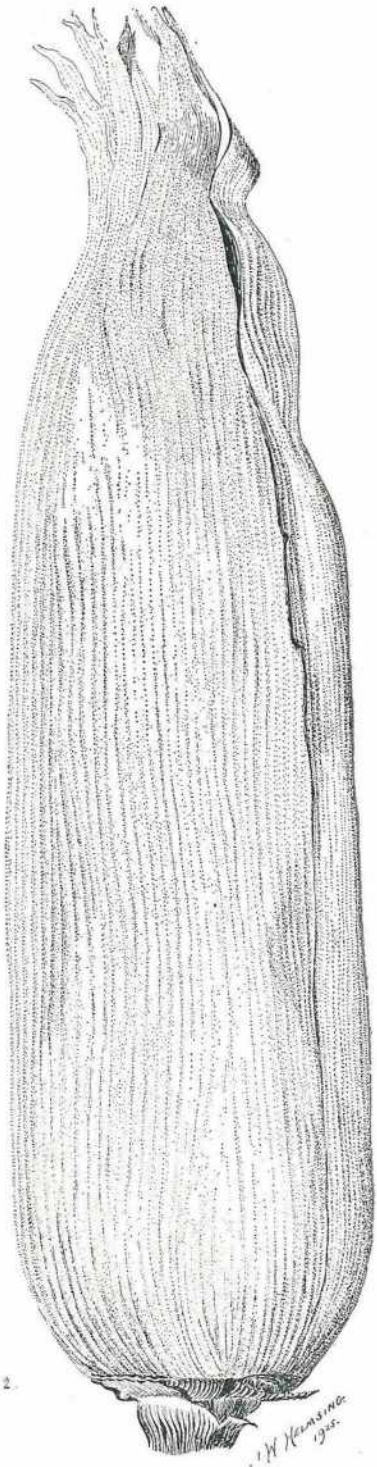


Fig 2.

Plate 41.

Fig. 1.

Fig. 2.

Fig. 3.

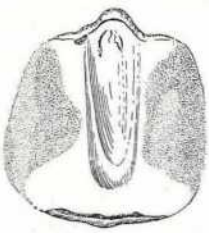


Fig. 4.

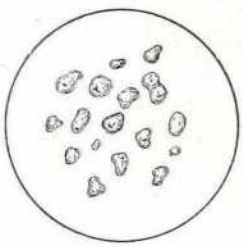


Fig. 5.

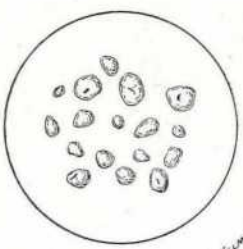


Fig. 6.

PLATE 42.

Fig 1.

Fig 2

Fig 3.

Fig 4

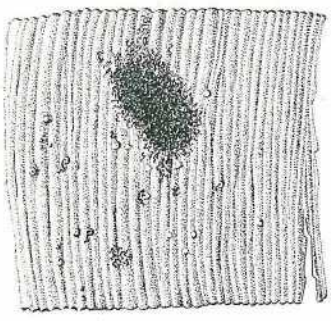


Fig 5

Fig 6.

PLATE 43.

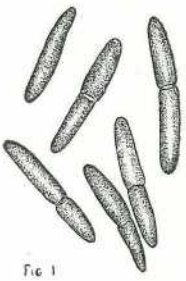


FIG 1

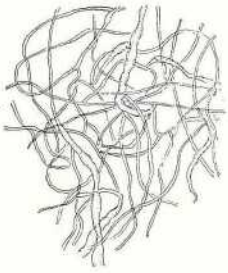


FIG. 2.

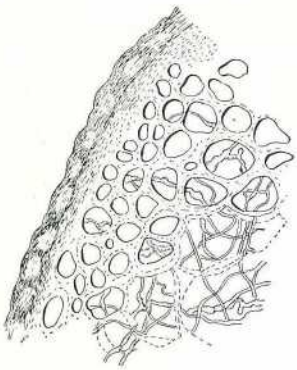


FIG 3

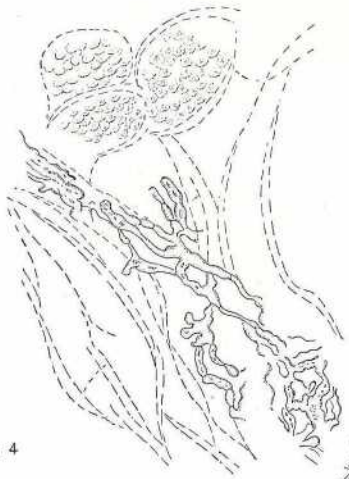


FIG 4

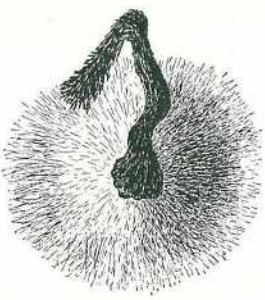


FIG 5

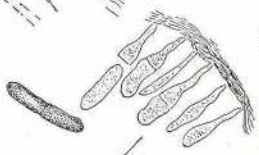


FIG 6 a.

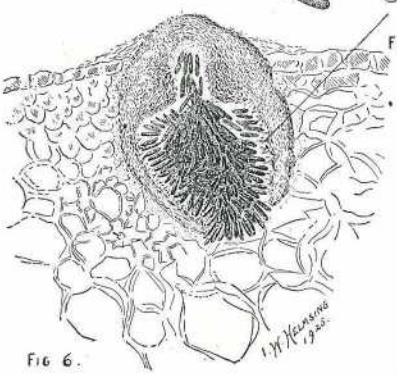


FIG 6.

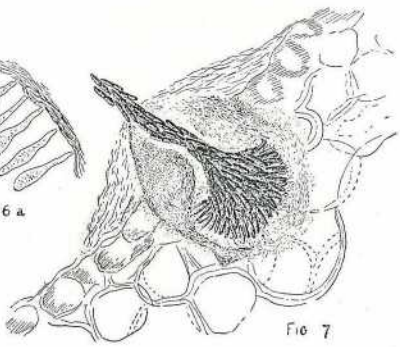


FIG 7

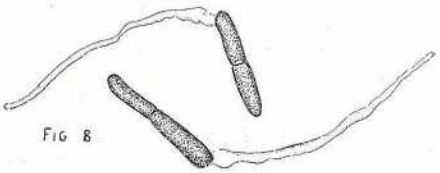


FIG 8

PLATE 41.

BUNCHY TOP—WHAT IT IS, HOW TO DETECT IT, WHAT TO DO.

BY THE BUNCHY TOP INVESTIGATION COMMITTEE.

This article has been written for the purpose of enabling banana-growers to recognise the disease, known as Bunchy Top, at its earliest stages. It cannot be too strongly urged on all banana-growers that it is the serious duty of every man engaged in the industry in any part of Queensland to examine his plantation at regular intervals, and to report at once any occurrence of the disease to the Department of Agriculture and Stock, Brisbane.

If this is done at once, and, further, the recommendations carried out, there is no reason why the disease cannot be eradicated from any or every plantation in a newly affected area. These notes are also available in pamphlet form.

SOME FACTS ABOUT BUNCHY TOP.

1. Bunchy Top in bananas is a disease due to the presence, in diseased plants, of a germ (so minute that it cannot be seen with the eye under the highest powers of the microscope).

2. Once the disease has made its appearance in any banana plant nothing on earth can remove that disease or cause the plant to recover.

3. Once the disease has made its appearance in any banana plant, in nearly every case all plants or suckers in that stool will develop the disease.

4. The disease can be carried from any diseased plant in a plantation to other plants in that or neighbouring plantations, by means of the dark banana aphis, which occurs wherever the banana plant is grown.

5. The banana aphis does not cause the disease, but serves to carry the disease from one plant to another, in much the same way as a certain kind of mosquito transmits malaria from one human individual to another.

6. The disease takes, generally, about a month to appear after aphides from a diseased plant have been placed on a healthy plant.

7. Consequently you cannot trust any sucker which has been obtained from a plantation in which Bunchy Top is present, or any plantation which is close to a plantation in which Bunchy Top is or has been present; since the plant may be at the stage in which the disease is present, but sufficient time has not elapsed to enable the symptoms to appear.

8. The shifting of suckers out of any plantation affected with Bunchy Top is, in practice, sure to start the disease in any plantation

to which such suckers are taken. Aphides will then serve to carry the disease to other plants in that and neighbouring plantations. In time, unless the following recommendations are carried out to the last letter, the disease will ruin the plantation and even the area in which your plantation is situated.

9. Bunchy Top has been discovered during January in the area between the Brisbane and Caboolture Rivers.

10. Suckers have been sent from this area to all parts of Queensland, even as far north as Innisfail, during recent years, and even within the last two months.

11. The disease is very strongly developed in some plantations just south of the Caboolture River.

12. In some of these plantations it has been present for three years.

13. It has now been proved that in every plantation so far inspected, north of the Caboolture River (as well as south of that river) which has received suckers from a certain one of these badly affected plantations, as far back as 1923 (more than two years ago), Bunchy Top is now present.

14. If you have received any suckers during the past three years from the area south of the Caboolture River, or from any other person who has obtained suckers from that area during the past three years, there is every chance that you may have Bunchy Top now in your plantation.

HOW TO TELL BUNCHY TOP.

(When reading this section, constantly refer to the illustrations at the end of the notes.)

1. Inspect carefully each plant, young and old, in each stool in your plantation at regular intervals.

2. Examine the youngest leaf in each plant in each stool by holding the leaf in such a way that you can see through it from the back of the leaf.

3. If the leaf is diseased there will be seen broken greenish streaks between the veins, that is to say, lines broken into longer and shorter portions, or having the appearance of the Morse Code signs. These will first be seen at the lower end of the leaf, but when the eye is used to it they will be seen throughout the leaf. (See Figs. 1 and 2.)

This is the first symptom of the disease.

4. Sooner or later dark streaks will appear in the stalk of the leaf and in the midrib.

5. If the original plant has been born with the disease, that is to say, has been taken from a diseased corm or bulb, every leaf will show these streaks. (Fig. 4.)

6. If the plant was originally healthy, but has contracted the disease as the result of the germ being carried to it by aphides, then only leaves developed some time after the infection will show the disease. Hence, the safe procedure in all cases is to examine the last leaf, and then you will not miss the disease. (Figs. 5, 6, 7, 8.)

7. In plants born with the disease, all the leaves will from the beginning be narrow, short-stalked, brittle, with curled margin, and stand erect, thus giving the typical bunchy-top appearance, and will, in addition, show plainly the typical green streaking. (See Fig. 4.)

8. In plants which were originally healthy but have contracted the disease, this narrowing of the leaf, short-stalked condition, brittleness, and bunched appearance, &c., will only be seen in leaves which develop several weeks later than the first appearance of the green streaks.

9. If you are careless and do not detect the trouble until plants have got to that stage, you have been giving aphides plenty of time to transmit the disease to other plants.

WHAT TO DO.

1. Observe most religiously the Proclamation just issued, prohibiting the sale of suckers from any plantation unless such plantation and neighbouring plantations have been actually examined and pronounced free from Bunchy Top.

2. If you have received suckers during the past three years from any place south of the Caboolture River, or from any other grower who has received suckers from that area during that time, treat your position as serious.

3. If such is the case, notify the Department of Agriculture and Stock, Brisbane, as to the person from whom you obtained the suckers, the time you received them, and the number of suckers you procured.

4. This information will be of the greatest value in protecting the industry, and in helping you in protecting or saving your plantation.

5. If you treat your own interests seriously enough and offer the information, you will be greatly helped by advice.

6. Carry out at least a weekly examination of each plant in each stool, paying careful attention to the last leaf in each plant, and

observing whether there is any trace of the characteristic broken dark-green streaks in the leaf-blade. A definite day at least each week should be set aside for this purpose, if at all possible.

7. Do not plant out more suckers than can be satisfactorily dealt with in such a weekly inspection.

8. Deal at once with any affected stool as follows:—

(*a*) Spray the whole stool thoroughly, as well as the surrounding soil, with Black Leaf 40, in order to kill any aphides present, and so stop them when disturbed from spreading to other stools. Strength of Black Leaf 40—two egg-cups of solution to a kerosene tin of water.

(*b*) Dig out the stool complete, even if only part is affected, and cut all parts of the plants into slices with a cane knife, or suitable implement. (There is no necessity, nor is it advisable, to carry away such material, which can be left to die on the plantation.) (A very conscientious grower might well give an additional spraying to the cut-up material, and might see that the material is burnt if possible.)

9. Remember that if any one plant in a stool is diseased, the whole stool must be regarded as diseased. Otherwise you will find you are wasting your time by only removing those plants which are diseased in a stool. Remove the whole stool.

10. Success in fighting the disease lies in the earliest detection of diseased stools and their immediate destruction.

11. Growers should encourage their neighbours to follow the above procedure as diligently as themselves, since without such help every assistance is being rendered towards gradually transforming areas now lightly affected into heavily affected areas.

A PROCLAMATION

By His Excellency the Honourable WILLIAM LENNON, Lieutenant-Governor of the State of Queensland and its Dependencies, in the Commonwealth of Australia.

[L.S.]

WM. LENNON,
Lieutenant-Governor.

WHEREAS by "*The Diseases in Plants Acts, 1916 to* 1924," it is amongst other things enacted that the Governor in Council may from time to time, by Proclamation, declare that the removal of any or every tree, plant, or vegetable from or out of any nursery, orchard, or other place shall be either absolutely prohibited or permitted only as prescribed: Now, therefore, I, the Honourable WILLIAM LENNON, the Lieutenant-Governor aforesaid, in pursuance of the authority vested in me by the said Acts, and with the advice of the Executive Council, do hereby declare that no banana sucker or banana plant shall be removed from or out of any nursery, orchard, or other place in Queensland unless the plantation or garden in which such banana sucker or plant is growing has been inspected within fourteen days of the digging of such sucker or plant, and that such sucker or plant is certified to be free from disease by an inspector: And I do further declare that this my Proclamation is not and is not to be deemed to cancel or in any way affect the Proclamations or any of them made under "*The Diseases in Plants Act of* 1916" and/or the Acts first hereinbefore mentioned, and published in the *Government Gazette* of the twenty-second day of December, 1923, the sixteenth day of February, 1924, and ninth day of January, 1926.

Given under my Hand and Seal, at Government House, Brisbane, this twenty-first day of January, in the year of our Lord one thousand nine hundred and twenty-six, and in the sixteenth year of His Majesty's reign.

By Command, M. J. KIRWAN.

GOD SAVE THE KING!

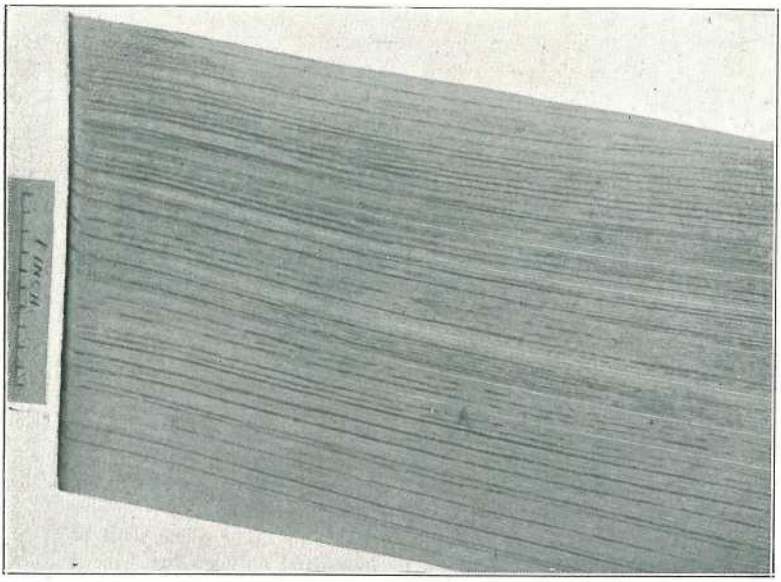


PLATE 45.

Fig. 1.—Portion of the leaf-blade of a Bunchy Top leaf, viewed from the underside, showing advanced stage of the dark-green streaking. The appearance of streaks of this nature, perhaps only four of five in number in the first instance, between the veins of the leaf-blade, is the first symptom of Bunchy Top. When looking for these streaks examine the underside of the leaf so as to allow the light to pass through the leaf.

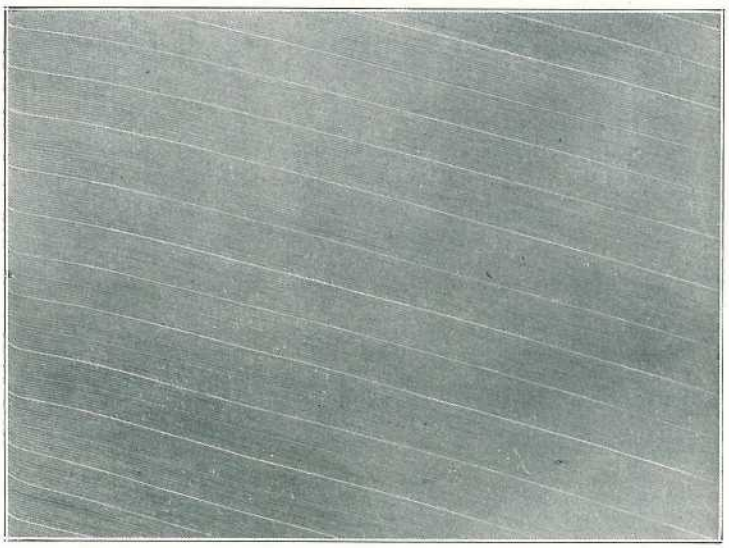


PLATE 46.

Fig. 2.—Portion of the leaf-blade of a healthy leaf viewed from the underside. Note the absence of streaks in the healthy leaf.

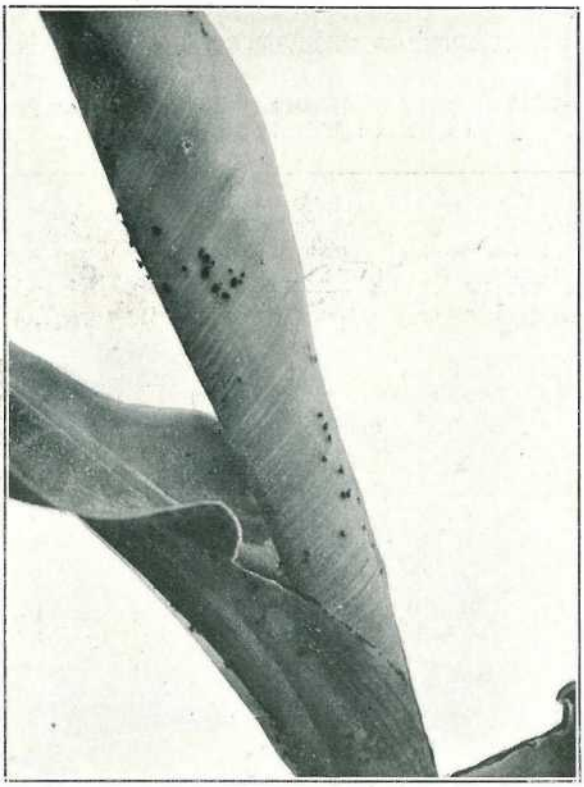


PLATE 47.

Fig. 3.—Several banana aphides (the wingless stage) on the unfurling heart leaf of a young plant. (Photographed natural size.)

