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QUEENSLAND AGRICULTURAL JOURNAL

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Event and Comment.

The Wheat Yield—Record Bushel Weights—Estimate Exceeded.

THE Minister for Agriculture and Stock (Mr. W. Forgan Smith), in the course of a recent press announcement, expressed satisfaction with the statement of the Wheat Board concerning the extraordinarily high bushel weight of the new season's wheat in course of daily delivery at the Board's numerous depôts, ranging as it does from 64 to 67 lb. per bushel straight from the harvesting machines, and constituting what appears to be a world's record in this respect. These results go to strengthen the principle so generally advocated by the Department that the wheatgrower who designs and bases his cultivation and other work on scientific lines must ultimately succeed. It augurs well for the future development of this State that improved agricultural practices are gradually tending towards increased production which modern civilisation now demands. This harvest's high bushel weight will be associated nearly everywhere with high yields, and the estimated return of a few weeks ago should be easily surpassed. These yields go to show the possibilities of the development of the State as a producer of wheat, and give promise that wheat-growing might be engaged in successfully on a more extensive scale than at present, particularly in newer districts, such as the South-Western areas.

Last summer's rains were well up to the average, and where careful methods of cultivation were followed crop results were entirely satisfactory. Happily, the June rainfall was generous, fully 3 inches in most parts, and although the falls were light enough during the growing season of the wheat, rendering the outlook anything but promising in September, the October rains saved the situation, and the present magnificent crop is the result.

One has only to witness the activity displayed at the Wheat Board's receiving depots to realise the advantages of the growers' own system of organised marketing. "It is gratifying to know," added the Minister, "that the growers generally and their representatives on the Board are alive to the advantages of co-operating with

the officers of the Department of Agriculture who are assisting to put the wheat-growing industry on a better footing. Wheats bred and carefully tested out by the several Field Officers of the Department are now well distributed throughout the Wheat Belt. Some of these come under the category of high bushel weight combined with yield. 'Watchman' wheat, grown in the Maranoa district, is a notable example with an official weight of 68 lb. to the bushel (against the standard of 60 lb. to the bushel). This variety is a production of the Roma State Farm, and it is significant also that the first crop harvested this year in the Allora district, 'Novo,' which yielded 40 bushels to the acre, also had its origin at the Roma State Farm.

"A record crop of 'Pusa' wheat, grown in the Pilton district the season before last, returned 46½ bushels per acre. It is not at all unlikely that even this extraordinary yield will be exceeded this harvest. It is interesting to note that about twenty years ago a few grains of this variety were obtained in an exchange from India, and after a series of trials extending over several years to test the adaptability of the variety to Queensland conditions, it was brought into general cultivation, and ranks as one of the most favoured varieties at the present time.

"The recent innovation in the way of a Wheat Crop Competition will promote a great deal of interest, and will focus a closer attention on the part of the growers to the esentials of wheatgrowing as a business. The fifty-one crops entered in the competition are reported upon by Mr. Quodling, Director of Agriculture, the judge of the competing wheats, as being generally of a very high standard."

Queensland at Work—A Picture of the Tropical North.

"NOWHERE else can the same rural energy be seen—the fertile land oozing wealth, the busy farmers breaking in their fields and renewing their crops, the canecutters slashing down their abundant harvest, the fussy tramway engines dragging long lines of cane-laden trolleys through the fields to the nearest mill, where, working twenty-four hours a day with three shifts, elaborate machinery, and contented workers are squeezing out Australia's sugar." Mr. Donald Mackinnon, some time High Commissioner for Australia in America, had that to say in the course of a recent Press interview in Melbourne on North Queensland affairs. "The sugar belt, from Townsville to Cairns," he added, "is at the moment the most heartening part of Australia that any Australian can look upon. Our country can nowhere else show the same spectacle of man-directed energy. Nowhere else in the world is the white man handling tropical production with such success. There is a big Australian responsibility on those who are building up this part of our country. It is our vulnerable frontier, and we must be watchful lest, through misconception, we do them an injustice and discourage them in their important responsibility."

The Romance of Queensland.

"QUEENSLAND has more romance in its settlement than any other State," said Mr. Amery, Secretary of State for the Dominions in the British Cabinet, at a public function at Maryborough, which he visited in the course of his recent tour in this State. He added that it had been borne upon him what a great and rich State Queensland was. First, there was the romance in the fact that Queenslanders had courageously developed this great heritage of theirs with white labour. They had departed from all the experience of the past, and had embarked upon the experiment of building up a white civilisation from top to bottom in a tropical country. He warned them to avoid the great evils which resulted from a mixture of races of people of different planes of civilisation. They would certainly have to face difficulties—difficulties which to many other nations had appeared to be insurmountable. Time alone would show whether the ability and resource of her people would enable them to solve those difficulties. They had gone a long way towards vindicating the policy of a "White Australia" that they had set up. They had built up the sugar industry in Queensland by white labour. That was a great achievement, as that industry had hitherto been regarded as being capable of development by black labour only. He knew perfectly well that the maintenance of the sugar industry involved considerable sacrifices upon the part of Australia as a whole. But they had achieved this much. They had built up a great industry, which was conducted on a high level of technical efficiency, and by that means had supported a considerable population along this Queensland coast, which was capable in time of great development. Thus the experiment was at least well worth making. Time alone would show how far it would be successful. He was sure they had been well advised not to complicate their national life with racial problems. A policy such as the "White Australia" policy had never been attempted before in any part of the Dominions. Therefore, in respect of Queensland, that constituted a romance in itself

The Finger Cherry Causes Total Blindness—A Warning.

RECENT pathetic cases of total blindness in children, caused through their eating the fruit of the native loquat or finger cherry, have again aroused public attention. Warnings have been issued repeatedly by this Department as to the risk of eating or even handling this native fruit. In collaboration with the Department of Public Instruction, another notification has been widely circulated which emphasises the danger of its consumption which leads to the paralysing of the optic nerve followed by total and permanent blindness, and even death. A number of cases, the Minister for Public Instruction (Mr. Thos. Wilson) said, in his announcement to the Press, had lately been reported from the Cairns district, but his Department had taken action in this respect as far back as 1914. The circular just issued contained a coloured illustration, and one was being sent to each group of sixty children so that ample provision was made for the bigger schools. The printed statements in the circular set forth the danger accompanying consumption of the finger cherry and warning children against handling, eating, or having anything whatever to do with it. Teachers were asked frequently to direct the attention of the children to the illustration and facts set forth in the circular. The fruit occurred in the scrub lands between the Herbert River and a point beyond Cooktown. It has also been reported as existing as far south as Mackay.

An American Looks at Australia.

COLONEL BIRCH HELMS, representative of Messrs. Blair and Co., one of the leading bond operating houses in New York, lately visited Australia to investigate financial conditions. In the monthly publication of Blair and Co. he has issued a short statement of his impressions. He describes Australia as "a virgin land with wonderful pastoral prospects. In time it will feed and clothe the world, with its tremendous resources of wheat and wool, beef, dairy products, and fruit." The country, he says, has a promising future, but in attaining the peak of its development large investments of foreign capital will be required. Here England and the United States will find a useful opportunity for the investment of their funds. He says that through the adoption of a protective tariff Australia is endeavouring to build up an industrial community in its midst, and large foreign corporations are establishing their manufacturing plants in the several States of the Commonwealth. However, pastoral and agricultural development seemed to Colonel Birch Helms to be the great promise of Australia for the next few years, as the climate, like that of California, is very salubrious and equable. In fact, the average man lives under better conditions and has more time for recreation than has any other individual on the face of the earth—the American not excepted. Australia is described as an ideal country for pioneering Britons and Americans to settle in, just as was the Far West of the United States in the early eighty's. The pioneer spirit, he remarks, is welcomed in Australia, for it is this spirit of the country which is evidenced in the establishment of a new capital at Canberra for the Commonwealth, now aged only twenty-six years.

Primary Produce Experiment Stations.

FROM a farmer's point of view the most important measure submitted to Parliament in the present session was the Primary Produce Experiment Stations Bill, which was introduced by the Secretary for Agriculture (Mr. W. Forgan Smith) on 8th November. The object of this measure is to establish experiment stations to serve agriculture in general along lines similar to the organisation of the Sugar Experiment Stations, which have proved so valuable in the sugar industry. Under its provisions more immediate consideration will be given to banana-growing, which has developed into one of our best land-settling agencies. Further expansion of this industry must follow intenser settlement of our tropical jungle lands and, as in other forms of husbandry, the effective control of pests and diseases is a substantial factor in its success. Science is to be called into economic service, and by the establishment of experiment stations in what might be called strategical areas, it is planned to equip the banana-grower with all the information and guidance necessary for him to solve his biological, pathological, and cultural difficulties. Much research work of immense benefit to the industry has already been done by both the Department and the University, but it is obvious that the establishment of an experiment station right in the field, so to speak, will be followed by greater co-ordination of effort in community service and more active co-operation of the farmer with the scientist in the fight against the pests and diseases that levy undue toll on primary industry. One of the special features of this issue is the report of the Minister's second-reading speech on the measure, which will be read with interest by all concerned in the enrichment of our rural life.

Bureau of Sugar Experiment Stations.

THE SEASON'S SUGAR PRODUCTION.

The Director of Sugar Experiment Stations (Mr. H. T. Easterby) has announced that the tonnage of cane to be crushed this season, according to the estimates supplied by the mills, is about 3,576,092 tons.

This should give an output of some 483,000 tons of raw sugar of 94 net titre for Queensland, which will be the highest production, with the exception of 1925, when it reached 485,585 tons of raw sugar for Queensland.

The present season has been exceptionally favourable to the ripening of the crop, and the commercial cane sugar in the cane has been on the high side at nearly every sugar-mill.

The production in New South Wales will be about 23,000 tons of raw sugar. This is not so good a crop as last year. With the small production of beet sugar in Victoria, the total yield for Australia should be about 508,000 tons, practically all raw sugar, and it has been necessary to export sugar overseas in larger quantities than in 1926.

ENTOMOLOGICAL ADVICE TO CANEGROWERS.

By EDMUND JARVIS, Entomologist.

Be Ready to Combat French's Cane Beetle.

During the present season third-stage grubs of *Lepidiota frenchi* Blkb. may be expected to cause local damage to young shoots of plant and ratoon cane. These grubs, after having passed the winter in their second instar in resting-cells situated from 15 to 20 inches below ground, usually moult for the last time as soon as warm weather commences, and making their way to the upper and warmer portion of the soil start feeding again.

Keep a good lookout for indications of the presence of this cane pest, which is betrayed by sudden wilting and yellowing of the affected shoots. Fortunately such attack is generally confined to small areas, and on this account may easily be overlooked when affecting a stool here and there. In the event of decided infestation, extending over several square chains, it is advisable to fumigate the stools with carbon bisulphide. This should be done with as little delay as possible, as two or three third-stage grubs of this beetle are able to effect serious root damage in a period of twenty-four hours. Use an ordinary hand pal-injector, such as can be supplied by Danks and Co., of Melbourne, or Cooper, Pegler, and Co., Limited, London E.C. Allow at least four days to elapse after a heavy downpour before fumigating friable well-drained volcanic soils, and six to eight days in the case of clay-loams.

Treat both sides of affected rows with ¾ oz. injections made 15 to 18 inches apart and 4 to 5 inches from the nearest plants.

Keep the top soil in loose well-worked condition throughout the aerial existence or flighting season of the beetles.

Watch for Emergence of Cane Beetles.

Greyback cane beetles are likely to emerge this month, immediately after the first heavy thunder showers. Any farmer chancing to notice unusual numbers of these beetles congregating in one place, in a manner suggesting that something might have attracted them to the spot, are asked to at once communicate with the Entomologist at Meringa Experiment Station, by 'phone or by wire, in order that such occurrence may receive thorough investigation.

In the event of large numbers of greybacks being observed in feeding-trees growing close to cane land, these should be collected and destroyed. Control work of this kind will be found profitable during a period of about six weeks dating from the day of emergence of cockchafers from the soil. The position near fences of favourite food-plants of this cane beetle—notably the native figs of either small-leaved varieties, such as the "weeping fig" or broad-leaved kinds, or the so-called "Moreton Bay Ash" (*Eucalyptus tessalaris*)—should be located a few days before appearance of the beetles, to be collected from during the flighting season.

Moth Borers are still doing Damage.

Young shoots of ratoon or plant cane showing "dead-hearts" should be cut out, taking care to sever same at a point about 2 inches below ground level, and be either burnt or crushed to destroy caterpillars or pupæ or moth borers, three species of which are at present breeding in cane shoots.

CANE BORING INSECTS.

The Director of Sugar Experiment Stations (Mr. H. T. Easterby) has received the following report from Mr. J. H. Buzacott (Assistant to Entomologist at Meringa Experiment Station) on a recent visit to the Babinda area. This was undertaken in order to obtain puparia of Ceromasia sphenophori, and to make certain observations in connection with the occurrence in that district of various cane-boring insects.

BABINDA.

This district was visited on the 2nd October, and whilst there the opportunity was taken to inspect some of the outlying sections as well as farms in the immediate vicinity of the town.

Beetle Borer *(Rhabdocnemis obscurus* Bois.).

The beetle borer was the chief pest met with, and this was fairly bad everywhere. The infestation was at its worst in Badila crops, although Clark's Seedling had also suffered considerably.

On many farms Tachinid flies were found to be firmly established, but these latter received a severe check during the cyclone; for whilst the terrific wind and rain would easily destroy the delicate adult flies, at the same time damaged cane and humid weather would present ideal conditions for a heavier infestation of borers. In fact, the borer was noticeably present in the tops of practically all cane that had been injured during the blow.

Grubs.

Very few blocks of cane obviously affected by grubs were seen, and an area at Mooliba which, last year, was markedly attacked, this year shows no indication of their presence. On one selection at Bartle Frere, male digger wasps were seen in large numbers, flying over the ground between the rows of young cane and presumably awaiting the emergence of females.

Large Moth Borer *(Phragmatiphila truncata* Walk.).

"Dead-hearts" caused by caterpillars of the large moth borer were in evidence everywhere, particularly in cane closely bordered by dirty headlands. Quite a number of pupæ were found on stripping the trash from the tops of the cane.

Tineid Moth Borer *(Ephysteris cheresaea* Meyr.).

Larvæ of this minute insect cause similar damage to that caused by the large moth borer, but the Tineid only tunnels in very young shoots, principally of ratoon cane. It was encountered in many places, and at Mooliba was seriously damaging the shoots of young ratoons.

Bud Moth *(Opogona glycyphaga* Meyr.).

The bud moth was quite common, but its larvæ did not appear to be causing severe damage anywhere.

Army Worms.

One of the species of army worm (*Cirphis unipuncta*) was very prevalent, and at Babinda was responsible for stripping to the midrib the leaves of 7 acres of young plant cane. At the time when the inspection was made, all the larvæ had pupated in the soil, and an Ichneumonid wasp (*Lissopimpla scutata* Krieg.), one of the chief pupal parasites of this army worm, was to be seen in thousands flying over the field. It is probable that very few of that destructive brood of caterpillars will escape the assault of the Ichneumons and various other parasites, and so the cane will not be further destroyed by an attack of a second and larger brood of plague worms.

Other of the very minor pests were observed, such as Linear bugs, aphides, and leaf-eating beetles, but as these were not of any economic importance, no comment is made upon them.

CANE PEST COMBAT AND CONTROL.

The Director of the Bureau of Sugar Experiment Stations (Mr. H. T. Easterby) has received the following report from the Entomologist at Meringa, Mr. E. Jarvis, on the work of this Experiment Station during the period, September to October, 1927:—

Fumigation of Pupae of Greyback Cockchafer.

Laboratory experiments conducted at Meringa during August, 1921, proved conclusively that pupæ of this cane beetle, when lying in compact soil, quickly succumb to fumigation with carbon bisulphide, the fumes from which appear to find ready entrance through the large open spiracles described last month (August to September report). Following up this matter, preliminary field tests conducted during September, 1921, demonstrated that this fumigant is able also to penetrate through the walls of the subterranean pupal chamber of this beetle; injections made at a depth of 8 inches from the surface in ploughed ground proving fatal to pupæ lying at an average depth of 11 inches. Subsequently, in 1923, it was found that half-ounce injections of bisulphide, administered on both sides of rows on which the cane had been destroyed by grubs, and placed 15 inches apart, 6 inches from centre of stools, and 8 inches deep, yielded excellent results on red volcanic high land, which had been ploughed about 5 inches deep. When examined twenty-four hours later we discovered that the fumes had entered pupal cells situated fully 18 inches below the surface, and in those where transformation from pupa to perfect insect had taken place had killed the beetles.

Some of the Dangers induced by "High Cutting."

An extract from a publication dealing with the control of conditions associated with root diseases of sugar-cane appeared in last month's "Australian Sugar Journal" (vol. xix., p. 372), in which certain ill-effects likely to result from the careless practice of high cutting were pointed out by the author, J. A. Faris, of the Cuba Central Experiment Station.

Irrespective, however, of such drawbacks as reduction of plant vitality—owing to the failure of shoots springing from buds above ground to establish roots—it will interest Queensland growers to learn that in portions of the Cairns district high cutting has a tendency to encourage the activities and distribution of the smallest of our three common moth borers of cane, *Ephysterus chersæa* Meyr.

This little insect, which has been termed "Tineid moth borer" (see Bulletins Nos. 11, 18, 19, 3 (revised edition)), was described by the present writer in the year 1919, when bred for the first time from young ratoons collected at Meringa, Kamma, and Pyramid, the tiny caterpillar tunnels in the basal portion of young cane shoots (5 to 10 inches high) biting through the central core and killing the heart-leaves. Outwardly the damage corresponds in general appearance with "dead hearts" caused by our two other moth borers, *Phragmatiphila truncata* Walk. and *Fossifrontia* sp. Unlike larvæ of the latter moth, however, the caterpillars of *E. chersæa* never feed upon or inhabit the central rotting core, often, indeed, vacating a shoot as soon as having tunnelled across the juicy basal portion, and entering another ratoon. During August, 1926, an outbreak of this borer occurred at Redlynch, Stratford, and Freshwater, near Cairns, among ratoons growing both in alluvial sandy soils, and high lands of volcanic origin; the cane attacked being in all cases Badila.

Further, during the present month (September, 1927), this pest was reported by Mr. J. H. Buzacott, Assistant to Entomologist, as occurring rather commonly in shoots of ratoon cane on various cane areas around Mooliba, in the Babinda district.

Not being an indigenous species but having, in the opinion of Dr. Guy A. K. Marshall, been probably introduced into Australia from Natal, it is quite possible that in the absence of its own natural enemies and other controlling agencies this insect might in a country like Australia increase abnormally and, perhaps, become troublesome to canegrowers in the near future. In India it bores the stems of rice plants (*Oryza sativa*) and certain native grasses, but appears to be effectively controlled in that country by its natural parasites.

In the Cairns district this moth attacks chiefly ratoons which, on account of high cutting, happen to spring from buds situated above ground level, such injury being far less noticeable among shoots of plant or first ratoon crops which originate mostly from buried eyes. During an infestation at Pyramid, occurring on a clay-loam river flat, an average of about one-third of all the ratoons in each of the twenty stools examined—taken from three different spots on the affected plantation—had been destroyed by moth borers during a period of less than four weeks' growth; about 50 per cent. of this loss having been effected by *Ephysteria chersæa*.

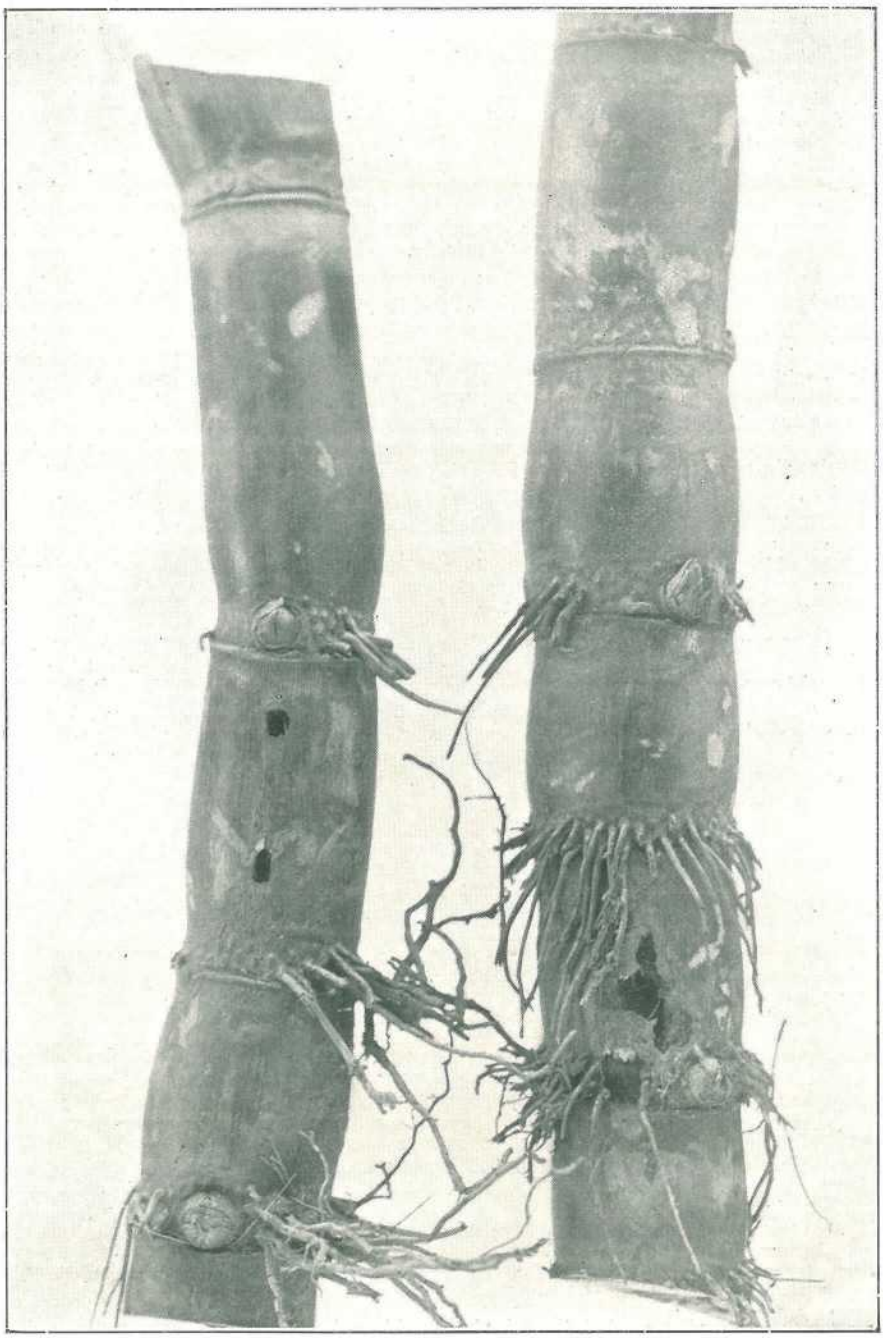


PLATE 145.

EXAMPLE OF GOOD CUTTING, AT ABOUT GROUND LEVEL, SHOWING POSITION OF BORER TUNNELS CLOSE TO THE GROUND, AMONGST ADVENTITIOUS ROOTS DUE TO SHADED CONDITIONS BETWEEN THE CANE ROWS.

High Cutting Encourages Breeding of Weevil Borers.

Growers should note also that high cutting of cane chancing to be infected by the beetle borer, *Rhabdocnemis obscurus* Boisd. cannot be too strongly condemned.

The larvæ (grubs) and pupæ of this dangerous pest generally occur in the last inch or two of the stick nearest the ground, this being especially the case in light infestations, when the bottom of the cane at about ground level is almost invariably the portion attacked. One of the best methods of controlling this beetle borer is to cut the crop low, by which means practically all the larvæ and pupæ likely to be present on a plantation are thus removed from the land and destroyed during the process of milling. In the event of high cutting of the crop, however, a large percentage are sure to be left behind, and these larvæ, after transforming into pupæ and stopping in their tunnels for a time, ultimately produce beetles which at once turn their attention to next season's ratoons.

The accompanying photo. of basal portions of cane sticks (from a crop slightly attacked) illustrate the abovementioned habit of this insect of injuring the cane at about ground level.

Evidence of this may often be seen on trucks of borer-affected cane standing in a mill yard, where it will be noticed that about 60 per cent. or more of such damage is usually betrayed by holes in the bottom ends of the sticks, indicating where tunnels of this beetle borer have been cut through transversely.

Controlling Third-stage Grubs of *Lepidiota frenchi* Blkb.

In districts where good rains were experienced in September the grubs of *Lepidiota frenchi* ("French's cane beetle") may be expected to cause damage during the next three months (October to December). This will be effected by grubs which have passed the winter in resting cells, 15 to 20 inches below ground level; and after moulting into the third instar made their way to the surface upon feeling the approach of warm weather.

Damage by this pest is fortunately confined mostly to small areas of a square chain or so, on which in many cases only a few stools are seriously affected; external symptoms resembling those caused by grubs of the greyback cockchafer.

Upon first observing signs of wilting or yellowing of the leaves, no time should be lost before fumigating such stools with carbon bisulphide. Be careful to allow at least four days to elapse after a heavy downpour before treating friable, well-drained soils, and six to eight days in the case of clay-loams.

CANE PESTS AND DISEASES.

The Director of the Bureau of Sugar Experiment Stations, Mr. H. T. Easterby, has received the following report upon the Mossman district from the Assistant to Pathologist, Mr. E. J. F. Wood, B.Sc., for the period 5th October to 13th October, 1927:—

MOSSMAN.

The disease situation in this district seems to have improved upon that which prevailed last year, for many fields have been pointed out to me as having been ploughed out owing to Leaf Stripe infection. As the season is more than half over, the present is rather an unsatisfactory time to come, as it tends to lower the percentage of disease observed. Much of the ratoon cane is not yet old enough to allow of inspection, and this will be the case until the new year. Furthermore, many of the blocks which remain uncut at present will be ploughed out, as cane intended for ratoons is usually cut earlier to give the crops time to mature for next year. For these reasons the inspection made recently will give an erroneous idea of the amount of disease present, as it is apparent to one in the district that Leaf Stripe is more prevalent than my figures for the farms inspected show. The work given in this report is based on the general trend of things in the area.

I am very pleased that the mill is attacking the question of seed control, and must congratulate the manager and cane inspector on the vigour with which they are working along these lines. The farmers are urged to buy all plants from other farms solely through the mill, so that they will have a reasonable chance of getting healthy plants. I am also glad to see that many farmers appreciate the effort that the mill is making in this direction, and I think that they may rest assured that the Pathological Staff of the Bureau will give them all the assistance that they

can. The cane inspectors usually make a preliminary inspection of cane which is to be sent to another farm, and this is the only satisfactory way of exchanging plants.

I know of one case where a farmer was warned by one of our staff that a block of cane was diseased, and, subsequently sold it to other farmers for plants. Luckily, they were warned in time, and the majority did not plant it. This sort of thing is criminal, and steps should be taken to punish a farmer who knowingly sells badly diseased cane, and thus jeopardises the whole district. This sort of thing undoes all the work that others may do to control the disease situation.

There is still one stool of Mosaic in the area, and the farmer through negligence still allows it to remain. It has now been there two years, and the farmer has known about it. Just at present it is not showing, as the cane has just been cut, but I urge him to get rid of it as soon as it does show.

Leaf Stripe and Leaf Scald are the two serious diseases in the district, and both are widely distributed. The former attacks B. 147, Q. 855, and D. 1135, so that these canes should be carefully watched, as also should Pompey, which is being planted on the poorer soils. Where the disease is bad the cane should be ploughed out after harvesting, as the wind-blown fruits are easily carried, and the disease can spread rapidly with the prevailing wind. In lightly infected fields, the diseased stools should be ploughed out, especially on those to windward. Burning the trash of infected fields is advisable, and the wholesale burning of cane probably tends to prevent the disease from spreading more than it does.

Leaf Scald was observed to be causing considerable damage in a field of Badila at Whyambeel Creek, and in Goru and Clark's Seedling near the town. The latter two canes are affected all over the area, though there are some farms in which the latter variety is clean. On one farm the disease was seen badly affecting a young field of plant cane of this variety—due entirely to lack of seed selection. This field was planted by contract without proper supervision. Luckily most of the diseased cane was dying, but not enough to prevent a few stools carrying the trouble over to the ratoons.

In the Mowbray area no Leaf Scald or Leaf Stripe was found, and here is a source of clean seed cane for the other areas. On some of the farms on the River, Spindle Top was seen, though this trouble seems very restricted. Other farms were apparently clean, and the thick black Badila is the truest to type seen since I left Ingham.

The following areas were visited:—Both banks of Whyambeel Creek up to Falls Creek, Saltwater, Myalo, Boondarra, Ferndale, Cassowary, and Mossman itself; and Scald and Stripe occur in all of them.

With regard to varieties—

Badila needs careful attention and selection of plants to free it from Leaf Scald.

Clark's Seedling (H.Q. 426) is a very sweet cane and well suited to the area, but is very susceptible to Leaf Scald, though not to Leaf Stripe. Farmers with infected fields should get rid of the variety as soon as possible and then get clean seed from another farm through the cane inspector. Scald will wipe out the cane, as at Goondi.

Goru should be a prohibited variety, as it is only a carrier for Leaf Scald.

Pompey should be carefully watched and its planting regulated, as it is known to be highly susceptible to Leaf Scald and Leaf Stripe. I regard it as dangerous in this area.

Q. 813 is a cane with very fine powers of disease resistance, and gives a fair crop with a good density. It matures early, strikes and ratoons well. It is not planted nearly as much as it deserves.

E.K. 28 gives a good density and crop, planted at the right time, but is a slow striker and ratooner. It should not be planted at Mossman before September, and matures late. It is susceptible to disease and should be watched.

Korpi, Oramboo, Nanemo are apparently giving good crops in tonnage and c.c.s., and the two former canes are worth a thorough trial. The latter is suspected of being susceptible to Leaf Scald, though little exact information on these canes is available.

B. 147 is highly susceptible to Leaf Stripe and should not be planted where this disease is present. Otherwise it is a good cane.

Q. 855 is also susceptible to Leaf Stripe, but is a good variety otherwise.

B. 156 is susceptible to disease, and is not a desirable cane.

The Director of the Bureau of Sugar Experiment Stations (Mr. H. T. Easterby) has received the following report on the Cairns district from the Assistant to Pathologist (Mr. E. J. F. Wood, B.Sc.) for the period 13th October to 16th November:—

CAIRNS.

The disease situation in the Cairns district is not satisfactory, as, apart from the presence of Leaf Scald and Top Rot, which are widespread, there are Mosaic, Gumming, and Leaf Stripe in limited areas, and the farmers do not seem to realise sufficiently the importance of exterminating them before they become a serious menace to the industry. It is in order to impress this aspect on them that I submitted a separate report on the Mosaic and Gumming situation in this area.