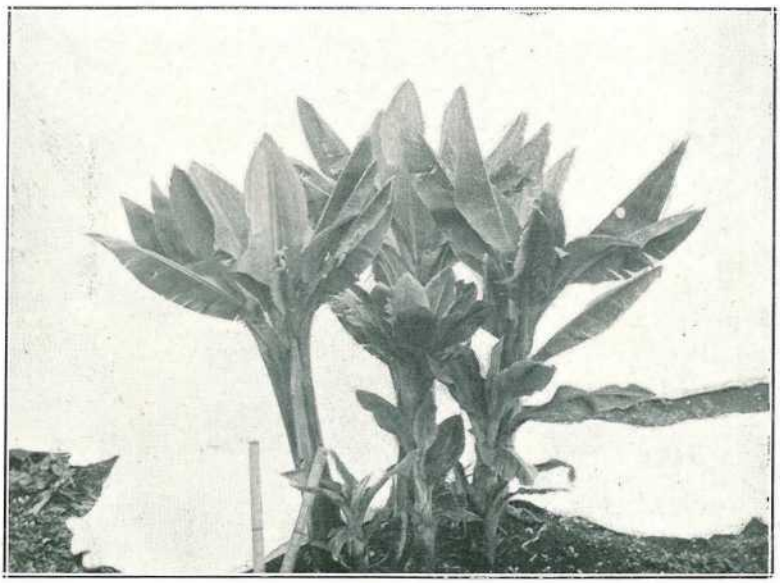


PLATE 48.

Fig. 4.—A Bunchy Top stool, eighteen months old, derived from the planting of an infected butt, showing all suckers in an advanced stage of the disease. Note stunting of plants, "rosetting" of the leaves, and the narrowness and upward rolling of the leaf-blades.

Figs. 5 to 8.—Illustrating the development of Bunchy Top in a young plant to which infected aphides had been transferred.

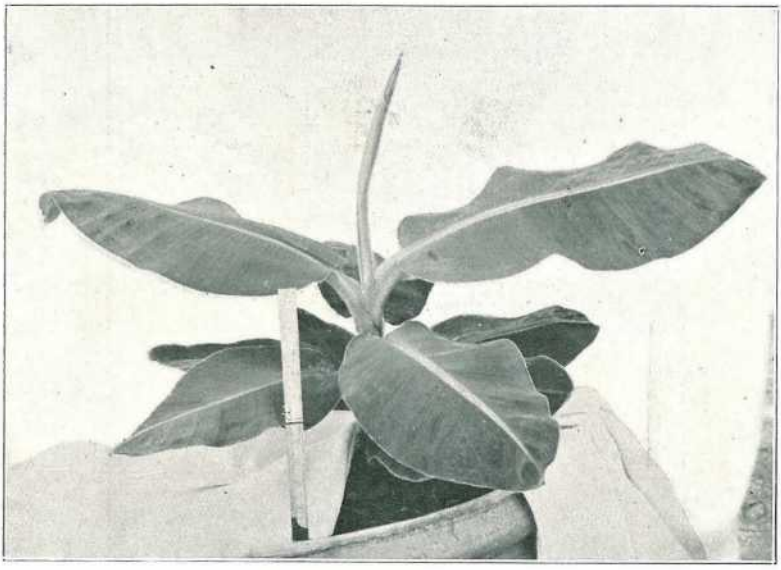


PLATE 49.

Fig. 5.—Young healthy plant. Notice the arrangement of the healthy leaves and the appearance of the unfurled heart leaf.

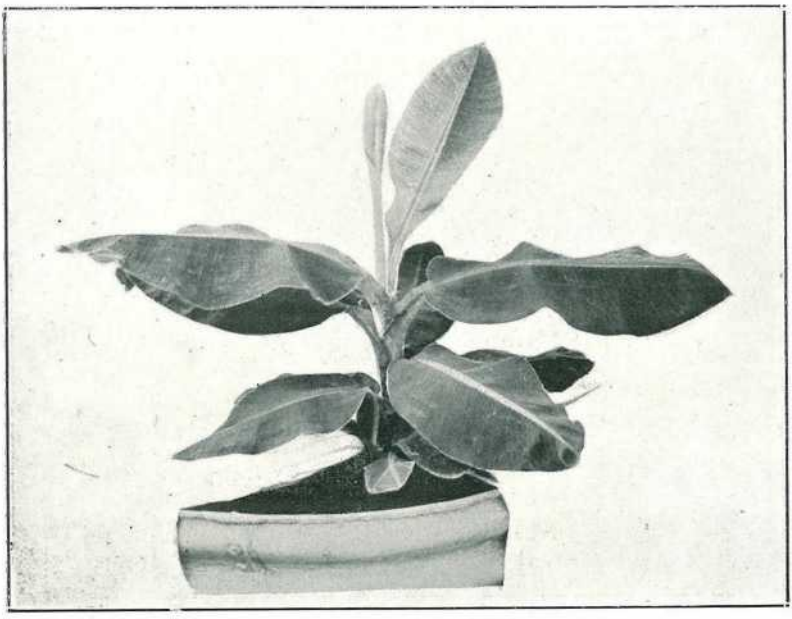


PLATE 50.

Fig. 6.—Later, same plant showing an abnormal Bunchy Top and funnel-like heart leaf.

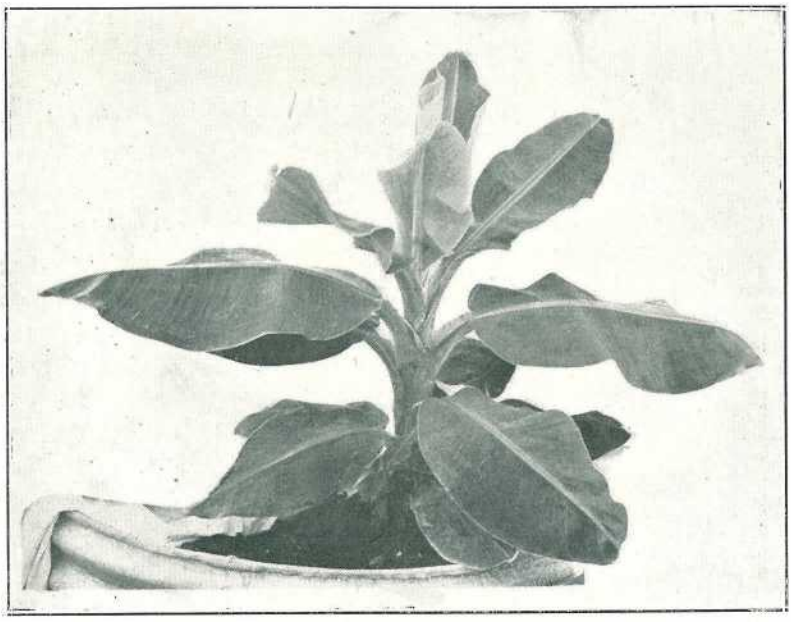


PLATE 51.

Fig. 7.—Later stage in development of Bunchy Top in the same plant. Note the narrowness of the Bunchy Top leaves, their erectness, and the upward rolling of the margins of the leaf-blades.

PLATE 52.

Fig. 8.—Same plant, four months after the appearance of the first symptoms of the disease in the plant, showing the typical "rosetting" of the Bunchy Top leaves.

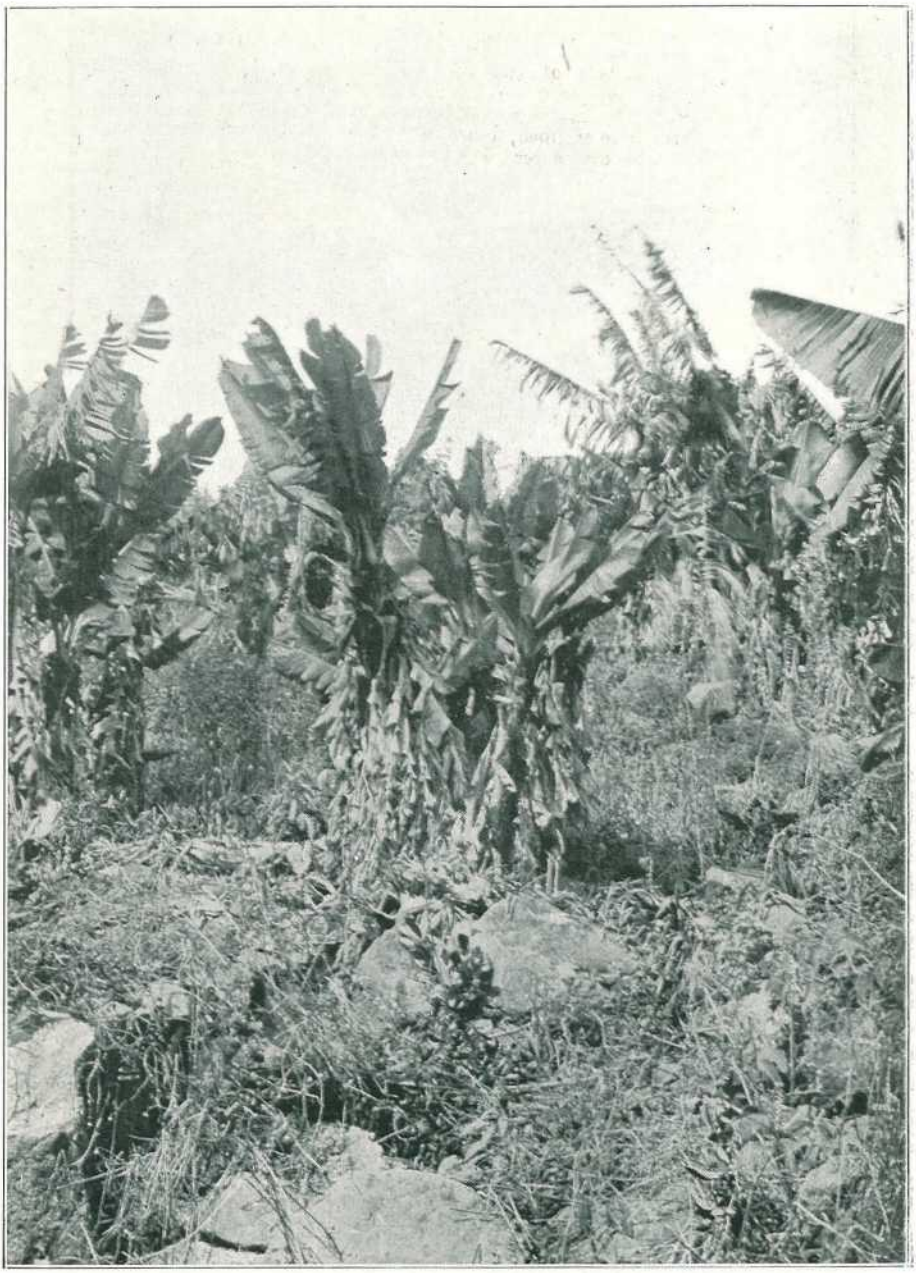


PLATE 53.

Fig. 9.—Showing a Bunchy Top stool. Note that leaves are bunched together, narrow, and stand more erect than normal.

WHEAT TRIALS IN THE SOUTHERN BURNETT.

By A. E. GIBSON, Instructor in Agriculture.

With the knowledge that a market was available at the Maryborough mill, growers in the shires of Nanango and Weinholt have planted wheat from year to year throughout that rich belt of country running from Nanango to Murgon. Production, however, has not been consistent. Statistical returns show that in the two shires, in 1916, the aggregate area under wheat exceeded 5,000 acres, and in 1919, only 26 acres were cropped, and that the average area cropped with wheat for a nine-year period was 676 acres, which returned an average of 10¼ bushels per acre.

Enquiries show that growers suffered disappointment in the main, from a variety of causes:—

The selection of an unsuitable variety;

From rust and frost;

Through sowing certain varieties at the wrong time of the year to suit their respective periods of development; and

By planting on poorly prepared land which was not in good physical condition to withstand a dry spell.

With the object of determining the suitability or otherwise of a number of new wheats bred at Roma State Farm by the manager, Mr. R. E. Soutter, side by side with a few standard varieties, comparative trials, both in the field and under experiment plot conditions, were carried out by arrangement last season with Mr. F. Gustafson, of Murgon. The soil chosen was typical of the red volcanic friable loams of the district, and the farm, prior to cultivation, was partly forest and partly scrub country. Special attention was given in the preparation of the land, to keeping the surface in a well-worked condition, consequently when the wheat was sown on the 28th and 29th May, an excellent "strike" was obtained. Harvesting took place on the 1st and 2nd November, 157 days from the date of planting. The rainfall was as follow:—

June	312 points
July	69 points
August	209 points
September	145 points
October	Nil.

The total during cropping period—735 points.

Wheats Tested in Experiment Plots.

Commercial Varieties.—Amby, Bunge No. 1, Canberra, Gluyas, and Pusa No. 4.

Roma Wheats.—Waterman, Watchman, Redman, Redchief, Ringer, Radio, Redskin, Amber, Florida, Warrior, Amberite, Marco, Beewar, Pinto, Cedric, Polo, Bindii, Ruby, Pilot, Three Seas, Pacific, Buffalo.

Note.—Watchman, Cedric, and Three Seas are grown in commercial quantities in parts of the Darling Downs and Maranoa districts.

Field Plots, Roma Wheats.—Three-acre plots of Pilot and Florida.

Other varieties planted by Mr. Gustafson.—Gluyas, 6 acres; Florence, 6 acres; Currawa, 3 acres; Roma Red, 3 acres; Pusa No. 4, 3 acres.

As the conditions under which the wheats were grown proved favourable, growth and development of the individual varieties was exceptionally good, the straw ranging between 4 feet and 5 feet in height and carrying well developed ears. Data was obtained of the characteristics of each kind, which will be useful for reference purposes. The results from the field plots showed that when land is well prepared and suitable varieties chosen, good yields in average seasons are to be expected. "Florence" returned 40 bushels; "Florida" 37 bushels; "Pilot" 33½ bushels; "Pusa No. 4" and "Roma Red" 18 bushels each, and "Gluyas" 15 bushels per acre, respectively.

Although some of the yields were undoubtedly good, the clean, well-grown, attractive looking crops were most promising from a hay point of view. Obviously, farmers in this part of the State might well turn their attention to a dual purpose crop, invaluable in such an important dairying and mixed farming centre.

QUEENSLAND PINEAPPLES IN NEW ZEALAND.

The Minister for Agriculture (Hon. W. Forgan Smith) has received from Mr. H. W. Mobsby, F.R.G.S., the Queensland representative at the Dunedin Exhibition, the following report which appeared in the "Evening Star," Dunedin, of 4th instant, regarding the display of Queensland pines at the Exhibition. The journal in question pays a fine tribute to the quality of the Queensland pines and points out the disability under which the Queensland growers are labouring in connection with the New Zealand export market:—

CANNED PINEAPPLES—AN ANOMOLOUS POSITION.

WHY PENALISE AUSTRALIA?

The pineapple, that fine luscious product of the tropics, has always been a favourite fruit when it could be obtained at reasonable prices and in good condition. We do not grow pineapples in New Zealand, but some fine specimens have recently come from Fiji and Queensland and have found a ready sale in the Exhibition. The latest shipment arrived yesterday from Australia and was displayed on the Queensland exhibit in the Australian Court, together with some bananas from the same State.

And in addition to the fresh pines there is here displayed an attractive array of the canned fruit, nicely labelled, and, judging by the sample shown in a transparent jar, of excellent quality.

The question naturally arises: Why do we see so little Queensland canned pineapple in the shops of the Dominion? The answer to this sets us pondering. It appears that for some unaccountable reason the Australian product is handicapped by an extra 10 per cent. duty. While the Straits Settlements may send in their pines under the British preferential tariff of 25 per cent., Australia, on the same class of stuff, must pay 35 per cent.? Again, it may be asked Why? Australia is British just as the Straits Settlements are; she is our near neighbour and our natural kinsmen. Her pines are canned by white labour (mostly returned soldiers), and she packs something like 400,000 cases per year, the quality being absolutely guaranteed by the Queensland State Government.

On the other hand, the Straits Settlements' pines are packed by cheap Chinese and Malay labour, and the conditions under which the packing is done are admittedly not so strictly supervised, while the quality has been declared by many business men here to be inferior to that of the Queensland fruit.

In 1924 New Zealand imported from the Straits Settlements £27,840 worth of canned pines; from Hawaii (American territory) £3,379 worth, and from Queensland £593 worth—or 1½ per cent. of the total imports. Why? Because the extra duty placed the Australian product at an unfair advantage. It is surely only fair and reasonable that the latter should, at the very least, be admitted on an equal footing with similar products from the other British possessions. If this were done Queensland would be quite satisfied to stand or fall on her clean, well-packed, guaranteed pineapples.

AN INTERESTING PLANT.

BY C. T. WHITE, F.L.S., Government Botanist.

On going through a collection of plants from Western Queensland collected by Dr. Macgillivray in August, 1923, several plants previously undescribed were found, and several also proved new records for the State. These have now been described and recorded in the last volume of the "Proceedings of the Royal Society of Queensland."

Among the material was a species of Gomphrena which seemed new, and of which a description was drawn up and an illustration prepared. On closer examination, however, it was found to be the same as *Gomphrena leontopodioides* described recently by Dr. K. Domin, a Czecho-Slovakian botanist who travelled extensively in Queensland in 1910 and made large collections. The species is represented in our herbarium from Bulloo River, south of Adavale (Dr. W. Macgillivray, Blackall (R. A. Ranking), and Darr River (C. W. de Burgh Birch).

The genus Gomphrena is widely distributed over the warmer regions of the globe, and fifteen species are natives of Tropical Australia. A species of Gomphrena known as Bachelors' Buttons is common in garden culture; purple and white are the common shades, but others occur.

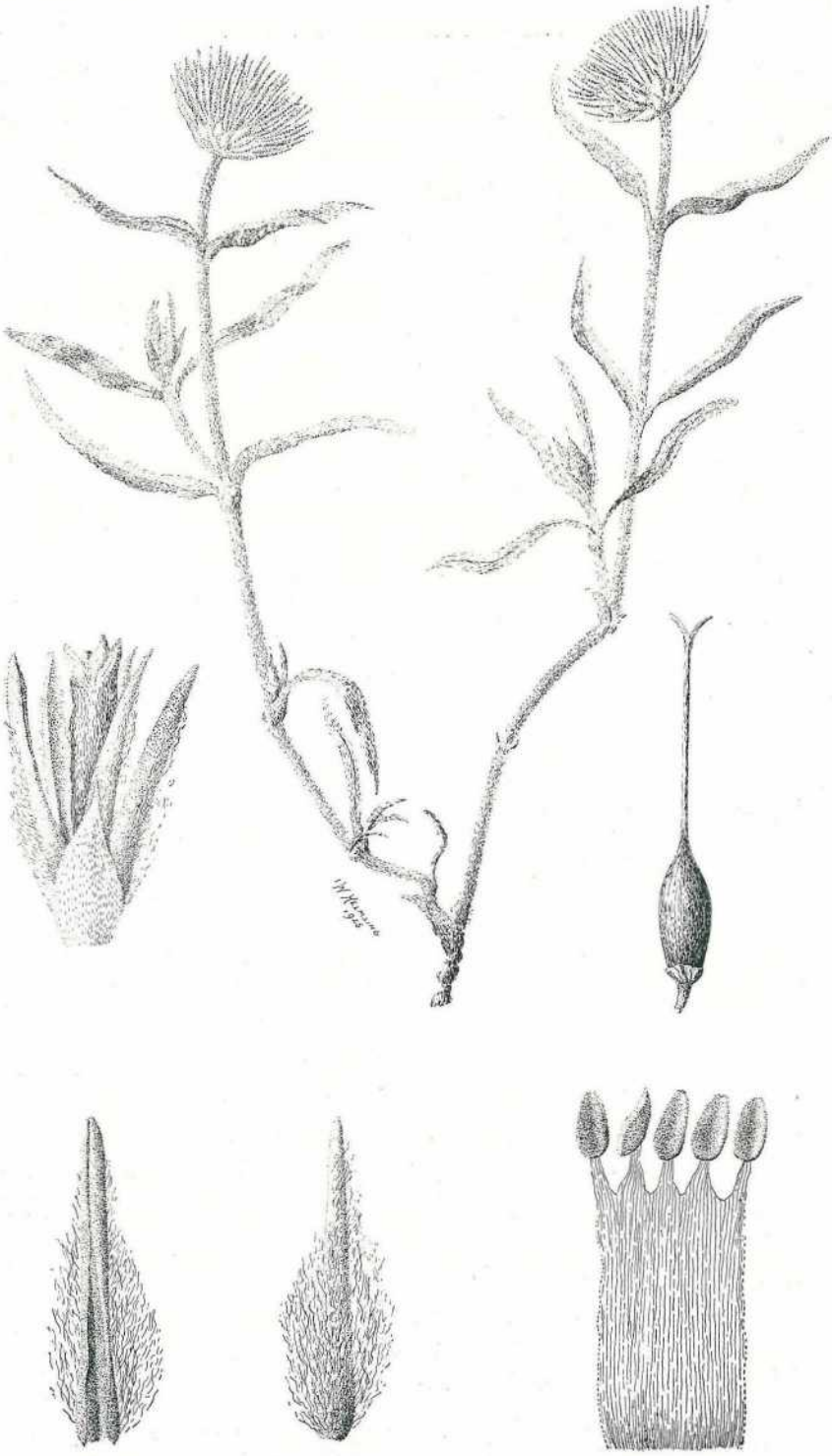


Plate 54.—Gomphrena leontopodioides.