Leaf Scald.

Leaf Scald is widespread, and was observed in the Mulgrave area at Aloomba, and right through to Deeral. It is very prevalent in this area, but less so at Highleigh, and occurs on most farms at Riverston, Upper Mulgrave, and the Little Mulgrave. In the Hambledon area the disease is, on the whole, more prevalent than at Mulgrave. No plant control is exercised, and the result is ignorance on the part of the farmer, who is also uninterested in control, so long as the diseases do not interfere with his tonnage. The percentage of diseased plant cane was, I think, greater than that at any other mill except South Johnstone, and perhaps Mourilyan.

Top Rot.

Top Rot is occurring all over the area, and is very puzzling in the aspect that it presents. It was seen on the Upper and Lower Mulgrave, at Aloomba, Sawmill Pocket, and through the Gap, at Freshwater, Redlynch, Jungarra, and Smithfield. It seems to be at its worst, however, on the river flats. In all cases it is in the "red streak" stage, and has been reported to have appeared and disappeared again in the course of a fortnight. On one farm a field was inspected and found free, and a fortnight later showed the disease on reinspection. At the beginning of my visit (17th October) the disease was hard to find, even on farms which are, as a rule, very subject to the disease, while at the end, a month later, it was showing up very markedly on most farms in the Freshwater area, where it seems to be most prevalent.

Leaf Stripe.

Leaf Stripe is confined to a small patch at Highleigh which is to be ploughed out, one which is being carefully rogued and on which no disease could be seen at Hambledon, and four farms at Sawmill Pocket. The affected varieties are D. 1135 and Pompey. Clark's Seedling, both at Mossman and on the Burdekin, seems to have some powers of resistance to this disease, and it would perhaps be well to replace the susceptible canes by this variety, for the time being at any rate. The danger lies in the susceptibility of B. 147 to the disease, as this cane is extensively grown in the Mulgrave area, and is gaining favour at Hambledon.

Cane Varieties.

It is suggested that, if possible, the varieties Korpi and Oramboo be introduced to the areas, as Pompey and Clark's Seedling are susceptible to diseases. Nanemo seems to be susceptible to Scald, for this disease was seen in the variety at Babinda, and in the Mulgrave. Q. 813 is a cane worth growing, and some farmers have already had good results from this cane. The resistance of this cane to disease is well known.

The farmers are urged to do their utmost to get rid of the diseases which are just coming into the district, even if it necessitates drastic measures, and to watch the planting of all Badila and other canes so as to control Leaf Scald.

Farmers in the Cairns district who desire information with regard to diseases should get in touch with Mr. Curlewis, the secretary of the Cane Growers' Council, who will communicate with me, or with the Pathologist who happens to be nearest.

The Director of the Bureau of Sugar Experiment Stations, Mr. H. T. Easterby, has received the following report (17th November, 1927), on Mosaic Disease in the Cairns district, from the Assistant to Pathologist, Mr. E. J. F. Wood, B.Sc.:—

Mosaic Disease in the Cairns District.

This disease has previously been reported by Mr. Gibson, Northern Field Assistant, from two farms in the Hambledon area, and the occurrence was confirmed by Mr. Kelly, of the Bureau. It was seen in both cases in Shahjahanpur, a cane after the Uba type, which has a thin stick and is a profuse stooler and is, in Queensland, 100 per cent. infected with Mosaic as far as our records go.

I have to report a new occurrence of the disease in the Mulgrave area, where no previous records of the trouble exist, except for an isolated case at Aloomba in H. 109. This block and one of the infected farms at Hambledon have been ploughed out, but the other block, which has been in existence for some years, is being cut, and the farmer promises to plough it out.

An example of the danger of leaving such a field came under my notice recently. A farmer happening to be on this farm saw the cane which is carrying the disease, and which incidentally shows little signs of the infection, and thinking it a new variety, took some plants home, with which he filled up the misses in some plant cane (Pompey). Now Pompey is a highly susceptible variety which shows up the disease very markedly in loss of tonnage, and the spindling and dwarfing of the stick, so that, had I not gone on to the farm when I did, it is possible that all his varieties would have been badly infected during the next few years, for all his canes (H.Q. 426, Pompey, and D. 1135) are very susceptible. In this way, the negligence of one farmer and the extreme carelessness of another might have laid the district open to an epidemic of another serious cane disease.

With regard to the Mulgrave outbreak, which occurs at Highleigh, this is in two fields of B. 156, the plants in both cases having been brought from Mossman. This cane is highly susceptible to disease, especially Mosaic, and should on no account be planted in the Mulgrave area, especially after this discovery. Both the farmers on whose farms the disease occurs have planted up areas of the diseased cane, and this is going to serve as a source of infection to the other farms and varieties in the district. The farmers are urged to get rid of these fields as soon as possible. It would pay them to plough the canes straight out, and to cut their losses.

A rather peculiar feature about the Mosaic in the Cairns district has been its slowness in spreading by secondary infection, and this is possibly due to the fact that the carrier is not present in the area or is at least unimportant. Many farmers, especially in the Mulgrave area, have recently planted corn, and it is well known that the corn aphis is an insect vector of Mosaic. Whether this insect is present on the corn I do not know, but I do not doubt that it will soon become so, and when it does we will have the complete cycle for the spread of the disease. I have seen Mosaic on the corn so planted. For that reason I would warn the farmers against the planting of maize, as they will see from Mr. Bell's reports to the Bureau, the ravages of Mosaic where it is grown with corn in Louisiana.

We must look to the immediate future as well as to the present, and even the biggest rivers have small beginnings. It is from such negligence, or lack of knowledge as I have instanced above, that most of the serious epidemics of diseases in canes have begun. The introduction of half a dozen sticks of gummed cane is supposed to have caused a serious outbreak of this disease on the Clarence. This is the reason for my stressing the occurrence of this disease, which is able to cause most serious ravages.

It has done so in South Africa, where they have been reduced to the planting of Uba, which is, I think, agreed by men who have studied the question to be a very retrograde step, but the only one which could cope with the situation. This is the opinion of all those whom I have met who have studied the Uba question abroad. The same course was adopted in Porto Rico, and the Bulletins which they published at the time show what ravages the disease was causing there. Cuba controlled the disease by seed selection and rogueing or digging out the diseased stools, and vast sums of money were spent on this. In Louisiana the position is still critical, as Mr. Bell's report shows, and even in the southern districts of Queensland the position is far from satisfactory.

Mosaic is an insidious disease which does not seem to affect the crop to any extent, and may at the same time reduce the tonnage very greatly. Five tons per acre are not unusual, but this does not appear to any extent to a man looking at the field, and 5 tons on 30 acres are 150 tons, roughly £300.

The time to strike is at present, before the disease gets a hold. It is wrong to say "it is not spreading" and to take no more notice, for by the time it really does spread it will be too late to eradicate the disease without very great expense.

Gumming.

The gumming situation at Aloomba seems to have improved considerably, and only one farm was seen to be infected. The cane was H. 109, and the farmer has ratooned it again in spite of my advice. Gum is an insidious disease and seems to lie dormant sometimes for long periods, so it is hard to state the exact position. Farmers should watch for a recurrence of the disease, and should plough out the cane as soon as possible after they notice the trouble. There is no need to do more than to point to the trouble which the Bundaberg mills have had with gum this year.

Cane Crops Prospects.

The Director of the Bureau of Sugar Experiment Stations, Mr. H. T. Easterby, who has been visiting the sugar districts of Cairns, Innisfail, Mourilyan, South Johnstone, Herbert River, Mackay, and Bundaberg, has returned to Brisbane. He reports that the present season has, on the whole, been particularly favourable to the growth of cane, and has also had a marked influence in ripening the crops, so that the commercial cane sugar this year has been exceptionally high. The consequence will be a large yield, second only to the 1925 season.

In every district the outlook for next year is most favourable, and if the ensuing climatic conditions are good, it is possible that the 1925 season may be eclipsed.

CAIRNS.

At Cairns, the mills were working smoothly and putting through large tonnages of cane every week. The crop, due to the cyclone earlier in the year, was not so large as in the two previous years, but was of excellent quality. Great quantities of sugar were being manufactured and shipped away. Parts of the Cairns district were dry and wanted rain, but showers have since fallen.

A visit was made to the Atherton Tableland with the secretary of the Cairns-Mossman Cane Growers' Executive (Mr. Curlewis), and the Mulgrave Mill cane inspector (Mr. Hoare) and two officers of the Sugar Bureau, for the purpose of inspecting cane growing on the Tableland and at the Kairi State Farm as to its suitability for plants, and to ascertain if a supply could be depended on. The Cairns executive have taken this matter in hand, and the Bureau will, by means of its officers, inspect the cane from time to time as to freedom from pests and diseases.

JOHNSTONE RIVER.

The next district visited was the Johnstone River. At Innisfail the weather had been dry and cool for some time, but useful showers were then falling. The cane was cutting out well. Matters at South Johnstone Mill had considerably settled down, and the mill was putting through about 6,800 tons of cane per week. Owing to the long drawn out industrial turmoil, however, it will be impossible to crush all the cane, and the estimate has been reduced by some 50,000 tons of cane, some of which being cut late last year may stand over. Up to the end of October 81,000 tons of cane had been crushed.

The Goondi Mill was doing fine work, and it is expected that all the crop will be harvested by the end of this month.

At Mourilyan, a new fourth mill had been put in. This factory was experiencing a good run. The average commercial cane sugar for the season had been 14.5 per cent., but at the end of October was 15.3 per cent. Many new improvements to the mill were noticed.

The Tully Mill was handling a big crop and working most successfully. The very high tonnage of 8,051 was put through the rollers during one week.

Owing to shipping shortage sugar stocks were not getting away as rapidly as desired. 2,500 tons of raw sugar were stored at Mourilyan, and 3,500 at the South Johnstone Mill.

Grubs were not very bad this season, but the beetle borer was greatly in evidence. The most serious disease is Leaf Scald, to which the Pathologist of the Bureau was devoting considerable attention.

Owing to the prolonged cool weather the germination of the young plant cane was slower than usual at this time of year.

The harvesting of the experiment plot at South Johnstone was finished on the 25th October. Some of the new seedlings raised at that station had given fine results, one in particular yielding 77 tons of cane and 11 tons of sugar per acre. It is hoped that next year a few of these new South Johnstone seedlings will be available for distribution.

HERBERT RIVER.

Thanks to the courtesy of the Colonial Sugar Company's officials, the writer was enabled to see a great deal of the Herbert River in a short time. This district has made a wonderful recovery from the appalling disaster which overtook it in February last by floods. Nature can overcome its ravages, but the large loss of life which then took place will not be forgotten quickly. Large plantings of cane have taken place in all areas, and, if favourable weather ensues, a tremendous crop is anticipated for next year. Grubs were not doing much damage and the beetle borer is not affecting more than 1 per cent. of the cane. The disease situation is being kept well in hand by the company on the Herbert River.

MACKAY.

A record crop is being harvested in the Mackay district, and it is anticipated that 100,000 tons of sugar may be manufactured. The present official estimate for Mackay is 98,000, but if the commercial cane sugar content is maintained the crop may easily reach the century. This district is in a very prosperous condition, as land values have never been inflated and the wealth produced is largely spent in the district. The mills are all doing excellent work, and some high tonnages are being crushed weekly. The commercial cane sugar is very high. Demonstrations of the Falkiner Cane Harvester were taking place during October. This is an elaborate machine, very different to the original. It is not yet perfect, and requires further experimentation.

The Farleigh Mill at Mackay has a big crop this year, and since its taking over by the farmers last season has been doing well. A large tonnage of cane (55,000 tons) is now drawn from the Northern coastal areas opened up by the railway. It is contemplated to put in a new large fourth mill next year. The mill has done and is continuing to do good work. At one time a large quantity of Uba cane was grown (up to 25 per cent.). This has now declined to 2 per cent.

BUNDABERG.

A fine harvest is also being experienced in the Bundaberg district, though some crops were affected by frost earlier in the year, and a considerable area has been injured by the gumming disease, which, unfortunately, is very prevalent this season. More resistant varieties must be introduced. So far Q. 813 and H. 227 show great resistance to the gumming disease. Varieties showing high resistance to this disease in other countries have been imported by the Sugar Bureau for trial, and it is also hoped that some of the new South Johnstone seedlings will also prove resistant.

The weather experienced in the North was wonderfully cool for this time of year, due to the prevalence of south-easterly winds. As a rule, the north wind is much in evidence in October and November, but not so this year. Another factor was the continued cloudy weather. It looks like a repetition of the 1916 season, which was followed by a record crop. Everywhere large areas have been planted, and if conditions remain favourable a large crop should eventuate next year.

The Assistant to the Entomologist at Meringa, Mr. J. H. Buzacott, has submitted the following report (18th November, 1927) to the Bureau of Sugar Experiment Stations:—

HAMBLEDON AREA.

The following pests were observed during the week ending 10th November, on farms served by the Hambledon Mill:—

Wasps Attacking Sorghum.

On the 1st November a visit was made to Redlynch to observe some wasps attacking a crop of sorghum out there. They proved to be specimens of a small *Crabronid* which were nesting in the stems up near the seed head by tunnelling out the pith and stocking the cavity thus formed with small flies (*Acalyptrata* and *Trypetidæ*). Practically every stick in the small crop examined was treated in this manner, the nest occupying about a foot of the upper end of the stem. The infestation is hardly of economic importance, as neither the growth nor the seeding of the sorghum seems to have been affected, although in a heavy wind the weakening of the stems thus would probably cause them to break.

It is most unlikely that this same insect would ever tackle cane, unless perhaps the stem of the arrow when the cane went to seed.

Beetle Borer.

Some farms on the Barron River flats, which in the last few years have not had beetle borers, are suffering from its ravages this year. The February flood and cyclone is probably responsible for this spread or reappearance, whichever it may be, but the infestation was comparatively light in every case which came under notice.

Moth Borers.

The moth borer has been bad at Sawmill Pocket this season as evidenced by the large number of "dead-hearts" to be seen. These are particularly numerous in places where the flood deposited debris.

In Stratford, Freshwater, and Redlynch "dead-hearts" were also fairly common.

Tineid Moth Borer.

This little pest (*Ephysteris chersæa*) was damaging young ratoons at Redlynch and Freshwater.

Grubs.

Grubs of French's Cane Beetle (*Lepidiota frenchi*) are up working after their resting period deep down in the ground. They are now in the third stage, and are considerably damaging cane in Sawmill Pocket. They are eating the sets of young cane bare of roots, and the consequent wilting and dying of the leaves is becoming very noticeable.

Termites.

A small species of termite (*Coptotermes* sp.) was discovered to be the cause of young plant cane dying on a farm at Edmonton. The termite was completely hollowing the sets, thereby removing the shoot's source of nourishment. The field in which they were observed was surrounded by forest and the soil was very dry. It was probably to obtain moisture that the termites attacked the cane. The small brown house ant (*Pheidole megacephala*) was exerting a considerable control by attacking the termites.

Leaf-eating Beetle.

The leaf-eating beetle (*Rhyparida morosa*) was found congregating on a small fig plant (*Ficus opposita*) growing in a canefield. There must have been many hundreds of the small beetles on the fig, and riddled cane leaves nearby showed that they had not confined their attentions to the fig leaves.

The Director of the Bureau of Sugar Experiment Stations, Mr. H. T. Easterby, has made available for publication the following report for the period October-November, 1927, from the Southern Assistant Entomologist, Mr. R. W. Mungomery:—

THE CANE-ROOT APHIS.

Mention was made in a previous report (see "Queensland Agricultural Journal," October, 1927, page 338) of a subterranean aphis which attacks the roots of sugar-cane, and which was found in association with the mound-building ant *Aphænogaster longiceps* Sm. This aphis is in all probability a native species, but on account of its secluded life it has remained unnoticed and undescribed. The actual instances of subterranean aphides attacking cane roots in Queensland have been comparatively rare, but as aphides are much more numerous in temperate regions than in the tropics, it is likely that more of these insects will be met with in these parts, as the entomology of sugar-cane is more thoroughly investigated in the southern sugar districts.

Although only of minor importance as a cane pest, it was thought advisable at this juncture to record the occurrence of this aphis in connection with sugar-cane. It was first noticed on the roots of ratoon cane at Oakwood, in the Bundaberg district, where numbers were found in the galleries which had been excavated by the ant *A. longiceps*. More recently, Mr. Bates, of this station, while carrying out investigations in Childers concerning cane grub control, found the same aphis attacking young plant cane. On this Childers farm, it was attended by a common small brown ant *Pheidole proxima* Meyr., and by the combined activities of the aphis and ant, the cane attacked showed a noticeable yellowing and appeared to be very weak.

So far, the winged form has not been found, but an attempt is being made to breed this form in order to establish its identity. The form most frequently met with is the wingless vivaparous female, and the following is a brief description of it:—

> Large pear-shaped, light yellowish coloured aphis about 3.5 mm. in length, and about 2.25 mm. at its greatest width, the body being covered with small hairs and also with a light dusting of a powdery secretion, which renders it of a duller appearance. It is without cornicles.

This species appears to be dependent to a great extent on ants, for none have so far been found on cane roots where ants have been absent. As many as thirty have been found clustered together on the roots of young plant cane, but in the case of ratoon cane they seem to be more evenly distributed over the larger root system and it is more usual to find them in groups of five or thereabouts. Nymphs, or the immature forms, when first produced are of a rich buttery yellow, and after the lapse of a few days they secrete the white powdery covering which is present on the adult insects, but they are somewhat darker in colour than the adult insect.

The writer has found the same aphis feeding on the roots of nut grass, though they were not so plentiful there as on the cane roots nearby. Thus the mere ploughing out of cane would not serve as a check on this insect, for nut grass would act as a host during the time the land was fallow, and subsequent generations would reinfest cane when it was again planted on that land. The real solution of the problem seems to be the extermination of the ants.

The Small Brown Ant (*Pheidole proxima* Meyr.).

This ant, which is a very common one in our canefields, not only becomes a pest indirectly through its attendance on such sap-sucking insects as aphides and mealy bugs, but is, itself, at times also directly responsible for minor damage to cane.

From its liking for the sweet globules of honey dew proffered by these insects, it is easy to understand that the sweet juices of mature sugar-cane would also be readily accepted and sought after by them. When cane sets of the variety Q. 813 were planted for experimental purposes during this spring, ants of the above species were found to have invaded the sets, tunnelling under the hard rind and eating the softer central portion of the cane stick. This undermining of the rind at the nodes, at points from which spring the roots, prevented many of the roots from developing as they would have done under normal conditions.

These ants are often found nesting in portions of cane stools, and it is probable that they are responsible for more damage than was hitherto supposed.

GRUBS FOR "GRUB."

TURNING CANE PESTS TO PROFITABLE ACCOUNT.

The Director of the Bureau of Sugar Experiment Stations (Mr. H. T. Easterby) has made available the following report from the Entomologist to the Bureau at Meringa (Mr. E. Jarvis) dealing with some of the ways in which "greyback" cockchafers and their grubs when collected in great numbers may be profitably utilised:—

Profit in Cane Beetles.

In view of the fact that in some of our sugar-growing districts vast numbers of cane beetles and their grubs are annually collected and destroyed, it is advisable to briefly outline a few of the ways in which such valuable organic material—amounting at times to many tons in weight—may be turned to profitable account.

About the year 1913, for example, growers in the Cairns district alone caught 22 tons of "greyback" cockchafers, representing no less than 10,644,480 individual beetles, which, after being weighed in by the "receiver," were merely emptied out of the sacks and thrown away.

In Russia or France, however, the monetary value of these insects would certainly have been recognised, and the bodies converted into manure by the following process.

How to Convert Cane Beetles into Manure.

One of the best methods is to dig a pit in firm sub-soil, a few yards long, and of a width and depth of about 5 feet.

After throwing into it sufficient beetles to form a layer 3 or 4 inches deep, stir in enough lime water to prevent any specimens from crawling out, then sprinkle a dressing of dry lime over them, and on top of this a layer of earth about 9 inches in depth. Continue to fill in with alternate layers of beetles, lime, and soil, until the pit is full. In this way a manure can be prepared from cockchafers equal in value to some of the good commercial fertilisers. That obtained from the European species known as the "May Bug" (*Melolontha melolontha*) is said by Guenaux to "equal that of

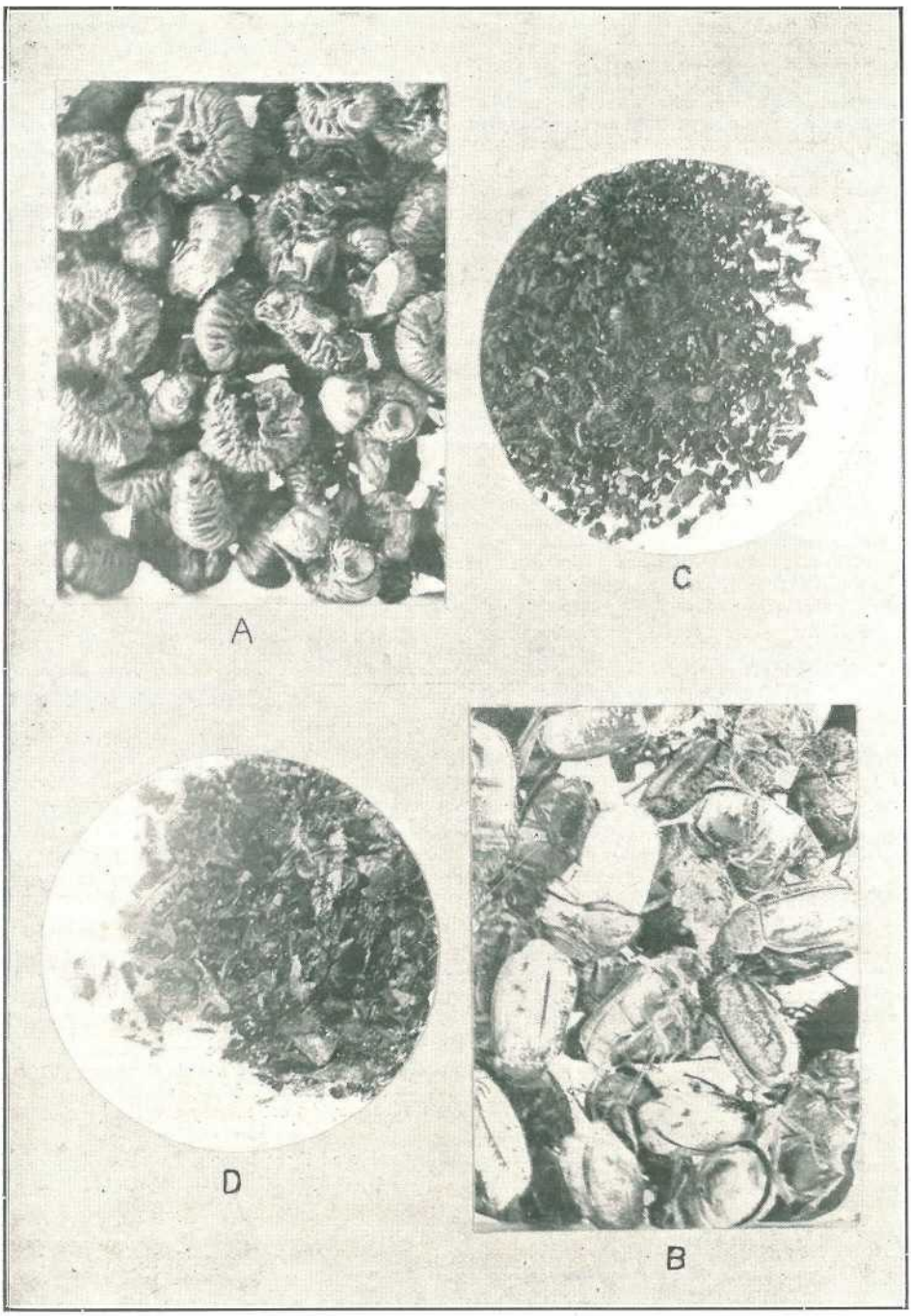


PLATE 146.

A.—Dried grubs of "Greyback" Cane Beetle.
B.—Dried "Greyback" Cockchafers (*Lepidoderma albohirtum* Waterh.).
C.—Meal prepared from the dried grubs.
D.—Meal prepared from dried Cane Beetles.
(All photos natural size, original.)

the best manure as regards phosphoric acid and potash, and is eight times richer in nitrogen. One hundred pounds of beetles are, therefore,'' he remarks, ''equal to 800 lb. of manure, of a value of about 3s.''

The dried bodies of our own ''greyback'' beetle contain 10.20 per cent. of nitrogen, 1.75 of potash, 1.66 of phosphoric acid, 63.75 of proteins, 4.82 of fat, and 1.75 of lime.

Value of Cockchafers as a Poultry Food.

The very large percentage of proteins (63.75 per cent.) contained in dried bodies of our cane beetle, *L. albohirtum*, makes this insect exceptionally valuable as a food for poultry, small animals, and insectivorous birds. It should be mentioned here, that when the first specimens of this beetle were analysed in the year 1922, it was found, to the surprise of those interested in this matter, that the specimens tested contained 0.16 per cent. of arsenic.

The reason for the presence of this poison was thought at the time to be probably due to the fact that the beetles analysed had been caught close to canefields in which the soil had been treated with large quantities of arsenious acid (white arsenic), administered at depths of 3 or 4 inches at the rate of 80 to 200 lb. per acre amongst cane roots upon which grubs of this species were feeding. Seeing that these grubs are continually ingesting, and passing soil through their bodies to extract any organic matter, it appeared likely that the amount of arsenic swallowed by them in this way —although not enough to prove fatal—might gradually accumulate, and be retained in the system throughout the pupal and beetle condition. This supposition was ultimately proved to be correct, as samples of grubs and beetles of *albohirtum* caught during the last year or two and submitted to Marsh's test were found to be free from any trace of arsenic.

When visiting the Sydney Zoological Gardens in 1923, I showed examples of dried grubs and ''greyback'' cockchafers to the Curator, and we threw them to insectivorous birds, &c., to see if they would eat them dry, either whole or when broken into pieces. Mr. Le Souef subsequently discovered that his birds preferred them in a softened condition, and later on advised me as follows:—

> ''The grubs that you left were very good food, and when soaked were readily taken by our insectivorous birds. We would be glad if you would quote for the food at per lb. We might be able to use about 100 lb. per annum.''

It should be mentioned here that when discussing this matter with the Curator he told me there was a sure market in Sydney for dried grubs, and there would be no difficulty in disposing of large quantities at a good price.

The most profitable way in which to market a commodity of this kind would be in the form of small packets holding about 3 or 4 oz., got up after the style of those sold to bird-fanciers, containing dried insects, puparia of flies, ant-pupæ, &c. This preparation commands a ready sale, as many kinds of birds and small animals will not thrive properly in confinement unless supplied at intervals with some such natural animal food containing certain vitamines that appear essential to their wellbeing.

A coarse meal, consisting of the crushed bodies of our grubs and ''greyback'' cockchafer beetles, could be more easily prepared than the abovementioned article, and would probably meet with as ready a sale. The wholesomeness and palatability of this insect as poultry food is evidenced by the avidity with which these grubs and beetles are greedily devoured by our native insectivorous birds and mammals.

In some parts of Russia the cockchafers, when used for poultry food, are first mixed with an equal volume of bran.

Cockchafers used as a Cattle Food.

It will be of interest to state here that during the year 1918, in which a flight of the destructive cockchafer, *Melolontha melolontha*, was expected, an order was issued by the Swiss Department of National Economy desiring all Communes to collect, kill, and utilise these beetles. ''Special emphasis,'' states N. Criddle, ''is laid on this last point, as these insects form a valuable cattle food.''

Obtaining Oil from Cockchafer Beetles.

The method usually adopted in other countries for extracting oil from the bodies of these beetles is to crush them in barrels or tubs until a completely homogeneous dough is obtained, which, after the addition of water ''is left,'' we are told by Professor A. Novak, ''for three or four months. The oil rises gradually to the surface and is removed. It can be used for ordinary lamps, giving a good flame without odour or smoke; about 20 litres of oil are obtained from 100 litres of

beetles. To extract the fat, the beetles are killed with chloroform or formalin, and then placed in a glazed earthenware vessel, into which a narrow pipe is inserted, reaching to the bottom of the pot; the vessel is covered with a lid, having a hole for the passage of the pipe, and when this is heated on a slow fire, the fat will gradually flow out from the pipe. This becomes thick after cooling.''

Cane Grubs as a Food for Man.

About eleven years ago, during the great war, some very interesting experiments were made in the United States to determine the food value of grubs of beetles to the genus *Lachnosterna*, which in that country attack the roots of sugar-cane.

It was thought by Dr. L. O. Howard, Chief Entomologist at Washington, that in view of the shortage and increasing price of old staple foods at that particular time, practical suggestions regarding any cheap inexpensive foods would be eagerly welcomed by the general public. ''Doubtless many foods,'' he remarks, ''now considered excellent were first discovered by starving people. Possibly oysters, clams, snails, crabs, lobster, crawfish, and shrimps were first eaten by people who could get no other food. . . . Two kinds of insects from the viewpoint of abundance and possible food value at once suggest themselves—namely, grasshoppers, and the larvæ of *Lachnosterna* in this country, and of *Melolontha* in Europe, the so-called 'white grubs.' ''

During the course of the experiments in question, *Lachnosterna* grubs were served up in the form of stew, salad, soups, &c., the various seasonings used for these foods being salt, vinegar, butter, pepper, oil, paprika, and onions. A party of ten gentlemen (prominent American entomologists) tasted and compared notes as to the flavour of the different dishes from which the grubs were eaten as well as the broth. The stew was considered by most present to taste much like crab meat and lobster.

''All thought it agreeable, and were sorry when it was all done.'' Those who drank the broth preparation ''agreed that it was not only perfectly unobjectionable but really appetising.''

The salad also was ''found very palatable,'' although in chewing, all those present discarded the tough skin of the grubs.

The general conclusion arrived at, as a result of varied experimentation, is practically embodied in the following statement made by Dr. Howard:—''I feel sure that 'white grubs' will be shown to have a positive food value, and am equally sure that the prejudice against insects as food is perfectly unreasonable.''

This opinion, coming as it does from one of the world's leading economic entomologists, and being based on results obtained from practical research work, should exercise a marked influence on any further developments of a like nature that may become necessary in the future.

It may be mentioned, in conclusion, that the protein content of beetles belonging to the genera *Melolontha* and *Lachnosterna* have been found by analyses to be similar both in character and quantity to those contained in the higher animals which form a part of human food.

FIELD REPORTS.

The Central Field Assistant, Mr. E. H. Osborn, reports (*1st November*, 1927):—

BANANA POCKET.