Flower x 3.
Bracts x 4.
Ovary and Style x 4.
Staminal Tube x 3.

POULTRY—MANSON'S EYE WORM.

Mr. Henry Tryon, Entomologist and Vegetable Pathologist, writes:—

With regard to Manson's Eye Worm of chickens, technically known as *Oxyspirura Mansoni* (Cobbold), but originally regarded erroneously as a Filaria, and that has the general habits described by your Proserpine correspondent. This was first brought under notice as occurring in Australia by the present writer (report of Entomologist and Vegetable Pathologist 1907-8), in 1908, he having identified specimens of Chicken Eye Worms, as *O. Mansoni*, that he had received in 1907 from the Herbert River district. He, moreover, then stated:—"Examples of this troublesome nematode were communicated also, previous to 1907, by the Department's Poultry Expert, H. Fern, as fowl parasites unknown to him; he having received specimens from some of our Northern coastal farms—Cairns and Townsville especially. It does not appear that it has been previously identified or remarked as occurring in Australia."

Since 1907, however, S. Dodd, Veterinary Surgeon (1909); Dr. Georgina Sweet, Parasitologist (1910); Dr. A. Bereinl, Director Institute Tropical Medicine, Townsville (1913); and W. Nicholl (1914) have alike treated of its occurrence—in coastal Queensland—but do not appear to have ascertained anything regarding either its biological history, or laid down the treatment of poultry subject to its presence. Although Dr. Sweet seemed to find in it a new kind of Oxyspirura—that she named *O. parvarum*, an opinion not now favoured.

However, 1904, *i.e.*, anterior to these records, B. H. Ramson, of the Zoological Laboratory, Bureau of Animal Industry, U.S.A., devoted a portion of Bulletin No. 60 of the Bureau, to an illustrated account of "Manson's Eye Worm of Chickens," but since then nothing further appears to have been written concerning it—from a broad standpoint. Thus the life history still awaits elucidation, involving, evidently, very difficult research. We know, however, that the male and female parasites occupy together the eye-cavity, living in the interval between the organ itself and the nyctitating membrane that protects it. Also that several of these little white thread-like worms may simultaneously infest the same eye, in fact, as many as 200 have been found in a single one. The female Oxyspirura again lays many eggs, and these persist in the worm until their embryos are developed within them. Ramson discovered that if a female worm with its numerous mature eggs was cut to pieces so as to free these and fluid containing them, then injected into the chicken eye, no development took place, the embryo-worms, in fact, dying. He also discovered that when the eggs were fed to a chicken, a young fowl, and full-grown hen respectively, no parasites could afterwards be recovered from their eyes. As the result of his experiments he concluded as follows:—"It seems probable, however, that it is necessary for the embryos to pass a certain period of their existence either free or in an intermediate host before they will develop to maturity."

With regard to the distribution of Manson's Chicken Eye Worm outside Australia, it has since long been pointed out that generally speaking: "The parasite is restricted to localities bordering on the sea-coast." It was originally met with in 1878, Amoy, China, and since then in Brazil, Mauritius, Jamaica, and Florida successively.

As to the matter of treatment, we have only on record that recommended by Dr. Emmerey de Charmoy (Mauritius), and following him for the most part by the U.S.A. authority. Thus R. H. Ransom writes as follows:—

"The treatment consists in the removal of the worms, combined with the treatment of the associated catarrh. The worms may be removed either by direct mechanical means, as with a small forceps, which operation is more or less dangerous and painful to the fowl, or by irrigating with a solution of bicarbonate of soda, or with a 1 or 2 per cent. creolin solution. The irrigating has the effect of partially dislodging the worms, which may then be removed entirely by wiping away with a soft cloth. Further treatment is directed towards alleviation of the inflammation, or the cure of the catarrh that may have been established. Irrigation of the eyes with a mildly antiseptic solution, such as a 4 per cent. boric acid solution or 1 per cent. creolin solution, is indicated, together with irrigation also, of the nose and mouth, if the nostrils are affected. Anointing the eyes with a mixture of lard nine parts and iodoform one part, or with carbolised vaselin, is likely to give good results in some cases.

"The general sanitary conditions should also be attended to, and stimulating food furnished."

These recommendations regarding treatment were published in 1904. Should any treatment, promising greater effectiveness than it, have been referred to by subsequent writers, and I become apprised of the facts, you will be advised.

MECHANICAL TREE-FELLING WITH A SAW-PLANE.

A French engineer has invented a new machine for the falling of trees by machinery, also plank sawing, &c., which is giving very interesting results. This machine, weighing 270 lb., called "Saw-Plane" by its inventor, has just been adopted by the French Ministry of War, and by most of the French timber and forestry concerns. The process of cutting is quite *sui generis*; the sawing is done per medium of a cutting chain, which encircles the tree and turns at a lineal speed of 7 metres per second. Trees may be cut level and square with the ground. The chain is composed of links bearing each two tracing-knives and a plane, hence the name of Saw-Plane.

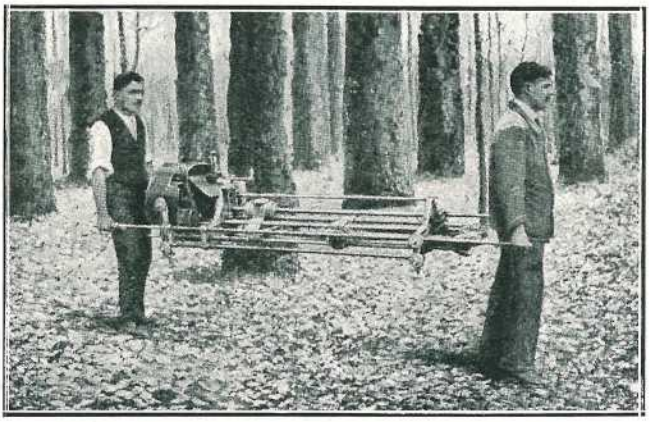


Plate 55.—The Saw-Plane.

The sawing speed is about one second per inch of thickness for soft wood and about two seconds for hardwoods.

A poplar bole of 40 centimetres diameter is cut in thirty-five seconds, oaks measuring 90 centimetres, two minutes. The biggest oaks, measuring 1¼ metre, take twelve minutes.

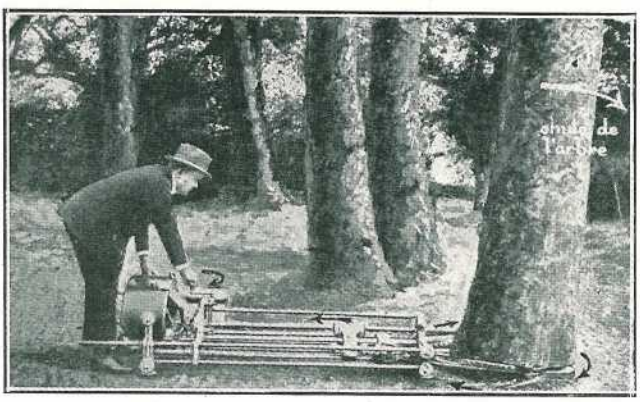


Plate 56.—The Saw-Plane at Work. The Tree is cut Level and Square with the Ground.

It is worthy of note that the machine falls trees of any diameter with the same facility, and passes from one diameter to another without loss of time.

As the sawing goes on the tree sags on the saw line without jambing the cogs, and it finally falls on the opposite side of the machine. The sawing of a tree with the Saw-Plane does not entail the use of ropes or of a jack, and reduces felling expenses by 75 per cent.

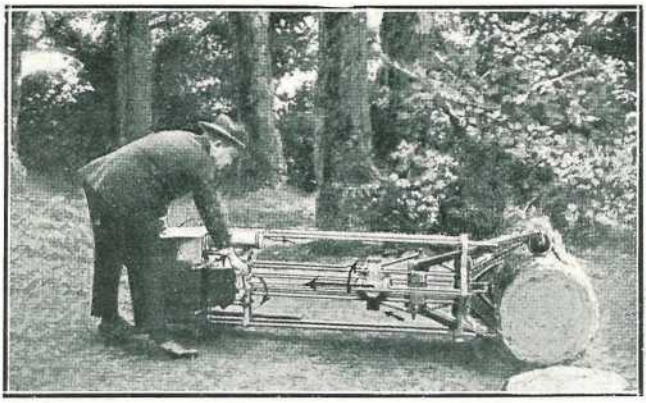


PLATE 57.—SLICING THE FALLEN TREE.

WEEDS OF QUEENSLAND.

No. 41.

RIVINA (*RIVINA LÆVIS*).

By C. T. WHITE, Government Botanist.

Description.—A slender, branching plant 2 to 3 feet high. Leaves on long stalks of ½ to 1½ inches. The leaf itself (blade) ovate-lanceolate in shape, variable in size, 2 to 5 inches long, ¾ to 2 inches wide, dark-green above, paler beneath, veins raised underneath. Flowers small, in slender racemes in the forks of the branches, at first only 1 inch long but lengthening in fruit to about 4 inches; the flowers themselves white tinged with pink, about 2 lines across. Fruit at first white, then pink, and finally a bright red when ripe, fleshy, about ¼ inch in diameter, filled with a red, watery juice and containing a single seed; seed black, about 1 line across, covered with short rather scattered bristles.

Distribution.—A native of Brazil. In Queensland it is found as a weed in coastal localities from Brisbane northwards to the Atherton Tableland. Generally speaking, it occurs along scrub tracks and edges, along fences, &c., where it can get partial shade.

Common Name.—In Queensland, owing to its property of tainting milk, it is sometimes known as "Stinking Weed," a name, however, applied to several strong-smelling plants.

Botanical Name.—Rivina, in honour of Dr. A. Q. Rivinus (born in 1652), for a long time Professor of Botany and Medicine at Leipzig; *lævis*, Latin, meaning smooth, in allusion to the smooth stems.

Properties.—In the "Queensland Agricultural Journal" for February, 1924, Mr. F. J. Watson, Instructor in Dairying, has a note on this weed.*

He states: "The attention of dairymen is called to a weed or shrub which is at the present time a frequent cause of a very serious defect in cream. This plant is not usually eaten by cows, but sometimes in time of drought one or more cows of a herd will take a liking to it, with the result that if their milk is mixed with that of others the whole becomes tainted. The taint is abominable, and is so penetrating that the cream from the milk of a single cow fed on the plant will taint a whole vat of cream and the butter made therefrom; and as cream so tainted is liable to be condemned as unfit for human consumption, it behoves dairymen to be on the lookout for cows addicted to the habit of eating the weed, and to exclude their milk from use for dairy purposes. . . . . Cows that eat the plant are easily distinguished from others by the fact that their milk tastes and smells of the plant, and their excreta give forth a very unpleasant odour."

The plant has several times been received for identification with the report that it gave a very unpleasant odour to the milk of cows that fed on it.

Eradication.—On account of the sheltered position in which the plants grow, hand-pulling or hoe-chipping is the only satisfactory method of eradication.

Botanical Reference.—Rivina lævis Linn., Mant., p. 41.

*The weed is referred to an allied plant *Monococcus echinophorus*, but there is no doubt that from his description *Rivina lævis* is the plant referred to, a mistake having arisen in some way. *M. echinophorus* is a scrambling or semi-climbing shrub with burr-like fruits.

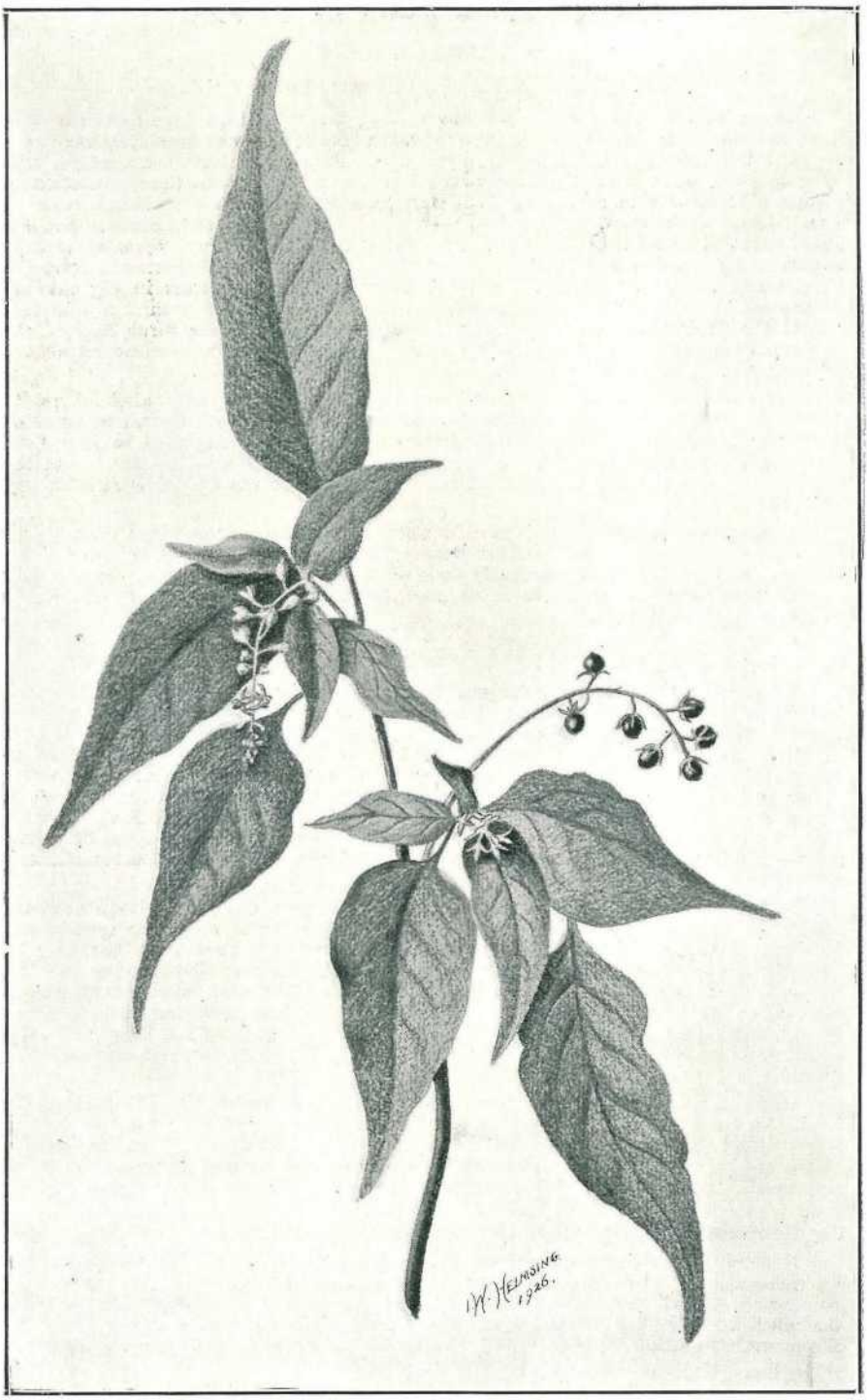


Plate 58.—Rivina (Rivina lævis).

ADMINISTERING MEDICINE TO PIGS.

SOME USEFUL RECIPES.

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

There is no more unpleasant or even annoying job on the farm than that associated with the compulsory drenching of the pig, this where it becomes absolutely necessary to force the animal to swallow some drug which its somewhat stubborn nature tells it it does not want to swallow and with all effort connected with the administration of which it refuses to accommodate itself. The pig ever was a stubborn brute, it excels itself when it comes to taking medicine. Fortunately, the necessity for the administration of medicine does not often present itself, and these occasions can be separated by a wider space in accord with the care and attention bestowed upon the animal and upon its breeding. There is no royal road to success in pig raising. It has been said that "half the breeding is in the feeding"; certain it also is that "half the feeding is in the breeding," for a mongrel pig, the scrub hog of the American backwoods, and the bush pig of our own country takes an immense amount of food and gives but little result.

Such medicines as castor oil (the best grade of which is styled "ol ricini ital") or raw linseed oil and many powders are best given in the food, the oil in doses of from two fluid ounces (roughly, two tablespoonfuls) for young pigs to four fluid ounces for full-grown animals; and for preference the oil should be mixed with the food and be given as the first feed of the day and whilst the animal is still hungry or thirsty.

All in-pig sows should be given a four-ounce dose of castor oil three days before due date for farrowing, and another dose after farrowing if the bowels are at all costive. If this rule was consistently followed hundreds of sows which die annually at and after farrowing would be saved, and the young pigs would grow and develop to much more advantage.

Preparing a Bran Mash.

To prepare the castor oil for use follow this procedure:—First secure one or two dippers full of wheaten bran (for preference) or pollard, and meal or some waste bread crumbled up, place in a clean bucket; now measure out the amount of oil to be given and pour into the dry bran or meal; mix thoroughly so as to incorporate bran and oil, then thin down to the consistency of thick cream using either warm water or warm skim milk; add just sufficient table salt (say, half a teaspoonful) to destroy the taste of the oil, and give as the first feed of the day. Compel the animal to take brisk exercise about four hours or so after this, and the result will invariably prove beneficial. The bowels will be freed of accumulations of fœces (dung) and digestion will proceed normally.

Many medicines can be given in the food in this way, while such drugs as sweet spirits of nitre (in teaspoonful doses)—than which there is no better remedy for kidney or bladder (urinary) troubles—can be added to the food (slop food) or be given in the drinking water. Where, however, the pigs are so ill that they have no desire for food or water, yet where some internal medicament is necessary, resort must be made to drenches and to a drenching bit (see Fig. 1), drenching horn, (a cow's horn suitably prepared), or at worst to a clean boot or shoe with a hole cut in the point through which, when inserted into the animal's mouth, the medicine can be passed.

Drenching pigs is by no means a satisfactory task, and if the sick animal can be induced to take the medicine in the food or drinking water much trouble and worry will be saved. Never, under any circumstances, persist in giving the drench to the animal if it does not follow freely, otherwise choking and other complications may result. Do not feed or water the pigs for an hour or more after drenching.

Pig Powders, Proprietary Medicines.

Numerous inquiries are received during the course of the year as to whether we recommend the use of proprietary medicines put up in the form of various pig powders. Of such proprietary medicines there are several on the market, notably the much advertised Karswood Pig Powders, Dennis' Canadian Pig Powders, S.S. Worm and Condition Powders, S.S. Lice Powder, S.S. Scour Cure, S.S. Pneumonia Powders, Kossolian Blood Salt, Broncholine, Curdolix, Easakof, Pneumonia, Cough, and Cold Powders, and several others procurable both here and aboard. All these doubtless possess to a greater or lesser extent some virtue and healing power, but one and all will be quite valueless unless their use is accompanied by a thorough clean up of the pig premises, and by improved methods of accommodating, feeding,

and caring for the pigs generally, and even more important still by culling out all unsatisfactory stock, and by the introduction of better stock; stock carrying better quality, better breeding, and greater disease-resisting powers for stock of low vitality and unrecorded breeding are prone to all sorts and conditions of disease, and their use will always be unsatisfactory. Clean out the culls and introduce better breeding stock and the need for medicines will rapidly disappear.

Balloon Capsules.

Probably the simplest method employed in administering worm medicines to pigs is per medium of capsules, those illustrated here (see Fig. 2) being of the balloon capsule type, washed down with a mouthful or two of water. The illustration (Fig. 3) also shows the patent jaw opener for use in injecting these worm pellets, the particular instruments illustrated are styled "Peter's Special Metal Gun and Jaw Opener." The capsules illustrate (Figs. 2 and 3) are also manufactured by the same firm—viz., the Peter's Hog Serum Co., operating in the United States of America. These worm capsules each contain a full dose of liquid oil of chenopodium inside of a transparent soft gelatine shell (the capsule). It is claimed to be the latest method of "worming" pigs, and judging by the extensive sales these products enjoy in the United States they are both simple and efficacious. The special advantage claimed by the inventor of these capsules is that each capsule carries the correct dose; each pig must be treated separately, thus each pig stands so much better chance of being freed from the intestinal parasites, which these medicines aim at destroying. Each capsule carries sufficient oil of chenopodium to dose a pig, weighing from 50 to 100 lb., for heavier pigs two or more capsules would be necessary. Where pigs are heavily infested with worms the dose would need to be repeated in four or five days' time. So far these worm capsules are not available on the Australian markets, but supplies could readily be obtained from overseas if required. They will be tested out during the year and a report published later on. The directions for use are simple. First, fill the special gun (Fig. 3) with water, insert the capsule, open pig's mouth with special jaw opener, and squeeze bulb injecting the capsule over the back of the tongue forcing it down the pig's throat with the water. Care is, of course, necessary to prevent choking. Fig. 4 shows another type of hog holder for use in handling heavier pigs.

Drenching the Pig.

No attempt should be made to dose or drench a pig suffering from diseases of the respiratory passages (bronchitis) or lungs (pneumonia, pleurisy, &c.), as in these diseases the respiratory organs are inflamed and very sensitive and tender, and the animal is likely to choke in swalloying the fluid. If the fluid penetrates into the substance of the lungs serious complications would result. In any case when meidcine must be given per medium of a drench, the animal must be properly restrained preferably by being first caught, a loop of strong rope or webbing passed through his mouth behind the tusks and over his snout, securing the rope to a stout post or rail in such a position that the head can be lowered immediately if required.

When giving the medicine, which must be done cautiously, permit ample time for the animal to swallow each mouthful, and lowering the head immediately if there is any indication of choking or obstruction.

If the animal weighs less than 100 lb. an attendant should catch the pig and straddle him with his back between the holder's legs, at the same time grasping both front legs and raising the pig's head sufficiently high for the drenching horn or shoe to be placed in position.

It is preferable to give fluids through a tube or by means of a horn or shoe, as in this way little or none of the medicine will be wasted. It is certainly advisable to "gag" the animal by first inserting a small piece of soft wood between the upper and lower jaws, thus allowing room for the shoe or horn to be passed into the mouth.

When the medicine is in the form of a powder and has to be given in this way it is better to mix it with a small quantity of honey or treacle, and if necessary flour, making the mixture fairly thick, then place sufficient on a long handled ladle or spoon (using the handle end), or a piece of soft wood slightly grooved out to carry the mixture; in these cases also great care must be taken to deposit the mixture on the back of the tongue, otherwise it will not be swallowed.

Most medicines can be given in the form of ball, capsule, or pill, and when these are being prepared on the farm they should be mixed in a small ball of moistened flower or pollard and be given to the animals in this form.

The Use of the Hypodermic Syringe.

Some drugs must be administered per medium of the hypodermic syringe. In diseases such as those affecting first the muscular and nerve tissue (cases of snake bite, for instance) where a quick-acting drug is necessary, it is preferable to have the drug given in this way, but in these cases a qualified veterinarian should be engaged to do the work, for if such medicines are not correctly administered or if an overdose is given the results may be disastrous.

The Administration of Vaccines, Serums ; Vaccination.

Fortunately for the Australian pig raiser we are not troubled with the more serious infectious or contagious diseases such as hog cholera (here called swine fever), swine plague, swine erisepelas, anthrax (pigs), foot and mouth disease, or rinderpest, so that wholesale vaccination with hog cholera serums, mixed infection serum or virus, &c., is not necessary. This form of treatment appears to have become a necessity under American conditions, and, in some instances, also in the United Kingdom and on the Continent. No attempt should be made to inject serums or virus into pigs unless it be strictly under official instructions from the Chief Inspector of Stock or veterinary officers of the Department of Agriculture and Stock, Queensland, or the Chief Inspectors of Stock in the other States. It is specially urged in all cases of doubt as to the nature of disease from which pigs are suffering, that the advice of the veterinary officers should be immediately sought.

We have to thank our somewhat strict and rigid quarantine regulations and our qualified veterinary officers for the comparative freedom from disease of stock in this country. It is to be hoped that we may long remain as free from contagious diseases as we are at present, especially in so far as pigs are concerned. Climatic conditions also favour healthy stock, and in this regard Queensland is especially favoured.

Rectal Injections, Enemas.

Rectal injections commonly referred to as enemas are sometimes used in the treatment of pig diseases, especially in severe cases of constipation or bowel stoppage or of diarrhoea or other bowel affections. Enemas usually consist of warm soapy water to which possibly some form of oil (olive oil, salad or lucca oil or glycerine) has been added, but no irritating drugs should be given in this way, otherwise the bowel tissue may be injured. Irrigation of the uterus and womb of breeding sows for diseases of these organs is also frequently recommended.

Administration of Drugs by Inhalation ; Fumigating.

The administration of drugs through the air passages by inhalation is also sometimes advised. Occasionally chloroform or other anaesthetic is administered, but in all these cases a special knowledge of the methods that are to be employed is necessary, and it pays to employ a "vet."

Treatment for Skin Diseases.

The application of remedies for the treatment of skin diseases and for the purpose of freeing the skin and hair of parasites (hog lice, &c.) is a different and a much more simple process, even when dipping is necessary, though dipping is rarely advised in the case of pigs, for they can be sprayed to much more advantage. Care should be taken in all cases to see that the mixtures applied have been properly compounded and that no drugs of an irritating nature have been used.

A simple and efficient mixture for the treatment of hog lice is made up as follows:—Mix together benzine ½ pint, kerosene ½ pint, fish or neatsfoot oil 7 pints. This lice mixture should be stored in a glass or tin container and should be suitably labelled. Apply by hand or per soft cloth, brush, or spray after the animal has been washed and freed from accumulations of mud and filth. As the lice eggs (nits) already deposited will hatch out in three days' time a second application of oil, three or four days after the first, is necessary. Further applications of the mixture in a month or so, and then occasionally, should keep the pigs free from infestation. Young pigs from one or two days old upwards are specially subject to infestation, and they should not (they are, however, often neglected) be overlooked when treatment is being arranged for.

Peculiar Ear Disease.

In cases where the pig is suffering from that peculiar disease of the ear of the pig technically known as "Suppurative Otitis" in which the pig carries his head on one side and appears partly paralysed, see special pamphlet on this subject obtainable on application to the Department of Agriculture and Stock, Brisbane.

Abscess Formation.

In cases of abscess formation after castration, technically known as "Schirrous Cord," see special pamphlet now in course of preparation on "The Castration of Pigs," also obtainable on application to the department.

USEFUL PRESCRIPTIONS.

A Reliable Healing Ointment.

The following prescription is well worth keeping on hand. It is a reliable healing ointment for application to open wounds such as those resultant upon castration or operations on abscesses, &c. The wound should first be thoroughly cleansed before applying the ointment, and until healing takes place the pig should be isolated from the rest of the herd in a clean, dry well-bedded sty. The ointment should be kept in a clean porcelain or glass container suitably labelled, and should be on hand at all times in case of emergency. Any chemist would make up a couple of shillings worth. The recipe is as follows:—Iodoform 1 part, oil of eucalyptus 14 parts, oilve oil 20 parts.

The following prescription has proved very efficient as an internal irrigant (a wash) for syringing the uterus and womb of breeding sows who fail to hold to the service of the boar. Recipe: Chinosol 15 grains, glycerine 2 ounces, distilled water 6 ounces. Use two ounces of this mixture in a pint of warm water (previously boiled) and inject per enema syringe daily for several days before service by the boar. This remedy has proved very effective in the case of milch cows, and it is well worth trial with breeding sows.

Treatment for Pigs Suffering from Inflammation of the Lungs (Pneumonia), Catarrh, or Common Cold.

In these cases careful feeding and comfortable housing is the best remedy, as indeed it is in most pig diseases. Isolate sick animal in a warm, dry, well-bedded sty protected from draughts, use plenty of clean soft bedding daily; give only soft laxative nourishing food (gruel, &c.), green foods and milk, and plenty of fresh clean water. An occasional ounce packet of Epsom salts dissolved in the drinking water will be helpful, as also will one teaspoonful of sweet spirits of nitre given in clean drinking water. Compel animals that take regular exercise daily to keep bowels and bladder in good order.

In cases of pneumonia and pleurisy, a plaster of mustard and olive oil smeared over the ribs and chest and covered with brown paper and a light rug may be effective.

Colic and Gastric Troubles.

In cases of colic, usually resulting from gastric troubles, severe indigestion, &c., in which severe abdominal pain is manifest, follow treatment. First give only light nourishing gruel, *i.e.*, milk with a small quantity of bran to make a light bran mash; secondly, the addition of one or two ounces of castor oil in warm milk or in the mash, the latter if the animal is eating well, or give as a drench if necessary (up to 4 ounces of oil in severe cases in grown stock). Keep the animal warm and quiet, and follow with careful housing as already advised. Repeat the castor oil (adding a few drops of chlorodyne if the pain is still manifest) if the animal is constipated.

Constipation.

In cases of constipation follow advice given above *re* feeding, housing, &c. Change diet, giving plenty of soft succulent green food (lucerne, &c.). Compel the animal to take regular and brisk exercise to relieve bowels and bladder. This is a very common trouble with breeding sows close to farrowing and bacon pigs being forced along in the fattening stages with corn. Give castor oil as above recommended, and in severe cases where the dung is hard, scanty, and clay coloured, first give two or three ounces of Epsom salts in warm water as a drench, and follow with extra castor oil or raw linseed oil. In very severe cases resort must be made to enemas of warm soapy water to relieve the passages of accumulations of dung. Use water at a temperature of 104 deg. Fahr., and add an ounce of olive or castor oil or glycerine to the water.

Diarrhœa or White Scour.

A special pamphlet has been prepared on this subject; this gives all the information available. It is available on application. In young pigs not yet weaned the trouble is due usually to overfeeding of the sow and to the fact that the suckers are taking more milk than their digestive organs can cope with, thus gastric troubles are set up and bowel disorders result.

Lumps or Pustules on the Legs and Feet.

In cases where lumps or pustules and abscesses form on the legs and at the joints, and in cases of multiple abscesses generally, write the department, giving full description of the trouble. These cases are largely due to wet, cold sties and to a form of rheumatism.

Protrusion of the Rectum, Piles, Prolapsus Ani.

In cases of protrusion of the rectum more commonly referred to as piles or protrusion of the mucous membrane of the rectum, in which the mucous membrane protrudes as a dark purple swelling under the tail, diet must first receive attention, all "grassy" foods, whey, butter-milk, meat soup, must be cut out of the ration. Constipation or diarrhoea must be relieved by giving oil as suggested above. The protruding portion of bowel should, early in the attack, be well washed for ten minutes with warm water to which has been added a disinfectant such as Lysol, then besmeared with olive or carbolised oil and be returned to its normal position, and, if necessary, held in position by bandages. Very little food should be given (such as a drink of light gruel) and that of a laxative nature.

If straining continues, give a dose of from 10 to 60 drops of chlorodyne or 30 drops of laudanum in a small quantity of warm water, the larger dose in the case of a bacon pig or an animal carrying more age.

If necessary in these cases enemas of warm soapy water are worth trial. Prevention must be accepted as better than cure.

Inflammation of the Udder (Garget) and Milk Fever (So-called).

In these troubles treatment must first aim at relieving the udders of milk, two, three, or more times per day. Give the sick animal two ounces of Epsom salts with 4 to 6 drachms of sulphur in a warm bran mash. When possible foment the udder with hot water and then massage gently with the fingers and apply the following ointment:—Extract of belladonna 1 drachm, gum camphor 1 drachm, vaseline 3 ounces. If the teats are very sore the sharp black "needle" teeth of the suckers should be cut off with a small pair of pliers (see Figs. 5 and 6) and the following mixture applied as a lotion to the sow's udder two or three times a day:—Sulphate of zinc 5 drachms, acetate of lead 5 drachms, distilled water 1 pint. These remedies have all been recommended, and in some instances suggested by the veterinary officers of this department, and can be regarded as efficient yet not costly.

Inflammation of Prepuce (Sheath) of Young Boars.

This trouble in young boars is not uncommon. Treatment must first aim at cleansing the parts by fomenting with hot water and disinfectant. (Use 1 teaspoonful of phenyle to 1 pint of water.) Keep the urinary opening free of accumulations of dirt and syringe out the sheath with the same solution. Repeat treatment daily, and squeeze out all urine regularly until recovery takes place. In severe cases it may be necessary to open sheath to facilitate syringing, but in case of a valuable animal the veterinary surgeon had better attend to this. See Fig. 7, young boar suffering from this affection.

Sunstroke—Heat Apoplexy.

In cases of sunstroke or heat stroke (apoplexy), in which the animal frequently lies in a comatose condition as if death had already taken place, treatment must first aim at having the animal removed to a cool, moist atmosphere, near a water trough in the case of a overheated bacon pig at a saleyard or trucking station. Pour cold water first on mouth and snout, then on face and head, moisten the ground on which the animal lays, but do not pour cold water over body. When an improvement is noticed a wet bag may be placed over the body, but this is not advisable till improvement takes place. The animal must be kept very quiet. Bleeding is often resorted to, the ear being slit or the tail cut off above the brush to allow of the loss of a certain amount of blood, but though this may be effective as a temporary relief, the loss of blood weakens the animal considerably and the result may be fatal. Avoid overdriving the animals, for in these cases, as in all other disease conditions, prevention of the trouble is far better than any cure.

Paralysis of the Hindquarters.

In cases of paralysis of the hindquarter, rickets, and similar diseases. A special pamphlet is available at the Department of Agriculture and Stock, Brisbane, dealing with these diseases, and readers are advised to secure a gratis copy. Reference is made in this pamphlet both to the several causes and to suggested methods of treatment.

Intestinal Parasites.

For long round white worms "Ascaris Suilla" (see Fig. 8) note the following. See references earlier in this article to the use of oil of chenopodium capsules, &c. Where capsules are not available, treatment must first aim at keeping the animal without food for from twelve to twenty-four hours.

The following prescriptions are useful:—(1) Give ½ to 1 teaspoonful of oil of turpentine in a cup of warm milk as a drench, followed immediately by a two-ounce dose of Epsom salts. Repeat dose in a week if thought necessary.

(2) An alternative treatment is 1 teaspoonful of turpentine, 20 drops of liquid bichloride of iron, and 4 ounces of raw linseed oil as a drench.

A very reliable remedy tested out extensively at American Agricultural College piggeries is as follows:—A powder is given composed of santonini 8 grains, calomil 2 grains, bicarbonate of soda 1 drachm, arnica nut powder 2 drachms. Note.—If santonini is not procurable, increase calomil to 3 grains in making up mixture. This is one dose for a pig weighing 100 lb. It is best given in the form of a ball of moist pollard when the animal is very hungry and be followed by a 2-ounce dose of castor oil.

For lung worms (*Strongylus paradoxus*), small round worms about ½ to 1½ inches in length infesting the lungs: Follow advice already given *re* isolation, housing, and feeding. The veterinary surgeon had better attend to treatment, as it involves treatment by inhalation; this necessitating a form of fumigation by burning sulphur, &c. Fortunately, our piggeries are practically free of lung worms, and it is rare that treatment is necessary.

For kidney worms (*Schrostoma punguicola*, also called Stephanurus dentatum). This worm inhabits the kidneys, and becomes embedded in the kidney fat and in other organs. Reference is made to its development in the pamphlet on "Paralysis of the Hindquarter," for it is popularly supposed, but frequently erroneously, to cause this disease. There is no reliable medicinal treatment. Preventive measures only are advised. The same may be said of the thorn headed worm (*Echinorrhyneus figas*) (see Fig. 9), a similar type to the ascaris, but more difficult to treat, and of the whip worm (*Tricocephelus crenatus*) inhabiting the large bowel, and the pin worm (*Oesophogastoma dentatum*). The several remedies already suggested may be effective if persisted in, but preventive measures must always occupy a prominent position in any form of treatment. Where pigs are properly cared for intestinal parasites do not cause much trouble.

Food Poisoning.

This trouble, technically referred to as "Botulism," results from the use of an oversupply of some irritant, such as salt water (water in which corned beef, pickled pork, or ham has been cooked), or of soda water, lye, hot cabbage water, very hot soup, &c. One of the most prominent symptoms is severe abdominal pain resulting from inflammation of the stomach and intestines; diarrhoea is also usually present and the animal may suffer from convulsions and partial paralysis.

Where valuable animals are to be treated a veterinary surgeon should be called in, for treatment must be prompt to be effective. Preliminary treatment consists of giving the animal repeated doses of white of egg well beaten up or four ounces of olive oil in a cup of warm fresh milk. If lead poisoning is suspected—*i.e.*, where the animal has had access to waste paint, paint pots, the lead lining of tea chests (which they sometimes chew), give repeated small doses of Epsom salts in addition to above. A further article dealing with this subject will appear in an early issue of the "Queensland Agricultural Journal."

Mange, Scab, Nettlerash, Itch *(Sarcoptes Scaba).*

In cases of skin diseases of this description treatment consists in first softening and removing the scurf and scales with soft soap and warm water, repeated washings, and applying the following lotion every day or two until cured:—Flowers of sulphur 3 ounces, potassium carbonate 1 ounce, neatsfoot oil 1 pint. Mix while the oil is being warmed.

In cases of ringworm (*Tinea tonsurans*) which are comparatively common on the udders of breeding sows, and of cow pox on their udders and teats, repeated washing and painting with a dilute solution of tincture of iodine is advised, also the application of carbolised vaseline. The various forms of skin diseases require different treatment, hence if the outbreak is severe call in the district stock inspector or obtain advice from the veterinary officers.

In cases of treatment for hog lice (*Haematopinus suis*) the veterinary staff also advise the following:—After disinfecting, cleaning up, and lime washing sties, give the animals careful attention, nourishing food, and as an alternative treatment apply the following lotion:—Stavesaen seeds 1 ounce, water 20 ounces. First bruise the seeds and boil in water for two hours, afterwards making the mixture up to the original quantity—20 ounces. Another dressing they advise is flowers of sulphur 3 ounces, potassium carbonate 1 ounce, neatsfoot oil 1 pint. See further particulars *re* this dressing under heading of mange.

If a large number of pigs are infested with lice and the dressing of individual animals is too laborious, a dip or bath is recommended containing the following ingredients:—10 lb. slaked lime, 22½ lb. sulphur, 20 gallons water. Use in proportion of one part of the mixture to three parts of water.

The lime and sulphur should be mixed together in a smooth paste by the addition of a little water. This paste should then be thoroughly stirred into the 20 gallons of boiling water, and the mixture kept at a slow boil for three hours, or until it becomes a dark orange colour. If the mixture is properly made, there should be no sediment, but if a sediment occurs the mixture should be strained. For ordinary purposes it is used in the proportion of one part of this mixture to three parts of water at a temperature of 105 deg. Fahr. Repeat the dipping or spraying—for it can be used as a spray—in eight days if necessary. In all cases of skin diseases and of infestation by parasites disinfection and lime washing of pig premises is absolutely necessary.

Prolapsis Uteri.