A short visit was paid to this fertile area in the middle of September, and the conditions were found to be very good, for practically all varieties of cane were yielding good tonnages and satisfactory density. The original estimate of 12,000 tons still holds good.

Many new residences were noticed, and three substantial bridges over Saltwater Creek have been constructed. Vegetables grow splendidly hereabouts, potatoes especially being a very payable proposition, for one grower had disposed of 10 tons at £16 per ton, and still had another 4 tons awaiting sale.

Varieties.

The main varieties are N.G. 15 (Badila), N.G. 426 (Clark's Seedling), M. 1900, and Q. 813, with smaller quantities of other canes. N.G. 15 grows splendidly, one block of third ratoons looking good enough for a 30-ton crop, whilst September plant was lying down profusely and should run into a 40-ton proposition. H.Q. 426 also looked very vigorous, one eleven-months-old crop yielding a 32-ton crop.

Q. 813 on the poorer of the soils was really good, one first ratoon paddock cutting a 40-ton crop, with an average density of 15.5. M. 1900 in the very heavy soils is also shaping well, whilst E.K. 28 was showing exceptionally good growth on a fairly good class of soil. H.Q. 409 was also being tried out on a small scale, but the stalks seemed too thin. The young plant cane looked well, as also did the young ratoons where worked up soon after cutting.

Diseases.

The area is very free from diseases, none being observed at the time of my visit.

Pests.

Slight damage had been done in odd places by grubs and rats. Upon the whole the prospects of the Pocket are very bright, for it possesses first-class soil, good climatic conditions, and a mighty good class of settlers (mostly ex-Diggers of the A.I.F.).

While at Banana Pocket my thanks are due to Mr. and Mrs. Lascelles for accommodation. Such help is much appreciated by the officers of this Bureau.

ROLLINGSTONE TO INGHAM.

This region, comprising the cane area supplying the Invicta mill (Giru), was next visited. Some 32,000 tons supplied by about 100 growers represents the output of the areas inspected. Crops were cutting very well for both tonnage and density.

As regards planting for next year, it seemed to be very heavy, especially about Yuruga, Helen's Hill, and Toobanna. These latter sub-areas have progressed wonderfully since my last visit some twelve months ago, and new growers were met.

At these three places crops of splendid Badila were seen growing upon soil that was formerly considered too poor and badly drained to cultivate, and yet is now turning out very good crops, although in many cases the cultivation has been rough.

Varieties.

N.G. 15, H.Q. 426, H.Q. 409, Q. 813, Korpi, Nanemo, Oramboo are grown. N.G. 15 is easily the most popular, and some fine crops were noticed. To Toobanna one grower, upon poor greyish soil, cut 118 tons from 2½ acres, getting, too, a density of 14.5 early in September, no fertiliser being used. At Coolbie, an 8-acre paddock of young N.G. 15 (hand planted and well cultivated) showed a 100 per cent. strike, and was stooling out beautifully.

H.Q. 426 is also grown to a certain extent locally, and so far looks healthy, although when its liability to gum is considered it behoves growers to be very careful, and remember that this variety is still barred by the C.S.R. Co., and that practically all the H.Q. 426 under review is the result of seed obtained from the Herbert River area, and therefore subject to suspicion.

H.Q. 409 grows well upon the poorer areas and has given good c.c.s. values, but arrows very profusely. Q. 813 upon the poorer and preferably stiffer soils turns out well, planted late, and should be more popular when its comparative freedom from disease is considered. Many inquiries were made about E.K. 28, as so far very little has been grown in the area.

Disease.

Red Rot in H.Q. 426 was noticed in several paddocks, being very bad in one plant crop at Moongabulla, the c.c.s. values for the first two tests being 12.4 and 12.9. Probably 15 per cent. of the cane had been badly attacked.

Spindle or Needle Top disease, as described by Mr. Ferguson Wood in his August report, was met with in isolated Badila stools, and is certainly accountable for a decided loss. Control measures as outlined by him are to be recommended.

GIRU.

The local mill (Invicta) had accounted for about one-half its crop when the area was inspected. Good growing conditions had been experienced, and, in consequence, the crops were both heavy and rich in sugar. Heavy plantings had taken place, the early plant looking uncommonly well. The ratoons, where worked up in time, were also very promising, some third and even fourth ratoons N.G. 15 carrying good growth.

Varieties.

Practically the same as upon the lower Burdekin. Of the newer ones E.K. 28 is very satisfactory, tonnage and density both being good; 40-ton crops averaging about 15.5 being noticed in several places. Large areas of it are now being worked for 1928.

Disease.

Very little disease of any sort was apparent, although doubtless present. Growers are advised to use the very greatest care in seed selection, and on no account to obtain seed from another area unless the same has been thoroughly inspected by a competent man.

Pests.

Grubs and borers have accounted for minor losses.

AYR.

With the exception of 95 points of rain at the end of September, dry conditions had prevailed, and nearly all the irrigation plants were busy. The crops were generally cutting up to about their estimate, but were carrying a very high density, as the following figures show for the week ending 24th September:—Kalamia, 16 c.c.s.; Pioneer, 16.16 c.c.s.

As well as the present season being satisfactory, next year's crop prospects are good, for large areas of early planted young cane were seen and are so far forward that they cannot fail to grow into heavy crops next year. Wherever one went surprisingly good crops were seen, and at present it seems that the two local mills will be heavily taxed to handle the 1928 crop. Where ratooning had been carried out straight away after harvesting the young cane was looking very well.

Varieties.

N.G. 15, H.Q. 426, B. 208, Goru, M. 1900, E.K. 28, and Q. 813 are grown, with the first three easily in the lead. Extremely good returns have been obtained from the first-named cane so far. One Norham grower started the season with a weekly average of 16.06 c.c.s. and cut 800 tons for just over 16.0 c.c.s., all in heavy plant cane.

B. 208 was also wonderfully high, another grower averaging 17.3 c.c.s. for eleven weeks, whilst another averaged 18.3 c.c.s. for one week. Its great danger to disease is, of course, the drawback, for if Leaf Stripe spreads from this variety to the others, then the damage would be very great.

E.K. 28 has given most surprisingly good results this season, from August to date, one of the best being a Brandon grower who, for a weekly average delivery of about 45 tons for the last month, has averaged 16.6 c.c.s. for a 40-ton crop, his last c.c.s. being 17.6, and a fair tonnage still to harvest.

Another Airdmillan grower is cutting a 40-ton crop of good density, which, owing to its rather backward state, had been estimated to cut 33 tons per acre. This is a particularly bad block to water, and the results are therefore most gratifying.

Practically nearly every grower has now some of this variety planted for 1928.

Diseases.

Diseases were very hard to discern at this period, Leaf Stripe in B. 208 being the only one apparent.

Pests.

White ants, grubs, borers, &c., have done a certain amount of damage in isolated places, but only to a limited extent.

The Central Field Officer, Mr. E. H. Osborne reports (12th November, 1927):—

HOME HILL.

At this centre weather conditions were dry and practically all the growers were watering. Very satisfactory work was being carried out by the mill (Inkerman), and the estimated tonnage of 126,000 tons was expected to be put through by about the third week in December.

Unusually high density returns have so far characterised the season's operations, for good sugar contents as well as heavy tonnages have been obtained from many of the rich deep alluvial flats, that are generally rather low in c.c.s. As regards the prospects for 1928, there is every present prospect that a bumper crop will be harvested.

Very large areas of young plant cane were noticed looking well forward (the majority being early plant), and bar some unexpected reason should develop into a splendid crop. The young ratoons were also showing very healthy growth.

Taking the Home Hill area as a whole, it is progressing remarkably, and now that the irrigation system has become properly established its benefits are being experienced, and local growers are now far more satisfied.

Varieties.

These are practically the same as grown on the Ayr side of the river. Of the newer canes E.K. 28 is easily the most popular and has given most satisfactory results both in tonnage and density, for it roughly averages from 35 to 40 tons per acre with an average density of, say, from 15.5 to 16.0. It is also worth mentioning that in many cases these returns were obtained from land that was formerly considered too rich for this cane. So satisfactory has it proved that nearly every grower has from a small to quite a large area of the cane planted for next year. Q. 813 has also given consistently good returns on several farms, and as it becomes more acclimatised to local conditions will get more popular on some of the poorer classes of soils.

Diseases and Pests.

Very little disease was noticed during this visit, although doubtless it was present. A little Mosaic and Leaf Stripe was noticed in B. 208 young plant and young ratoons. Growers are again cautioned against planting too much of this cane so susceptible to disease, for there is nothing to stop it spreading its diseases to the other standard canes of the Burdekin, and surely growers have already enough troubles without looking for more. The after effects of Top Rot were noticed in the quantity of dead stalks on many farms that otherwise would have cut very heavy tonnages. In one or two places red streaks were noticed in young plant Badila, but only to a limited extent. *Pests.*—White ants were noticed doing minor damage mostly adjoining headlands on a number of local farms, and generally in the vicinity of dead timber. Borers had also done slight damage in many places, generally near a main drain.

BOWEN.

Very little cane is now being grown here, fruit and vegetables being the main products. The small tonnage harvested this year, however, gave better density returns than in past years. Some very good Badila in particular, as well as N.G. 24 B (green Goru), were seen. Inquiries were made for E.K. 28 for plants for next year, so it is probable that a little extra may be planted either this year or early in 1928.

MACKAY.

As only a few days were spent in this district, very few farms were inspected, and these few only in the vicinity of Racecourse Mill. This mill was crushing splendidly, averaging about 4,200 tons week after week, and showing an average c.c.s. for the season of a shade under 15.0. Crushing had been greatly facilitated by the fresh state of the cane hauled along the recently completed Homebush tramway. In the limited time at my disposal, some remarkably nice plant cane was seen, mostly looking green and healthy and in a fair state of cultivation.

Varieties.

H.Q. 426 (Clark's Seedling), Q. 813, N.G. 15 (Badila), Malagache, E.K. 28, 7 R. 428 (Pompey), M. 1900 are the most popular hereabouts, with Q. 813, H.Q. 426, and M. 1900 the chief favourites. Of these, Q. 813 certainly seems the most suitable on account of its being so free from disease, its good striking qualities, and rapid growth. H.Q. 426, unfortunately, is very liable to disease, as mentioned hereafter. M. 1900 is a very good cane to cut late, but wants watching for Red Rot. E.K. 28 is giving very good returns locally, and is liable to become more popular. It is also a late cane. Pompey (7 R. 428) upon suitable ground gives good results, and is also a late cane to harvest. Badila upon the rich deep flats is easily the most suitable cane, both for tonnage and density.

Diseases.

Red Rot in H.Q. 426 plant and ratoons and M. 1900 plant and ratoons was noticed to be doing a great deal of damage, being responsible for losses in weight and also in c.c.s. The dangers of this disease have already been outlined very comprehensively by Mr. E. J. F. Wood (Assistant Pathologist), and control measures suggested, and growers are advised to give these measures a trial, otherwise the disease is certain to spread.

The Northern Field Assistant, Mr. A. P. Gibson, reports for the month of October:—

BABINDA.

Rain and sunshine alternated. The former replenished the water supply, freshened the vegetation, and swathed the wonderful background of mountain beauty in a dripping blanket of mist.

Rainfall.

August, 1 point; total recorded for September, 397 points; that for the year has been 143.65 inches. Over 18 inches has fallen since the mill commenced crushing.

The Crop.

The cane had lost the beautiful dark-green appearance which generally denotes speedy growth. The drier and cooler conditions experienced had assisted in its removal, but had retarded its growth. Some growers appeared to be disappointed because of the poor and patchy nature of some fields. Such alternating conditions were due probably to one or more of the following conditions:—(*a*) Late harvesting; (*b*) inferior drainage coupled with early grub destruction; (*c*) improper and insufficient tilling. The crop is cutting quite up to early expectations, and the estimate of 190,000 tons remains unchanged.

Harvesting and Milling.

The cane supply is being well maintained and good progress is being made. The mill continues to run smoothly and well, turning out some 1,000 tons sugar weekly. It is working a greater number of hours weekly. This appears to be a judicious move, more especially when a factory is faced with overmuch seasonal cane. Some of the benefits are as follows:—(1) The period of crushing is shortened; (2) the subsequent crop is benefited thereby; (3) a greater percentage of the crop is milled when the cane possesses its maximum amount of sugar, therefore more sugar is made. Against this, of course, is the payment of much factory overtime. 105,000 tons of cane had been milled, and the percentage of burnt cane is gradually increasing. The average crop quality is exceptionally high, the greatest weekly c.c.s. being 16.12 per cent. This is the highest since the inception of the mill. It seems obvious that the factory must carry on into January to treat the matured cane still offering, in spite of the increased number of hours crushing.

Ratooning and Cultivation.

The unusually long stretch of rainless weather that prevailed till quite recently enabled most farmers to do more and better field work. This has been of great advantage in promoting the growth of the new crop as well as assisting to conserve the soil moisture. Ratooning is too frequently delayed; improved returns would be obtained by performing this important and necessary work as soon as practicable after trash burning. This serious fault is too general.

Varieties.

Three main sorts are grown—Badila, still the king of its kind under the northern sun and one suitably raised in the better lands; H.Q. 426, our best medium land cane and leader in the field so far as sugar is concerned. (We are afraid to recommend overmuch of this being grown owing to its great susceptibility to most diseases. This variety, however, is too valuable to lose, for, if lost, the industry would be much the poorer, therefore it behoves our farmers to devote more care when selecting seed. This alone will save it from possible extinction). The Goru canes could easily be discarded; they are only fair in sugar, and are now highly diseased. Q. 813, Oramboo, Korpi, and some E.K. 28 may be grown with profit, on selected soils.

BARTLE FRERE.

Another fine crop has been raised in the shade of Bartle Frere, Queensland's highest mountain. Canes produced on such Northern volcanic porous upland red soils generally mature more slowly than do those grown on the alluvial deposits. Some wondrously rich soil was noted at South Russell. This rather narrow stretch of land extends some 2 miles along the picturesque Russell River and is sandwiched between it and a great swamp. Leaf Scald is much too prevalent here. Farmers are urged to procure a stock of disease-free cane for their next planting.

Plant Cane.

There is a big area of plant cane. Generally, the cane had germinated favourably, and had been freshened by some rain. Planting cane in roughly made drills run out between unploughed exhausted stubbles is bad, and must finally end in disaster. My attention was drawn to a Badila seedling said to have self-germinated in a flower-pot; three plants were obtained, and these were planted on the headland of a Badila field. No difference between it and Badila could be detected by the writer, save that it had stooled wonderfully well and was outstanding in growth.

Pests and Diseases.

Where a crop is wholly carried on from cuttings there may be a rapid spread of pests and diseases, also a gradual weakening unless the greatest care is exercised when plant-selecting. Grub destruction is severe on crops growing in a salient of volcanic porous red soil jutting into the granitic kind at Bellenden-Ker, also on similar land met with over the Russell River. Weevil borer damage is acute in parts; the tachinid fly, its valued parasite, appears well established. Big moth and the Tineid moth borer were noted; their presence may easily be detected by dead hearts; the larvæ make one or more holes in the shoot about ground level and sever the leaf arrow at the base. Leaf Scald is the principal disease. This was found mainly in Goru, H.Q. 426, and to a lesser degree in Badila. The characteristics of this are much in evidence in most fields seen, and seem to vary according to variety. Unfortunately, this continues to spread, through ignorance and the want of understanding of the great importance of systematic selection of plants. We can, however, only point out such diseases, and at all times urge our farmers to do better things.

MOSSMAN.

Weather.

Bright and cloudy days and some patchy rain were experienced. A good fall of rain is urgently needed to replenish the dried creeks and freshen the now very parched vegetation. Rainfall to 12th October: Mossman, 67.00 inches; Mowbray, 53.29 inches. August, the very dry month, was of untold benefit; it was mainly responsible for bringing the 1927 crop to maturity early, also hurrying along the harvesting and cultural operations.

The Crop.

The sugar lands are scattered, and in parts vary much in quality; with judicious tilling and manuring, followed by more thoughtful plant selection, they could possibly be made to yield a higher tonnage. It seems very evident that the assigned cane area cannot produce cane enough for the mills' seasonal requirements. Early in the year the crop prospects appeared most promising, though the area to cut was known to be some 300 acres less. Generally, it was thought the tonnage to crush would not fall far short of that milled in 1926. Heavy wind and flood damage followed; this, coupled with dry weather periods and much pest destruction, had reduced the early crop forecast of 82,000 tons to 72,000. One redeeming feature, however, is the good mill work and the phenomenal quality of the crop. Many hundreds of people depend on this mill for their living.

Harvesting and Milling.

There appeared more harmony between employee and employer, and increased efficiency in field and factory. Practically all the cane is burnt prior to its harvesting; this improper practice results in untold all-round losses. Cane enough to keep the harvesters engaged for two days is burned. This is supposed to be fired between 6 p.m. and 6 a.m. It is truly difficult to accurately estimate the amount required; this, combined with fire getting out of control, frequently results in overmuch being burned. The mill average c.c.s. has been surprisingly high. The cane appeared to have reached the peak of quality about the end of September. It is indeed refreshing

to note the general improvement in the condition of harvested cane and crop transportation. Rapidity in removing harvested cane from field to mill cannot be underestimated. The factory has 25 miles of portable rails. During the slack season two bridges and some 28 chains of a 30-lb line were constructed. Upwards of fifty truck wagons are used for transporting cane from field to permanent way. The weather has been ideal for their use. Forty-five thousand tons of cane had been milled to the 11th October; 27,000 yet remained. The factory is crushing about 4,700 tons weekly, and making upwards of 700 tons sugar. This quantity is removed as soon as bagged to Port Douglas, from whence it is shipped to Cairns.

Varieties.

Many varieties are raised. The more important are mentioned below. The area truly cannot be classified as being a Badila-growing one, yet more might be successfully grown. H.Q. 426 is highly favoured and one difficult to replace. Less D. 1135 and B. 147 might be grown and the planting of more Q. 813, Oramboo, Korpi, and possibly E.K. 28. H.Q. 285 has been recommended in my previous reports as being a kind suitable for this area. E.K. 28 requires studying, especially the time of planting and its cutting. Great disappointment prevails here because of the exceptionally poor strike. Too early planting, too much soil covering, and apparently poor seed used may have been responsible for its great failure. Many a promising variety has been lost to the industry because its little peculiarities were not understood. Try Pompey in the poorest of soil in a small way first of all; it should do better here than further south.

This district is much troubled with Leaf Stripe disease. Do not plant any more Goru at Mossman; that seen is badly diseased with Leaf Scald.

Cultivation.

Field work is decidedly better. There, however, is still much room for improvement. Farmers generally devote more time to cultivating the plant part of the crop, but too frequently neglect the ratoons. Fields that had been harvested some six or eight weeks back had not been worked since. The lack of timely cultivation is responsible for loss of soil moisture and poorer crops. When the cane is cut, most of the old roots perish, then is the time to ratoon; if delayed, the new roots are severed and the crop growth naturally is retarded.

Ratooning.

The common practice is to plough away from the cane row and the rough sometimes levelled by a roller. When overmuch rain falls the left side channels drain the excess water. In a dry time the whole field should be levelled; this considerably reduces the surface area exposed.

Diseases and Pests.

The wide distribution of diseases and pests is the result of uncontrolled district importations which have and are still taking place, but to a lesser degree.

Leaf Stripe is the main disease, and is found mainly in B. 147, D. 1135, and to a lesser degree in H.Q. 426 and Badila. To control this disease I can only recommend the following:—

(*a*) Better plant selection.
(*b*) Dig out affected stools in less-infected areas.
(*c*) Plough out severely diseased fields as soon as possible.
(*d*) Important—See that none of the old stubble remains prior to planting.
(*e*) Rotation. Plant with leguminous crop after ploughing out.
(*f*) Plant with a resistant variety change.
(*g*) Do not use tops from diseased fields for feed purposes.

Leaf Scald was noted on many fields. Army worms and similar moth borers to those found at Babinda were noted. Grub and rat destruction was great in parts.

MOWBRAY AREA.

Land of quality is found adjacent to the river and lesser creeks which water and drain it. Badila is the cane generally grown. Unfortunately, the spot is rather a dry one, and the crops raised, although excellent in quality, are backward. Good water, it is said, is easily obtained. This being so, irrigation might be successfully conducted. The cane seen appeared disease-free.

The Southern Field Assistant, Mr. J. C. Murray, reports on the period from 10th September to 12th October:—

BUNDABERG.

In the course of the month work was carried out in the Bundaberg and Nambour districts. Control work in connection with Fiji disease was also done. The canegrowers in the counties of Canning, Ward, March, and Stanley are reminded that no plants may be transferred from one farm to another without the permission of an inspector under the Diseases in Plants Act. Growers requiring permits are requested to get in touch with the Director, Bureau of Sugar Experiment Stations, Brisbane.

Farming Efficiency.

The crushing at Bundaberg was in full swing, with a tonnage per acre slightly in excess of what was estimated at the beginning of the season. The c.c.s. content of the cane is fairly high. A good class of labour is available, guided by a staff of efficient and well-trained industrial leaders.

Much has been said of late about efficiency. While the highest standard of efficiency in our cane industry is desirable, it is also necessary to know what constitutes efficiency, before using the term in a general sense. Many men in selecting an institution as an example of efficiency, or otherwise, really could not explain themselves if they were asked to give logical details in support of their statements.

In the particular phase of efficiency that it is desirable here to discuss—farming efficiency—much depends in endeavouring to obtain the maximum on the financial status of the farmer. The average canegrower is an intelligent man who is keen on regarding his industry as a highly organised business, but in too many instances he is in the struggle to make ends meet, handicapped by lack of capital. He may, superficially, appear to draw away from the breadline, but the financial institution and credit-extending business could tell a different tale.

Leaving the matter of potential efficiency, the details that contribute to better results will be discussed in their relation to the Bundaberg district.

Ploughing.

In the area under review this section of field work is being done thoroughly and scientifically. Tractors and modern ploughs are in use, also subsoilers and rotary cultivators. Extensive subsoiling is done when there is strong tractor power.

Planting.

Various types of planters are in use, the smaller growers using the horse implements, while the plantations are using double drillers and planters. The cane is being planted on an average of 8 inches deep with about 3 inches of covering. The writer is of the opinion that the average grower covers his plants too much. Nearly everywhere this spring there can be observed farmers relieving their sets. It is one distinct drawback in regard to the planting implement that the amount of covering cannot be controlled. Rain or shine, the same heavy covering goes on. This does not matter greatly in the porous red soils, but it is very important to study the amount of covering in badly drained lands.

Plant Selection.

Everything a grower does goes for nothing if he cannot obtain good plants. Often a grower, through oversight or lack of conviction, allows affected or poor plants to go to his soil.

It must be borne in mind by every grower that diseases such as Mosaic, Gumming, and Fiji are a serious menace to the industry if not controlled, and it is only by collective effort that they can be kept in check, and the sooner the farmer who pooh-poohs the likelihood of disease decimating his crop realises his foolishness the better. The soundest recommendations that the whole field of science can furnish have been presented to the Queensland sugar-growers from time to time on disease control, and it is in their own interests to apply those recommendations.

Fertilisation.

The matter of obtaining correctly balanced fertilisers is receiving careful attention by the growers as a body. Many are trying local experiments, and all farmers are urged to make trials. What might be termed decentralisation of experiment is all-important in manuring the soil; that is to say that Mr. A., of Oakwood,

may obtain results extremely satisfactory to himself, but that they would be of no use to Mr. B, half a mile away at Goeburrum, nor perhaps to the immediate neighbour of A.

Varieties.

In planting, great care must be taken to select a variety that is proving of the maximum value. In the Woongarra area a great deal of trouble and loss is being caused through gumming disease (*Bacterium vascularum*). Careful study of this serious cane malady has shown that it is caused by growths of microbes within the fibres. It has also been demonstrated that certain canes are more resistant than others to this disease. The most resistant cane to gumming disease at present is the Q. 813. This cane is well known and easily obtained, and although, perhaps, on some soils this cane will not do well, the fact remains that it will produce, on the whole, gum-free canes; therefore the farmers are recommended to grow Q. 813, and the cane inspectors and plantation managers are respectfully asked to assist the Bureau Staff in this recommendation. N.G. 16, N.G. 15, M. 1900 Seedling, and D. 1135 should be left alone for a time, or most carefully selected from areas right outside the Bundaberg district. The attention of canegrowers is drawn to the thorough and careful considerations of Mr. D. S. North, Plant Pathologist to the C.S.R. Company, on gumming disease.

NAMBOUR.

The heavy rains that fell early in the year were followed by a very dry spell, then a succession of winter frosts, and upon the heels of the frost about 6 inches of rain. It can be observed then that the year has not been favourable for the growth of crops. Nevertheless the c.c.s. value of the cane is high, and the mill management reports no set-backs from gummed cane. The latter highly satisfactory state can probably be attributed to two causes—(1) extensive planting of Q. 813 and (2) more careful plant selection.

The cane that has just been planted is going to have a slow time owing to the abnormally heavy rain soaking the soil, but it appears to be germinating well, as a careful survey of several planted areas showed.

The Southern Field Officer, Mr. J. C. Murray, reports for the period 14th October to 12th November:—

NAMBOUR.

The last report on field work was written from Nambour. A complete survey of the district had not been made at the time, so that it will be necessary to set down notes made after writing the last report.

Every effort is being made to encourage the growers to make local experiments with varieties and manures. If each farmer could make a small experiment plot on his farm, devoting, say, an acre to the work, he would find that the information gained in relation to fertilising alone would pay him over and over again for his trouble. Each crop taken from the land does away with some of the plant food in the soil. How to feed that soil properly and prevent complete wastage can only be determined by local experiment.

The following are details noted in the sub-areas:—

Coolum.

Cane varieties growing here include Q. 813, Q. 970, Q. 1098, D. 1135, and N.G. 15. The farmers generally consider that the first-named is the best of these. As is well known in the Coolum area, drainage is the most serious problem facing the growers. The writer understands there is a comprehensive scheme afoot at the present time for the purpose of effectively draining the Coolum farms, and if this is brought to maturity then some fine canegrowing land will be at the disposal of the farmers, who, up till now, have had an up-hill fight in this particular district.

Maroochy River.

Many of the agricultural troubles encountered this year have been caused by unfavourable weather early in the year. However, good tillage has greatly improved matters, and just at present the young plant and ratoon crops look well.

The principal enemy the farmers in this area have to combat is the ever-present gumming disease. It is almost impossible to completely rid the canefields of this serious menace, but by growing resistant varieties and carefully selecting plants the malady may be prevented from doing serious damage. Farmers looking for information on gumming disease (and they always should be) are asked to write to the Director of Sugar Experiment Stations, or ask the visiting officer as many questions as they can think of.

When the writer was on the Maroochy River, two years ago, at a field day held there in connection with gumming disease, he recommended the farmers to plant Q. 813 and try as extensively as possible H. 227. This recommendation is repeated here. The first-named variety proved its resistance to gum and the latter is also showing resistance to a fair degree.

The resistant variety of all the matters named in connection with disease control is the best, and the position in disease-affected areas will keep getting worse and worse if farmers keep on casually planting Badila, D. 1135, and M. 1900 Seedling.

Great progress has been made on the Maroochy River over the last eight years. New farms have been made where tea-tree swamps were previously, nice homes have been built, roads improved, and tramways extended. The farmers have not really made any money, but they have faith in their district and the measure of comfort is due to careful ways and hard toil.

MARY VALLEY.

Fairly heavy crops have been grown here this year, although the c.c.s. value has, on the whole, been low. Taking this and long haulage into consideration the growers have not done very well.

Varieties growing are Q. 813, M. 1900, D. 1135, and Badila. H.Q. 285 is also making good growth. Farmers are recommended to grow principally Q. 813 and H.Q. 285. The cane in this district is healthy and free from disease on the whole.

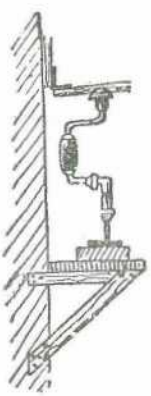
Growers here are reminded that at Bundaberg Sugar Experiment Station they can have tests made of their cane as a guide to maturity only.

BUNDABERG.

Conditions here could be summarised as under:—Germination: Fair; misses due to diseased plants and unfavourable soil conditions. Weed growth: Heavy, though not out of hand. Fertilising: Methods more satisfactory; more local experiment being undertaken. Cane vareties: Position serious through the majority being very susceptible to gumming. Diseases: Gum (*Bacterium vascularum*) very bad.

A TEMPORARY DRILL.

Recently it was necessary to drill holes in metal hinges with long flanges. To do this with only a hand brace and bit is a difficult job, as the drill required considerable pressure to make it bite. The device illustrated was fixed to a post,



and acted very well. A board was nailed to the post with a hinged arm, while below at the right height was a bracket to carry a small table or shelf. The leverage obtained was sufficient to drill holes easily.

ROOT KNOT OR NEMATODE ROOT GALL.

By ROBERT VEITCH, B.Sc., Chief Entomologist.

Nematodes or eelworms belonging to the species *Heterodera radicicola* are responsible for the development of the peculiar malformations occurring in root knot or nematode root gall. These extremely minute animals are found in enormous numbers in the soil in many districts in this State, and records of their destructive activities have been obtained from centres as far apart as Cairns and Coolangatta. The list of economic and other plants attacked by them is a very formidable one, and their presence in the root system is frequently associated with disastrous consequences to the plants attacked. It therefore seems desirable to give a brief account of these destructive organisms and to indicate lines along which some measure of relief may be obtained.

Appearance of Infested Plants.

An examination of the root system of infested plants usually yields ample and conclusive evidence of the presence of the parasitic organism. The typical feature in an attack by this species of nematode is the occurrence of extremely swollen or distended areas (Plate 147, Figs. 1 and 2; Plate 148, Figs. 1 and 3) at various points throughout the root system. The swellings or enlargements may be found occurring singly and at considerable intervals on the roots, or, on the other hand, they may be so close to each other as to give practically the whole of the root system a most peculiar and abnormally thickened appearance. These typical swellings are produced as a reaction to the irritation set up by the activities of the nematodes in the root tissue.

It is well to point out at this stage that, in the Leguminosæ or pea and bean family, certain beneficial root nodules are produced by a totally different organism. These nodules result from the presence of the nitrogen-fixing bacteria that are found in association with the root system of the Leguminosæ, and they must be regarded as being entirely beneficial. The root knots or nematode root galls on the other hand are frequently very detrimental to the welfare of the attacked plants.

The beneficial bacterial nodules may be distinguished by the fact that they are generally small or moderate-sized spherical bodies, which can usually be readily broken off from the sides of the rootlets on which they are found (Plate 148, Fig. 4). The root knots or nematode root galls, on the other hand, are swellings in the roots themselves and they are not readily detached therefrom. The difference in appearance between bacterial nodules and the nematode-induced root knots or galls is well indicated in Figs. 1, 3, and 4, Plate 148).

The roots are not invariably the only portion of the plant attacked, because in the case of the ordinary potato the tubers or potatoes are often infested, the whole surface not infrequently being covered with a

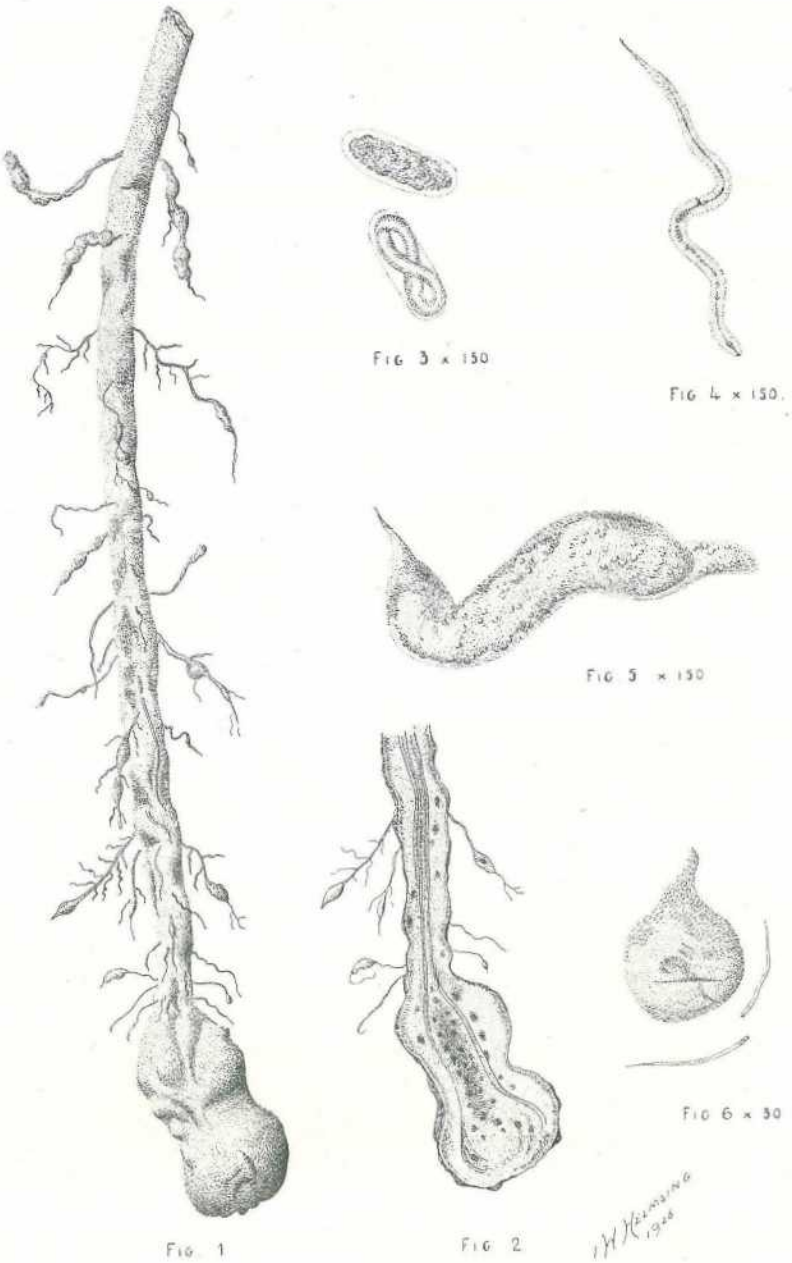


PLATE 147.

Fig. 1.—Infested Banana root.
Fig. 2.—Longitudinal section of Banana root showing Nematode infestation.
Fig. 3.—Eggs in different stages of development.
Fig. 4.—Larva.
Fig. 5.—Female.
Fig. 6.—Female (later stage).

series of swellings which give to the potato a characteristic "pimply" appearance (Plate 148, Fig. 2). In addition to the attack on the tubers the roots of the potato may be infested just as in other plants.

Effect on Infested Plants.

The effect that is produced by root-knot infestation varies very materially. Many of the species of plants included in the category of those that are attacked show but little evidence of the infestation in their roots, and, indeed, they appear to suffer little or no injury from the presence of the parasite. Other species of plants frequently show very considerable numbers of root galls on the roots, but, even so, in their case there is no definite evidence of serious damage arising therefrom. The third class is the most important for present purposes, for the species of plants included therein are subject to heavy infestations associated with very severe losses.

The galls that occur in the roots of infested plants belonging to these highly susceptible species disorganise the normal functions of the root system, and, as a consequence, there is very serious interference with the flow of soil moisture absorbed by the delicate roots for transference to the leaves and stalks. Very appreciable dwarfing, in the case of susceptible and severely attacked plants, is associated with that disorganisation in the transport of the raw materials required for the building up of plant tissue. Moreover, during hot dry spells such plants wilt much more readily than those that are uninfested. Infested plants of susceptible species are also generally paler in colour than those that have escaped attack, and they have a somewhat sickly yellowish appearance.

Where infestation is heavy and general conditions are favourable to the parasite, the death of the plant may occur much earlier than would normally be the case. The early collapse of the plant may be due entirely to the nematode infestation, but cognisance must also be taken of another factor—namely, the ease with which fungus or bacterial diseases can gain an entrance through the ruptured root tissues. These diseases may be the actual cause of the death of the plant or they may be merely a minor contributory factor.

Extent of Losses.

It would be very difficult indeed to give any estimate of the losses due to the presence of nematode root-gall infestation in Queensland. Local observations suggest that serious reductions in yield have followed in its wake, but no figures are available to indicate just how heavy these losses have been. Elsewhere, however, losses were estimated in some cases, and it is interesting to quote from these estimates. They indicated a loss of 20 per cent. in beans, 12 per cent. in potatoes, 25 per cent. in peas, 13 per cent. in tomatoes, and about 4 per cent. in cotton. Even a loss of 4 per cent. in a highly important crop such as cotton represents a tremendous wastage if it is a figure that is applicable in most cotton-growing countries and does not represent an abnormally high loss peculiar to the country in which the estimates were made.

Organism Responsible for Root Knot.

As already indicated, the malformations characteristic of root knot or nematode root gall are not due to insect attack, but are the direct result of the infestation of the root tissue by a very small eelworm.

Fig. 1.

Fig 2

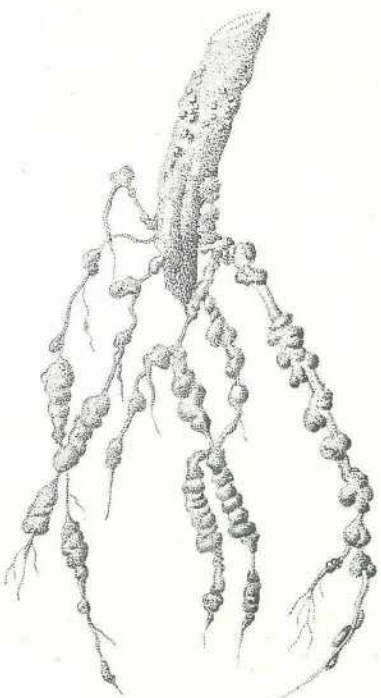


Fig. 3.

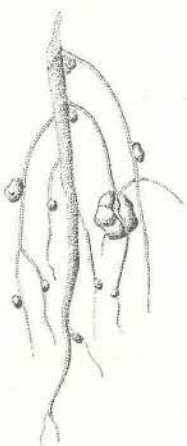


Fig. 4.

I W. Helmsing 1927.

Plate 148.

Fig. 1.—Nematode galls on Strawberry roots.
Fig. 2.—Nematode infested Potato.
Fig. 3.—Tomato root infested by Nematodes.
Fig. 4.—Bacterial Nodules on roots of Lupin.

(All ½ natural size).

Eelworms belong to the group of animals called nematodes because of their thread-like appearance. Some of these eelworms are parasitic on plants, others attack animals, including man himself, while still others are predaceous on individuals belonging to their own group—i.e., other eelworms. The species associated with root knot is *Heterodera radicicola*, a nematode that has a very wide distribution throughout the world.

Life History of the Root Knot Nematode.

The life history of this species has been worked out in detail elsewhere, but for present purposes the following brief outline is sufficient. The usual male and female sexes occur and the female is credited with the capacity to lay as many as 500 eggs. The eggs are provided with a tough shell, which serves to protect them against adverse conditions that may occur in the soil. They are extremely minute, being not quite $\frac{1}{250}$ inch in length.

After the usual incubation period, the eggs hatch and an extremely small thread-like animal emerges. This is the larval stage, and at its commencement the eelworm is about four times as long as the egg from which it hatched. The young larval eelworm moves about freely in the soil until it finds a susceptible plant; having succeeded in doing so, it enters one of the roots, generally choosing a spot near the tip of a young feeding root. A spear-like organ inside the mouth is then used for the purpose of feeding on the fluid contents of the tissue of the root entered by the nematode, and as a reaction to its presence the characteristic swellings are produced at the spot invaded.

In the case of the female eelworm growth is in breadth rather than in length, and eventually the female becomes a pear-shaped or flask-shaped body, which can be detected without the aid of a lens when the infested tissue is broken open and examined. The female nematode is then about $\frac{1}{30}$ inch in breadth and is a somewhat glistening pear-shaped object. The male also feeds in the root tissue, but it does not attain the flask-shaped form of the female; on the contrary, it remains long and worm-like. The various stages in eelworm development are illustrated in Plate 147, Figs. 3, 4, 5, and 6.

Figures are not available to indicate how many generations are passed through in Queensland in the course of twelve months, but, as twelve generations are possible in the Southern United States, there is every reason to believe that in Queensland at least a similar number of generations would be obtained.

Conditions Favouring Infestation.

Nematode infestation is generally at its maximum in light sandy soils in semi-tropical or tropical regions. The relatively slight variations occurring in the temperature in such areas permit of almost uninterrupted development, and the texture of the soils in question is also highly conducive to the excessive multiplication of soil-infesting nematodes.

Heavy soils are generally much less susceptible to infestation, probably on account of the difficulty experienced by the nematodes in moving from plant to plant in such soils. Where soils are subjected to

repeated flooding and are normally very wet, infestation is slight; on the other hand, if the soil is abnormally dry, infestation is also unimportant.

Means of Dissemination.

It is generally believed that the larval nematodes move through the soil at the rate of only a few feet each year. Such being the case, there must be some means of dissemination other than the mere haphazard wandering of the larval nematodes in search of the roots of susceptible plants.

Seedlings or nursery stock infested with nematodes have frequently been the means of establishing the pest in areas previously free from its ravages. Seed potatoes have been similarly responsible for nematode dissemination, while manure containing portions of the roots of infested plants has also been a factor in their spread.

The rapid dissemination of this pest has been facilitated by the ordinary operations of cultivation, for implements used in infested paddocks can transfer the nematodes to uninfested paddocks through the agency of the soil adhering to their various parts. They may similarly be transported in the soil adhering to the boots of workers or to the hoofs of animals. Drainage, irrigation, or other running water may also serve as a means by which the parasite can be transported.

Susceptible Plants.

The number of species of plants recorded as being attacked by the root knot nematode is now extremely large and is frequently being added to. Many of the most important plants cultivated by man for his own sustenance are included in the category of susceptible plants, and mention must also be made of the fact that many weeds are attacked.

Asparagus, banana, bean, beet, carrot, celery, cotton, cucumber, fig, grape-vine, lettuce, onion, papaw, pea, peach, pineapple, potato, pumpkin, strawberry, sugar beet, sugar-cane, sweet potato, tomato, and watermelon may be mentioned as some of the more important plants subject to severe attack.

Plants Resistant to Attack.

Among the plants that are immune to attack or but slightly affected, mention may be made of barley, broom millet, four varieties of cowpea (Brabham, Iron, Monetta, and Victor), grasses (most), maize, peanut, sorghum, wheat, and velvet beans.

Control Measures.

It will be evident from what has already been written on this subject that the control of the root-knot nematode parasitic on economic plants must of necessity present a very difficult problem. Here the farmer, fruitgrower, or nurseryman is dealing with a parasite that is for most of its life-time entrenched within the living root tissues of the plant to be treated or protected. When not in the plant tissues it is free in the soil, where it frequently occurs in enormous numbers. Further complications are caused by the fact that there are many weeds on which it can exist even if the land is cleared of susceptible cultivated plants.

It may be definitely stated that the cure of infested plants is quite outside the bounds of practicability, and hence control should aim at eliminating or reducing the numbers of nematodes inhabiting the soil where land is already infested. Where it is uninfested, every effort should be made to mantain it in that happy condition.

Nursery stock or seedlings showing any symptoms of root knot should not be planted on uninfested lands, and, indeed, such stock or seedlings are undesirable for planting even on infested lands. Care should also be taken to avoid the use of infested seed potatoes. Mention has already been made of the possibility of infestation by implements, live stock, running water, &c., and accordingly all practicable precautions to eliminate such sources of infestation should be taken. If these precautions are observed, uninfested land may be kept free of this very serious pest.

The fact that quite a number of valuable crops are immune or highly resistant to attack has been used to reduce infestation by means of rotation; a rotation being adopted in which these immune crops feature prominently. The immune or resistant crops were referred to in an earlier paragraph, and consideration might be given to the growth of certain of these crops where it is desired to reduce nematode infestation in order to permit of the subsequent growth of susceptible crops. The actual crop selected for the rotation would, of course, depend on many factors that cannot be entered into in these notes.

Infested greenhouses or seed-beds can be treated by methods that would be much too expensive on a field scale, and in this connection mention may be made of the fact that steam sterilisation of the soil in greenhouses in regularly carried out in many large establishments throughout the world. In cases where sterilisation is desired but steam is not available, much good may be effected by treating pots or other containers and their soil contents with boiling water at the rate of five gallons per cubic foot. After treatment, several days should be allowed to elapse before planting, in order to permit of the soil draining in a thoroughly satisfactory manner.

Even where infestation is present, susceptible plants may sometimes be kept on quite a profitable basis by a judicious combination of thorough cultivation and heavy manuring.

During recent years much experimental work has been devoted to an endeavour to control nematodes on a field scale by soil fumigation. However, so far as Queensland conditions are concerned no data are yet available to show that such is both economically practicable and effective.

AN INTERESTED READER.

An old Coolabunia subscriber, now settled at Mulgeldie, in the Upper Burnett, writes:—" . . . I am very interested in the 'Queensland Agricultural Journal,' for it is the best periodical for the farmer . . . . and I am willing to continue getting it as long as I can read. . . ."

THE CORN EAR WORM ON TOMATOES.

By ROBERT VEITCH, B.Sc., Chief Entomologist.

The insect known as the corn ear worm (*Heliothis obsoleta* Fabr.) is an extremely serious pest of many economic plants, but, as its popular name implies, it has gained particular notoriety as an enemy of corn or maize. It is one of the most destructive insects associated with cotton in Queensland, and it is also undoubtedly the worst insect pest of the tomato in this State. When associated with the lastmentioned plant it is generally referred to as the tomato caterpillar or "worm." For present purposes attention will be devoted solely to its activities as a pest of the tomato.

The corn ear worm is notorious not only on account of its very wide range of food plants but also because of the fact that it has been found to occur in many different countries, and is, in fact, practically cosmopolitan. It belongs to the family of moths known as the Noctuidæ, and is therefore allied to the very destructive species commonly referred to as cutworms and army worms.

Life-cycle Stages.

(*See Plate facing p. 591 in "Cotton Growing in Queensland," Part II., this issue.*)

The various changes through which this insect passes to maturity are typical of all moths, there being four very distinct and easily recognisable stages in its development—(1) egg, (2) larva or caterpillar, (3) pupa or chrysalis, (4) imago or adult or moth.

The eggs (Plate I., Fig. 1) when just laid are pearly-white in colour, but as the incubation period advances they darken very appreciably. Their shape somewhat resembles that of a dome, and in size they are about equivalent to that of half an ordinary pinhead.

The larvæ (Plate I., Fig. 2) are whitish when newly emerged from the eggs, but their colour soon changes, and in full-grown specimens it varies very greatly, some being pale-green, whereas others are dark-brown. A number of longitudinal stripes of different shades usually play a part in the formation of the colour scheme. The larvæ have three pairs of jointed legs on the thoracic segments and five pairs of unjointed abdominal and caudal legs; when full grown they measure about 1½ in. in length.

The pupæ (Plate I., Fig. 3) are of the usual lepidopterous type, being brown in colour and measuring about ¾ in. in length.

The moths or imagines (Plate I., Fig. 4) possess two pairs of wings, giving a maximum wing expanse of about 1½ in. The colour pattern is sufficiently detailed in the accompanying plate (Plate I., Fig. 4), and hence a written description thereof is unnecessary.

Life History and Habits.

The female moth, after mating, generally lays her eggs singly on the flowers, flower buds, or on the young foliage, thus ensuring that the larvæ, on emergence, will have an abundant supply of suitable food close at hand. Eggs may, however, be laid on other parts of the plant.

The number of eggs laid is generally regarded as being in the vicinity of 1,000, although as many as 3,000 have been recorded. Egg-laying is spread over a number of nights. The incubation period of

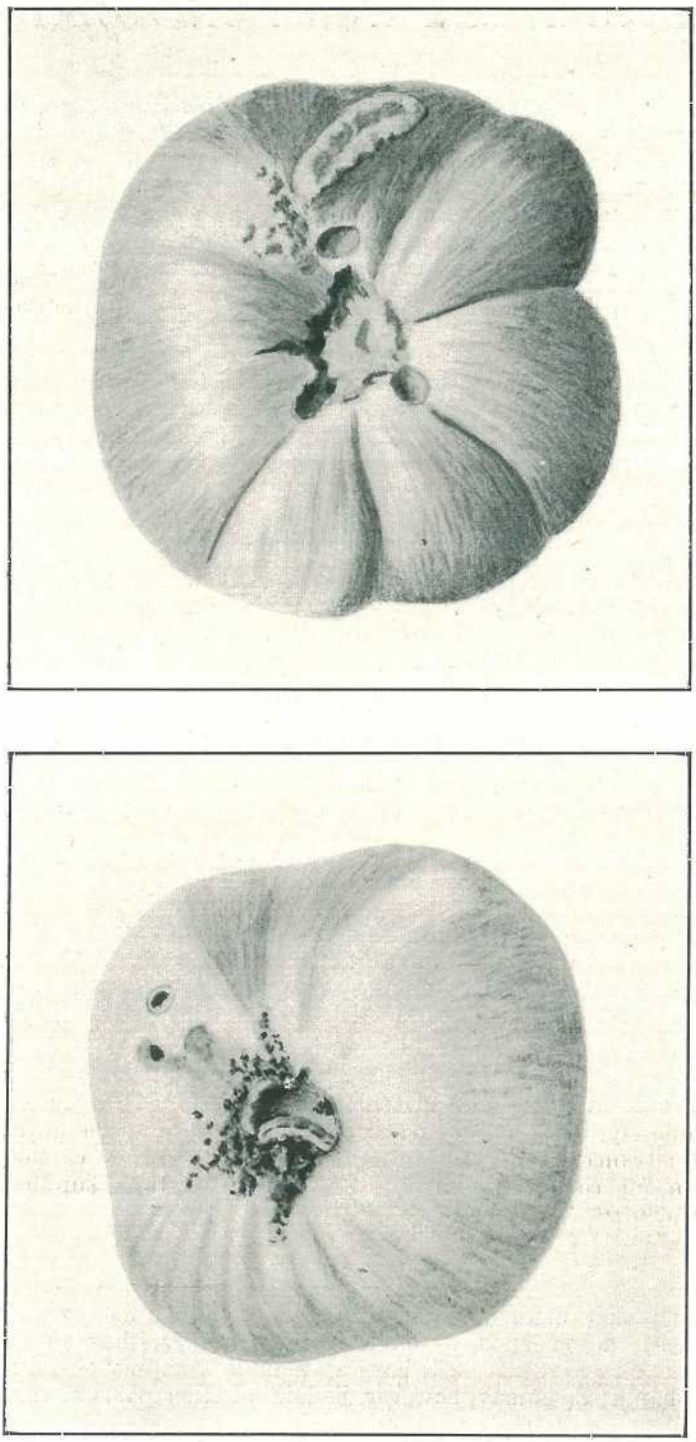


PLATE 149.—TOMATOES ATTACKED BY CORN EAR WORM LARVAE.
(*From water-colour drawing by I. W. Helmsing.*)

the eggs in the summer months is about three days, but in spring time six days or even longer may be spent in the egg stage.

The newly-emerged caterpillars eat the eggshells and then turn their attention to the flowers, foliage, or fruit of the plants on which they occur. The caterpillars may continue feeding on the foliage, but usually they make for the green fruit. The most destructive feature of their feeding activities is the attack on the fruit, which they enter at the calyx end (Plate 149). Each fruit within which a larvæ is feeding is rendered useless, and as the larva attacks fruit after fruit, each individual is capable of destroying a considerable quantity of tomatoes in the course of its short larval life. The injury in cases where the larva does not feed within the fruit is much less serious, and the tomatoes so attacked are not necessarily rendered useless. In bad outbreaks 50 per cent. or more of the fruit may be destroyed, and, unfortunately, infestation is not confined to the coast, for losses also occur in the Stanthorpe district. The caterpillars grow rapidly, and moult six times before becoming full grown. Full size is attained in two or three weeks, and then the insect passes on to the third stage in its life-cycle—namely, the pupa.

The full-grown caterpillar drops to the ground and burrows into the soil to a depth of a few inches. It then forms a small earthen cell inside which it changes to the pupa. In the pupal stage a tremendous transformation takes place, and a complete reorganisation of the body-contents results in the production of the moth or reproductive stage of the insect. The pupal stage generally occupies ten days or a fortnight in the warmer weather, but in cold weather the time necessary for the completion of that portion of the life-cycle may be greatly prolonged. No feeding takes place in the pupal stage.

At the end of the pupal stage the moth emerges from the earthen pupal cell and works its way out of the soil through a channel constructed by the larva prior to pupation. It then mates, lays eggs, and so the life-cycle is continued. The moth is generally considered to live for a period of about two weeks. It is nocturnal in its habits, but may occasionally be seen in the day time. It feeds on the honey of flowers, and is in itself responsible for no damage to tomatoes. The whole life-cycle from the laying of the egg to the emergence of the moth occupies from four to six weeks for the spring and summer generations in Queensland.

Natural Enemies.

Quite a number of natural enemies attack the corn ear worm, but, unfortunately, they do not exert their maximum influence until summer is well advanced, and, accordingly, the tomato-grower cannot depend on them for complete control. He must, therefore, supplement the natural control factors by artificial control measures.

The eggs are attacked by three very small wasps, *Trichogramma australicum*, *Trichogramma rara*, and *Neoteleonomus* sp. A small bug, *Triphleps australis*, also does good work by sucking the contents of the eggs and thus destroying them.

The larvæ are parasitized by four enemies, and two predatory wasps also serve to reduce their numbers.

Insectivorous birds, adverse weather conditions, and diseases also play a part in reducing the corn ear worm population.

Control Measures.

The fact that this pest has a wide range of plants on which it can complete its development suggests that, as one control measure, attention should be paid to other host plants growing in the vicinity of the tomatoes. If these alternative host plants are grown neither for profit nor for domestic use, and are neglected, they will serve merely as excellent breeding-grounds for the pest. They should therefore be destroyed. Should they be grown either for home consumption or for marketing, then they should be subject to suitable control measures that will keep them free from the corn ear worm. Included in the alternative host plants are maize, cotton, lucerne, tobacco, cowpea, bean, pea, cape gooseberry, and rosella.

Tomatoes that have been attacked by this pest should be collected and disposed of by deep burying or by boiling, or by any other suitable measure that will serve to destroy the caterpillars associated with them. In this way a check may be placed on the unduly large multiplication of the later generations.

Rotation is another important measure that may afford some relief from infestation, and if it is practicable to do so it is well to plant tomatoes after a crop that is not susceptible to attack by the corn ear worm. If that is done the tomatoes will get a cleaner start than would otherwise be the case.

Thorough cultivation in preparation for planting up will lead to the destruction of many of the larvæ and pupæ of this pest either by direct mechanical injury or by the exposure of these stages to adverse climatic conditions, and to the attacks of predatory enemies such as birds.

Spraying or dusting with arsenate of lead is regularly practised in many districts in Queensland for the control of the corn ear worm on tomatoes, and much benefit is usually derived from this control measure. The crop must be treated several times at somewhat frequent intervals, the applications commencing not later than the date at which the first fruit appears. Careful observations leading to the detection of heavy egg-laying by the moths will frequently indicate the most appropriate times at which to spray or dust.

Dusting is carried out with a dust gun, and is dependent on suitable atmospheric conditions for success. It should be attempted only when there is little or no wind blowing, and is best undertaken when the dew is still on the plants early in the day. Various brands of dusts are on the market, and some of these have been specially prepared for application to tomatoes. Fruit that has been sprayed or dusted should be cleaned before packing.

COTTON GROWING IN QUEENSLAND.

PART II.

Pests of Cotton in Queensland.

A Bulletin for farmers giving an account of the Insect Pests of Cotton and their habits, and some measures for controlling them.

By

E. BALLARD, B.A., F.E.S.

Commonwealth Cotton Entomologist.

FOREWORD.

In publishing this short account of the chief cotton pests of Queensland, the author is conscious that there are many shortcomings, notably in the direction of remedies for controlling the insects which levy their toll year by year.

The pests of cotton in most cotton-growing countries follow very much the same lines, and in other lands remedies have been used which might be applicable to Queensland, on the other hand they might not.

Where any definite remedy is recommended in the following pages, the cotton-grower may rest assured that it has been tried under Queensland conditions and found to be successful and economical enough to be used.

The Corn Ear Worm commits the most spectacular damage, and in the case of this insect the forms of control have been proved on too many occasions for their efficacy to be doubted.

If in the case of some of the other pests remedies are for the moment lacking, it is an advantage to know who one's enemy is even when one cannot at the moment defeat him.

It is hoped that the cotton farmers will take the trouble to acquaint themselves with the insects that live on and in their cotton, so that in the first place they may be able to take attacks at the beginning and so more easily combat them, and secondly they will avoid sleepless nights caused by the appearance of some perfectly harmless insect.

A fruit farmer to be successful has to be something of an entomologist, and the cotton farmer should follow his example.

It would be easy to give many instances of innocent insects accused of damage and dangerous ones given unblemished characters, but it is hoped that this bulletin will help to make it increasingly difficult for the guilty to escape.

INTRODUCTORY.

The problems attending the production of a crop of cotton cannot be separated from those arising from the activities of insect pests, and the measures to be taken to avoid losses are as much a part of good farming as the proper preparation of a seed-bed or cultivation of the growing plants.

Next to a sufficient rainfall and suitable soil, insects play the chief part in deciding whether a farmer will harvest a crop of cotton or not.

This does not mean that Queensland suffers more from insect pests than other cotton-growing countries. It must be realised, however, that insects are a constant menace and precaution must be taken to defeat them.

Large numbers of different species of insects take their toll of the cotton plant. Some attack the stem, some the leaves, some the bolls and squares. Fortunately the great majority make little or no impression on the crop and can be disregarded. Certainly, except in special cases, it is not an economic proposition to use insecticides against them.

Of those which are of importance some only occur sporadically, others are of annual occurrence.

An outline of the life histories of these is given below as it is essential to know something about them before the measures which should be taken against them can be understood.

MAJOR PESTS OF COTTON.

(A) Pests of Annual Occurrence.

These pests are confined to those which attack the bolls (and the seeds therein), squares, and flowers, or all three. They are, further, either caterpillars, or grubs as they are more usually termed locally, or sucking insects.

Of the former the most important is—

THE CORN EAR WORM.[3]

(Plate I.)

This insect is by no means peculiar to Australia, being found all over the world, and often though not always as a pest of cotton, as it has a very large number of other food plants.

The Corn Ear Worm, in the form in which it is most familiar to the farmer who sees it eating off squares and boring into bolls, is about

[3] *Heliothis obsoleta* Fab. Known to some farmers as the Maize Grub. It has been decided to adopt the American common name so as to avoid confusion with *Conogethes punctiferalis*.

Heliothis obsoleta F.

Fig. 1.
Egg x 20.

Fig. 2.
Larva x 2.

Fig. 3.
Pupa x 2.

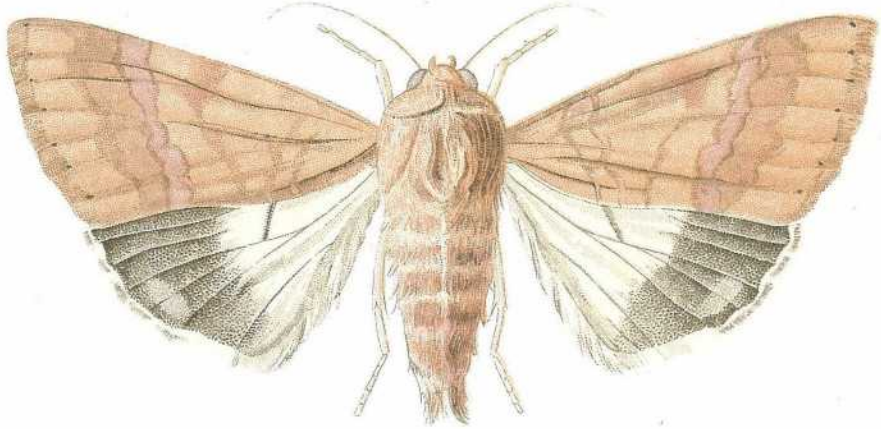


Fig. 4.
Imago or Adult x 3.

I. W. Helmsing. 1926.

PLATE I.—THE CORN EAR WORM (*Heliothis obsoleta*)

1¼ in. in length and of variable colouring—green, green with longitudinal stripes of a paler green, sometimes brown, sometimes a dark green and black. The colour schemes are numerous. It is often stated that it attacks a crop suddenly, overnight as it were.

Although it will sometimes migrate, such sudden appearances very seldom occur. What actually happens is that the grubs pass unnoticed until the peak of their attack is reached and the worst damage done.

Life History.

The life history of the grub is briefly as follows:—

The parent is a moth (Plate I., Fig. 4) with greenish grey or yellowish fore wings measuring 1¼ in. across the outstretched wings. The hind wings have a deep, dark-brown border. The female moth after pairing proceeds to lay her eggs one at a time on the cotton plant, only a few on each plant, always near the top. In this way the young larva is assured of tender food. The moth can lay up to 1,000 eggs. They are not all laid the same night, but egg-laying takes place in bursts spread over several days.

The Egg.

(Plate I., Fig. 1.)