Breeding sows as a result of difficulty at farrowing sometimes experience further trouble in that the breeding bag (the womb) falls away from its natural attachments and protrudes from the vulva in much the same way as does the mucous membrane of the rectum in "Prolopsis Ani." It appears as a large purple sac protruding from the mouth of the vulva. Sows in this condition frequently die before help arrives. Treatment must aim at immediately cleansing the parts and replacing them as advised under the heading Protrusion of the Rectum, Piles. Great care must be taken to keep the sow very quiet and clean, on very light diet, and to see that both the bowels and bladder are free. With care and attention there is no reason why recovery should not take place.

Dropsical Conditions.

Pigs sometimes suffer from dropsy. Fig. 10, p. 286, illustrates a Middle Yorkshire sow suffering from dropsy of the womb. When after death we post mortemed this sow we took between twelve and thirteen gallons of fluid from her abdominal cavity. This is a disease which the veterinary surgeon should be called in to attend if an animal was unfortunate enough to develop the trouble. The writer recently post mortemed a Berkshire boar at Kingaroy who had developed dropsy almost as severe as this Yorkshire sow.

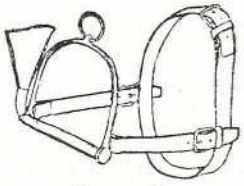


PLATE 59.

FIG. 1.—A suitable type of Pig Drenching Bit of special value to the breeder of valuable stud pigs. The bit is inserted in the pig's mouth, and the straps are passed round the head at back of the ears. It simplifies drenching.

PLATE 60 (Fig. 2).—THE BALLOON CAPSULE READY FOR USE.

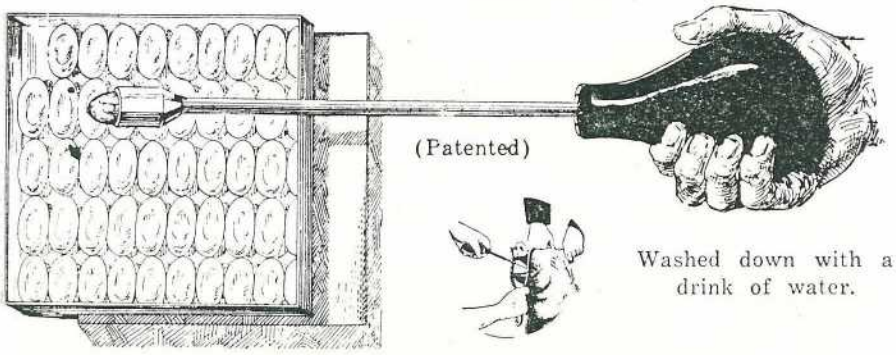


Plate 61 (Fig. 3).—Peters' Balloon Capsule Outfit.
(Showing the patent metal gun, jaw opener, and box of capsules.)

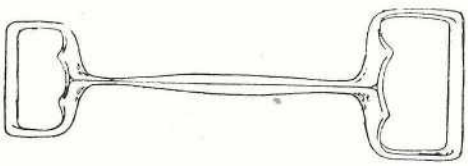


Plate 62.

Fig. 4.—A convenient instrument for inserting into the pig's mouth in order to hold him whilst being drenched or operated on. This is a very strong instrument, enabling the operator to handle a heavy sow or boar with comparative ease.

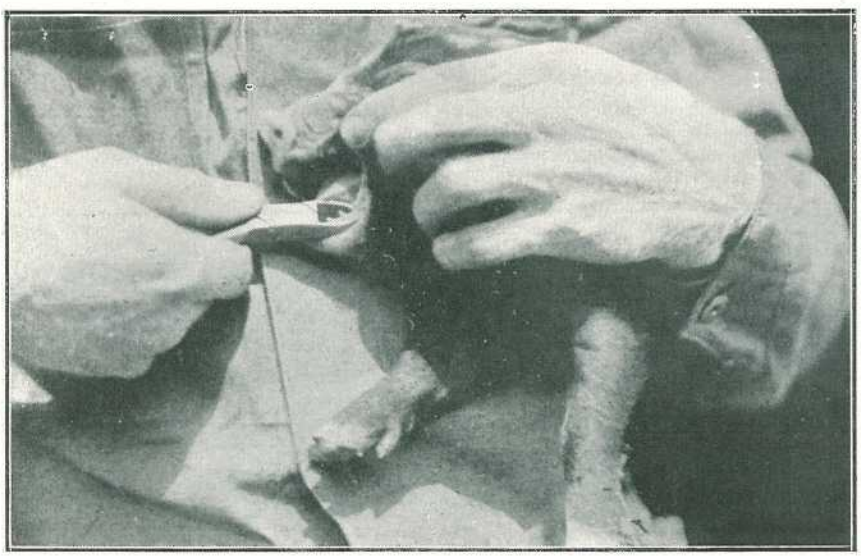


Plate 63 (Fig. 5).—Nipping off the Sharp Black "Needle" Teeth of a Sucking Pig.

Removing these teeth does not affect the pig injuriously, yet it saves the sow much pain and annoyance, for when the suckers fight for their place at the teat they bite and injure the teats as well as injuring their own tongues and lips. It is good practice to remove these needle teeth.

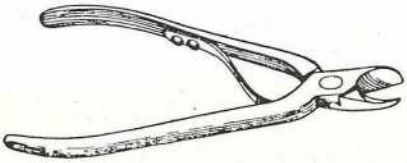


PLATE 64 (FIG. 6).—A PAIR OF PIG TEETH NIPPERS.

Quotations for instruments of this description can be obtained from manufacturers or retailers of veterinary appliances.

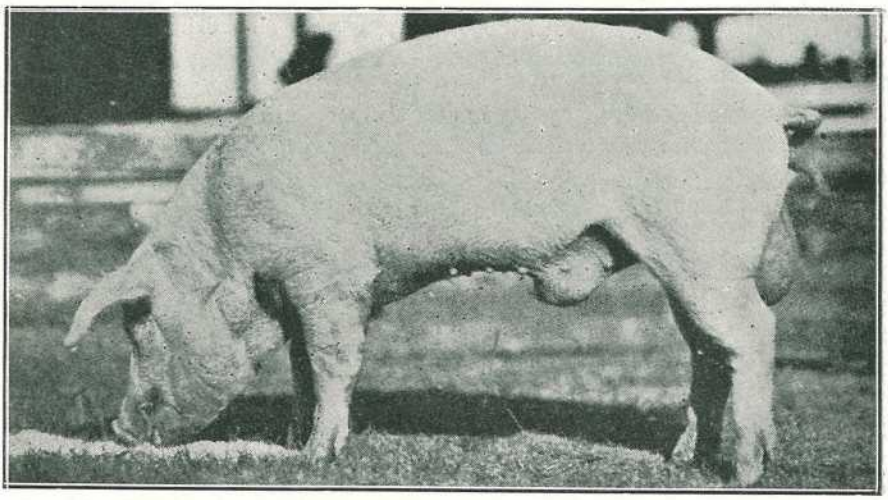


PLATE 65 (FIG. 7).—YOUNG BOAR SUFFERING FROM INFLAMMATION OF PREPUCE (SHEATH).

A common trouble among boars from six to twelve months old.

FIG. 8.—Well developed specimens of the Long Round White Worm of the pig technically known as Ascaris Suillae. These worms vary from 8 to 12 inches in length, are white in colour, and are as stout as a piece of No. 8 fencing wire. This is the commonest of the parasites infesting the intestines of the pig.

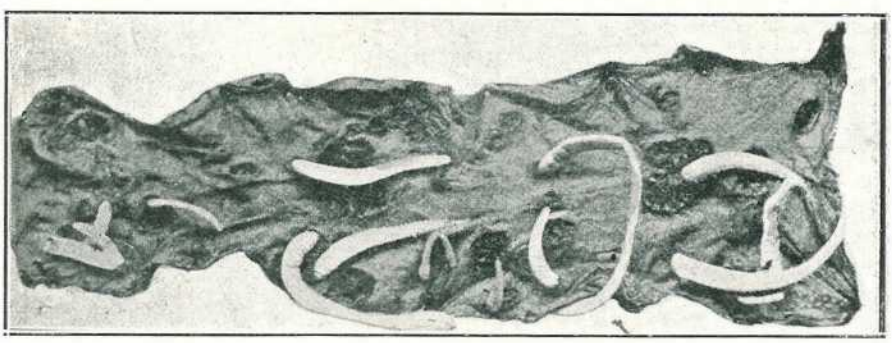


PLATE 66.

FIG. 9.—Portion of pig's intestine, showing Thorn Headed Worms attached to the mucous membrane of the intestines. These worms are provided with a set of hooklets by means of which they attach themselves to the walls of the intestine while their feeding apparatus is forced into the mucous membrane. Thus they feed on the nutrients, being absorbed into the system from the food stream. These worms vary from six to twelve inches in length. They are pinkish white in colour. Those illustrated were much shrunken and were immature when this photograph was taken.

Plate 67 (Fig. 8).

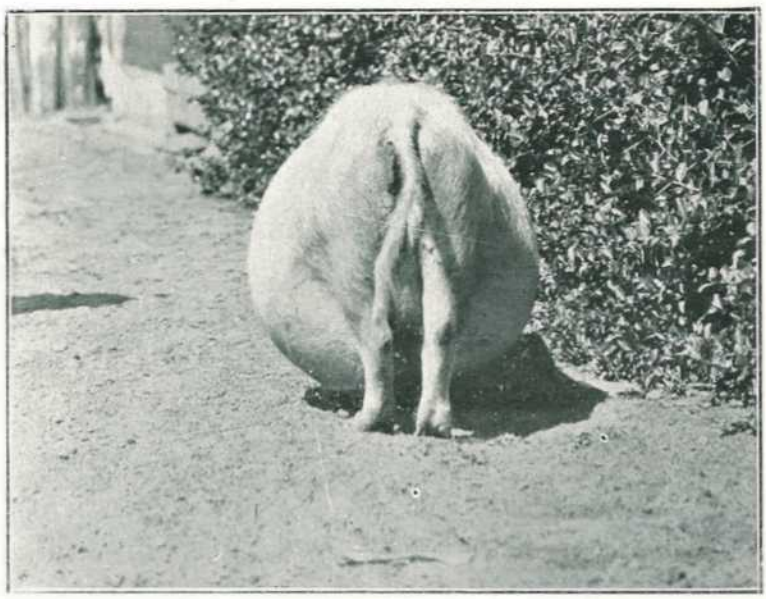


PLATE 68 (FIG. 10).—BACK VIEW OF MIDDLE YORKSHIRE SOW SUFFERING FROM DROPSY OF THE WOMB.

The sow died a few days after this photograph was taken.

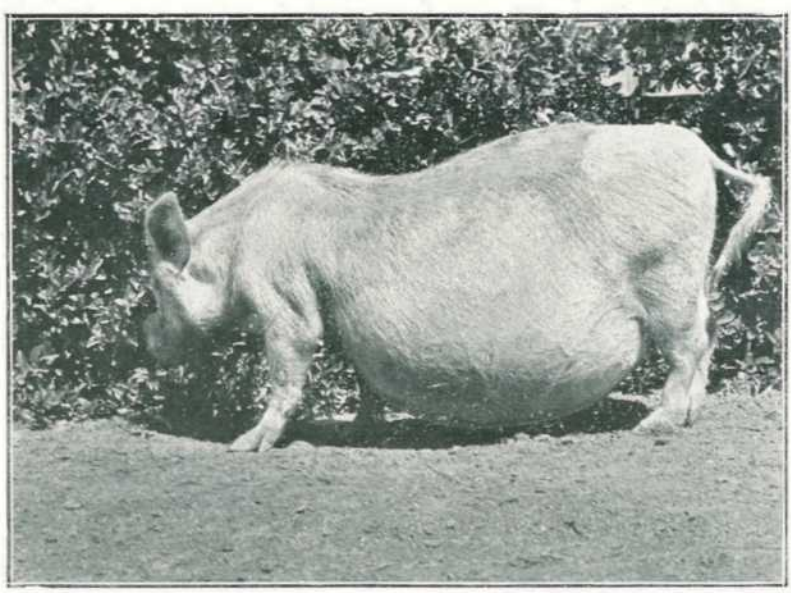


PLATE 69 (FIG. 11).—ANOTHER VIEW OF THE SOW ILLUSTRATED IN FIG. 10.

She had a long and painful illness and lost condition. When opened twelve or thirteen gallons of fluid was taken from her abdominal cavity. An unusual disease and one from which pigs rarely recover.

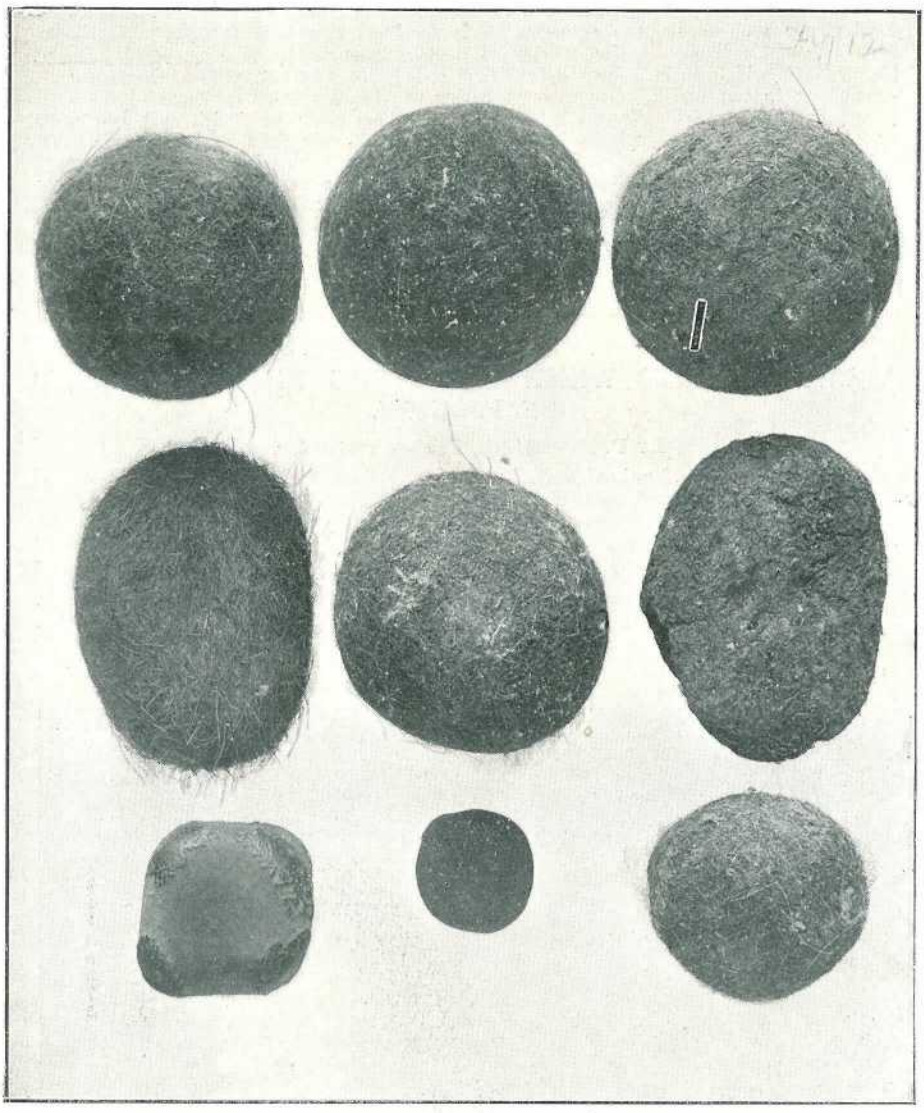


Plate 70 (Fig. 12).—Hair Balls from the Stomachs of Pigs and Cattle.

These hair balls, technically known as "Trichobezoars" are composed of fibrous matter, hair, wool, and a certain amount of earthy matter. The top row were each about as large as a tennis ball, the middle row from the stomachs of pigs (one each) were about the size of an oval cake of toilet soap, while the lower row varied from the size of a golf ball to slightly larger. The two to the left in the lower row were composed of very fine earthy matter compacted together. These were collected by Mr. Slaughtering Inspector E. C. Todd, of Cairns, and the Instructor in Pig Raising.

WOOLLY APHIS AT STANTHORPE.

Reports received by the Chief Entomologist (Mr. Veitch) indicate that very satisfactory progress has been made in the distribution of *Aphelinus mali*, a valuable parasitic enemy of the Woolly Aphis (*Eriosoma lanigerum*); this beneficial insect was introduced to the Stanthorpe district some time ago by the Department of Agriculture and Stock, the colonies being received from the Cawthron Institute, New Zealand. The parasite successfully overwintered in 1925 in most of the orchards in which it had been established earlier in that year, and from late in September to the end of December a series of colonies totalling 5,000 individual parasites has been distributed, mainly to those orchards in which this beneficial insect had not previously been liberated, and Mr. Jarvis (the Stanthorpe Departmental Entomologist, who has been in charge of this work) is able to report that "This useful parasite is now established in practically every orchard in the Granite Belt, and accounts of the good work it is accomplishing are continually reaching us." Information is also to hand to the effect that the parasite has spread into New South Wales orchards situated 30 miles from Stanthorpe.

PARASITIC WORMS WHICH INFEST THE DIGESTIVE ORGANS OF POULTRY.

BY P. RUMBALL, Poultry Instructor.

A large number of animal parasites are found in the digestive tract of poultry, some of which cause serious disturbances of the digestive functions, while others again are apparently harmless. Those principally met with, however, can be classed as round worms (nematoda) and tape worms (Cestoda). The former variety, by reason of the fact that they are the most common, claim prior attention. Various varieties are found in the crop and provintriculus or glandular stomach, gizzard, intestines (both upper and lower portions), and the ceaca or blind gut. The latter variety are responsible for serious losses and are particularly hard to expel. The accompanying plates should give poultry-breeders some idea to what extent infestation is possible.

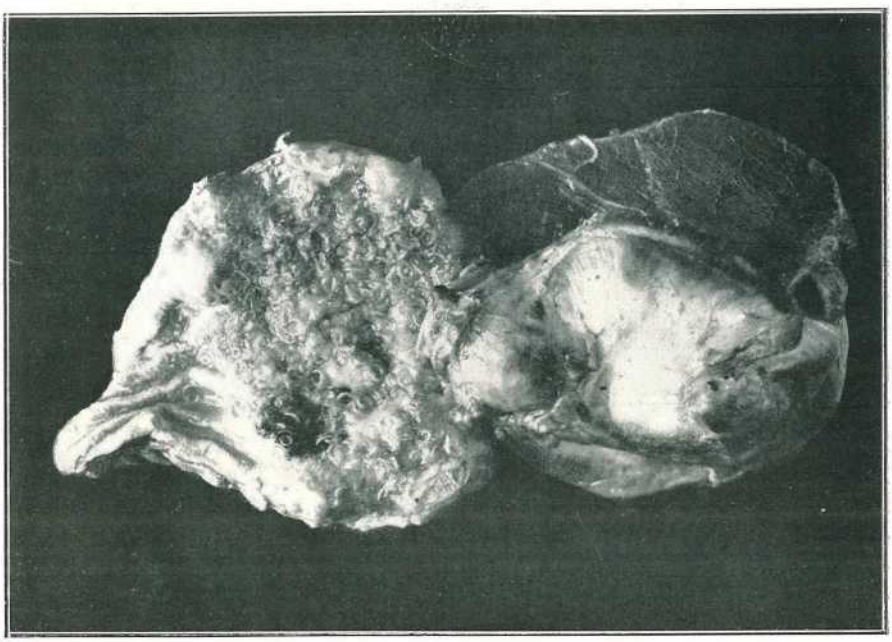


PLATE 71.—DISPHARAGUS NASUTUS WHICH INFESTS THE PROVINTRICULUS OR STOMACH OF FOWL (NATURAL SIZE).

That portion of the digestive tract between the crop and gizzard known as the provintriculus, or glandular stomach, is shown in Plate 1, heavily infested with worms. These worms were more or less encysted in the walls of the stomach, causing ulceration and eventually rupture.

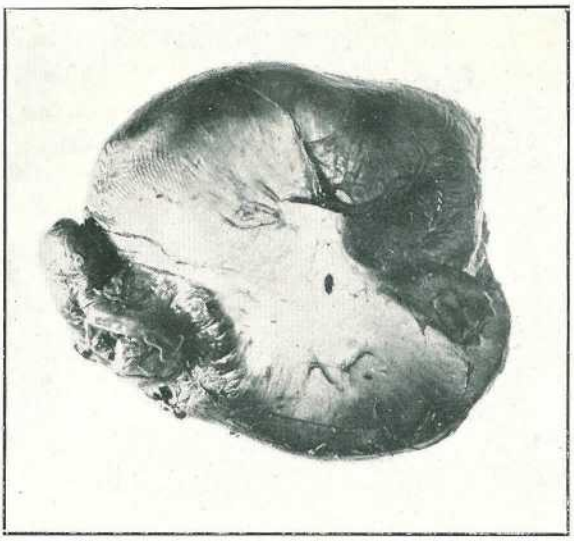


PLATE 72.—SPIROPTERA HAMULASA, GIZZARD WORM OF FOWL (NATURAL SIZE).

From the above plate the nodules caused by the gizzard worm are illustrated. On examination of the lining of the gizzard perforation will be noticed, and on removal of the lining the end of the worm will frequently be seen protruding from the muscular tissue. They are difficult to extract complete and vary considerably in size.

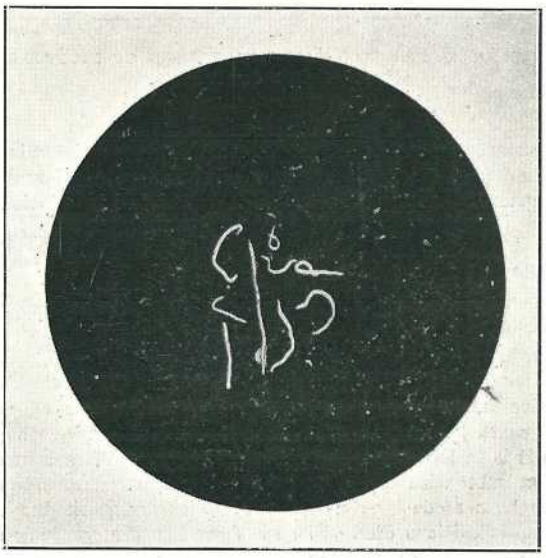


PLATE 73.—GIZZARD WORM (NATURAL SIZE).

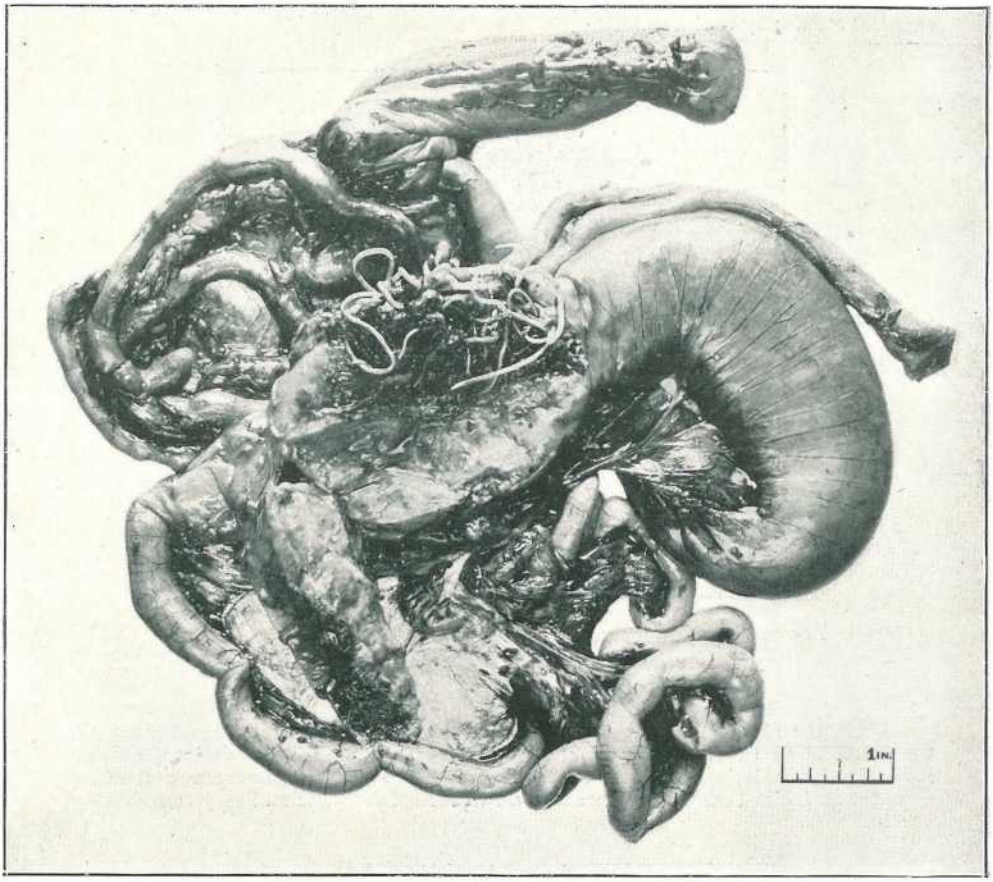


PLATE 74.—INTESTINE OF ORPINGTON HEN WHICH DIED OF STOPPAGE DUE TO TUMOUR AND BALLING OF WORMS.

This plate illustrates possibly one of the most common of intestinal parasites met with in poultry, and also the harm ensuing on their unchecked multiplication. In all probability the tumourous growth was due to parasitical infestation.

Life History of Round Worms.

It is not intended to trace in detail the life history of the various round worms found in poultry—in fact, in many cases it is unknown—but briefly with those most frequently met with. The adult female lays her egg in the digestive tract which is voided in the excreta. This egg undergoes portion of its development in the soil, enters the digestive tract of poultry by adhering to portions of food, and there completes development. In order that correct development of the embryo worm takes place while it is in the soil, moisture is necessary, which accounts for the more general infestation met with in damp and wet yards. Numerous post mortem examinations have been made by the writer of unthrifty stock due to the presence of worms, and from conditions disclosed he is forced to the conclusion that propagation may take place by certain varieties of worms in the infested host itself. A study of the illustration on p. 288 lends colour to some extent to this theory.

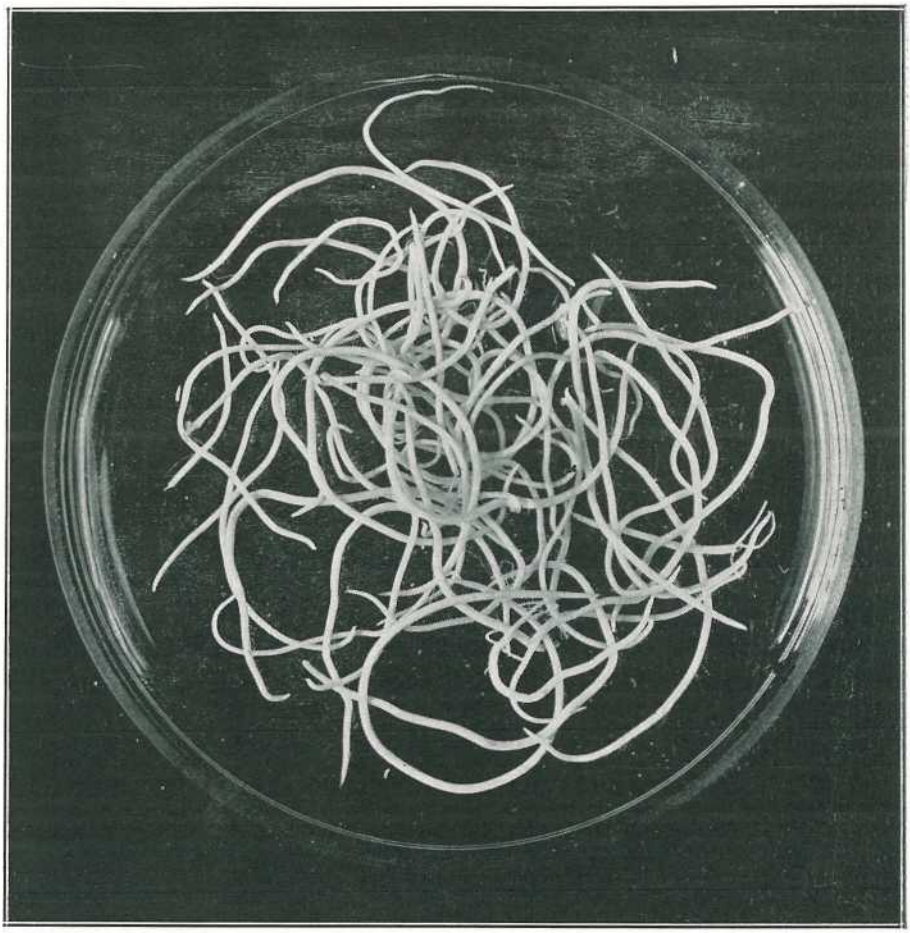


Plate 75.—Long Round Worms (natural size) which were Removed from Intestines of Bird illustrated in the Plate on the preceding Page.

Preventive Methods to be Adopted to Avoid Infestation.

Having a general idea of the life history of round worms, what action can be taken to prevent general infestation? As worms are spread from bird to bird by eggs, infested stock should never be brought on to relatively clean premises. As the eggs are found in the excreta from infested stock, particular attention should be devoted to the regular cleaning up of droppings; by doing so you not only assist in preventing the spread of worms, but preserve your fowl manure in its most valuable form. It is impossible to thoroughly clean the runs attached to poultry buildings, but they can be spaded over occasionally and, where accommodation allows, spelled. The feeding of all mash foods, foods to which eggs would readily adhere, should be done in suitable receptacles, and where large numbers of birds are yarded together several should be provided to prevent portions of the mash from being spread about the yard.

Worm-infested stock are poor producers, and where infestation is severe the vitality of the birds is lowered, rendering them more susceptible to disease. Young chickens when hatched are of necessity free, and every effort should be made to maintain them in this condition, particularly so during their growing stage. To do this they should be reared on ground which has not been fouled by adult stock. Do not make use of chicken rearing pens, brooder houses, &c., as temporary quarters for stock of any kind; by strictly adhering to this principle it is possible to place in the laying pens well developed stock that will give results. On the other hand, if growing

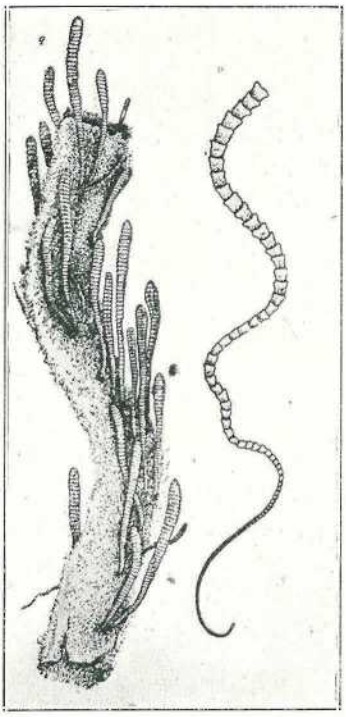


PLATE 76.—DREPANIDOTÆNIA INFUNDIBULIFORMIS.

a.—Worm;
b.—An inverted piece of chicken's intestine with numerous tapeworms attached.

stock become infested their growth is retarded and their vitality so lowered that they fall easy victims to diseases of an epizootic nature, such as roup and chicken pox, both of which are prevalent during the growing period and frequently assume a more virulent form with this class of stock.

Diagnosis.

The symptoms which indicate the presence of worms are not very characteristic. The birds become dull, weak, emaciated, and sunken in face, losing all colour both in head and legs. The plumage loses its lustre and becomes roughened. Where infestation is not severe they are ravenous, but with the increase of worms their appetite diminishes, and they have no inclination to look for food. Their walk becomes stiff, and diarrhœa is often present. Generally birds infested with worms have the appearance of suffering from some chronic disease.

Medicinal Treatment.

Too much reliance must not be placed on the ease with which worms can be expelled by medicants, as the best are only partially effective. Therefore it should be the aim of producers to avoid infestation by every means in their power. Santonin is undoubtedly the best vermifuge, but, unfortunately, it is too costly for general use. If used, give at the rate of 1 to 5 grains per bird in the mash. Tobacco dust has been used also with some degree of success by mixing 1 lb. with every 50 lb. of mash.

Medicated oil of turpentine mixed with equal quantities of cotton seed oil or linseed oil can be given by means of a syringe, in doses of one or two teaspoonfuls according to the age of stock. In administering this, every care must be taken to prevent its entering the wind pipe.

Before administering any of the following, fast the birds for twenty-four hours, then follow treatment in two hours by giving Epsom salts at the rate of 1 oz. to fifteen adult or twenty half-grown birds.

Tape Worms.

There are many species of tape worms found in fowls. They, however, cause little trouble owing to severe infestation being rare. The tape worm requires an intermediary host. One of the species infesting poultry has for its intermediary host the common house fly, and another the earth worm. An excellent treatment for tape worms is oil of male fern, areca nut, or powdered pomegranate root bark. A heaped teaspoonful of the latter added to the mash for fifty birds occasionally will keep stock free from tape worms. Areca nut given in the mash at the rate of 10 grains per bird is also efficient, while oil of male fern should be given at the rate of 10 drops per bird. However, before administering any of the above the birds should miss a feed and medicinal treatment should be followed by a purge in two hours.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF JANUARY, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALLS DURING JANUARY, 1926 AND 1925, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Jan.	No. of Years' Records.	Jan., 1926.	Jan., 1925.		Jan.	No. of Years' Records.	Jan., 1926.	Jan., 1925.
North Coast.	In.		In.	In.	*South Coast*—continued:	In.		In.	In.
Atherton	11·55	24	11·80	10·54	Nambour	9·01	29	10·36	15·36
Cairns	16·18	43	21·83	10·21	Nanango	4·49	43	4·43	7·62
Cardwell	16·48	53	3·52	13·09	Rockhampton ...	8·69	38	3·94	7·62
Cooktown	14·68	49	7·25	5·50	Woodford ...	7·22	38	7·01	10·01
Herberton	9·46	38	11·26	9·10					
Ingham	15·73	33	3·12	14·48	*Darling Downs.*				
Innisfail	20·12	44	14·51	13·43					
Mossman	14·05	17	12·82	18·03	Dalby	3·31	55	4·41	5·83
Townsville	11·28	54	3·75	10·95	Emu Vale ...	3·13	29	3·43	5·32
					Jimbour	3·60	37	4·84	7·92
Central Coast.					Miles	3·79	40	6·07	3·84
					Stanthorpe ...	3·55	52	3·90	6·69
Ayr	11·51	38	1·42	7·81	Toowoomba ...	4·86	53	4·84	6·53
Bowen	10·02	54	3·46	6·08	Warwick	3·52	60	5·48	6·17
Charters Towers ...	5·66	43	2·64	9·46					
Mackay	14·75	54	3·40	6·93					
Proserpine	16·30	22	2·65	10·54					
St. Lawrence ...	9·82	54	5·48	5·70	*Maranoa.*				
					Roma	3·36	51	1·70	2·22
South Coast.									
Biggenden	5·28	26	2·93	8·00					
Bundaberg	8·96	42	2·90	13·66	*State Farms, &c.*				
Brisbane	6·29	75	3·01	7·49					
Childers	7·59	30	2·27	10·78	Bungeworgorai ...	2·27	11	1·32	2·11
Crohamhurst ...	12·56	30	9·15	11·86	Gatton College ...	4·06	26	...	4·18
Esk	5·40	38	7·24	8·64	Gindie	3·77	26	3·10	7·60
Gayndah	4·68	54	1·61	5·83	Hermitage ...	3·00	19	6·01	5·21
Gympie	6·62	55	2·07	11·80	Kairi	7·48	10	18·14	8·30
Caboolture	7·43	38	4·10	9·12	Sugar Experiment Station, Mackay	11·56	28	3·62	5·85
Kilkivan	5·53	46	1·14	5·65					
Maryborough ...	7·38	53	4·91	13·79	Warren	5·76	11	5·42	2·14

NOTE.—The averages have been compiled from official data during the periods indicated; but the totals for January, 1926, and for the same period of 1925, having been compiled from telegraphic reports, are subject to revision.

GEORGE G. BOND,
Divisional Meteorologist.

General Notes.

Nitella, Characeæ as a Possibie Mosquito Preventive.

Nitella is a genus of Characeæ, several species of which occur in Queensland waters, growing round the edges of ponds. The plants grow completely submerged and root in the mud. Attention was first drawn to the matter by Caballero, a Spanish scientist working with Chara foetida, and the inference he drew was that some toxic substance harmful to the mosquito was secreted by the plants. Experiments conducted in Morocco, Spain, and Madagascar supported the theory, it being thought that the natural water in which Characeæ often grow does not harbour the larvæ whether Chara is present or not. The matter is still somewhat doubtful, so that experiments conducted in Brisbane by Mr. Buhot, one of the inspectors on the staff of the Commonwealth Department of Public Health, have considerable interest. Mr. Buhot, using a species of Nitella (sp. not yet described), found that the aquarium with the Nitella growing in it was always free from mosquito larvæ, and even when eggs and larvæ were artificially introduced into the water they failed to develop. Control tanks alongside were full of "wrigglers." The water used in all cases to fill the tanks was the ordinary town supply.

Payment for Peanuts by the Peanut Pool Board.

The following communication on the subject from the Secretary of the Pool, Mr. W. Muir, of Crawford, Kingaroy line, has been received:—

"At the annual meeting held in November growers were acquainted with the position, and they were told that sales would extend into the New Year, also that a tremendous increase in the demand for seed was likely. Quite a lot of the growers have been told that it is the intention of the Board to pay in full as early as possible, early February most likely, which, of course, would include money for seed. This is being arranged so that no injustice will be done, and the grower who is unable to pay for his seed will simply pay interest on it, the Board having complete security in the coming crop. Some growers either do not know or wilfully misunderstand the position, but there is a coterie who would for selfish ends like to see the pooling system go down. The year the Pool came into force one grower hawked a few sacks he had around Roma street and elsewhere with practically no results; however, the Pool looming up scared buyers into buying and sellers into selling, so that this grower cleared his stocks. Although some of the discontented growers have been knocked about by the Pool (according to their statement), every one of them have much larger areas under peanuts this year than ever. Owing to the smallness of last crop the position has been much harder to handle. In this way we have had to distribute a small crop to practically the same amount of customers, only in lesser quantities, consequently the returns have been much lower than could have been had we had a good crop, which means that it takes longer to get in enough money to enable a further advance being made. No doubt this entails a certain amount of sacrifice on the part of the grower, but in the interests of the future possibilities of the industry it is imperative. The bulk of the growers are reasonable when the position is explained to them."

Sorghum and Pigs.

There is a certain amount of risk in feeding "second growth" Planters' Friend and other varieties of sorghum to stock prior to the stage at which the plant flowers and the seed heads form, this especially so during humid weather with the very young shoots of the second growth. It is not advisable to feed sorghum to stock before the seed heads form, for prior to this stage the plant has not matured, nor is it as appetising or nutritious as is the case after flowering.

Some authorities consider that, provided the young sorghum is cut and allowed to wilt for twenty-four hours before use, it can be fed without risk, but is is preferable to follow the advice given above and allow the plant to mature before cutting it for stock feed. Both types of sorghum—viz., the Sweet Sorghums and the Grain Sorghums—provide excellent crops for pig feeding purposes, the grain sorghum being grown solely for the grain, which has a feeding value similar to other cereals, such as maize and wheat, although stock appear to prefer maize and barley to any other cereal grains if they have their free choice of them. In Queensland saccaline has proved an ideal crop for pig feeding, so also has improved cow cane and the softer varieties of sugar-cane.

Staff Changes and Appointments.

Mr. S. H. Fraser and the Police Magistrate Ingham have been appointed Government representatives on the Aramac and Kennedy Dingo Boards respectively.