When first laid the eggs are small white objects, and once familiar with them they are very easily seen. After the first twenty-four hours the eggs begin to change colour, and just before hatching, which takes place in two and a-half to three days in the summer, they are orange yellow.

The Grub.

(Plate I., Fig. 2.)

From them emerge a tiny grub, which first eats the egg-shells and then wanders into the terminal bud and feeds on the young tender leaves. As they get older they attack the squares, which, being hollowed out, are shed.

This is the first symptom of Corn Ear Worm attack, which is often overlooked, the square-shedding being attributed to the weather or other causes. The grubs cast their skins six times (in the summer every two to three days), and after the sixth moult are ready for the next stage, the pupa.

Pupa.

(Plate I., Fig. 3.)

This stage is passed in the soil usually close to the plant. The grub drops to the ground and burrows down for about 1 in. to 1½ in., and there makes a small cell. Here it turns into a pupa (Fig. 3), and from nine to eighteen days after burrowing the moth emerges and begins laying (if a female) in some three or four days' time. So the whole cycle starts again—Egg, two and a-half to three days; grub, fourteen to twenty-one days; pupa, nine to eighteen days. The moth lives about fourteen days, laying most of the time. Life from egg to egg, twenty-nine and a-half to forty-two days for the summer and spring broods.

If each female lays an average of 500 eggs, and all hatch, and half are females, the descendants of one moth will reach 125,000 in under two months. Fortunately all eggs do not mature, for reasons to be given hereafter.

HABITS.

The grub, as has been stated above, starts feeding in the young leaves which are just unfolding. It soon starts on the squares and destroys numbers of them, not by eating them all, but by eating holes in them, sometimes smaller, sometimes larger.

Any damage to a square even if quite slight results in its being shed. If the cotton plant is engaged in putting on its first squares when the numbers of Corn Ear Worms are at their greatest, then the squares and flowers are eaten as fast as they are formed, and as a result the plant sets no or very few bolls, and puts on only vegetative growth. This is what very frequently happens in the case of late-planted cotton, and accounts for the big losses to cotton farmers in the 1923-24 season, when most of the cotton in the State was late-planted owing to the dry spring of 1923.

The maximum attack develops about the first week in January to the middle or end of February. After this time the attack begins to die off as the grub's natural enemies begin to make themselves felt, and with cooler weather the life cycle is prolonged. Behind the coastal ranges where frosts are experienced, and where the chief cotton-growing areas will be, May sees the last of the Corn Ear Worm as it descends into the soil and there passes the winter. Moths of the spring generation probably begin to emerge in September, but no large population is bred up until late December or the New Year. When grubs are in their fifth and sixth stages they often attack full-grown bolls, and from their habits of wandering do a good deal of damage in this way.

If they simply stayed in one boll and consumed it, it would not matter so much, but they often eat through one lock and then leave, and the damaged lock is attacked by moulds which may ruin the whole boll. This is never so serious as eating the early squares, because a damaged boll may still yield some cotton, while if squares are eaten as they appear the plant tends to put on only vegetative growth and no bolls are produced at all.

Early-planted cotton has set so many squares and bolls by the time the Corn Ear Worm population is large that it can afford to lose a lot of them. As many as 60 per cent. can be lost and still yield a profitable crop. The square formation always manages to keep ahead of the grub. So far as we know at present, the latest date for sowing which will enable the crop to escape serious damage from Corn Ear Worm seems to be the middle of October.

It might so happen that an early planted crop is an impossibility through failure of winter and spring rains. When this is the case, special precautions have to be taken.

Remedies.

These are of two kinds—firstly, by use of a trap crop, that is a crop more attractive to the Corn Ear Worm than cotton; and secondly, by the use of an insecticide.

Trap Crop.

The most effective is maize. As its name implies, Corn Ear Worm has a great liking for maize, preferring it and tomatoes almost to anything else, even when the maize is only 18 in. high.

The trap crop is so used that it keeps the majority of the Corn Ear Worms in the maize until the cotton has got a good start.

This system was applied on the Research Station at Biloela with great success in the 1925-26 season.

The maize was planted as follows:—For every sixty rows of cotton six rows of maize were sown at the same time as the cotton. Five or six weeks later four more rows, and five weeks later another four. The third planting was badly hit by a drought, and matured very late. In spite of this the first two plantings enabled us to harvest over 1,200 lb. of seed cotton to the acre.

On the same farm, where the second planting had not been done and the third was stunted (as it was all over the farm), the amount of cotton was so small as not to be worth picking, and thus 6 to 7 acres were lost.

The essential part of the trap crop idea is that the maize should be cut just before it ceases to be attractive to the moths as a place on which to lay their eggs—i.e., before the silk dries up. It is at this time full of grubs which are thus destroyed.

The cut maize can be put into a silo or fed to cattle. In either case thousands of grubs are prevented from completing their development, and the second sowing is growing up to catch those moths still on the wing or emerging from the soil after the first sowing of maize is cut.

It is most important to cut this first sowing; the second should be cut also, but can be left if time does not permit of its being cut. *The first should never be left standing.* If it is it simply acts as a breeding ground.

The cost of sowing, cultivating, and cutting a trap crop comes to 25s. 6d. per acre of maize, exclusive of charges for the farmer's time and cost of stacking in silo.

Natural Enemies.

The Corn Ear Worm is not allowed to have things all its own way, for it is preyed upon by a variety of enemies, and under certain climatic conditions it is killed by a bacterial disease.

It was stated above that all eggs do not hatch. Apart from those which are washed off the plants by heavy rain, others are sucked by a

small bug,[4] and others again are parasitised by three minute parasitic wasps.[5] The grub itself is parasitised by four different species, and two predatory wasps also prey upon it. Altogether we have thirteen enemies of this insect, including the grub of an unidentified Carabid beetle. The full effect of these numerous enemies is not felt until towards the end of midsummer, so that, although they are a great help, the farmer has to supplement their attack with his own efforts.

The little egg-sucking bug is always abundant on maize, where it goes to feed on Aphis, but it is quite common on cotton also. In certain circumstances grubs attack and eat one another.

Control by Means of Insecticides.

Definite results from the use of insecticides have not yet been obtained.

Experiments designed for the 1926-27 season at Biloela were rendered negative firstly by the dry spring, and then by excessive rainfall, but are to be continued in the following season (1927-28).

The result of such tests as we were able to make shows that calcium arsenate dust applied at the rate of 15 lb. to the acre will stop an attack.

It seems that two applications when cotton is squaring (in January in a normal year), at a fortnight's interval, are all that will be required. The present price of calcium arsenate is 1s. 4d. per lb. in bulk.

SUMMARY.

(*a*) (i.) The Corn Ear Worm is a caterpillar which hatches from an egg laid by a moth on maize and cotton (and a number of other plants).

(ii.) It does most destruction to the cotton crop during January and February.

(iii.) On the cotton it feeds first in the tender leaves at the top of the plant and then eats squares, and bolls if present.

(iv.) It prefers maize to cotton.

(*b*) *Protective Measures.*—(i.) If an early sowing of cotton is not possible, then, in the first week of November or at the time of planting, sow six rows of maize for every sixty rows of cotton. Five to six weeks later sow four rows of maize for every sixty rows of cotton. Five to six weeks later sow another four rows of maize for sixty rows of cotton. Cut first and second sowings when silk begins to dry (say seventy-five days from sowing). Never leave them standing after this time.

(ii.) If early sowing is possible, this in itself should ensure protection so far as experience goes at present. The latest date at which cotton can safely be sown to escape harmful Corn Ear Worm attack is the middle of October.

(iii.) Experiments with insecticides are not yet completed, but will be published later. So far it appears that two dustings with calcium

[4] *Triphleps australis* China.

[5] *Trichogamma rara* Girault; *Trichogamma australicum* Girault; *Neoteleonomus* sp.

Conagethes punctiferalis.

Fig. 1.
Egg x 30.
(After E. Ballard.)

Fig. 2.
Larva x 3.

Fig. 3.
Pupa x 2.

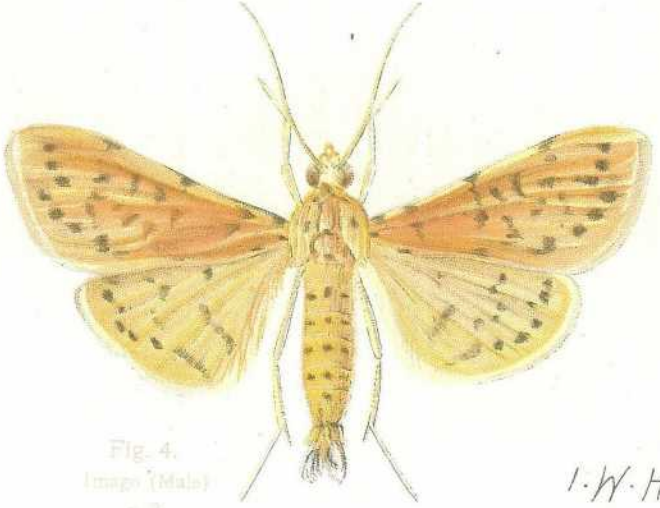


Fig. 4.
Imago (Male)
x 3.

I. W. Helmsing. 1926.

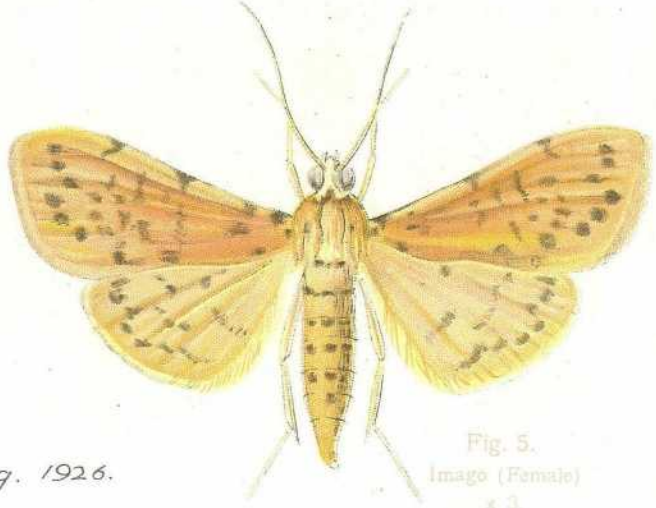


Fig. 5.
Imago (Female)
x 3.

PLATE II.—THE PEACH GRUB (*Conagethes punctiferalis*).

arsenate at the rate of 15 lb. of dust per acre at the time of squaring (two to three months from planting) at fourteen days' interval will check an attack.

THE PEACH GRUB.[6]

(Plate II.)

This insect is not so important a pest of cotton as the Corn Ear Worm, or the sucking insects which will be described later, but is taken now as, like the Corn Ear Worm, it is a pest of maize and in other ways its habits are similar.

Like the Corn Ear Worm, too, it is not peculiar to Australia, but exists in many other places as well.

The life-history of the Peach Grub is briefly as follows:—

The moth (Plate II., Figs. 4, 5) is a handsome orange-yellow insect with black spotted wings which measure rather less than 1 in. when stretched out. The eggs, which are very small cushion-shaped objects, when laid on cotton are put between the bracts and the boll, but are also laid on the boll itself. When ready to hatch, they are a conspicuous red colour. The little caterpillar or grub hatches out from the egg and burrows into the boll, often feeding about on the outside before burrowing in. The favourite place of entrance is at the bottom of the boll. Like the Corn Ear Worm it wanders about to a certain extent, and it is often difficult to tell whether a boll is attacked or not unless the under side is examined.

The full-grown grub (Plate II., Fig. 2) is usually a dirty-green colour, with many large oval darker green spots formed by a thickening of the skin. Sometimes it is distinctly pink, but the spots are dark green. When disturbed it drops towards the ground on a thread of silk. This is a very characteristic trick. The Peach Grub makes a large entrance hole and devours the seeds inside the boll. It generally leaves a small tube of silk hanging from the hole; this tube is always covered with excreta. Not only the bolls but also the stems may be attacked either from the side or bored directly down from the growing point.

When the grub is full fed, which takes about three weeks in late summer, it spins a cocoon inside a dried and damaged boll or on the outside, using the bracts as additional covering; or it may spin a leaf to a boll and make its chrysalis (Plate II., Fig. 3) inside. It does not pupate in the ground like the Corn Ear Worm. In course of time the moth emerges and mates, and the life cycle starts again.

As the weather cools in the autumn an increasing number of grubs spin cocoons or hide in old bolls (or damaged maize cobs) for the winter, emerging as moths in the spring.

On the coastal areas moths will come out in midwinter, but inland not until September.

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[6] *Conogethes punctiferalis* Gn.

Practically no infection of cotton takes place until the end of February, and by the time a generation has been produced of sufficient numbers to be dangerous most of the cotton has been picked. *In all cases where Peach Grubs have done serious damage it has been found that cotton was planted late* or the season was such that cotton matured late.

Early planting, so desirable for other reasons, ensures protection from the Peach Moth. In localities where it is numerous it will take some of the top crop, but in anything approaching a favourable season this can be allowed to go, as it will in any case be poor-quality cotton owing to the boll-rots, which will be mentioned later.

To help keep the Peach Grub under control, cut and burn the crop as soon as a profitable picking has been obtained (as near the middle of July as possible). In this way all the overwintering grubs in the damaged bolls will be killed. Cows can be turned into the fields to eat off the remaining green bolls, but this should not be regarded as a method of control by itself, but simply as an accompaniment to the cutting and burning in July. Never store maize in the cob, as it is sure to contain grubs which will give rise to moths in the spring.

When a maize trap crop is being grown on the farm, numbers of Peach Grub Moths will be attracted to it. Indeed, the drying up and ripening of the ordinary commercial crop of maize seems to be the primary cause of Peach Grub Moths being driven to the cotton.

Besides maize and cotton, Peach Grubs attack sorghums, many kinds of fruit, beans, cowpeas, and castor.

SUMMARY.

(*a*) (i.) Peach Grub is a caterpillar about 1 in. in length, generally a dirty light-green colour with large conspicuous darker green spots. Its parent is a yellow moth with black spots on the wings.

(ii.) Eggs are usually laid by the moth on the boll, which the caterpillar attacks from below and eats out the seeds.

(iii.) The chrysalis is made inside or outside the damaged boll.

(iv.) The grub passes the winter in similar situations.

(*b*) *Protection.*—(i.) Early planting as for Corn Ear Worm.

(ii.) Cut and burn crop as soon as economically possible (mid-July).

THE PINK BOLL WORM.[1]

(Plate III., Figs. 4, 5.)

This insect occupies at present a peculiar position amongst Queensland's cotton pests, in that, although it has been found in a seashore living species of Hibiscus all down the Queensland coast, it is only a pest of cotton as far south as a little below the 26th parallel.

[1] *Platyedra gossypiella* Saunders.

It is well established as a cotton pest in those districts first associated with cotton-growing, notably the coastal side of the ranges from Bundaberg to Rockhampton, the Dawson Valley, part of the Burnett, the Boyne Valley, and a very light infestation in the Callide Valley.

This boll worm is the caterpillar stage of a small greyish brown moth with fringed hind wings. The moth is very difficult to find in the field, but is sometimes seen amongst stored seed cotton. The boll worm itself is about ½ in. long when mature. It has a dark or lightish brown head, and is either more or less completely salmon-pink or the pink colour appears as spots. The only insects with which it is likely to be confused are a half-matured Peach Grub or a very small bright-pink caterpillar found in damaged bolls, but which is only a scavenger; and it can be distinguished from the former by the large dark-green spots on the Peach Grub and the Peach Grub's untidy habits of feeding, and from the scavenger by the more slim appearance, smaller size, and smaller light-brown head of that insect.[8]

Eggs are laid by the parent moth on bolls, often in the crack along which the mature boll will split, or at the base of the bracts surrounding the boll. The grub hatching from the eggs bores into the boll, sometimes feeding on the boll-wall for a time before entering a seed.

The wound made by its entrance into the boll heals up, and until the boll is opened there is nothing to show that a Pink Boll Worm is inside. Bolls about half-grown are preferred. When the grub is ready to turn into a chrysalis it cuts a hole to the outside. This is a very characteristic elliptical hole quite unlike the large holes made in bolls by Corn Ear Worm, Peach Grub, or Rough Boll Worm. The small brown chrysalis can often be seen in recently opened bolls or sometimes in the bracts of green ones.

When pressed for food the Pink Boll Worm will eat all parts of the cotton plants, but normally it prefers bolls.

The Pink Boll Worm has great powers of resistance to adverse conditions, and can, when mature, lie dormant for considerable periods. The writer has received live Pink Boll Worms from a sample of cotton which had been lying in a Sydney office for nearly two years.

What the Boll Worm does is to curl up inside a cotton seed, sometimes pulling another one over it and spinning the two together. In this state it can resist a surprising amount of drought and flood, heat and cold. It is this habit of lying up in the seed which has enabled it to penetrate into so many cotton-growing areas.

This pest has done a considerable amount of damage in Queensland in some places. The remedies are as follows:—

(1) *Never* grow standover cotton in any circumstances, and discourage your neighbours from doing it.

[8] *Pyroderces* sp. When any doubt exists, send specimens to the Chief Entomologist, Department of Agriculture, Brisbane.

(2) Do not ratoon, as the more early maturing ratoon plants give an advanced food supply to Pink Boll Worm, and annual cotton will then suffer.[9]

(3) Clean up fields after the last cotton crop, in more or less normal years by the middle of July.

It is better to sacrifice a few pounds of stained lint than to risk carrying Pink Boll Worm over the winter. Bushes should be heaped and allowed to dry and then set on fire. So far as can be managed, leave no bolls or trash lying in the fields, discourage all volunteer plants, and burn all old bushes, bolls, and trash at the end of the season. The greener the crop is when cut, the less fallen dried bolls there will be.

If all farmers in the Pink Boll Worm areas will co-operate in this, the pest will never assume first-class importance. If they neglect to do so, the cotton-growing industry might quite possibly be ruined.

The remaining remedy, that of disinfecting all seed by heat, is at present performed by Government, and presumably has had a good effect, as no new areas of Pink Boll Worm infection have been found since the 1924-25 Pink Boll Worm survey was made, after which date all seed for sowing has been treated by heat.[10]

Two machines are installed for treating seed, one at Rockhampton and one at Whinstanes. The seed is heated to 140 deg. F. and samples taken at intervals for testing germination.

The temperature of 140 deg. F. is sufficient to kill the boll worms, and does not injure the seed, which can survive a very much higher temperature.

(B) Minor Pests and Pests of Sporadic Occurrence.

CUTWORMS.[11]

These grubs turn up in certain years, and when they do so commit great havoc. They have not yet been sufficiently studied to enable one to say that they will be of annual occurrence. In November 1925 and October 1926, many early crops were lost and resowing necessitated by them.

Their method of attack is either to eat the leaves of seedlings when only a few inches high, or else to girdle the little plant, ringbark it as it were, so that it falls over and dies.

The grubs feed only at night, hiding by day in the soil near the plants.

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[9] This is not mere theory but has been proved in three consecutive seasons.

[10] Apparently some doubt exists as to whether the Queensland Pink Boll Worm is the same as the one which has penetrated into almost all cotton-growing countries and done untold damage. Whether it is or not, it behaves in the same manner and is very closely related, and is potentially as dangerous.

[11] *Euxoa radians* Guen.

Like the Corn Ear Worm and Peach Grub, Cutworms are one stage in the life cycle of a moth. We do not know the causes of their sudden appearance, nor why they should be present in some years and absent in others.

They can, however, be controlled when they do appear. This can be effected by spreading a poisoned bait around the plants. The Cutworms will be attracted to this, feed on it, and die. The poison often takes a little time to act, but once it has been eaten the grubs cease to feed.

The presence of Cutworms can be detected when large pieces are seen to have been cut out of the first leaves, or when a seedling is seen to be girdled and has fallen over. If the soil in the vicinity of such seedlings is scraped over carefully, one or two dark, dirty-green grubs will be seen lying curled up under the soil. They are about the size of the Corn Ear Worm. This will be a sure indication that Cutworms are present, and steps should be taken at once to destroy them.

Apart from the poison bait, the formula for which is given below, chickens are useful allies of the farmer. Once they have been shown a few Cutworms and where they can be found, they will eagerly feed on them.

The formula for the bait is as follows:—Bran, 25 lb.; Paris green, 1 lb. Mix well together, then add molasses and sufficient water to ensure a mash damp enough just to crumble in the fingers.

This should be put out late in the evening. It might be necessary to repeat the application in a week's time. In late 1925 the cotton at Gatton Agricultural College and a plot in Brisbane were saved by the timely use of this bait, and success was obtained in 1926 in several localities by the same means.

Observations made at Biloela in 1926 showed that there was an intimate connection between the presence of bullhead and pigweed (specially the former) and Cutworm attack. It was found that, where bullhead was present either on headlands or in the fields and had not become straggly, it was always chosen by the Cutworm moths as a place under which to lay. It appeared that a shaded, moist soil was essential for egg-laying (although under certain conditions a moth will lay anywhere when forced to do so). Eggs are normally only laid in the soil and under cover. For a time, provided there is enough of the wild food plant, the grubs will feed on it, scattering later to the cotton.

Where fields are kept clean, our observations all pointed to the fact that attacks by Cutworms are *always the result of invasions from headlands or neighbouring weedy paddocks.*

We have seen no evidence to support the idea that eggs are laid under cotton plants, but everything points to their being laid in normal circumstances under low-growing, spreading weeds such as pigweed[12] and bullhead,[13] especially the latter.

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[12] *Portulaca oleracea.*

[13] *Tribulis terrestris.*

Once more the necessity for clean cultivation for control of insect pests is demonstrated.

Cutworms, as is the case with other pests, have their enemies, which seem to make themselves felt very quickly. These includes a fly,[14] a predatory wasp[15] (a very hard worker which must destroy numbers of Cutworms), a parasitic wasp,[16] and an egg parasite.[17]

If an attack is noticed in time, it will seldom be necessary to bait a whole field; baiting in front of the attack and in the occupied area will be sufficient.

THE ROUGH BOLL WORM.[18]

(Plate III., Figs. 1, 2, 3.)

This boll worm is seldom a really serious pest, although it does a fair amount of damage in some localities in certain years. Like the other boll worms it is the caterpillar stage of a moth (Plate III., Fig. 3), a small insect with straw-coloured fore wings with a green, wedge-shaped strip running along the length of them, the narrow end of the wedge being towards the body. The moths measure ½ to ¾ in. across the outstretched wings.

The moth lays small white or bluish tinted eggs on the upper leaves and stem of cotton plants, one or two at a time on each plant. From these hatch the caterpillars (Plate III., Fig. 1), which either bore into the terminal or attack squares and eventually bolls.

When nearly mature the boll worm is about ¾ in. in length. The forepart near the head is chestnut brown, then a dark-brown area, then yellowish green and set with orange-coloured fleshy spines, those on the upper surface being surrounded by a dark-brown patch. The general effect is of a yellowish grey caterpillar with darker markings, the grey effect being produced by fine yellow lines on a dark background. The caterpillar is a very distinctive one and could not be mistaken for anything else.

The cocoon (Plate III., Fig. 2) is a greyish-coloured object, in shape rather like an upturned boat. It is made anywhere on the plant. The Rough Boll Worm sometimes does some harm to young plants by killing the terminal bud and causing heavy branching. When a big crop is set these branches often split off from the stem.

There is another caterpillar[19] which behaves in a very similar manner to the Rough Boll Worm. As a general rule it ceases to be a pest after early January, but late in the season sometimes increases

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[14] Tachinidæ (unidentified).
[15] Sphegidæ—*Ammophila suspiciosa* Sm.
[16] Braconidæ (unidentified).
[17] *Schedius euxoæ* Gir. n.sp.
[18] *Earias huegeli* Rozenk.
[19] *Crocidosema plebiana* Zeller.

Fig 1

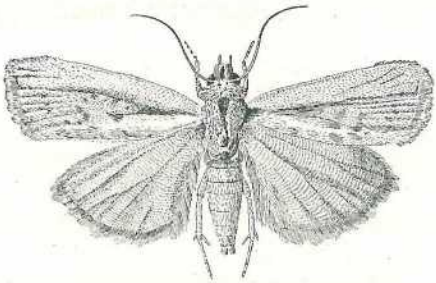

Fig 3

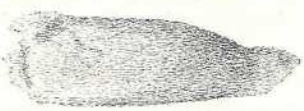

Fig 2

Fig 4

Fig 5

Fig 6

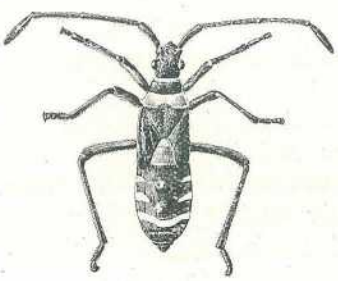

Fig 7

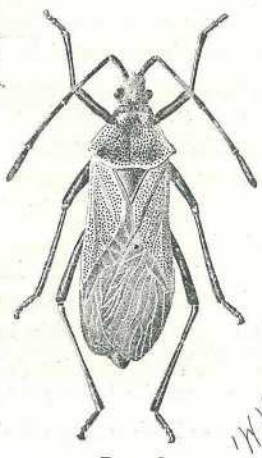

Fig 8

PLATE III.

FIG. 1.—Larva of *Earias huegeli.*
FIG. 2.—Cocoon of *Earias huegeli.*
FIG. 3.—Moth of *Earias huegeli.*
FIG. 4.—Pink Boll Worm larva (*Platyedra gossypiella*).
FIG. 5.—Pink Boll Worm Moth (*Platyedra gossypiella*).
FIG. 6.—Adult of *Oxycarænus luctuosus.*
FIG. 7.—Fifth instar of *Aulacosternum nigrorubrum.*
FIG. 8.—Adult of *Aulacosternum nigrorubrum.*
Fig. 6, × 5; all others by $2\frac{2}{3}$.

again. This caterpillar is a small grub with a dark head with a faint pinkish flush just behind the head, but otherwise colourless. It is usually heavily parasitised and does not as a rule call for remedial measures. There are two other grubs which appear on the cotton. One[20] is a large grub rather bigger than the Corn Ear Worm, with a light stripe running the length of its body and a series of black triangular markings. When in a cotton field it will attack leaves, squares, and bolls. The eggs are laid in a mass covered with brown hair on the under sides of leaves, and the little, freshly hatched caterpillars feed in a group, scattering later as they grow older. The chrysalis stage is passed in the ground. The moth is a handsome insect with dark-brown fore wings marked with buff and with a violet patch near the upper angle. Fortunately these insects are only rarely seen in cotton fields.

The other grub is a green looper[21] caterpillar which eats leaves and occasionally bracts. The chrysalis is made in a rolled-up leaf. The moths are marked with yellow and brown, the males being darker than the females.

It is very rarely that this insect does any harm, indeed it often does good to a plant which has set too much leaf after excessive rain.

In 1923, in many places a small leaf-eating beetle did a lot of damage by defoliating the plants.[22] It has not been in evidence since that time. Should it reappear, the fact should be reported to the Chief Entomologist and specimens of the beetle sent to him.

The Stainers.

(Plate IV.)

The insects whose activities have been described in the preceding pages have four distinct phases in their lives, of which only one actually damages the cotton. Those phases are the adult moth, the egg, the caterpillar, and the chrysalis or pupa. The caterpillar stage is the destructive one. There is another class of insects, the bugs, which shows differences from the foregoing. Firstly, in the method of feeding. The bugs obtain their food by sucking; their mouths are provided with structure adapted to this, whereas caterpillars have jaws and bite their food. This difference is important, as it means that the bugs cannot be controlled by poisoning their food, while this is perfectly possible in the case of caterpillars. Secondly, there is no pupa or chrysalis stage; and thirdly, the young bugs or nymphs bear a general resemblance to their parents, and damage is done to plants by either nymphs or adults.

In most of the pests to be considered in this bulletin, the adults lay eggs either in the soil or on the cotton plants. The young bugs hatching from these soon begin to feed; they differ from their parents chiefly in

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[20] *Prodenia litura* Bois.

[21] *Cosmophila flava* F.

[22] *Monolepta rosea* Blkb.

Fig. 1.

Fig. 2

Fig. 3

Fig. 4.

Fig. 5

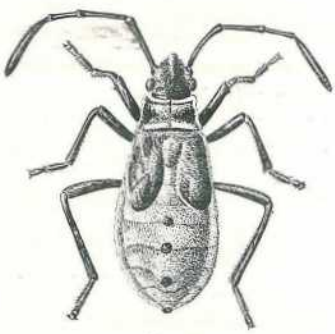

Fig. 6

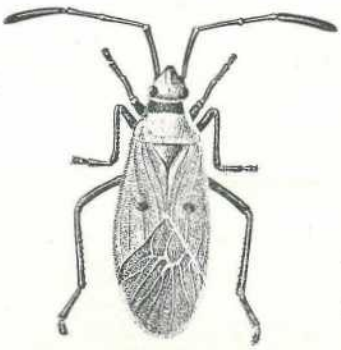

Fig. 7.

Fig. 7A

Fig. 9

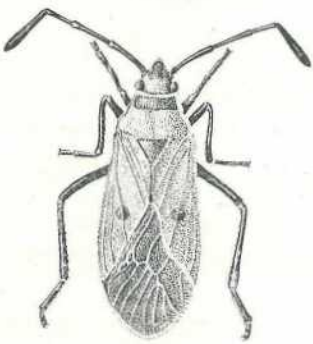

Fig. 8

Fig. 8A

PLATE IV.—THE COTTON STAINER (*Dysdercus sidæ*).

FIG. 1.—Egg × 12.
FIG. 2.—First instar × 12.
FIG. 3.—Second instar × 6.
FIG. 4.—Third instar × 6.
FIG. 5.—Fourth instar × 8.
FIG. 6.—Fifth instar × 4.
FIG. 7.—Adult male × 3.
FIG. 7A.—Posterior ventral segments (male) × 3.
FIG. 8.—Adult female × 3.
FIG. 8A.—Posterior ventral segments (female) × 3.
FIG. 9.—Femur × 8.

size and in the absence of wings. During the nymph life they cast their skins, or moult five times and after the fifth assume the adult form. The rudiments of the wings are visible after the third and fourth moults.

Feeding is effected by means of two pairs of needle-like structures, the stylets, which are enclosed in a jointed sheath, the rostrum. The stylets when applied to one another form two channels down one of which is a flow of saliva, and up the other the plant juices can be sucked; at the same time they are thrust into the part of the plant on which feeding is taking place, so that they are used for both sucking and piercing. The rostrum is not pushed into the plant, but is either folded under the body while feeding is in progress, or serves as a guide for the stylets.

This briefly is a general account of the habits of the bugs which is necessary for an understanding of the harm done by them, and the measures which must be taken to control them. The three insects to be considered now all damage the seed, and two of them damage the developing boll as well. They are the Harlequin Bug,[23] the Cotton Stainer,[24] and the Cotton Seed Bug.[25]

THE HARLEQUIN BUG.