Mr. W. Ellison, junior, of Bald Knob, Landsborough, has been appointed an inspector under the Diseases in Plants Acts.

Mr. J. C. Pryde has been appointed temporary inspector of Stock, Brands, and Slaughterhouses, and will be stationed at Charleville.

The Officer in Charge of Police, Mount Coolon, has been appointed an Acting Inspector under and for the purposes of "*The Diseases in Stock Act of* 1915" and "*The Slaughtering Act of* 1898" as from the 11th February, 1926.

Mr. Gerard Guy Greaves, Wamuran, has been appointed an Inspector under "*The Diseases in Plants Acts,* 1916 *to* 1924," as from the 13th February, 1926.

Regulations *re* Citrus Fruits.

Approval has been granted by the Lieutenant-Governor in Council to certain additional regulations under "*The Fruit Marketing Organisation Acts,* 1923 *to* 1925," empowering the Committee of Direction of Fruit Marketing to make a levy on all citrus fruits marketed for the year ending 28th February, 1927.

Removal of Banana Plants.

As a further protection against Bunchy Top in bananas, a new proclamation has been issued, declaring that no banana sucker or plant shall be removed from any nursery or orchard or other place in Queensland unless such plantation or garden in which such banana sucker or plant is growing has been inspected within fourteen days of the digging of such sucker or plant, and that such sucker or plant is certified by an inspector to be free from disease. Certain districts have, however, been previously proclaimed from which it is unlawful to remove any banana or plant under any conditions. The proclamations respecting these districts are still in force.

Special Levies.

Owing to the reorganisation of the Council of Agriculture on a commodity basis and the dissolution of the various District Councils, the Council of Agriculture has been given power, by regulation, to receive moneys supplied by means of certain special levies, which levies were formerly imposed by the District Councils mentioned below:—

Stanthorpe District Council.—Levy at the rate of 10d. per ton of all fruit and/or vegetables consigned by them or on their behalf from any railway station in the Petty Sessions District of Stanthorpe to any place outside such district.

Mackay District Council.—Levy of 2d. per ton of all sugar-cane delivered at the Farleigh and Cattle Creek Sugar Mills, and 1½d. per ton of sugar-cane delivered at Plewstowe Mill.

Mackay District Council.—Levy at rate of 7d. per ton of sugar-cane from the Homebush area and delivered at the Farleigh and North Eton Central Sugar Mills.

The abovementioned levies will only be collected by the Council of Agriculture until the respective dates on which they were to expire when collected by the District Councils.

Grade Standards for Apples and Pears.

In pursuance of the provisions of the Fruit Cases Acts, provision has been made for the grading of apples and pears. Three grade standards have been fixed—"Special," "Standard," and "Plain"—and all apples and pears offered or intended for sale shall be graded into such standards, particulars of which can be obtained from the Department of Agriculture and Stock or from the Committee of Direction of Fruit Marketing.

"Matured Fruit."

For the purposes of the Regulations under the Fruit Cases Acts, "matured fruit" has been more clearly defined. In the case of pineapples, fully developed fruit during the months of April to September inclusive shall contain not less than 8 per cent. sugar content, and during the months of October to March inclusive not less than 10 per centum. In the case of oranges and mandarins, the citric acid content shall not exceed 1½ per centum; and in the case of deciduous stone fruits, the kernel must be matured inside the stone and the fruit must not be picked when the kernel is in the jelly stage. The fruit may be still hard and firm, but shall have attained its full growth, and the skin must give an indication of the colour of the particular variety.

Local Sugar Cane Prices Boards.

The term of office of members of the Inkerman, Invicta, Kalamia, Mourilyan, and Pioneer Local Sugar Cane Prices Boards has been extended to the 28th February, 1926.

Milk and Cream Testing.

Result of examination in the Theory of Milk and Cream Testing held at various centres on the 21st November, 1925:—

Moodie, Archibald Faine, High School and College, Gatton.
Coleman, Frank Clifford, High School and College, Gatton.
Schroder, Carl Alexander, High School and College, Gatton.
Baker, Walter S., H.T., State School, Malanda.
Davidson, John, H.T., State School, Sarina.
Christian, Clifford Stuart, High School and College, Gatton.
Atherton, David Ord, High School and College, Gatton.
Stubbersfield, E., care of Butter Factory, Murgon.
Porter, Thomas J., High School and College, Gatton.
French, John Leslie, Kelvinhaugh, *viâ* Dalby.
Lehfeldt, John Cousins, Kalapa, *viâ* Rockhampton.
Brimblecombe, Victor Joseph, High School and College, Gatton.
Anderson, Alexander Milne, State School, Mount Mee, *viâ* D'Aguilar.
Vogler, Cyril Reginald, Butter Factory, Boonah.
Ralph, Norman Thomas, "Avondale," Cooroy.
Hobgen, Thomas, State School, Sugarloaf, Stanthorpe.
Aplin, William, High School and College, Gatton.
Menery, Hal, High School and College, Gatton.
Volz, Herbert John, Caboolture.
Moller, C., care of Wide Bay Co-operative Dairy Co., Gympie.
Shea, Wilfred Matthew, Conlon street, Roma.
Logan, Martin Patrick, Wilson street, Paddington.
Volker, Herbert Justus, Westbrook.
Harvey, James Peel, High School and College, Gatton.
Kelly, Michael John, Rosevale, *viâ* Rosewood.
Bilborough, Arthur Wheeler, Springbrook, *viâ* Mudgeeraba.
MacHardy, Robert, High School and College, Gatton.
Hale, John Francis, Moola Cheese Factory, Kaimkillenbun.
Wallis, William Donald, Herries street, Toowoomba.
Dawson, Arthur William H., Butter Factory, Dalby.
Feckner, Walter, Pittsworth Dairy Co., Linville.
Tadman, F. W., 119 Fitzroy street, Rockhampton.
Newton, Stanley William, Doctor's Creek, Haden.
Mullins, M., Bony Mountain, *viâ* Cunningham.
Francis, Stephen Collier, Second avenue, Wilston.
Murphy, Arthur, Barrett street, Booval.
Geoghegan, William, Boonah.
Soutter, George Vincent, Silvermist Cheese Factory, Malanda.

Poisoned Baits for Flying Foxes.

An efficient poison bait for flying foxes can be made as follows:—With a packing needle thread some apples on a length of binder twine, and out of each apple scoop a small conical piece, using a small sharp-edged spoon for the purpose. In the opening so made a small quantity of strychnine is deposited. To ensure a correct amount for each apple a measure may be made by pushing a pen nib, point inwards, into an ordinary penholder. So much strychnine as will remain on the reverse end of the nib should be spread into the hole in the apple, and the cone-shaped piece that had been cut out replaced. The bait should be prepared, if possible, twelve hours before it is to be used in order that the strychnine may have time to affect the whole apple. The apples being thus poisoned, they should be securely tied to the branching top of a long sapling. Select a tree that the foxes have been visiting, strip it of fruit, and at sundown tie the sapling to the tree so that the top projects above the tree itself. This method is also effective where parrots are doing damage in an orchard.

Caution.—The great drawback is the danger that attaches to the use of the poison. Every precaution should be taken to keep children out of the orchard, and notices should be conspicuously displayed on every boundary. Special care should be taken that the poisoned fruit is securely tied on so that the flying foxes or parrots cannot carry it away and drop it where it may be eaten by children or stock. The poison should be kept in a plainly marked bottle and under lock and key; similarly the prepared apples must be securely locked up until it is time to tie them to the trees.

Opossum Boards.

An Order in Council has been issued constituting opossum districts in the State. These districts, which approximately comprise that portion of Queensland east of the 144th meridian of longitude, are as follows:—

Moreton, Darling Downs, South-Western, Wide Bay and Burnett, Central Coast, Central Western, Northern Coast, Northern.

Provision is made by regulation for the constitution of a Board for each district to consist of three members—one appointed by the Government, one to be elected by landowners, and one to be elected by the trappers. Triennial elections are provided for.

The election of members of the Boards for all districts will be held at the Department of Agriculture and Stock, Brisbane, on the 19th April, 1926, and the date of nomination has been fixed for 12th March, 1926.

Bitter Bush, Quinine, or Native Cinchona Eradication.

Alstonia constricta or Bitter Bush eradication is best carried out by poisoning the plants with arsenical solution. Standing trees may be "frilled" by making a succession of downward cuts right round the tree into the sapwood, each cut overlapping the other so as to leave no unsevered bark or sapwood for the conveyance of food-containing sap for the tree. The solution should now be freely poured into the frill with a watering can (without a rose) or old teapot or kettle.

Bitter Bark suckers freely, and the eradication of sucker growths in paddock or cultivation areas is more difficult; the suckers might be cut down, however, and a solution painted over the cut stumps with a brush or swab. These also, of course, can be grubbed out, and constant grubbing will exhaust the old roots eventually. An arsenical solution poured round the grubbed plant would no doubt be effective, but would poison the ground for some time for all other plants.

A suitable solution is: Arsenic 1 lb., caustic soda 2 lb., or washing soda 3 lb., water 4 gallons. The soda is necessary to help the arsenic dissolve, and the addition of whiting is recommended because it dries white and shows which trees or plants have already been treated. If ordinary washing soda is used boiling will be found necessary to bring about complete solubility, but if caustic soda the heat generated does away with the necessity of boiling.

Proposed Cotton Board.

The Department of Agriculture and Stock advises that the following nominations have been received for election as Growers' Representatives on the proposed Cotton Board:—

District No. 1 (Lockyer District).—James Scanlan, Flagstone Creek; Ferdinand A. Kajewski, Ma Ma Creek.

District No. 2 (from Helidon to Toowoomba, Darling Downs, Maranoa, &c.).—John F. E. Olm, Brigalow; Edw. V. Little, Miles.

District No. 3 (from Brisbane to Ipswich, Brisbane Valley Line, South Coast Line, and North Coast to Gunalda and Branches).—David C. Pryce, Toogoolawah; Chas. Litzow, Vernor.

District No. 4 (Gayndah-Mundubbera Line).—Donald B. Greggery, Mount Lawless; James Bryant, Chowey Siding.

District No. 5 (North Coast Line from Theebine to Gladstone and all Branches except Gayndah-Mundubbera Line).—Robert J. Webster, Murgon.

District No. 6 (Dawson Valley Line and Central Line West from Kabra and Branches).—Jos. H. J. Koets, Alma Creek; Harry R. Brake, Don River; Charles G. Young, Wowan.

District No. 7 (North of Gladstone West and from Rockhampton to Malchi on the Central Line, Whole of the Boyne Valley Line).—John E. Harding, Dalma Scrub; Arnot V. Jorgensen, Mount Larcom; George Edw. McDonald, South Yaamba.

"Fruits of Foresight."

We have received an interesting pamphlet issued by Shirley's Fertilisers Proprietary, Limited, entitled "Fruits of Foresight." This pamphlet contains a large amount of very valuable information in a condensed form, and should prove most useful to every man on the land, for, though dealing primarily with the use of fertilisers in the plantation, orchard, and vineyard, it contains much general information of value to all primary producers. The advice tendered is the result of many years of scientific and practical experience, and is therefore well worth the careful consideration of our readers.

"Bunchy Top" in Bananas.

The Minister for Agriculture and Stock (Hon. W. Forgan Smith) has announced that since the discovery of Bunchy Top at Dayboro' on the 30th of December last, the energies of officers of the Fruit Branch of the Department of Agriculture have been concentrated in an effort to locate the extent and check the further spread of this serious banana malady. Approximately 1,000 acres of banana plantations have been inspected to date, and of that area approximately 400 acres, situated in the Rush Creek and Moorina districts, have been found to be more or less seriously affected. Steps have been taken for the eradication of all diseased stools, and failure to carry out the instructions of field officers in this respect will involve delinquent growers in a very heavy penalty. The matter of the distribution of plants from infested plantations has been of great concern. In nearly every case of this nature where it was known that plants had left infested plantations during the period of infestation, the growers concerned have fallen in with the recommendations of Departmental officers, and have removed and destroyed all such plants. It was found that Bunchy Top was little known in the North Coast areas, and instructional work by field officers as to the history, detection, and control of the disease was greatly appreciated by all growers visited.

Entomological Research at Stanthorpe.

The Minister for Agriculture (Hon. W. Forgan Smith), referring to recent Press comment, to the effect that several attempts had been made to induce the Agricultural Department to station a research officer within the Stanthorpe area, but without effect until Mr. Perkins of the University went there, when "peculiar to relate the Agricultural Department also thought it advisable to send an officer to carry out research work there" said that, as a matter of fact, a deputation waited upon him on the 30th January, 1922, when he was acting as Minister for Agriculture. This deputation was from the Southern Queensland Fruitgrowers' Association, and interviewed him on the subject of an appointment of an entomologist to investigate the fruit fly problem in the Stanthorpe district. On the following day Mr. Smith secured the approval of Cabinet of the temporary appointment of Mr. Hubert Jarvis for this purpose, and the final result was that Mr. Jarvis actually assumed duties at Stanthorpe on the 11th February, 1922, or within a fortnight of the deputation's bringing the matter under the Ministerial notice. Mr. Jarvis has been in Stanthorpe ever since, and the Minister is very gratified to observe favourable Press comments on Mr. Jarvis's valuable work.

Four months later (or on the 1st July, 1922) Mr. Perkins, research scholar of the Queensland University, went to Stanthorpe to carry out research work on behalf of the University and the Stanthorpe Fruit Growers' Association. The endowment of the University is accepted as one of the functions of the Government, and the Minister is also accordingly very pleased at the good work that is being done in the Granite Belt by Mr. Perkins.

QUEENSLAND SHOW DATES, 1926.

Killarney: 10th and 11th March.
Milmerran: 31st March.
Sydney Royal: 29th Mar. to 7th April.
Herberton: 5th and 6th April.
Miles: 7th and 8th April.
Pittsworth: 8th April.
Chinchilla: 13th and 14th April.
Kingaroy: 15th and 16th April.
Toowoomba: 20th to 22nd April.
Nanango: 29th and 30th April.
Dalby: 29th and 30th April.
Taroom: 3rd to 5th May.
Oakey: 6th May.
Toogoolawah: 6th and 7th May.
Murgon: 6th and 7th May.
Goombungee: 13th May.
Boonah: 12th and 13th May.
Kilkivan: 12th and 13th May.
Roma: 19th and 20th May.
Wondai: 19th and 20th May.
Ipswich: 19th to 21st May.
Wallumbilla: 25th and 26th May.
Esk: 26th and 27th May.
Maryborough: 25th to 27th May.
Childers: 29th to 31st May and 1st June
Marburg: 2nd and 3rd June.
Bundaberg: 3rd to 5th June.
Gin Gin: 8th to 10th June.
Woombye: 16th and 17th June.
Lowood: 18th and 19th June.
Gatton: 30th June and 1st July.
Kilcoy: 1st and 2nd July.
Laidley: 7th and 8th July.
Biggenden: 1st and 2nd July.
Woodford: 8th and 9th July.
Wellington Point: 10th July.
Maleny: 21st and 22nd July.
Rosewood: 23rd and 24th July.
Royal National: 9th to 14th August.
Crow's Nest: 25th and 26th August.
Coorparoo: 28th August.
Wynnum: 3rd and 4th September.
Zillmere: 11th September.
Rocklea: 25th September.

Answers to Correspondents.

Axle Grease Recipes.

G.C., Kilkivan—

(A) Melt, but avoid boiling, 16 lb. fat, and dissolve in it 2¼ lb. sugar of lead; then add 3 lb. black antimony. The mixture must be constantly stirred until cold.

(B) Fat 2½ lb., camphor 1 oz., blacklead ½ lb. Rub the camphor in a mortar into a paste, with a small portion of the fat; then add the remainder of the fat and blacklead, and thoroughly mix.

Tanning and Unhairing Skins, &c.

G. A. MOORE, Brisbane—

Cut off useless parts of the skin, then soften by soaking it so that all flesh and fat may be scraped from the inside with a blunt knife. Soak the skin then in warm water for an hour, meanwhile mix equal quantities of borax, saltpetre, and Glauber salts with enough water to make a thin paste. About ½ oz. of each ingredient will give enough for an opossum skin and proportionately more will be required for larger ones. When the skin has soaked in warm water lift it and spread it out flat, so that the paste may be applied with a brush to the inside of the skin; more paste will be required where the skin is thick than when it is thin. Double the skin together, flesh side inwards, and place it in a cool place for twenty-four hours, when it should be washed clean, and treated in the same way as before with a mixture of 1 oz. sodium carbonate (washing soda), ½ oz. borax, 2 oz. hard white soap; these must be melted slowly together without being allowed to boil. The skin should then be folded together again, and put in a warm place for twenty-four hours. After this dissolve 4 oz. alum, 8 oz. salt, and 2 oz. sodium bicarbonate (baking soda) in sufficient hot water to saturate the skin; water should be soft, such as rain water. When this is cool enough not to scald the hands, the skin should be immersed, and left for twelve hours; then wring it out, and hang it up to dry. The soaking and drying must be repeated two or three times, till the skin is soft and pliable, after which it may be rubbed with fine sand paper and pumice stone to obtain a smooth finish.

To unhair soak in a fairly strong solution of lime, then push off hair with back of butcher's knife.

Chocolate Making.

C.C.M., Creek street, Brisbane—

To make chocolate, melt cocoa on a hot metal plate until paste is kept in a fluid condition. A proportion of sugar, with sometimes arrowroot, and some flavouring essence, most commonly vanilla, or cinnamon, &c., are added, and when thoroughly incorporated the semi-fluid paste is cast into moulds to cool. The proportions used for the best French chocolate are:—Two beans of vanilla and 1 lb. of best refined sugar to every 3 lb. of best cocoa.

Tanning.

J. GOODWIN, The Caves—see reply to G. A. Moore—

A second method is not so quick but should give better results. Collect some wattle bark and make a strong decoction by boiling or steeping the bark in water. A bushel of crushed bark, from a tannery, will be found an easy way of getting the best bark. The skin should be scraped clean on the inside, as in the lightning process, before steeping begins. It is best to let the skins lie as flat as possible while soaking; and a large square, zinc-lined packing case is therefore preferable to a barrel. The skins should be thoroughly covered by the liquid, which must either be changed once a week or boiled anew and skimmed. While the skin is out of the liquid each week it should be lightly scraped. Large skins take up to six weeks to tan well, but opossum skins will not require more than a month.

The "Queensland Agricultural Journal" is supplied to Queensland farmers free on the prepayment of postage (1s. per annum), and to farmers of other States at 10s. per annum.

Mauritius Beans.

E.J.W.N.—

The bean is not edible, but might be used for fodder if well dried, then chaffed, especially if mixed with bran, chaffed corn, sorghum, or molasses. However, you would be well advised to try cowpeas, which would meet your purpose and would do very well in your district.

Feeding Corn and Cob Meal to Pigs in Dry Times.

J.E.O.B., Kiamba—

The use of the husk and core of maize as a pig food is not specially recommended except it be fed in the early stages of ripening, when they are more succulent and less fibrous. A very much better form of protein and of succulent green stuff is available in lucerne and similar green feeds, and these would be of very much more benefit to the pigs than the dry fibrous husk and core remaining after the grain has been removed. The only advantage there would be in feeding corn and cob meal would be a case of severe shortage of green foods; in this case they would supply bulk and roughage, of which even pigs with their comparatively small stomach must have a certain supply.

The manager of the State Farm at Warren, *viâ* Rockhampton, reports satisfactory results for the feeding of corn and cob meal to both horses, dairy cattle, and pigs, this especially so during dry spells when there is little or no grain food available; at the State Farm, Warren, the corn and cob meal is fed in various forms. They prefer cooking same before feeding it to pigs.

The Instructor in Pig Raising, Mr. Shelton, however, has never specially recommended the grinding of the maize husk and cob, for results of experiments overseas do not appear to justify the extra expense. We have so far had no opportunity of testing this corn and cob meal in comparison with corn meal plus lucerne or other green foods. Either soaking or cooking the meal before use is recommended.

LEAF SPOT.