This very handsome insect is to be found in most of the Pacific Islands, in Queensland and New South Wales, and in the Northern Territory. In the 1923-24 and the 1924-25 seasons it did a lot of damage to cotton in Queensland, causing stained lint, damaged seed, and deformed bolls.

The Harlequin Bug is a large, shield-shaped insect from ¾ to nearly 1 in. in length. Its colouring generally consists of some combination of yellow and orange and metallic green or blue. Certain individuals are scarlet and blue, these latter appearing mostly in the spring and autumn. All show a great variety of pattern, and are very conspicuous insects and not easily overlooked. The nymphs are coloured blue or green and red, except just after moulting, when they are a brilliant orange-red. The average length of life in the summer in Queensland is as follows:—Egg, 16 days; nymph, 70 to 77 days; adult, 90 days, more or less according to circumstances.

Investigations carried out at the Cotton Research Station show that in a normal season the Harlequin Bug migrants begin to come into the cotton fields shortly before the first flowers open, and keep on arriving after that time for a month or more; in the meanwhile the first arrivals have laid eggs, and soon the population in the fields increases rapidly.

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[23] *Tectacoris lineola* F.; sometimes known as the Chinese Bug.

[24] *Dysdercus sidæ* Montr.

[25] *Oxycarænus luctuosus* Montr.

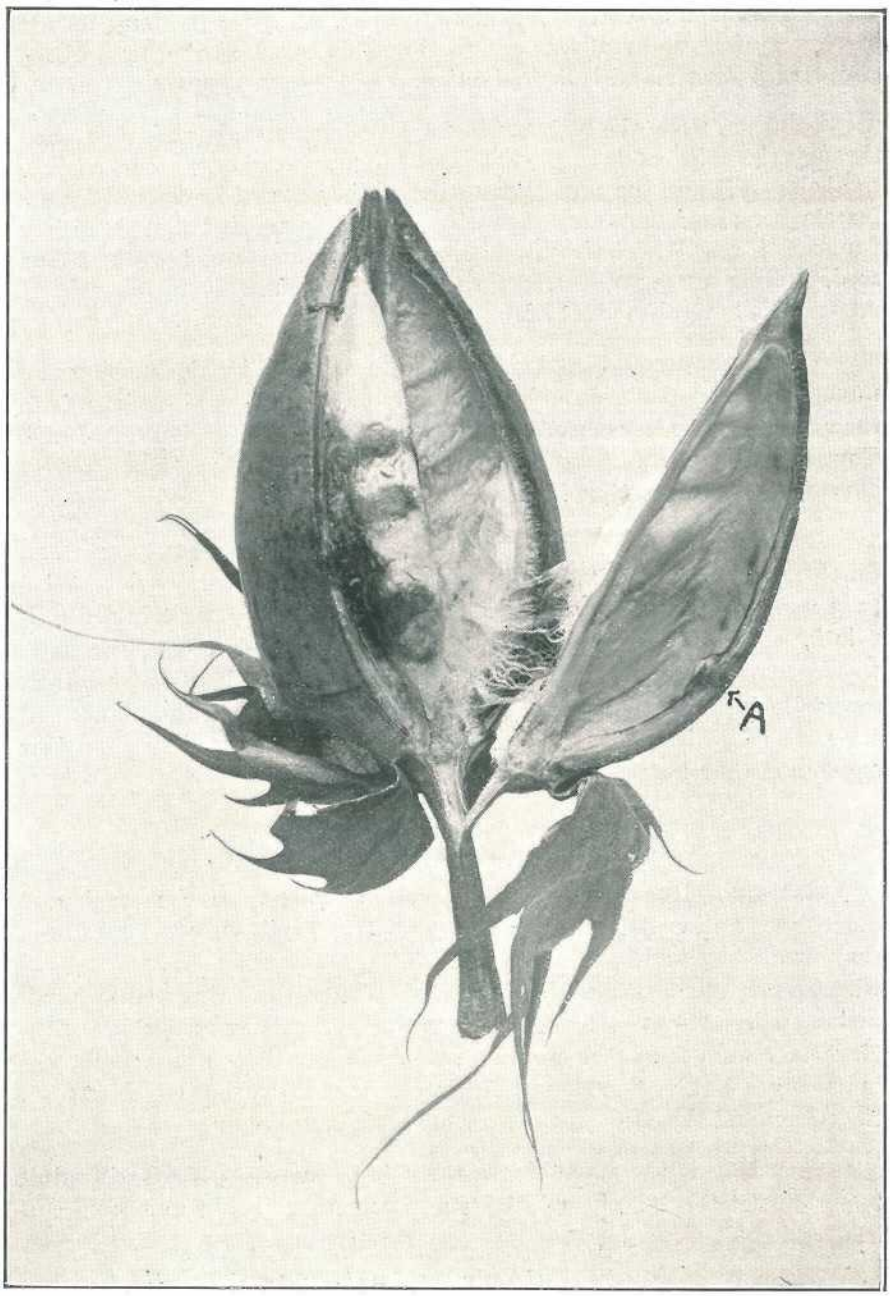

Plate V.

Showing damage done to cotton bolls by bug punctures through which fungus spores penetrate, staining and weakening the lint. At "A" is the callus surrounding the wound.

Young bolls are selected by the nymph and adults for food. When very young bolls are attacked, they are shed, but since the bugs do not breed very fast no great loss occurs from this cause, as the plants keep ahead with square and boll production.

Later on, when the bolls are bigger, the bugs are piercing them, and through the holes made in the boll-wall fungus spores or moulds get into the bolls and stain the lint. (Plate V.) When a seed is reached by the insects, as often happens, then that, too, becomes inoculated with a fungous disease.[26] The result is shown in brown-stained weak cotton, seeds failing to germinate, deformed and prematurely opening bolls. After bolls have opened, Harlequin Bugs feed on the seeds.

The actual amount of damage done to any boll by the sucking and puncturing alone is very small. The chief harm done by these bugs is in their providing a means of entrance to the moulds of boll-rot fungi. Towards the end of the season over 80 per cent. of the bolls will be affected by boll-rots alone.

Harlequin Bugs are on the whole lethargic animals, easily seen and caught. The eggs are laid some 80 to 120 at a time, wrapped round a twig or a leaf-stalk. They appear like a lot of small, pearly, pinkish pills side by side, forming a cylinder or very broad band around the place where they are laid. The nymphs generally live clustered together, especially in the early stages. Adults often sit about on the plants and are not easily disturbed. The females have the habit of sitting on their eggs until they hatch.

REMEDIES.

Harlequin Bugs come into the cotton fields from the scrub and places where other natural food plants exist.[27] While they are coming in they should be caught and destroyed. All egg-masses should be destroyed whenever found, as should also clusters of nymphs. Systematic hand-picking spread over a month will go far towards reducing infection. November and December would probably be the best months, but the bugs may not start coming in until later. It will depend on the state of the cotton and the effect of the previous spring on the bugs.

Very hot, dry weather checks the rate of increase; frosts kill adult bugs, but not the nymphs, which seem to be more resistant to extremes of heat and cold.

Like most insects the Harlequin Bug has its natural enemies, but they only exercise a partial control and do not keep it completely in check. Breeding appears to occur all the year round, although the life cycle is considerably prolonged during cold weather.

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[26] *Fusarium moniliforme.*

[27] Bottle and Kurrajong trees (*Brachychiton* spp.) and *Hibiscus* spp.

THE STAINER.

Description.

The Stainers when adult (Plate IV., Figs. 7, 7*a*, 8, 8*a*) are medium-sized insects a little over ½ in. in length. The front part of the wings is either dark brown, brown-grey, reddish brown, or almost orange, the exact colour depending partially on age. There is a black dot in the middle of each wing, and the ends of the wings are very dark iridescent green. Legs and antennæ or feelers are dark brown or black. The under side of the body is white with a certain amount of black. This white colouring changes to yellow as the insect gets older.

There is another bug with which these might be confused, but this is red or orange and black underneath, and there are no spots on the wings.[28]

Habits.

The Stainer has not yet been under observation sufficiently long for one to be absolutely certain when to expect the first arrivals in the fields. So far as we know, in a fairly normal season it will be about the beginning of the New Year, or approximately at the time the first bolls are beginning to open. The period of migration seemed to last a month of so, but a great deal depends upon meteorological conditions, and even more on the abundance and conditions of natural food plants. The bugs feed on green bolls, damaging them in the same manner as the Harlequin Bug. They show a decided preference for cotton seed, and provided the days are not too hot and dry numbers of Stainers can be found crowded into the open bolls, or on those which are just beginning to crack, for which they show a decided preference. Very hot weather causes them to remain inactive during the hottest times of the day, and they remain as much as possible in shelter. A heat wave such as that of February 1925 or the dry spring of 1926 checks them considerably. They are very dependent upon moisture, and will kill one another if they cannot get it. They have often been seen to feed on other insects.

Individuals will live as long as 65 days in favourable circumstances in the summer, and very much longer in the winter, the females laying as many as 850 eggs; probably 500 to 600 is about the usual amount (but much depends on the food upon which they are living). The number laid at any one time varies from about 50 to 100. They are always laid, a number together, either just under the surface of the soil or under a little clod or a piece of stick or some such protection. The eggs are like miniature hen's eggs (Plate IV., Fig. 1) when first laid—pearly, changing to orange before hatching. They hatch in 4 to 6½ days in summer. As the weather gets colder they may take over three weeks or a month, failing to hatch altogether when the average temperature is 60 deg. F. and below.

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[28] *Aulacosternum nigrorubrum* Dall.

The little bugs (Plate IV., Figs. 2 to 6) emerging from the eggs are orange-red until after their first moult, when they are red and black. They get more white on the hind part of the body or the abdomen as they get older, especially in the last stage before becoming adult. All except the first stage are keen feeders on cotton seed, and they will also suck green bolls and the stem. They are fond of shade and moisture. Left undisturbed and provided with suitable food, the Stainers will go on breeding all the year round, and can always be found males and females coupled together. The only difference that cold weather seems to make is that all the different stages take longer to complete. Development seems to cease when the mean temperature averages below 60 deg. F. The nymph stage in summer lasts altogether about four weeks, so that it does not take long for the first migrants from the bush to breed up a big population. The early pickings of cotton are always much more free from stain than later ones, for this reason: Very hot weather, by limiting the activities of the Stainers, also means cotton free from the brown stain which takes so much off the prices. This was very noticeable in the 1925-26 season, when prolonged hot, dry weather was accompanied by a very small Stainer population, and the cotton in consequence was of exceptionally high grade.

Other Food Plants.

Stainers feed on several wild and cultivated plants besides cotton, but principally on those related to cotton, or closely allied families such as species of wild and cultivated hibiscus, bottle trees, kurrajong, *Sida retusa,* and other common weeds. So far as our investigations have gone, not even kurrajong and bottle-tree seeds have the same food value for Stainers as cotton. *Sida* and *Malvastrum* seeds only enable them to reproduce small broods.

Control.

The stock remedies for Stainers are—

(1) Destruction of wild food-plants;

(2) Traps of cotton seed;

(3) Early clean-up of the crop; and

(4) A dead season when no cotton is grown.

No. 1 is out of the question in Queensland and will be for many years to come. No satisfactory trap is yet forthcoming which would commend itself to farmers, and experiments in this direction are still in progress. Insecticides are out of the question and need not be considered.

No. 3 is most important from every point of view, and is dealt with in detail later. It will be enough to say here that, if cotton is left to stand over or neglected, in the following season Stainers will get a flying start and begin breeding in the crop long before they would have done had there been a complete clean-up and burning of the previous

season's crop. *A standover crop is far more dangerous than any wild plants in the bush.* When cotton bushes are stacked and left to dry before being burnt, most of the Stainers present in the fields will collect under them and will be destroyed when the stacks are set on fire.

Summary.

(*a*) *Habits.*—(i.) Stainers begin coming in to the cotton in January, or later according to the season.

(ii.) Damage both by piercing bolls and admitting moulds and boll-rots and by damaging seed in open bolls.

(iii.) Life cycle in summer about five to six weeks.

(iv.) Eggs laid in the ground, young bugs feed on all parts of the plant, but specially seeds.

(v.) Flourish best in the presence of moisture and moderately high temperatures.

(*b*) *Protection.*—(i.) Traps are being tried but tests of this method are not yet completed.

(ii.) Clean-up of crop as soon as it is finished (June and July).

(iii.) Never leave cotton to stand over from one season to the next, as bugs shelter and breed in such fields.

COTTON SEED BUG.

(Plate III., Fig. 6.)

This little insect does no harm to cotton until the bolls open. It is coloured black with clear wings each bearing a large black spot. In length it is $\frac{1}{10}$ in. Early in the season it can be found feeding on the seeds of Sida sp., Wild Hibiscus, Flannel weed, and other related plants. It soon comes into the cotton and shelters in the squares, sometimes but rarely laying on a young boll. It does not begin to breed to any extent until bolls begin to open. Both young and adults feed on the seed, either in the mature boll or in a boll damaged by boll worms, and in which a hole has been cut. In very hot weather the open bolls are more or less deserted by day, but normally nymphs and adults crowd them.

Eggs are laid in the lint. They are quite easy to see once one is familiar with them, even when freshly laid. When nearly mature they assume a reddish orange colour (due to the developing nymph inside), and are then quite conspicuous. The eggs take 5 to 6 days to hatch and the whole life cycle occupies only about 20 to 30 days, so that multiplication is rapid.

The seed is damaged in the same manner as it is by the Harlequin Bug and the Stainer. This damage consists of a certain amount of mechanical damage, but a more serious thing is that the entrance for a fungus is made and very often the embryo in the seed is destroyed. (Plate VI.) In consequence, seed from a heavily attacked field shows

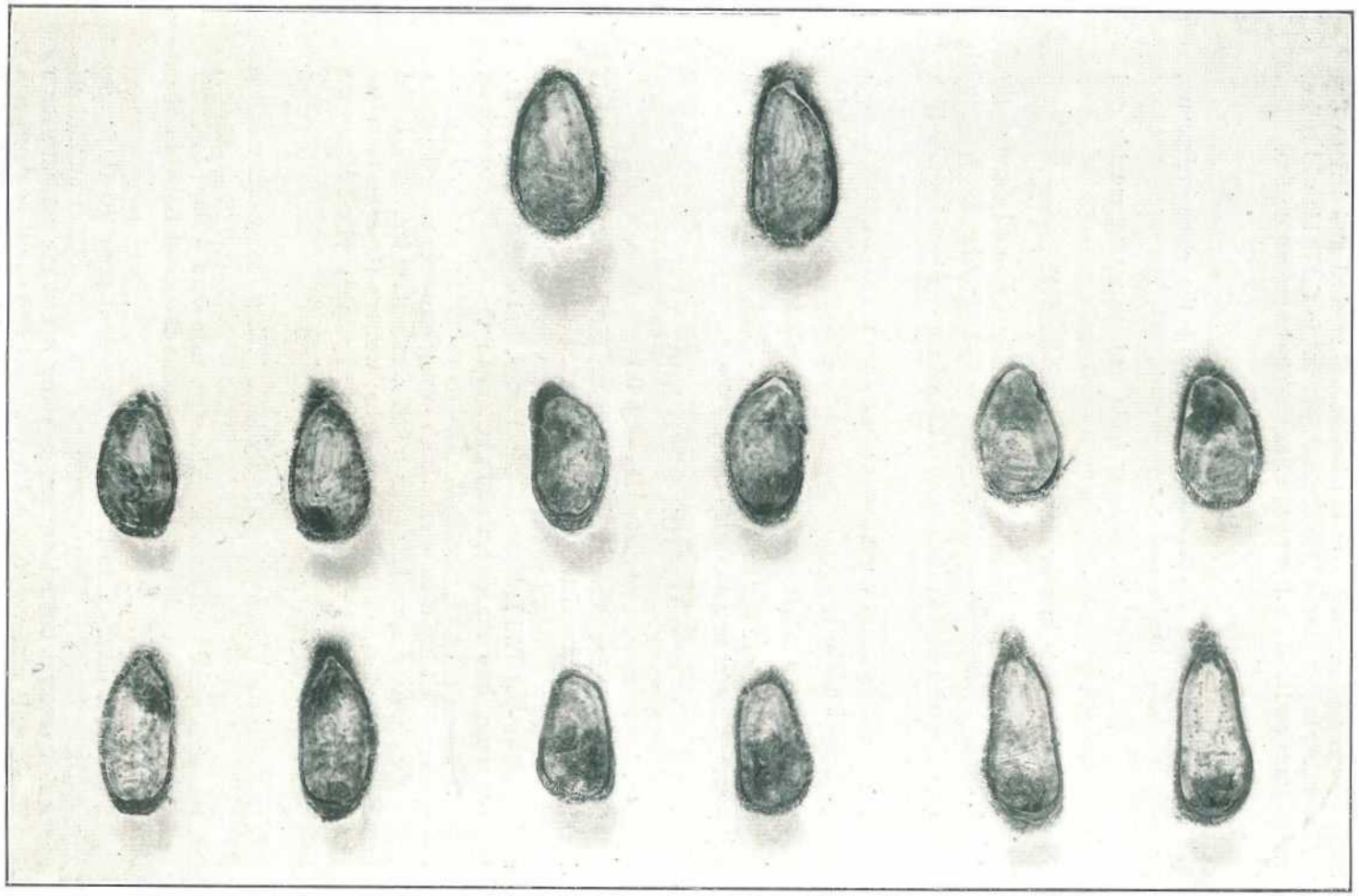

PLATE VI.

This Plate shows damage to cotton seed following piercing by *Dysdercus* or *Oxycarænus*. At the top is a normal seed and below two rows of seeds split, showing damage in different degrees.

poor germination, and the first pickings are better than subsequent ones. Seeds infected with the fungus sometimes germinate, but often the young root is subsequently attacked and the seedling withers. The effect of all three bugs is to reduce the amount of oil in the seed, so that a loss occurs whether the seed is used for sowing or not. The Cotton Seed Bug can often be seen sheltering in maize early in the season.

Bugs can be found sheltering in damaged and rejected bolls after picking is over. They seem to be resistant to low temperatures, for eggs and young ones have been found after hard frost and cold nights. High temperatures do not agree with them, and, in one lot of cotton which was under continuous observation during the exceptionally hot summer of 1926, the rate of increase was very low.

Remedies.

There is little that can be done to check these pests which would be economically possible apart from general cleanliness of the fields and headlands.

The damage done is confined to the seed, but in spite of this, with seed giving 65 per cent. germination under laboratory conditions if sown at the rate of 20 lb. to the acre, excellent strikes are obtained. At present this seed rate is all that is economically possible in the way of escaping from the effects of these bugs.

FALSE STAINER.

There is another bug[29] (Plate III., Figs. 7, 8) which, although at present of minor importance, might possibly become a major pest; indeed, even now in certain localities it causes quite a serious amount of square-shedding. This bug is in general appearance very like a Stainer and is often mistaken for one; it is known as the False Stainer. It belongs to a different family and has quite different habits. It is about $\frac{3}{4}$ in. in length with dark-brown or black legs and antennae, otherwise ochre-coloured except the membranous part of the fore wings, which is black. The under side of the abdomen is reddish or grey with black stripes.

The damage done by this insect is to squares and small bolls, which it pierces with its stylets and causes to shed. It arrives in the cotton fields late in November and is active during the next two months. The eggs are laid in small batches of 4 to 8 attached to a leaf, usually on the under side. They are small bronze objects flattened at one end. The nymphs (Plate III., Fig. 7) are conspicuously coloured black and red and yellow. There are two small parasitic wasps[30] which lay in the eggs, and which appear to keep the bug from becoming a serious pest; no other natural enemies have been found. The adults have been found during the winter sheltering in fence-posts.

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[29] *Aulacosternum nigrorubrum* Dall. (Coreidæ).

[30] *Hadronotus hirsutioculis* Girault; *H. nigricornis* Dodd.

In addition to the foregoing, several other bugs cause a small amount of loss every season by inducing square-shedding or by infecting small bolls with disease, but they are of very minor importance and do not call for remedial measures.[31]

Aphids.

Aphids are often found in some numbers on young cotton, but very seldom do any damage, as they are quickly controlled by their numerous enemies, and, provided the plant itself is healthy, need cause no alarm.

Jassids or Leaf Hoppers.[32]

These little insects are sometimes mistaken for Aphids, although quite distinct from them. They only become a pest on cotton grown in certain soils unsuitable for cotton-growing, generally red volcanic scrub soil deficient in phosphates and potash. When they occur in large numbers it is a fairly sure sign of unsuitable soil.

CONCLUSION.

This finishes the list of bugs which are likely to come to the notice of the cotton farmer.

After seeing such a list of pests one might be tempted to ask, Can cotton possibly be grown at all? The answer to that question is that even in poor seasons excellent crops have been harvested.

In 1926, in the face of one of the biggest Corn Ear Worm attacks which the writer has seen, 1,200 and 1,500 lb. to the acre from a November-planted crop were secured on the Cotton Research Station at Biloela, by using a trap crop of maize. Early planting is advisable for many reasons, and, as has been seen, this also is of great assistance in checking or avoiding pests.

Two of the most common weeds which follow on cultivation are bull-head and pigweed. While these are young they form the favourite egg-laying place for the Cutworm moth, providing both the food for the little grubs and the shelter and moisture that the eggs appear to require. The Corn Ear Worm also feeds on pigweed until it has become too old and tough, and a cotton field full of pigweed is sure to attract Corn Ear Worm moths.

Stainers also feed on *Sida*, *Malvastrum*, and other allied plants found in headlands and paddocks.

Good and clean cultivation helps the farmer, not only by keeping his crop healthy in itself but by making life harder for the insects.

Another most important point in insect control is the early and thorough clean-up of the paddocks in which a cotton crop has been

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[31] *Philia senator* (Pentatomidæ); *Ragmus importunitas* Dist. (Capsidæ); *Creontiades modestus* Dist. (Capsidæ).

[32] *Empoasca* spp.

grown. If a crop is "cow-pruned" or ratooned it will put out new shoots with the first rains, and in all probability, in the case of the former, unless there have been severe frosts, will have a sufficient number of bolls and flowers growing during the winter to support enough pests to ensure their getting a "flying start" with the first warm weather. Stainers and Cotton Seed Bugs pass the winter as adults; Pink Boll Worm can overwinter in old bolls and rubbish in the fields; so can the Yellow Peach Moth. When the cutting out of the old crop is delayed a bridge is provided between one crop and the next, and life is made easier for the pests. It is true that there are plants in the bush and scrub on which cotton pests can and do feed, but they are generally widely scattered and often not so nourishing as cotton. The farmer should aim at making the life of pests as difficult as possible. The standover crop, the crop which is cut out late, the paddock left with fallen bolls and rubbish in it, the ratoon crop, all help to keep pests going during the winter or give them an early start in the spring.

More than half the control lies in the hands of the farmer himself. It is realised that there are many difficulties to be met by the farmer in Queensland. These may include dry winter and spring conditions making an early plant difficult to get; or excessive rains when cultivation is impossible; or dry periods during the growing season. At the same time, if he would take a few simple precautions much loss could be avoided. Insects must be regarded as a constant factor in farming just as much as the weather or anything else, and precautions should be taken to control them.

TABLE SHOWING THE ACTIVITIES OF THE CHIEF COTTON PESTS THROUGHOUT THE SEASON IN INLAND DISTRICTS.

——	Corn Ear Worm.	Cutworm.	Stainers.	Peach Moth.
September..	Moths emerge from hibernation; first eggs laid on weeds, &c.	Moths emerge from hibernation	On wild food-plants	Moths emerge from hibernation
October ..	First generation grubs on weeds and maize if present	Eggs laid under weeds; grubs in cotton	ditto	Grubs in maize, beans, fruit, &c.
November	First generation ends; second generation on weeds, maize, and cotton	Grubs in young cotton planted late	ditto	ditto
December ..	Second generation on weeds, maize, and cotton; third generation begins end of month	Grubs on weeds on headlands, &c.	Migration from bottle-trees, &c., to cotton commences (date varies)	ditto
January ..	Third generation on pigweed, maize, and cotton	ditto	Migration to cotton continues..	ditto
February ..	Third generation ends; fourth generation on maize and cotton	ditto	In cotton	In cotton, &c.
March ..	Fourth generation on maize and cotton; life cycle lengthening	ditto	ditto	ditto
April ..	Fourth generation ends; fifth generation begins late in month on maize and cotton	ditto	ditto	ditto
May ..	Fifth generation on maize and cotton; hibernation begins with low temperatures	Hibernation begins	ditto	ditto
June ..	Hibernation in soil	Hibernation in soil	ditto	Hibernation in cotton, maize, &c. (if plants not destroyed)
July ..	Ditto	ditto	If bushes cut and burned, many destroyed; survivors in bush and standing cotton	ditto
August ..	Ditto	ditto	Survivors in bush and standing cotton	ditto

This table does not claim to be final. The exact date of hibernation will depend on whether the frosts are late or early and on the mildness of the winter. In a severe winter and late spring the emergence of those insects which hibernate in the soil will be delayed.

PRIMARY PRODUCE EXPERIMENT STATIONS.

LEGISLATION FOR THEIR ESTABLISHMENT.

MINISTER'S SECOND-READING SPEECH ON NEW AGRICULTURAL MEASURE.

"It is the intention of the Government to co-operate to the greatest possible extent with the growers in the industry, our desire being to secure the interest and assistance of the banana-grower in the same manner as was secured from the sugar-grower. By that means much good will result; the industry will be built up; a greater number will be employed in the industry; and the sum total of the wealth produced in the State increased."—*Mr. W. Forgan Smith, Minister for Agriculture and Stock.*

A new agricultural measure, having for its object the establishment of banana and other experimental stations, was introduced by the Secretary for Agriculture and Stock in the course of the month. Subjoined is the full text, taken from "Hansard," of the second-reading speech of Mr. Forgan Smith on the Bill, and which is of particular interest to rural producers.

The Secretary for Agriculture (Hon. W. Forgan Smith, *Mackay*): As I explained at the introductory stage of this measure, it is intended to give the Government power to establish experiment stations for all forms of primary produce, following very largely the principles set out in the Sugar Experiment Stations Act, which have been of so much value to the sugar industry.

The main object of the Bill is to enable the Government to carry out various forms of research work that is necessary in the various primary industries, and co-ordinating the various activities engaged in that direction at the present time with a view to bringing about better results than have been obtained hitherto, so that the growers themselves will be personally interested in the various activities carried out. There is a considerable difference between experiment stations of this kind and the ordinary State farms that have been established in the past. Since I have been Secretary for Agriculture, and before then, I have noted that the sugar-grower took a very keen interest in the work of the sugar experiment stations, and that the various field days held by Mr. Easterby, the head of the department, and the work of his officers were closely followed by all those concerned in that industry, whereas, on the other hand, the work of the ordinary State farm did not receive such attention. Of course, a good deal of valuable work can be and is being done on State farms and will continue to be done on certain of them; but the work done does not receive the attention which appears to be desirable.

Mr. Peterson: Some of them are in the wrong place.

Experimental Plots—The Present Departmental System.

The Secretary for Agriculture: Undoubtedly some of them are in the wrong place. The further point is often raised by settlers in the various districts that State farms may obtain certain results because they have ample machinery, ample labour, ample fertilisers, and all other resources at their disposal, while the farmer is not able to carry out his operations in the same manner. A good deal of success can be achieved by establishing experimental plots by arrangement with individual farmers in the various districts. The department frequently makes arrangements of that kind, selecting a good resourceful farmer in a given district. We make financial arrangements with him which are satisfactory to both parties, and then we are able to say to his neighbours that the work carried on by such and such an individual is an indication of what should be done throughout the district. Such a farmer sets a standard which his neighbours often endeavour to emulate; and it is our intention to continue and expand that policy as far as possible.

PLATE 150.—THE HON. W. FORGAN SMITH, DEPUTY PREMIER AND MINISTER FOR AGRICULTURE AND STOCK.

The Scientist and the Farmer.

Coming more particularly, however, to the work which it is proposed to do under this Bill, one must readily realise that, if good standards are to be maintained in Queensland, they can only be improved upon by our maintaining the highest degree of efficiency. In other words, we must bring science to bear on the problems of the average farmer and help him to solve those problems; and help him in his various difficulties with a view to enabling him to achieve better results from his own efforts than he has been able to achieve hitherto. Under the Bill we shall have power to deal with all forms of primary produce. It is intended, however, to apply ourselves in the beginning more particularly to the fruit industry.

Putting the Land to its Best Use.

Before I go on to deal with that, however, I wish to say that I have taken out some very interesting figures in connection with the primary products of Queensland, which I shall give to the House at a later date. I have also some interesting figures showing importations into Queensland and other States of Australia of products which, in our opinion, can be successfully grown in Queensland. Therefore, it is the function of my department, and the desire of all good Queenslanders, to see that the land of this State is put to the best use, and that information be made available to land settlers in regard to those crops which will find a ready market in Australia and which are suitable to the climate, soils, and conditions of this State. It is along that line that progress can be made and better results achieved. An example of the value of this kind of work can be seen in the sugar experiment stations I have referred to.

The Value of Sugar Experiment Stations Manifested.

When the Sugar Experiment Stations Act was passed the area of sugar-cane crushed in Queensland was 72,651 acres, and the yield 848,238 tons of sugar-cane, or an average of 11.68 tons of cane to the acre. The return from the cane was 92,554 tons of sugar, or an average of 9.44 tons of cane to the ton of sugar. Hon. members will note particularly those figures—a little over 11 tons of cane to the acre and about 9½ tons of cane to the ton of sugar.

In 1926 the area of cane crushed was 189,312 acres, which gave a return of 2,925,662 tons of cane, or an average of 15.45 tons of cane to the acre. From this cane 389,272 tons of sugar were made, or an average of 7.52 tons of cane to the ton of sugar. During the period of the activities of the sugar experiment stations the yield per acre increased from 11½ tons to 15¾ tons per acre, and the amount of sugar-cane required to produce a ton of sugar was reduced from 9½ tons to 7½ tons, showing remarkable progress during the period under review, and indicating that the industries in the State are getting a splendid return from the cost of the establishment of these experiment stations.

While giving due regard to the improvement that has taken place in the efficiency of the mills, I claim that most of that improved return is due to the improved methods of cultivation on the farms, due to the improvement in the various types of plants made available to the sugar farmer, and also to the research work accomplished in regard to dealing with the various diseases and pests which afflict that form of plant life. Well, I claim that what can be done in one industry can be done in all. Whilst the proportion of improvement may vary, all indications point to increased returns and greater economic advantages as a result of work along the lines I have indicated.

The Value of the Banana Industry.

As I pointed out yesterday, the banana industry is worth a little over £1,000,000 per annum to the people of Australia. It is an industry which gives a very good return to those engaged in it, and one which is capable of considerable improvement and expansion.

The hon. member for Windsor yesterday referred to the depreciation in quality of bananas. There is no doubt that depreciation in quality has taken place in certain districts. It will be the object of the stations which we propose to establish to lay down the facts with regard to that depreciation, to give the reasons for it, and to find a remedy. There is no doubt that one obvious reason can be stated at once. It is to be found in the depreciation of the lands under this crop. If men grow the same crop year after year without sufficient cultivation and do not fertilise, a depreciation

of soil values must eventually be brought about, with the consequence that good results cannot be obtained. Plant life suffers from malnutrition, and similar results accrue from it as in the case of human beings or stock. It must be understood that to get the best results from any crop proper soil is required, and that that soil requires careful tilth and must have some of its constituents periodically renewed if the same crop is to be grown regularly. It is not possible to carry out a proper rotation of crops in many areas in Queensland such as can take place in other countries or other States in Australia. However, the banana-grower in the main is deeply interested in the future of his industry. I have occasion frequently to meet members of the various sectional committees, including that dealing with the banana industry; and they show an alertness of mind and an understanding of the needs of their industry which appeal to me very much. When that attitude of mind is shown by anyone in an industry, we are justified in assuming that he is prepared to take whatever steps may be necessary to improve the conditions in the industry in which he is engaged; and it is as a result of requests of various kinds and discussions with the banana-growers themselves that I have brought forward the Bill we are discussing this morning. The experiment stations will be subsidised by the Government, but will also be a charge on the industry itself. In the case of the sugar experiment stations the cost is divided between the grower and the Government, a levy being made per ton of cane and payable at the mill. Under this Bill the Governor in Council is empowered to make a levy on the produce of the type which it is proposed to assist, and the fund so collected will be subsidised by the Government with a view to helping the producers to bear the cost of carrying on the activities of the stations. The banana-growers and members of representative organisations to whom I have spoken are quite willing to incur such a responsibility, and evidently feel that advantages will accrue to them from the scheme. There is also in that connection the important fact to be borne in mind that where people are financially interested in the results of the stations or nurseries they will take a more active interest in their work than otherwise, and we shall thus be able to secure complete co-operation between the department and the growers in the industry concerned.

The Fiscal Question.

I mention also—and this is an important phase of the problem to which the grower of bananas must apply himself in this industry—the question of the Australian tariff or the protection that is given to this industry. I lay it down as a definite principle in a fiscal policy that, where a Government gives protection to any industry, it is the moral responsibility of that industry to see that they supply the people with a sufficient quantity of the commodity protected and of good quality to meet their needs. In other words, the National Government say to the industry, "We will give you protection for this industry; we will place an import duty on this commodity, which will enable you to carry on your industry under Australian conditions"; but the responsibility then falls on that industry to rise to the occasion and supply Australian needs in sufficient quantity and of a sufficiently high quality to meet the reasonable requirements of all concerned. That is a principle with which I think everyone will agree; and it is on the maintenance and the carrying out of that principle that the continuance of the duty depends. One can readily understand that, if the general public make serious complaints that they are not being properly served by an industry, any Government would be compelled to pay attention to such a state of affairs.

Supplying Australian Needs.

A good deal of work has already been done in connection with the banana industry; and various organisations of farmers have applied themselves very closely to this problem, achieving considerable results, but much yet remains to be done. I feel that an extension of the industry is required to enable us to meet the needs of Australia. There are areas in Queensland eminently suited to the cultivation of bananas. In many portions of Southern Queensland this industry is being carried on, and the fruit of a high quality is exported from the State and sold locally; but, owing to the ravages of bunchy top in many districts, the production fell away to some extent, some areas being compelled to go out of production. However, Professor Goddard, acting in co-operation with the Department of Agriculture, and assisted by the Commonwealth Government in certain laboratory tests and experiments, has been able to provide a means of coping with this disease, although no remedy or specific that will immediately affect the result has been provided. It is unreasonable to expect that. Unfortunately, we cannot expect any specific that will provide for the immediate eradication of disease in plant or human life; but in connection with the banana industry methods have been set out, which, if followed properly, will enable

this disease to be kept under control. If the banana-growers in Queensland carry out the instructions of the department as set out by the investigation committee, this disease can be kept under control, and the losses that have occurred in the past will not be repeated in the future.

Bananas in the North.

As the hon. member for Windsor mentioned yesterday, in the northern portions of the State a considerable area was placed under banana cultivation many years ago, but that there has been a great falling off in the industry of late years. I was asked by the hon. member as to the chief reason for this falling off. There is no doubt that one reason has been the development of the sugar industry. The farmer and landholder in areas suitable for the development of sugar-cane found it a more valuable and satisfactory crop than bananas. That was due chiefly to the fact that sugar-mills were provided in suitable areas in the North, and those mills were at all times prepared to take the cane supplied to them by growers within their areas. In other words, the grower of cane was assured of a market in his own district, whereas the banana-grower at that time was dependent on shipping, and much loss resulted to him in transhipping his product from the place where it was grown to where it was sold. Boats loaded at Cairns or Innisfail often took a considerable time to reach their destination. The conditions under which the product was handled and various other factors militated against the the farmer securing the best result for his product. In addition, sailings were so few that often a farmer was not able to market his product in a fresh condition. Because of those reasons the banana-grower discontinued operations on a large scale; but in recent years, owing to the situation in the sugar industry where production has overtaken the consumption, farmers have looked to other activities to utilise their available land. There are very rich areas of fertile soil in North Queensland that are not required for sugar cultivation, and during the past two or three years we have been encouraging the holders of these lands to extend their operations into banana cultivation with a view to developing that industry, and with a view to enabling them to make a livelihood from that crop. The Department of Agriculture has been carrying out experiments with bananas at various State experiment stations in the North and on various Crown lands, with a view to developing a type suitable to the conditions obtaining there. Experiments have been carried out at South Johnstone and elsewhere by the fruit section of the department, and up to the present time they have given very satisfactory results, and a considerable development has taken place in the volume of export of bananas from the North. As a matter of fact, I am satisfied that it will be necessary in the very near future to run special fruit trains from North Queensland to cope with the production that is now being carried on there. (Hear, hear!) Another interesting feature is that the product of the grower on the Johnstone River and the northern portions of the State generally carries well and opens up in good condition in the markets in the Southern States. (Hear, hear!) I have heard nothing but excellent reports of the product grown in those areas. However, a good deal remains to be done in that connection, and I am satisfied that work along those lines will give a satisfactory return.

Commercial Varieties.

The type of banana grown is one that is also being dealt with. I think it was the hon. member for Windsor who yesterday referred to the Gros Michel banana that is grown in other parts of the world. Some years ago the Department of Agriculture imported suckers and plants of the Gros Michel variety, and these were distributed to banana-growers in Queensland with a view to trying them out under Queensland conditions. Unfortunately, a careful record of that distribution was not kept, and the result of the experiment cannot be regarded as satisfactorily affording a definite indication for or against that particular type of banana. Its development under Queensland conditions will require careful observation, so that its history may be carefully noted to determine whether it is a suitable banana for growing in the State. However, further experiments are being conducted to that end in North Queensland, and, as a matter of fact, a considerable portion of the new areas recently planted with bananas is represented by the Gros Michel type in addition to the Cavendish variety. It is interestng to note that nearly four-fifths of the commercial bananas grown in the world are of the Gros Michel type; and one large American firm—Elders, Fyffe, and Company—engaged in the exportation of bananas to Great Britain and other European countries has three-quarters of its turnover represented by that variety. At the same time, it must not be assumed that the Gros Michel is the only type of banana that can be developed and made suitable, a fact which is proved by the action of some of the companies in the West Indies recently sending an officer to Queensland with a view to testing the suitability of other types for their require-

ments. This type of banana is particularly liable to be afflicted by a disease known as the "Panama" disease, and in view of this fact we have been careful not to encourage the importation of the Gros Michel to Queensland, our experiments being conducted with plants that were imported here many years ago. We consider that it is safer to carry on research on a small scale in that way rather than to encourage importations from other countries with the liability of introducing undesirable forms of disease.

Transport.

In addition to growing the best types of bananas and ascertaining their liability to disease or otherwise, a good deal requires to be done in connection with the transport of this fruit. From investigations which I have recently made I find that a company operating in the West Indies has vessels specially constructed for the transport of this fruit in order to ensure its being marketed in as fine a condition as possible. On the railways special trucks are made available, and everything is done to ensure a high marketable quality. It will be seen, therefore, that a good deal of work requires to be done in this State to ensure the proper handling of the product after it has been successfully grown, because, if methods are laid down whereby bananas can be grown in commercial quantities, it is necessary also to provide for proper handling so that economic loss will not result in transit. In that and in other directions work will be undertaken under the measure now being considered.

The Government's Rural Policy.

It is the intention of the Government to co-operate to the greatest possible extent with the growers in the industry, our desire being to secure the interest and assistance of the banana-grower in the same manner as was secured from the sugar-grower. By that means much good will result; the industry will be built up; greater number of men employed in the industry; and the sum total of the wealth produced in this State increased. I think I have said sufficient to outline the main principles of the Bill, and, therefore, I have much pleasure in moving—

"That the Bill be now read a second time."

Honourable Members: Hear, hear!

GREEN MANURING.

By GEO. WILLIAMS, Acting Director of Fruit Culture.

The maintenance of a reasonable supply of humus in orchard soils, more particularly when planted with citrus, is universally recognised as a necessity, and the most economic way of ensuring it is by systematic application of green manure. Various crops are grown for the purpose, including barley, maize, natal grass, and legumes. The selection of a particular variety to be grown will be guided by local conditions, and in the case of deciduous fruits an autumn or early spring crop would be the most suitable. Summer crops would impede operations among fruiting trees and would not on account of orchard activities have a reasonable chance of development. Among citrus a summer crop is the most suitable, harvesting and cultural operations being against the success of a winter growth. Where land is liable to "wash," clean cultivation during summer months is inadvisable and the growing of a cover crop calculated to prevent damage by storm waters should be a regular practice. Where slopes are not very defined, cowpeas make an excellent covering and provide a heavy crop for ploughing in. Mauritius and other varieties of beans are also well suited for the purpose, but being particularly vigorous require more attention to keep them from over-running young trees; besides, when developed they are not so easily ploughed in. Although beans and peas have a decided tendency to improve the soil, they are not capable of making good deficiencies, and a liberal fertilising to induce luxuriant growth is most beneficial, for it stimulates both the trees and the cover crop; and, when the latter is ploughed under, such quantities as have been absorbed by it are augmented and returned to the soil. Light soils are generally deficient in humus or quickly become so after cropping and consequently are less capable of retaining moisture or the fertilisers that may have been applied. The deficiencies are reflected in the colour of the foliage, particularly when the trees are carrying a crop, and this in consequence is also affected detrimentally. Unfortunately, the practice of green manuring or maintaining the requisite supply of humus is not general. The illustration depicts the extent of growth attained by cowpea in Mr. T. Allen's orchard (Palmwoods) in light sandy loam.

PLATE 151.—COW PEA, A GREEN-MANURING CROP GROWING IN LIGHT, SANDY LOAM ON MR. T. ALLEN'S ORCHARD, PALMWOODS.

RURAL ROUTES IN QUEENSLAND.

THE WORK OF THE MAIN ROADS COMMISSION.

The Sixth Annual Report of the Main Roads Commission, from which the subjoined notes have been abstracted, commends itself strongly to all concerned with rural progress.

As a result of the carefully organised work of the Commission a net of well-constructed arterial highways is spreading gradually over the map. A survey of a year's activities discloses the extent to which the Commission has become a factor in the enrichment of rural life in Queensland.

Through the courtesy of the Commission we are enabled to reproduce herein some of the excellent plates contained in its Report, and which illustrate the value of its general community services.—Ed.

THE POLICY OF THE COMMISSION.

During the past few years a revolution in transport has been effected in most civilised countries, due to the increased use of the motor vehicle and the construction of better roads. In Queensland we have the experience of good roads having caused increases in traffic of more than 100 per cent. within a few years, and it is proposed to publish the traffic census studies which are in progress, to show the relation between road improvement and volume of traffic, which incidentally brings in its train additional maintenance costs.

The Commission has been subjected to some criticism at times for what has been described as "its piecemeal system of construction." Thinking persons will, however, realise that with the vast mileage of unimproved roads in this State it is not possible to start in some heavily trafficked centres and work continuously outwards to completion with a first-class pavement on any one road. More improvements have been effected where the traffic is densest, but in general the policy has been to take the worst sections of the road and make them as trafficable as possible within the shortest period of time possible. The work done has been of such a standard that it will be capable of progressive improvement from time to time as traffic demands need and give the greatest benefit to the greatest number. The opposite policy, which is advocated by some people, is to start constructing, continuously, high-class pavements, in all directions, radiating from the big centres. The effect of this would be that only a very small proportion of the traffic of the country would receive any material benefit from main roads construction.

Much of the work done to date has involved the construction of the very worst portions of the roads, and consequently the hold-up of traffic on main roads is nothing like so frequent as it was four or five years ago. At the inception of the main roads scheme in 1921 a system of roads—arterial and branch—was mapped and has been added to from time to time, but the endeavour has, all through, been to make a connected system of roads which in the course of time will, it is hoped, in the more closely settled areas, be all paved or all capable of being travelled in all weathers, whilst in the pastoral areas the construction of bridges and floodways will greatly assist transport.

The gazettal and construction of all these roads has been done in fullest co-operation with the Local Authorities of the State. No section of road has been constructed without the proposal having been first fully discussed with the Local

Authority, which in general has been the constructing authority, and the same may be said with regard to the whole planning of the system. Local knowledge has thus been fully availed of. The construction of main roads has stimulated a general improvement in Local Authority works, and road construction throughout the State and main roads methods have been adopted in very many shires, which have now provided modern road plant, thereby reducing the cost of their works and rendering more effective maintenance of their own roads possible.

The motor-car to-day has become such an adjunct to general travel that agitation for construction of trunk and arterial roads has been almost incessant. Considerable

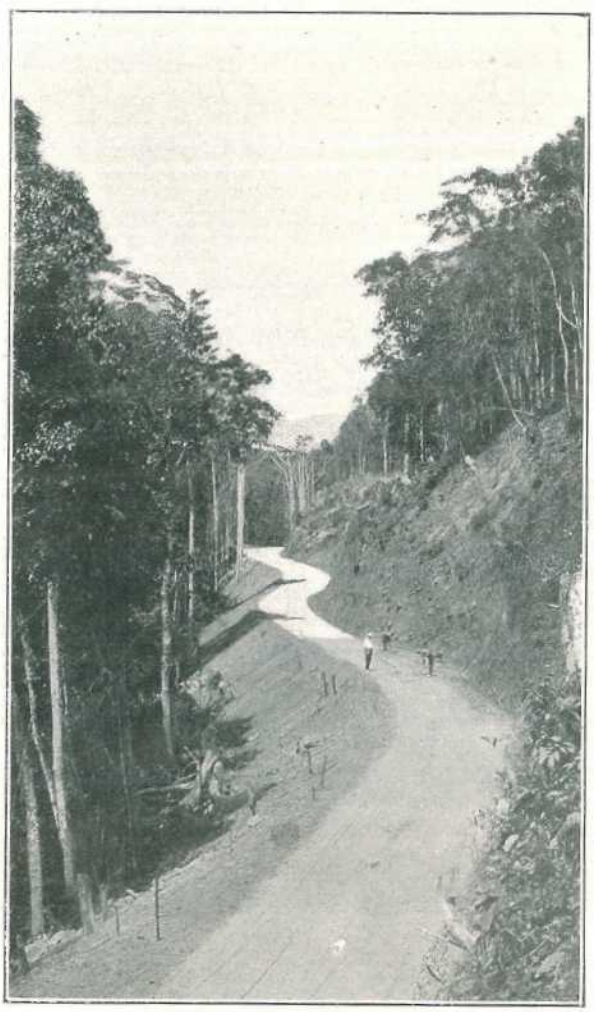


Plate 152.

Jungle Section, Gordonvale-Little Mulgrave Road, Gravelling in Progress.

agitation has existed for the construction of bridges on the South Coast road, between the Queensland border and Brisbane (in order to replace the ferries), and also in other parts of the State. It is understood that one of the Local Authorities obtains about £800 per year from a ferry contractor for the right to charge for the carriage of vehicles, &c., across the river. The ferry facilities are such that during holiday

time vehicles are often required to wait for over an hour. It is now proposed to bridge, at the earliest opportunity, these rivers where crossed by main roads, and plans are in course of preparation with this end in view.

"SELL OUR SCENERY."

It cannot be too strongly urged (the Report continues) that the tourist traffic should not be overlooked. The reports of most of the Highway Commissions of America stress this point, and the slogan "Sell our Scenery" is a common one. Some consideration might be given to the provision of funds for tourist roads or tracks in various parts of the State, as such money judiciously expended would be a sound investment in advertising alone. The Main Roads Act makes no provision for purely tourist roads to our national parks.

Proper co-ordination of road and rail services is essential to-day if this country is not to lag behind. The construction of good roads connecting centres of population and leading to railways should do very much towards keeping people on the land. What good roads have done in Victoria is illustrated in the Annual Report of the Victorian Country Roads Board for 1925, which reviews the effect of the roads

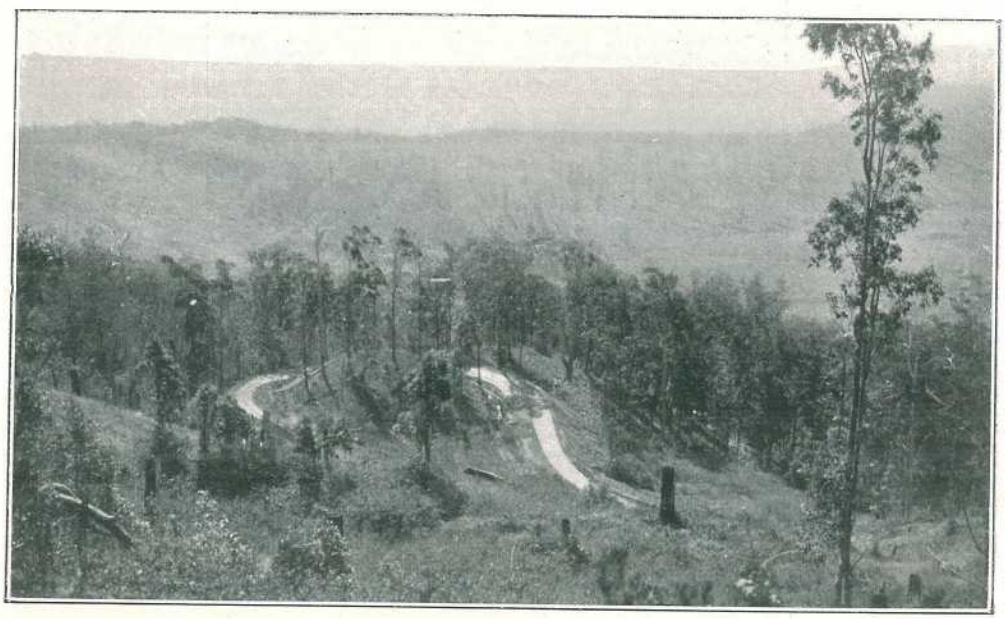


PLATE 153.

A LOOP ON PALMWOODS-MONTVILLE MOUNTAIN SECTION.

Connecting the Montville orchards with the North Coast Railway.

constructed by the Board in Victoria. It is stated that the increase in valuation of Gippsland properties in twelve years amounts to £28,000,000, whereas road construction amounted to £3,340,000 in the same period. Since the construction of the Point Nepean road, the increase in valuation has also been very apparent, having risen from £5,000,000 in 1913 to £13,940,000 in 1925. By Act No. 3425 the Victorian Government now provides £1,000,000 per annum for five years for main roads works, and £150,000 of this shall each year be employed for works in undeveloped mountain areas free of charge entirely to the shires.

The Report contains much useful information and valuable data, including sketch plans and plates showing the several methods of construction adopted by the Commission.

PLATE 154.
FOREST CLEARING ON APPROACHES, BARAMBAH CREEK BRIDGE, GAYNDAH-GOOMERI ROAD.

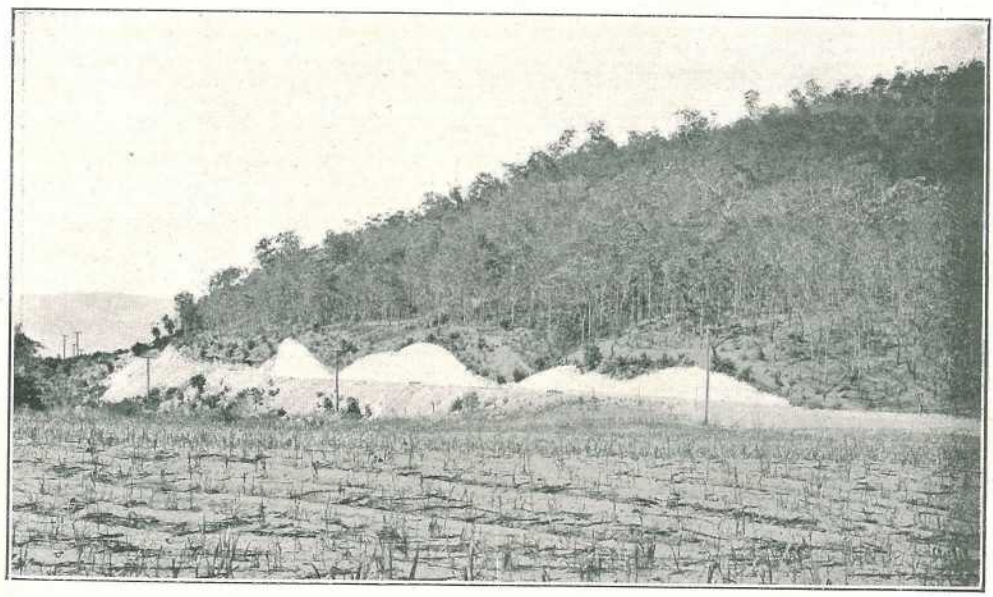


PLATE 155.
CAIRNS RANGE. SECTION SKIRTING CANEFIELDS, MULGRAVE VALLEY.

PLATE 156.

RAVENSHOE-MOURILYAN ROAD, EVELYN TABLELANDS, NORTH QUEENSLAND, AFTER SEVERAL YEARS OF TRAFFIC. MACADAM WITH LOCAL BINDER.

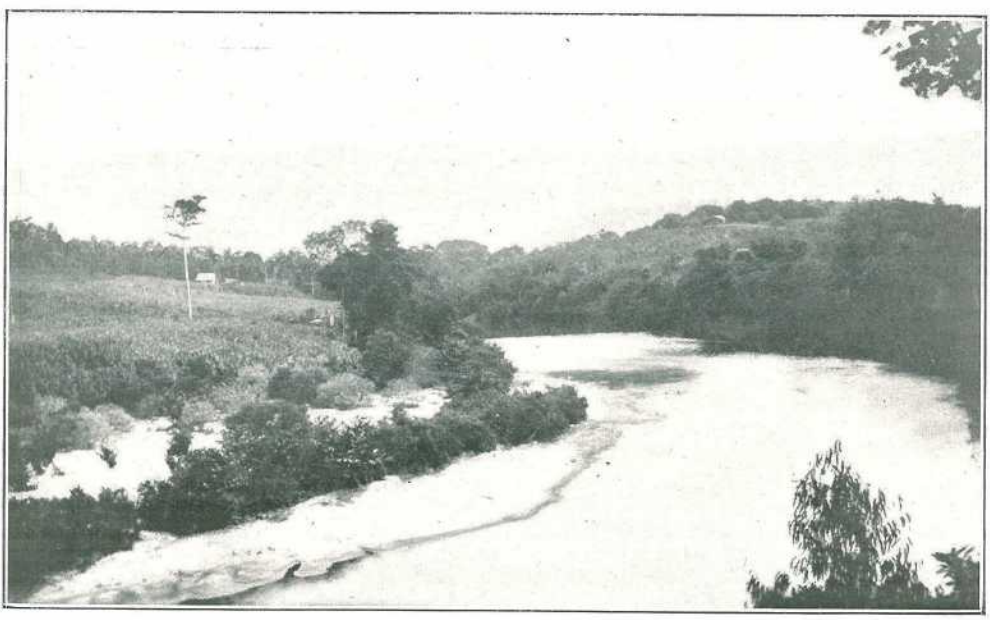


PLATE 157.

MULGRAVE RIVER VALLEY, SERVED BY CAIRNS RANGE ROAD.

PLATE 158.
BEAUDESERT-LADYBROOK. DEVIATION GRAVELLED NEAR BEAUDESERT.

PLATE 159.
ROMA-MARANOA GRAVEL ROAD.

PLATE 160.
GAYNDAH-GOOMERI, CRUSHED BASALT.

PLATE 161.
"C" CLASS METAL, GOOMERI-CHILDERS ROAD, NEAR BIGGENDEN.

PLATE 162.
LOW-LEVEL BRIDGE, STUART RIVER, WONDAI-PROSTON ROAD.

PLATE 163.
CAIRNS-PORT DOUGLAS ROAD.

AN AUTOMATIC GATE.

On page 486 of the last (November) issue, a descriptive note, together with sketch plan, kindly supplied by Mr. N. A. R. Pollock, Northern Instructor in Agriculture, of this gate was published. The principle on which it works is the original idea of Mr. Jack Jones, of Britannia Station, near Charters Towers, Queensland. Our plates, for which we are also indebted to Mr. Pollock, illustrate the gate in operation, its simplicity and efficiency.

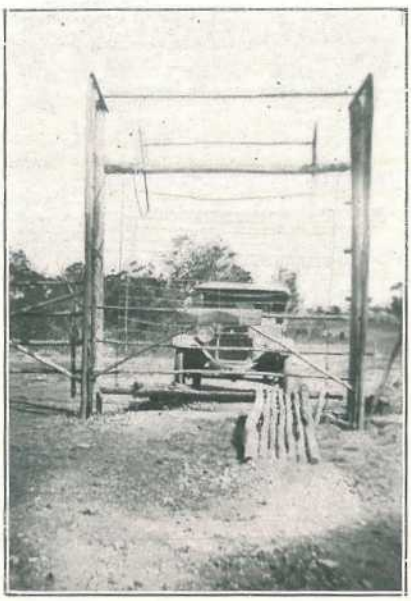


PLATE 164 (Fig. 1).—GATE DOWN; CAR APPROACHING.

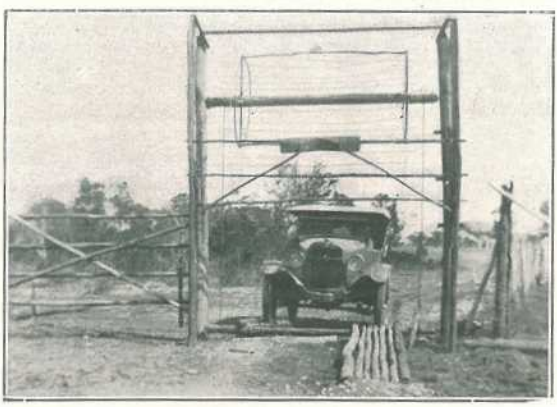


PLATE 165 (Fig. 2).—CAR HALFWAY IN; BEARER COMING UP; GATE RISING.

Plate 166 (Fig. 3).—Car Stationary Under Gate; Gate Up.

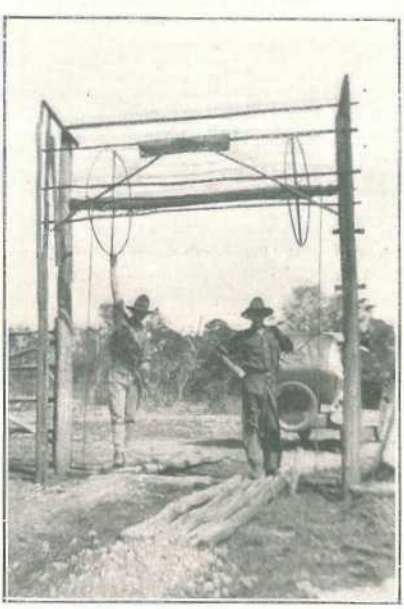


Plate 167 (Fig. 4).—Gate Risen by the Weight of Two Men Standing on Bearers; Gate Up.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF OCTOBER IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING OCTOBER, 1927 AND 1926, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Oct.	No. of Years' Records.	Oct., 1927.	Oct., 1926.
North Coast.	In.		In.	In.
Atherton	0.89	26	0·59	0
Cairns	1·84	45	1·72	0
Cardwell	1·95	53	2·11	0
Cooktown	1·05	51	0·10	0·66
Herberton	0·89	40	0·86	0
Ingham	1·55	35	1·66	0
Innisfail	2·88	46	5·35	0·09
Mossman	2·73	14	4·22	0·09
Townsville	1·26	56	0·45	0·07
Central Coast.				
Ayr	0·99	40	0·19	0
Bowen	1·06	56	0·90	0
Charters Towers ...	0·68	45	0 35	0·26
Mackay	1·77	56	1·98	1·22
Proserpine	1·74	24	3·25	0
St. Lawrence ...	1·75	56	3·01	0·12
South Coast.				
Biggenden	2·25	28	3·41	1 60
Bundaberg	1·99	44	3·01	0·74
Brisbane	2·56	76	7·15	0·87
Caboolture	2·49	40	2·55	0·96
Childers	2 39	32	4·86	0·51
Crohamhurst ...	3 39	35	5·74	0·56
Esk	2 36	40	6·38	0·42
Gayndah	2 34	56	4·19	0·43
Gympie	2·66	57	4·54	0·49
Kilkivan	2·54	48	5·09	0·60
Maryborough ...	2·60	55	7·05	1·05

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Oct.	No. of Years' Records.	Oct., 1927.	Oct., 1926.
South Coast—continued:	In.		In.	In.
Nambour	2·94	31	4·37	0·54
Nanango	2·28	45	3·38	0 15
Rockhampton ...	1·79	40	2·19	0·06
Woodford ...	2·50	40	2·55	0·31
Darling Downs.				
Dalby	2·03	57	2 66	1·16
Emu Vale ...	2·11	31	4·50	0·76
Jimbour	1·85	39	2·87	1·37
Miles	1·98	42	2·83	0·63
Stanthorpe ...	2·54	54	2·62	0·96
Toowoomba ...	2·55	55	3·16	1·29
Warwick	2·27	62	2·99	0·80
Maranoa.				
Roma	1·75	53	2 99	0·22
State Farms, &c.				
Bungeworgorai ...	1·52	12	2·12	0 22
Gatton College ...	2·05	27	2·84	0 82
Gindie	1·42	27	2·32	0·00
Hermitage ...	1·89	20	3·46	0 63
Kairi	1·10	12	0·70	0·22
Sugar Experiment Station, Mackay	1·56	29	1·86	0 75
Warren	2·14	12	2·58	0·00

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

GEORGE G. BOND,
Divisional Meteorologist

WELL WORTH READING.