Replying to a correspondent, Mr. Henry Tryon, Vegetable Pathologist, makes the following observations on some cherry-tree cuttings from a Eukey orchard:—

The cuttings themselves as far as the wood is concerned evince no apparent disease occurring either externally or internally on the tissues.

All the green leaves attached, however, manifest very distinct and well defined more or less circular spots, numbering from two to twenty-three on individual examples. These spots measure from 1 to 3 mm. in diameter and are of a reddish brown colour, and usually occur scattered from the leaf-margin to the midrib more commonly away from the latter and secondary veins. They appear on both leaf-surfaces. When received exhibited no trace of epiphytal fungus; but some of them, under moist conditions, manifested a few very small point-like dark spots in their centres.

These latter point to the cause of the trouble; they being in fact "acervuli" (*acervulus*—Lat. for little Heap) of a leaf parasite of deciduous trees (*Clastero sporium caspophilum*), and are composed each of a little mass of fungus hyphæ that have forced their way from the leaf tissue through the cuticle from beneath.

This fungus causes shot-hole effects in other deciduous trees in the Stanthorpe district, but I cannot recall a previous instance of its having come under my notice, as doing so there, so far as the cherry is concerned. In the apple it may occasion some trouble in the bark of the young wood.

I may state that its presence is quite unconnected with Brown Rot disease, that although found associated with fruit, flowers, and shoots does not occur in connection with the foliage.

THE QUALITY OF QUEENSLAND COTTON.

The Minister for Agriculture and Stock (Hon. W. Forgan Smith), in the course of a recent Press announcement, mentioned that his attention had been drawn to a news paragraph in which Mr. G. Evans, the late Director of Cotton Culture in Queensland, had been reported to have stated in his evidence before the Tariff Board in Melbourne that "for the sake of our reputation we are not going to send our cotton to Liverpool this year." It is evident, said Mr. Forgan Smith, that Mr. Evans's statement has been mutilated in transmission, as the quality of the Queensland cotton crop this year promises to be up to a high standard, and it is anticipated that the crop will be disposed of in the Liverpool market as favourably as in former years. The full text of the evidence given by Mr. Evans before the Tariff Board is meanwhile being obtained.

PLATE 77.—NOTABLE REPRESENTATION OF QUEENSLAND'S RURAL WEALTH, NEW ZEALAND AND SOUTH SEAS EXHIBITION, DUNEDIN, 1925-26.

A view of the Queensland Display on leaving the Canadian Court.

PLATE 78.—THE QUEENSLAND COURT, NEW ZEALAND AND SOUTH SEAS EXHIBITION, DUNEDIN, 1925-26.

General View from one corner, showing from left to right, Tropical Sugar Cane, Agriculture and Dairy Products, State Cannery, and Forestry.

PLATE 79.—QUEENSLAND COURT, NEW ZEALAND AND SOUTH SEAS EXHIBITION, DUNEDIN, 1925-26.
The Forestry Section. The comprehensive Mineral Section is immediately behind.

A NONDRIP PAINT BRUSH.

We like to buy the paint for the kitchen or living room, and put it on ourselves. But when it comes to the ceiling, with the drip of paint down the handle, we wonder if we shouldn't have had it done by some one else.

Here is a way to prevent the flow of paint from running down the handle and on to the hands. Probably there is a small rubber ball about the house that has

FOR PAINTING CEILINGS.

got punctured or lost its buoyancy. Cut this in half with a pair of shears, and then cut a small hole in the bottom of one half.

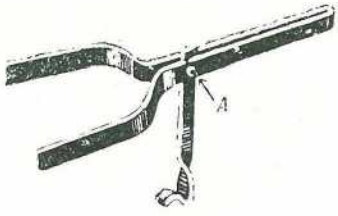
Slip the handle through this in the manner shown in the drawing, and you will have a dripless paint brush.

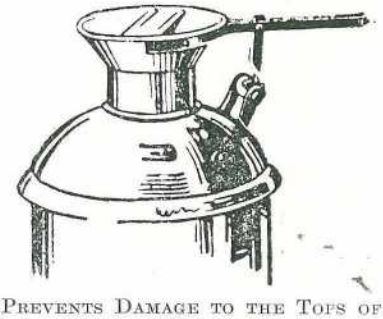
As the paint collects in the half sphere empty it now and then back into the pail, or let it flow down on to the bristles again.—"Country Gentleman."

WHEN CAN LIDS STICK.

When the cans of milk are being transported from the barn to the dairy house the covers are sometimes pushed down tight to prevent spilling, and it frequently becomes necessary to employ a hammer to loosen them. In this way cans that have been in use only a few months are badly damaged around the top.

To obviate this trouble, and at the same time simplify the work of removing the covers, a farmer has designed a very efficient little tool. A four-foot length of heavy waggon-tire iron is bent, as shown, to form a double-pronged lever with a second piece of the same material at A, which acts as the fulcrum. This is held in place between the two halves of the handle by means of a quarter-inch





THIS PREVENTS DAMAGE TO THE TOPS OF CANS.

bolt or rivet. The prongs of the device are twisted slightly inward at the upper edges, spacing the two just far enough apart so that they will engage the rim of the lid when in position for operation.

In use, the curved foot of the fulcrum piece is placed on one of the handles of the can with the prongs at either side, shown in the illustration.

By pressing down on the lever handle the lid of the can is raised quickly, and with little effort. This idea will no doubt appeal to many dairymen who have acquired skinned knuckles or bruised fingers in attempts to remove can lids that stick.—"Country Gentleman."

Farm and Garden Notes for April.

Field.—Those areas already lying in fallow for subsequent sowing with wheat should be kept in good tilth, using field implements that have a stirring effect in preference to those which tend to reverse the surface soil. The surface should never be allowed to cake; consequently all showers must be followed by cultivation, as soon as conditions will permit of teams and implements working freely.

Early fodder crops, such as barley (skinless or Cape) and certain varieties of wheat may be sown during April:—Growers of winter fodders will be well advised to study the article dealing with dairy fodder plots which appeared in February, 1922, Journal.

In those areas where seasonable rainfall permitted the planting of potatoes, these should now be showing good growth and must be kept free from all weed growths by means of the scuffler. If sufficiently advanced, and any doubt exists as to the prevalence of blight, advantage should be taken of fine weather to give a second spraying of "burgundy mixture," a calm and somewhat cloudy day being chosen if possible for the spraying.

Where land has been previously well prepared, lucerne sowing should be carried out this month, and intending growers of this fodder will be well advised to ascertain the germinating qualities of seed submitted to them for purchase. The difference between a good and bad "strike" is often traceable to the poor class of seed sown.

Maize and cotton crops should now be in the harvesting stage, and, once matured, are better in the barn than the open paddock, where weevils and other insects are usually prevalent at this season of the year.

Root crops sown last month should now be making fair growth, and during the early period of such should be kept free from weeds, and, where necessary, thinned out. Sowings of mangels, swedes, field carrots, sugar-beet, and rape may still be made where conditions of moisture will permit.

As the sowing season is close at hand for certain varieties of wheat—*i.e.*, those which require a fairly long period to develop in, every effort should be made to bring the seedbed into the best possible tilth and to free it from foreign growths of all kinds. The grading of all seed-wheat is strongly recommended, and growers who favour certain varieties should adopt a system of seed selection from prolific strains with a view to the raising of larger quantities of pure typical grain for ultimately sowing in their larger fields.

Pickling of wheat to prevent smut (bunt) is necessary. Germination tests should be carried out prior to commencing seeding operations.

Sorghums which have matured and are not immediately required as green fodder should, wherever possible, be conserved as ensilage to provide for a reserve, to tide over the period when grasses and herbage are dry. Succulent fodder of this description is the best possible form of insurance against drought, and for maintaining dairy and other stock in thrifty condition.

Kitchen Garden.—Hoe continually among the crops to keep them clean, and have beds well dug and manured, as recommended last month, for transplanting the various vegetables now coming on. Thin out all crops which are overcrowded. Divide and plant out pot-herbs, giving a little water if required till established. Sow broad beans, peas, onions, radish, mustard and cress, and all vegetable seeds generally, except cucumbers, marrows, and pumpkins. In connection with these crops, growers are recommended to adopt some form of seed selection for the purpose of improving the quality of vegetables grown by them. Just at present, selections should be made from all members of the cucurbitaceæ (pumpkins, cucumbers, &c.). Tomatoes should also be selected for seed. Early celery should be earthed up in dry weather, taking care that no soil gets between the leaves. Transplant cauliflowers and cabbages, and keep on hand a supply of tobacco waste, preferably in the form of powder. A ring of this round the plants will effectually keep off slugs.

Orchard Notes for April.

THE COASTAL DISTRICTS.

In the Orchard Notes for March the attention of citrus growers was called to the necessity of their taking the greatest possible care in the gathering, handling, sweating, grading, and packing of the coming crop of fruit, as the returns for the labour expended in the upkeep of their orchards will depend entirely on the condition in which the fruit reaches the market. Many growers fail to realise the very important fact that the success of fruitgrowing does not depend merely on the proper working and management of the orchard, so essential for the production of a good crop of high-class fruit, but that the manner in which the fruit is handled and placed on the market is of even greater importance. In no branch of fruit culture is this more evident than in the case of citrus fruits, as no fruit pays better for the extra care and attention necessary to enable it to be marketed in the best possible condition. Every season there is more or less loss in the consignments sent to the Southern markets, the percentage depending mainly on the weather conditions, the loss in a wet year being much heavier than that in a dry year.

A very large percentage of the loss is due to what is known in the trade as specking—viz., a rotting of the fruit caused by a mould fungus, and this loss can be prevented, provided necessary precautions are taken. Although this matter was dealt with last month, it is of such vital importance to our citrus growers that it is necessary to again refer to it.

In the first place, growers must clearly understand that specking cannot occur on perfect fruit, the skin of which is free from injury of any kind. The fungus causing specking can only obtain an entry into the fruit through an injury to the skin; it will thus be seen that the remedy for specking is to take every possible care not to injure the skin of the fruit in any way.

Few growers realise how easily the skin of citrus fruits is injured, especially that of fruit grown under moist and humid conditions, when the skin is full of moisture and so tender that the least sign of rough handling causes serious injury, as the cells of the skin are so brittle that they are easily broken, and when so broken a ready means of entry for the mould fungus is provided, and specking follows in due course.

The remedy for specking is in the hands of the grower, who must learn so to gather, handle, and transport the fruit from the orchard to the packing-shed that it does not receive the slightest injury, and further, that when it has reached the packing-shed it must be carefully placed in shallow bins or on trays and be exposed to the air for at least seven days, so that the surplus moisture in the skin may be removed, and the skin thus becomes toughened and less easily injured. This drying of the skin is known as "sweating," and during the time the fruit is being sweated it should be kept under observation, and all fruit showing signs of specking or injury from fruit flies, sucking or boring insects, mechanical injury or bruising, should be removed.

In order to prevent injuring the skin when gathering, all fruit must be cut and not pulled. Gloves should be used to handle the fruit, and when cut it should be placed in padded baskets or other suitable receptacles. Any fruit that falls or is injured in any way should be rejected, as it is not fit to send to a distant market. At the same time, if the injury is only slight, it can be sent to a local market for quick sale.

For Southern markets only perfect fruit should be selected, and further, it must be graded for size, colour, and quality, and properly packed, only one grade of fruit being packed in a case. The cost of cases, freight, and marketing is now so high that only the best fruit will pay to send to the Southern States, and even the best fruit must be properly graded and packed in order to produce the best returns.

All orchards, vineyards, and plantations not thoroughly clean should receive immediate attention as from now till the next rainy season the ground must be kept in a thorough state of tilth and free from weeds in order, in the first place, to retain moisture in the soil, and, in the second, to enable birds, ants, and predacous insects to get at and destroy the pupæ of fruitflies and other pests harbouring in the soil.

Banana and pineapple plantations must be put into good order, and kept free from weed growth.

Land to be planted with trees should be got ready, as, if possible, it is always advisable to allow newly cleared land time to sweeten before planting.

Strawberries can still be planted, and the earlier plantings must be kept well worked and free from all weeds in order to get a good crop of early fruit.

Scrub land intended for bananas can be felled now, as there will be little more growth, and it will have ample time to dry off properly in time for an early spring burn. Do not rush scrub falling, as it is work that pays for extra care. Lopping will improve prospects of a successful fire.

Keep a keen lookout for fruit flies, and on no account allow any fallen fruit of any kind to lie about on the ground unless you are looking for trouble with the ripening citrus crop. Keep the fly in check, and there will not be any very serious losses; neglect it, and there will not be much fruit to market.

The advice given with respect to the handling and marketing of citrus fruit applies equally to custard apples, pineapples, bananas, and other fruits. In the case of bananas handled by the Committee of Direction of Fruit Marketing, grading is now compulsory, and it will undoubtedly tend to stabilise the market for this fruit.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

Practically the whole of the fruit crop will have been gathered by the end of March, but several of the later-ripening varieties of apples grown in the Granite Belt may be kept for a considerable time, provided they are free from fly or other pests and are stored under proper conditions. Varieties such as Jonathan can be kept for some months at a temperature of 31 to 32 deg., and later varieties, such as Granny Smith and Sturmer can be kept till apples come again if stored at the same temperature. At the same time, although storing the fruit at this temperature under artificial conditions enables them to be kept for many months, the fruit can be kept for a considerable period, and marketed from time to time as desired, by storing it in a specially constructed apple-house in or adjacent to the orchard where grown.

Such a store can be cheaply constructed in the side of a hill out of the soil of the district and slabs of timber. The soil will make excellent pisé for walls, and the roof may be constructed of slabs covered with soil. Such a store can be kept at a very even temperature, and if the air is changed during cool nights—not frosty nights—the temperature can be reduced to a low point—low enough to keep the fruit in good condition for many weeks.

All orchards and vineyards not already cleaned up must be put in order, and all weeds destroyed. Keep the surface of the soil stirred so as to give birds and insects a chance to get at any fruit fly pupæ, as it is necessary to destroy this pest whenever there is a chance of doing so.

Land intended for planting during the coming season should be got ready in order to expose the soil to the cold of winter, thus rendering is sweeter and more friable.

If there is any slack time in the course of the month, go over all surface and cut-off drains and put them in good order. Also, if during periods of heavy rain, soft or boggy spots have made their appearance in the orchard, do what draining is necessary, as badly drained land is not profitable orchard land, and the sooner it is drained the better for the trees growing upon it. Soft or boggy spots are frequently caused by seepage of water from a higher level. In this case a cut-off drain will be all that is necessary, but where the bad drainage is due to hard pan or an impervious subsoil, then underground drains must be put in. After draining, the land should be limed. Liming can be done now and during the following three months, as autumn and winter are the best times to apply this material.

When the orchard soil is deficient in organic matter (humus) and nitrogen, try the effect of green-crop manuring, planting the grey or partridge pea and manuring the ground for this crop with a good dressing of finely ground island phosphate or basic phosphate.

Where citrus fruits are grown, they should now be ready for marketing. If the land needs it, it should be given an irrigation, but unless the trees are suffering from want of water it is better to stick to the use of the cultivator, as too much water injures the keeping and carrying qualities of the fruit.

The remarks on the handling and packing of citrus fruits in the coast districts apply to the inland districts also, but these districts have an advantage over the coast in that, owing to the drier atmosphere, the skin of the fruit is tougher and thinner and in consequence the fruit carries better.

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON, F.R.A.S., AND A. K. CHAPMAN.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

1926.	MARCH.		APRIL.		MOONRISE. MAR.	APRIL.
Date.	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	p.m.
1	5·46	6·24	6·3	5·50	7·28	7·48
2	5·47	6·23	6·4	5·49	8·1	8·28
3	5·48	6·22	6·4	5·48	8·35	9·12
4	5·48	6·21	6·5	5·47	9·10	10·2
5	5·49	6·20	6·6	5·45	9·48	10·56
6	5·49	6·19	6·6	5·44	10·30	11·58
7	5·50	6·17	6·7	5·43	11·13	nil
						a.m.
8	5·50	6·16	6·7	5·42	nil	1·1
					a.m.	
9	5·51	6·15	6·8	5·41	12·7	2·5
10	5·51	6·14	6·8	5·40	1·7	3·5
11	5·52	6·13	6·9	5·39	2·9	4·16
12	5·52	6·12	6·9	5·38	3·16	5·22
13	5·53	6·11	6·10	5·37	4·25	6·25
14	5·54	6 10	6·10	5·36	5·32	7·28
15	5·55	6·9	6·11	5·35	6·38	8·30
16	5·55	6·7	6·11	5·34	7·42	9·30
17	5·56	6·6	6·12	5·33	8·45	10·28
18	5·57	6·5	6·12	5·32	9·46	11·22
						p.m.
19	5·57	6·4	6·13	5·31	10·46	12·13
20	5·58	6·3	6·13	5·30	11·43	12·59
					p.m.	
21	5·58	6·2	6·14	5·29	12·38	1·41
22	5·59	6·0	6·14	5·28	1·31	2·20
23	5·59	5·59	6·15	5·27	2·18	2·56
24	6·0	5·58	6·15	5·26	3·3	3·29
25	6·0	5·57	6·16	5·25	3·42	4·3
26	6·1	5·56	6·16	5·24	4·21	4·37
27	6·1	5·55	6·17	5·23	4·56	5·10
28	6·2	5·53	6·17	5·22	5·30	5·46
29	6·2	5·52	5·18	5·22	6·2	6·25
30	6·3	5·51	5·18	5·21	6·39	7·9
31	6·3	5·50	...	...	7·11	...

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 somewhere about six hours before the sun sets, and 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.

Phases of the Moon, Occultations, &c.

The times stated are for Queensland, New South Wales, Victoria, and Tasmania.

7 Mar.	☾	Last Quarter	9 49 p.m.
14 ,,	●	New Moon	1 20 p.m.
21 ,,	☽	First Quarter	3 12 p.m.
29 ,,	○	Full Moon	8 0 p.m.

Perigee, 13th March, at 9 30 a.m.
Apogee, 25th March, at 2 54 p.m.

During the first half of the month there will be no planet visible before 9 p.m. Although Neptune will be above the horizon, it will not be visible to the naked eye. The planets Saturn, Mars, Jupiter, and Venus, being on the west side of the sun, will rise before it at the following times near the middle of the month. Saturn, about 9·17 p.m.; Mars, about 1·10 a.m.; Jupiter and Venus, about 3 a.m. Mercury will be at its greatest elongation, 18 degrees 23 minutes east, on the 14th, and should be noticeable, low down in the west, about half-an-hour after sunset. The brilliancy of Venus, high up in the east before sunrise, will be remarkable about this time of the month.

6 April	☾	Last Quarter	6 50 a.m.
13 ,,	●	New Moon	12 56 a.m.
20 ,,	☽	First Quarter	9 23 a.m.
28 ,,	○	Full Moon	10 17 a.m.

Perigee, 10th April, at 12 42 p.m.
Apogee, 22nd April, at 8 48 a.m.

On April the 8th, between 2 and 3 a.m., an interesting occultation of the planet Mars will take place well up in the eastern sky. A pair of binoculars or small telescope will afford a pleasing spectacle in watching the approach of the Moon toward the planet about 2 a.m., and its disappearance behind the Moon a quarter of an hour or twenty minutes later; the reappearance of the planet may be watched for about 3 a.m. on the opposite or upper side of the Moon.

Jupiter will be in conjunction with the Moon on the 9th at 11·22 a.m., but being at a distance of nearly 5 degrees from it, and not far enough away from the sun, it will not form a good daylight spectacle even in a pair of binoculars or small telescope. On the 19th Venus will be at its greatest distance from the Sun 46 degrees 16 minutes to the west of it and will therefore rise 2½ hours before the Sun and set about 2 hours 10 minutes before it. On the 23rd Mars and Jupiter will be in conjunction, Mars being uppermost and about 1 degree or about two diameters of the Moon above Jupiter. On the 28th Mercury will be at its greatest distance 27 degrees and four minutes west of the Sun, Mercury will therefore rise 2 hours 3 minutes before the Sun, and set 1 hour 11 minutes before it.