A Coalstoun Lake's subscriber writes:—"I have been getting the Journal for about fifteen years. . . . I always look forward to receiving it, and consider it well worth reading."

SOME EXTERNAL PARASITES OF POULTRY.

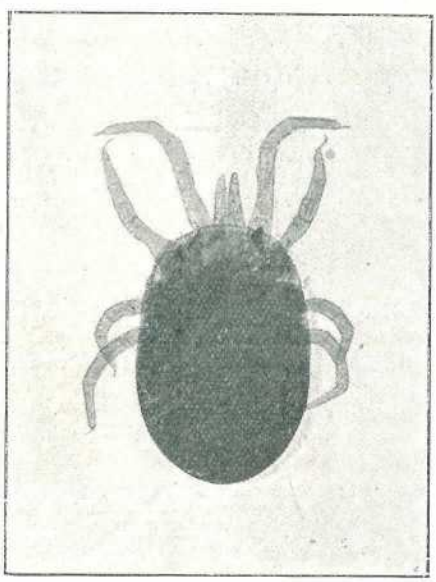
By P. RUMBALL, Poultry Expert.

From the investigation of various troubles affecting poultry one is forced to the conclusion that many breeders do not realise the serious effect that parasites have upon poultry. Parasites not only reduce the egg yield, causing at times the birds to be entirely unprofitable, but so undermine the general health of the birds that the latter become so weakened that they fall ready victims to all classes of disease.

Whenever fowls appear out of condition the first thing the breeder should ascertain is whether they are infected with parasites, and if such is the case, take measures to free the birds.

There are both internal and external parasites of a serious nature to which poultry are subject. An article upon internal parasites appeared in a previous issue of this Journal, copies of which may be had free upon application.

Among the external parasites we have those which live upon the bird itself during the whole of its life and those that live in the poultry buildings during the day, coming out at night to prey upon the birds. Among the latter type of external parasite is the poultry tick and the red mite. The tick is of such a serious nature that it has been the subject of an article also in a previous issue, copies of which are available free upon application.



From Victorian "Journal of Agriculture."]

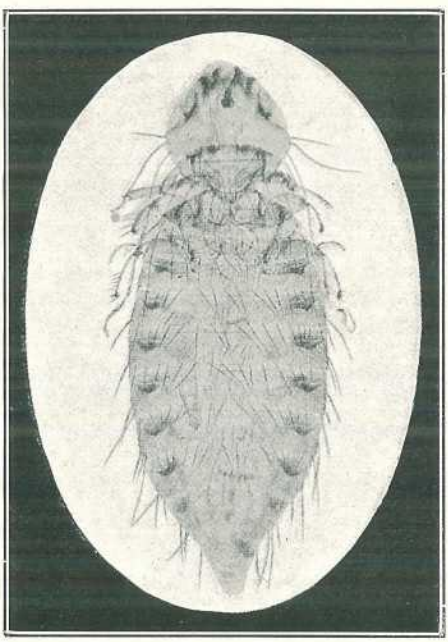
PLATE 168.—RED MITE. (MAGNIFIED 38 TIMES.)

The Red Mite.

This pest is probably second to the tick in importance as an external parasite. It is only red in colour when engorged with blood; when not engorged it is yellowish, greyish, or almost transparent. It hides by day in the cracks and crevices of the fowl house, nest boxes, &c., living in colonies. Where mites have congregated for a considerable time a mealy dust will be found, and around the crack or crevice of their hiding place will be noticed black and white specks, the excrement of the mite. The red mites usually only feed at night upon the body of the bird, but where infestation is severe they will be noticed upon the broody hen both night and day. The presence of considerable numbers will cause the birds to become droopy, weak, and their combs and faces pale. This is due to the loss of blood and broken rest of the birds. The egg yield, under such conditions, will be materially reduced, and the stock in a fit state to fall ready victims to disease organism. The complete life cycle of the red mite from egg to adult stage takes only seven days, and when this is coupled with the fact that the mite will live for four to five months the rapidity with which they increase will readily be understood.

Treatment consists in preventing the multiplication. In most cases where only a few mite are present they will be found under the perch where it rests on the perch supports. Perches should therefore be moveable and not nailed as is frequently the case. They should also be of timber with as few cracks as possible. Under these conditions it is then possible to lift the perches once a week and treat under them with a suitable preparation for the destruction of the mite. Pure kerosene is very effective, but a heavier oil is to be preferred, such as wood-preserving oil. If infestation is severe the mites may be distributed throughout the whole of the house and even among accumulated droppings under the perch. Under such conditions everything moveable should be removed and all wood work treated, the house thoroughly cleaned of loose earth and droppings, and a good spraying given with a kerosene emulsion to the whole of the interior. Even under this system of treatment some mites will escape, and the practice should be repeated at intervals of a week until the premises are freed from their presence.

To make the emulsion, boil up a pound of good soap in one gallon of water. When boiling remove from the fire and add one gallon of kerosene, stirring well and so thoroughly emulsifying the mixture. To this can be added another eight gallons of water.



From Victorian "Journal of Agriculture."

PLATE 169.—COMMON LOUSE OF THE FOWL. (MAGNIFIED 37 TIMES.)

Scaly-leg Mite.

The mite which causes this trouble is very common in Queensland, and is responsible for that unsightly scaly leg so frequently noticed among flocks of poultry. Its presence is easily detected when in sufficient numbers to cause trouble. The mite burrows under the epidermic scales on the surface of the leg and upper surface of the feet. The scabs become loosened and elevated by the formation of a whitish crust beneath them and the leg assumes an enlarged, roughened appearance. The trouble runs a very prolonged course, usually beginning between the toes. Unless treated the disease continues to progress and the birds become lame, at times only moving with difficulty; they lose flesh, their plumage lacks lustre, and death may follow from exhaustion.

The mite causing this trouble is known as *Sarcoptes mutans*. It is a strictly contagious disease, although not one that spreads rapidly from bird to bird. Stock hatched and reared by broody hens affected with the trouble rarely escape infestation, while with those artificially hatched and reared, although coming in contact

with infested stock in later life, the trouble does not assume such serious proportions. The mite lives on the juices of the leg, causing irritation and consequently a multiplication of the cells of the part and an exudation of serum, and it is from the union of these two products that the white powdery crust is formed.

Treatment consists in the application of a preparation that softens the scale and destroys the mite. If the legs of birds have been allowed to become very bad they should be washed in warm soapy water. This washing, especially if the leg be scrubbed with an old tooth brush, removes much of the powdery scale. In washing, however, care should be taken not to tear any scab off and cause the leg to bleed. After drying the legs may be treated with a good coat of any of the following:—

1. One part kerosene and two of olive or cotton seed oil.
2. Equal parts sulphur and lard.
3. 6 per cent. carbolic oil.
4. Carbolised vaseline.

The disease is not a difficult one to cure and when once eradicated from the farm, providing the mite is not reintroduced by affected purchases, there is no fear of reinfestation of stock taking place. When infestation is not severe no preliminary washing is necessary if the kerosene and oil treatment is used.

Depluming Mite.

This mite burrows into the skin near the base of the feathers, causing intense irritation and the feathers to become broken off close to the skin or to be entirely shed. This mite does not suck the blood, but subsists on the waste matters of the skin and feathers. Infected birds usually have a very ragged appearance, and the irritation frequently leads the birds to pluck their feathers and eventually cause the vice of feather eating.

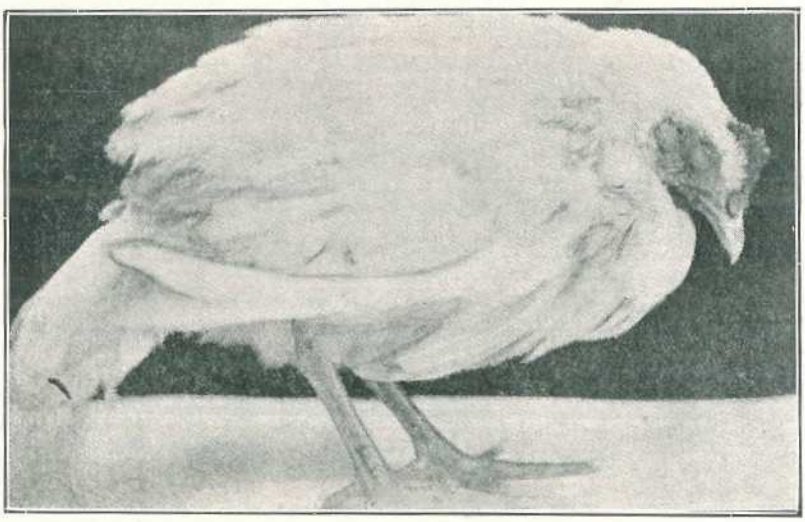


Plate 170.

This seven-weeks-old Single Comb White Leghorn cockerel is suffering from an attack by head lice. Note the unkempt plumage, dark, dried comb, eyes closed and general dejected appearance.

Treatment.—As the trouble is contagious, affected birds should be dipped and isolated as soon as noticed and the premises or pens disinfected. A suitable dip for this purpose consists of sodium fluoride ¾oz., flowers of sulphur 2 oz., a good household soap ½ oz., and one gallon of water. This mixture, as well as curing the trouble, will also destroy all forms of bird lice. If dipping cannot be resorted to several applications of lard and sulphur ointment will effect a cure.

It is, however, not desirable to dip a flock of birds that are in full lay, as the shock will assuredly cause a serious falling off in egg production, and in many cases the moulting of the birds.

Lice.

These of various species are more common to poultry than is generally thought, but in small numbers, as a rule, cause very little trouble. There are, however, exceptions, particularly with the head lice that affect chickens. This louse apparently has little effect upon the adult bird, but on chickens it causes heavy mortality. Unlike the majority of the parasites previously referred to poultry lice remain on the fowl constantly. There are many species, and in the great majority of cases those affecting fowls will not be noticed on ducks. Turkeys, pigeons, and geese also have species peculiar to them. Lice are not blood suckers like the mite and tick, but live upon the skin and feathers. Their presence is very irritating when in large numbers, and naturally they are not productive to the good health of the bird.

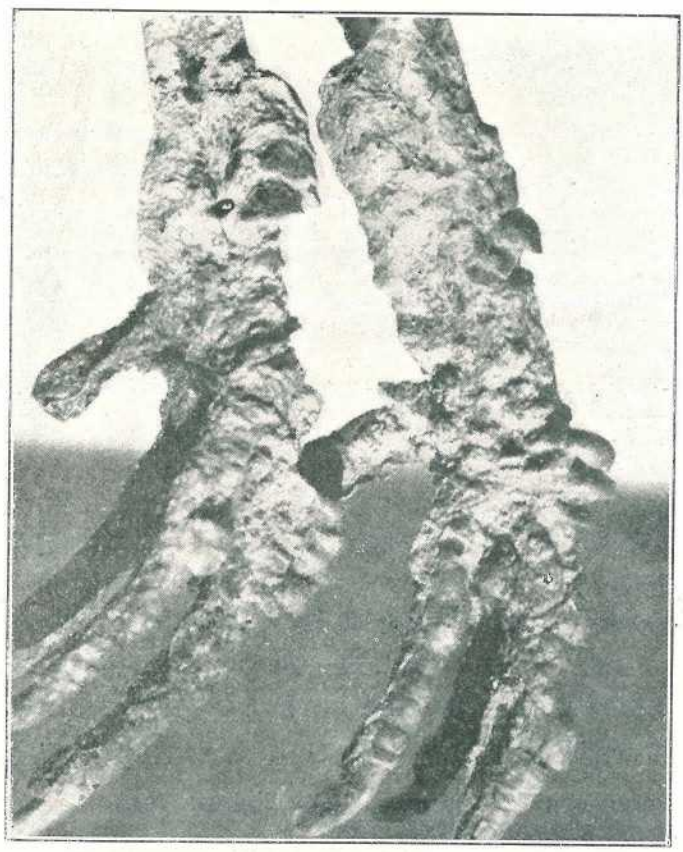


PLATE 171.—ADVANCED STAGE OF SCALEY LEG.

The general symptoms of lice infestation in chickens are droopiness, lowered wings, and ruffled feathers. In adult birds, with the exception of male birds, ill-effects are not shown, but severe infestation will be reflected by a reduced egg yield. Male birds, however, should be periodically examined for lice. They do not dust bath as freely as females, thereby permitting rapid reproduction of lice and consequently severe irritation. In the breeding pens the presence of lice is largely responsible for the lowered fertility of eggs, and male birds should receive regular treatment with some insect powder.

The Head Louse.

This is usually, as the name would indicate, found upon the head of the bird. Heavy losses are caused in young chickens by its presence. It is darkish grey in colour and will usually be found in an upright position along the feathers of the

head portions of the bird. If a careful examination is not made its presence may not be detected on account of its size. A few infesting a chicken will cause the chick to become very droopy in appearance with ruffled plumage and hanging wings, and will, if not treated, eventually cause death. With lice of any description in young chickens it is generally noticed that direct contact with adult stock has at some time taken place, therefore it is strongly advised to prevent this contact if possible.

Treatment lies in the direction of destroying the parasite by lightly smearing the head, neck, and under the lower mandible with salad oil. Do not plaster the chick with oil, a light smear applied with the tips of the fingers will suffice. Naturally if the chickens are mothered by a hen she should also be treated.

Other lice are—

(1) *The Body Louse.*—This is a large louse which may be noticed moving quickly about the body, particularly around the vent when the feathers are quickly raised. It is of a dirty straw colour, and the eggs are noticed in heavy clusters at the base of the feathers. These eggs hatch in about a week after being laid.

(2) *The Shaft Louse.*—A small light yellow louse found on the shaft of the feather.

(3) *Wing Louse.*—A dark grey louse, elongated in shape, found on wing feathers and moves very slowly.

(4) *Fluff Louse.*—A small louse found among the fluff of birds.

The treatment in all the above cases is prevention. A good dust bath will generally keep lice down to numbers that will cause little or no ill-effect to the birds. This dust bath could be composed of fine road dust and wood ashes. Flowers of sulphur may be added, also a sprinking of slacked lime, but if the dust is sufficiently fine, and occasionally moistened to induce birds to dust during the warmer weather, it will generally suffice.

Fleas.

In Queensland the most serious flea to poultryman is unknown. It, however, is common in Western Australia, and every care is being exercised to prevent its introduction into States not troubled with the pest. The flea is termed "Stickfast," and evidently takes its name from its habit of clinging tightly to the head, face, wattles, and lobes of birds. It is a blood-sucking insect, and its presence has been responsible for heavy mortality among flocks in countries where it is known. There are, however, many varieties of fleas in this State, and the writer has noticed fowl yards and houses infested sufficiently heavy to cause inconvenience to the producer concerned.

The thorough cleaning of premises in such cases is recommended and a good spraying with kerosene emulsion. As a general rule a flea lays its egg on the ground. Small grubs hatch from the eggs and undergo a portion of their life on the soil, feeding on organic matter, and from the cocoon stage emerge as fleas, hence the necessity of thorough cleaning of pens.

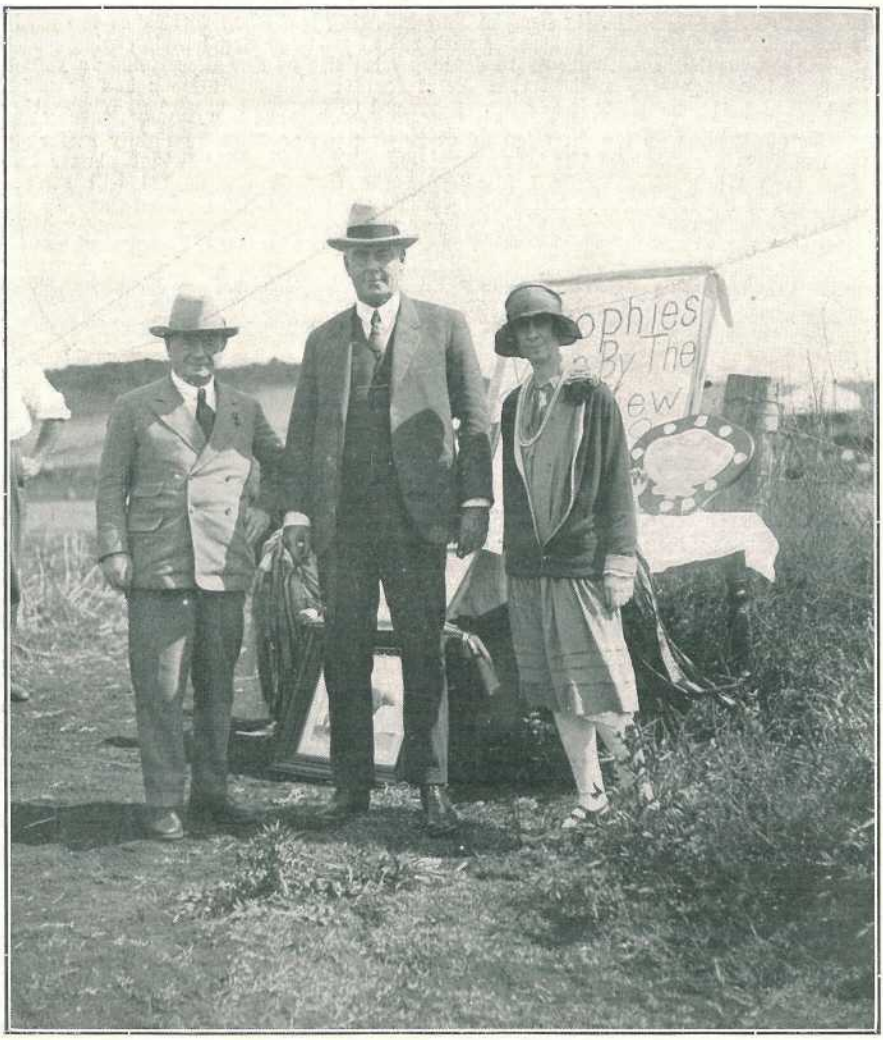


PLATE 172.—THE HOME COUNTRY AND THE DOMINIONS REPRESENTED ON A SOUTH BURNETT FARM.

In the group are the Right Hon. L. C. M. S. Amery, M.P. (Secretary of State for the Dominions and Colonies in the British Cabinet) and Mrs. Amery, with their host, the Hon. William McCormack (Premier of Queensland), at a wayside halting place.

In the course of their recent tour through Southern Queensland Mr. and Mrs. Amery and their staff saw something of a dominion in the making. They travelled through some of the most fertile provinces in the whole Empire. On the Darling Downs they saw a limitless sweep of waving wheatfields—a boundless sea of full-eared grain ready for the harvest. On the near North Coast they saw the wealth of our dairy lands; our orchard lands on the ranges, where man's industry and nature's artistry happily combine; banana plantations on buttressing spurs in belts of deep dark green, merging into the lighter shades of sugarfields that spread wide to the ocean's margin—an edging of golden sand and silver surf, the long wash of the blue Pacific. And in the South Burnett they saw a land that had emerged from the primitive to the practical, from rich promise to ripe fulfilment, in a short span of twenty years, and where are exemplified all the fine characteristics of a pioneer people and other strong qualities that go to the making of our race.

TYRE LIFE—HOW TO PROLONG IT.

Every year, literally, millions of miles of tyre service are lost through the failure of car owners to take care of their tyres.

Once the causes of the effects of the various tyre abuses are fully understood, the care of tyres is really so simple there is no excuse for car owners not getting out of them all the mileage the manufacturers have built into them.

Summarised the more important points for owners to pay attention to if they wish to get full value out of their tyres are:—

(1) Proper pressure, according to the schedules already published, must at all times be maintained, with the possible exception that when one strikes a very soft or sandy patch over which one wishes to drive one's car the pressures may be temporarily reduced in the back tyres, so as to give greater tyre surface in contact with the ground, and, therefore, greater tractive force can be exerted. As soon, however, as one has got out of the soft ground the tyres should be at once pumped up to their correct pressures again.

(2) A reliable tyre gauge is an absolutely indispensable part of a motorist's equipment. It should always be carried on the car, preferably in one of the pockets where it can readily be got at when required. Most makers supply two kinds of gauges—one for high pressure and the other for balloon tyre—and the car owner will naturally procure the kind to correspond with the type of tyres he is using. The tyre gauge should be used on all tyres, including the spare, at least once a week, and if any tyre is found not to be holding its pressure well the cause should be sought for and the defect immediately remedied, either by the owner, if capable, or by a reliable tyre expert.

(3) Correct wheel alignment is absolutely essential for long tyre life, and the slightest signs of tread wear, owing to faulty alignment, should be constantly looked for, and the fault corrected immediately it develops.

(4) Tread cuts, if they make an appearance, must be promptly repaired.

(5) Care in driving, such as in the application of brakes, and in keeping the side walls of the tyres from rubbing against the kerbs, will save many pounds in tyre wear.

(6) Next in importance to the care of the tyres themselves is that of the rims upon which they are mounted.

(7) In the case of motor vehicles which are habitually overloaded so that the total weight borne by the tyres is greater than that for which the makers have made them, these tyres should be replaced by over-size ones, designed to carry such weight.

(8) Last, but not least, see that your spare tyre is always ready to put on the minute that it is required. Never, under any circumstances, run a flat tyre after you have discovered that it is in that condition. If you do so you may easily damage both tube and casing beyond repair.

PROBLEMS OF MOTORISTS.

Often the anchorage bolts of motor supports work loose, causing annoying squeaks, motor pounding, and inexplicable vibration. Apply lubricating oil to the base of the supports, and pull the bolts up as tightly as they will go, making sure each nut is securely fastened with a cotter pin or lock washer.

Brake Rods.

The parts under the car that will rattle may usually be located by shaking them. If the brake rods are loose they can be prevented from rattling by supporting them in the centre with a length of coiled spring, properly attached to the frame. If the lubrication grooves in the spring shackle become clogged, the oil may be unable to reach the surface where it is needed. It is often good policy to remove the shackles and run a pipe cleaner or a piece of wire through the lubrication recess to remove all foreign substances and oil or grease. When replacing the shackle bolt thoroughly oil the surface, and if possible rotate it as it is replaced. Many distressing squeaks and rattles may be traced to the improper lubrication of spring shackle bolts.

Springs.

Unless the springs have been designed for lubrication, they should not be oiled, as they will function better in their original condition. The dry surfaces of the leaves tend to slow the action, and prevent rebound. The Buick Motor Company has sent letters to its dealers and distributors all over the world cautioning them against lubrication of the springs. The Cadillac Motor Company supplies one model equipped with spring gaiters packed with grease, but that chassis is for a special purpose, and is provided with shock absorbers to prevent sudden recovery of the springs.

Rim Lugs.

Rim squeaks, due to loose rim lugs, may be quickly overcome by applying a small quantity of oil or graphite grease to each lug bolt, and tightening each to its capacity. To be sure of an even tension on the tyre rims, it has been found advisable to tighten the bolts strictly opposite each other, and then to tighten each to its capacity in a clockwise manner. Oiling the bolts and nuts greatly facilitates tyre changing.

Wheels.

Creaking wheels are often caused by the drying of the wooden spokes. A few drops of kerosene allowed to work into the joints will restore them to proper condition. That suggestion has been handed down from the days when it was a practice to run the carriage into a creek to swell the wheel spokes. The action of the kerosene oil is more lasting, however, than that of water.

Steering Gear.

Turn the steering wheel from full left to right, lock, and see that all bearings are properly lubricated. Some steering mechanisms are more complicated than others, but if the car is equipped with a Jacox steering gear, such as is used on Cadillac, Oakland, Pontiac, Oldsmobile, and Buick, any backlash which may be the cause of annoying rattles may be easily removed by a slight tightening of the large adjusting nut at the top of the box. The adjusting nut is held in position by a pinch bolt, which must be loosened before an adjustment can be made. After the proper setting has been obtained, the pinch bolt should be retightened, so that the correct adjustment will be maintained.

TUNING UP A SLUGGISH ENGINE.

Most motorists think it is a most difficult job to undertake to tune up their engines and give them that vim and kick that is associated with the touch of an expert. Its original snap has only disappeared because of valve sluggishness. This is caused by stickiness in the valve guides. Take the valves out; clean the guides and then grind the valves in with the usual valve-grinding compound.

Sometimes it is entirely due to tightness of the valve-stem in the valve-guide, and this particularly applies to the exhaust valve. The material from which modern exhaust valves are made has a tendency to grow under the effect of heat. Closely examine the stem of the exhaust valve, and if there is the slightest appearance of binding, polish the stem by sliding emery cloth up and down; treat the valve-guide in the same manner, and it will be found that the usual snappiness is restored. Should, however, this fail, examine the contact-breaker; carefully clean the points, and see the breaker arc is not sluggish. Sometimes the fibre bearing in which the bell crank works swells, and temporarily grips the breaker arm. This makes for sluggishness that is hard to trace. The moral is: Make all the moving parts of the contact-breaker as free as possible.

Another point to watch is to see the points of the breaker are perfectly clean. With platinum points this is a secondary consideration, but with tungsten points it is of vital importance. Tungsten is a substitute for platinum—unfortunately, not because it is, in any state of form, superior, but because it is cheaper. In use it causes difficult starting and sluggishness, unless the points of the breaker are kept perfectly clean. If you can afford it, use only platinum points.

ENTHUSIASTS IN PIG RAISING.

[See opposite page.]

This photograph was taken recently on the occasion of a visit of inspection to the Queensland Co-operative Bacon Association's Factory at Murarrie by a party of boys, recent arrivals in Queensland, under arrangements organised by officials of the Salvation Army. The lads, all of whom are standing in this photograph, are migrants who were at the time undergoing an initial course of training on the Farm Home for Boys at Riverview, near Brisbane, preparatory to their going out as workers on Queensland farms. The officials in the foreground, reading from left to right, are:—Major D. S. Alexander, Superintendant of the Army Farm; Mr. J. Winders, understudy in Mr. Shelton's office; Mr. E. J. Shelton, Instructor in Pig Raising, and Mr. F. Bostock, Assistant Instructor in Pig Raising; the latter gives a series of lectures and practical demonstrations at the Riverview Farm each half year, or as required, and finally conducts an examination at the end of the term. In this way a very useful and practical work is being carried out, the visit to the bacon factory being part of the scheme.

PLATE 173.—GROUP OF INTERESTED ENTHUSIASTS IN PIG RAISING.

[For description of Plate, see page 640].

PLATE 174.—ENTHUSIASTIC MEMBERS OF THE MERLWOOD–CLOYNA DISTRICT PIG CLUB, 1927.

It will be noted that girls as well as boys, and children of varying ages, are interested in this progressive scheme, and that they are all believers in "Better Pigs on Every Farm." The photograph was taken on the occasion of a Club visit to the home of two Club members, at Messrs. H. Shelton and Sons' Farm, Merlwood. The two larger pigs were entered in the Club contest. Note also the clean, healthy surroundings, such as is necessary in all branches of stock raising, and the fine, healthy enthusiastic children of which Queensland is proud.

PLATE 175.—THE JOINT COMMITTEE AND JUDGES OF THE PIG CLUB, MERLWOOD-CLOYNA DISTRICT, QUEENSLAND.

All enthusiasts in Pig Club and other progressive schemes for the advancement of the district. This photograph was taken on the occasion of the Club contest in April, 1927. The same Committee was responsible for organising another equally successful Club contest with 37 members, and in connection with which a combined Pig Club Show and School Fête were held at Cloyna School, November, 1927.

A TON OF PORK IN SIX MONTHS FROM ONE LITTER.

AN AUSTRALIAN RECORD.

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

Just what does it mean when we refer to "A Ton of Pork in Six Months from one Litter" and when we refer to it as "An Australian Record?" It means just simply that the total live weight attained by this sow's litter of pigs—all but one of the pigs reared from the one farrowing—when less than 180 days old, scaled more than what we commonly accept as one ton, i.e., 2,240 lb., frequently in the trade called a "long ton" (as against 2,000 lb. spoken of as a "short ton" when dealing with the weight of pollard and other concentrates).

The litter of Gloucester Old Spot pigs to which reference is made in this report have created a new Australian record in this direction by attaining a total live weight —eleven pigs in the litter—of 2,314 lb. at the age of 23 weeks and 3 days, or approximately one week or more short of six months.

Writing in regard to this record-breaking litter, the breeders, Messrs. Russell and Johnston, of "Brechin," Bete Bolong, Orbost, Victoria, have this to say:—

> "The particulars we send you herein are the records of the weights, gains, &c., and the rations used in producing our Gloucester Old Spot Ton Litter in under six months. We think you will agree that this performance is a feather in the cap of this old world breed. We would very much liked to have had the opportunity of showing you the litter, for we are sure you would have been very enthusiastic over them. The Better Farming Train was in Orbost last week (October, 1927) and by special request we penned the pigs in the railway yards. Mr. Archer and his fellow-officers from the Victorian Department of Agriculture were very interested, and the former went so far as to say in his lecture that the Gloucester Old Spot breed would cross very well with the large White Yorks."

The special report which follows, supplied by Mr. J. Cowper-Johnston, a partner in the firm, details the methods followed, foods used, and results obtained. We pass this information on for the benefit of readers generally.

NOTE.—This record compares very favourably with what is referred to in America as the "World's Record Litter" of pigs—seventeen pigs in all in one litter which when 180 days old weighed 5,117 lb. They were Poland-Chinas, bred and fattened on the farm of the W. T. Rawleigh Company, Freeport, Illinois, U.S.A., and to which previous reference has been made in this Journal.—ED.

A GLOUCESTER OLD SPOT TON LITTER.

In producing a Ton Litter within six months, the object in view was if possible to give prominence to the many very excellent qualities of the Gloucester Old Spot breed of pigs. It is rather unfortunate that having been successful, the swine fever restrictions should prevent the publicity which exhibiting at the Melbourne Show or offering for sale in the open market would have secured. However, the accompanying records of weights, gains, and the rations used during the twenty-three weeks should give a very good idea of what the breed is capable.

Although the Gloucester Old Spot is the first breed to produce a Ton Litter in Australia, it must not be thought that it is the only breed that is capable of such a record; other breeds can, and no doubt will, emulate the Gloucester Old Spot, but they will have difficulty in beating the litter in question, the type, conformation and quality of the whole eleven pigs being of such an exceptionally high standard.

The conditions under which the experiment was carried out were far from ideal. Wintry weather was experienced with extraordinary frosts day after day, raw bleak days and 7½ inches of rain in a week retarded progress and, of course, increased the amount of food consumed. Again, the loss of No. 95 increased the length of time taken to produce the ton and helped to raise the cost of producing it. The late castrating of the boars must have also helped to keep the litter back. It was at first intended that the boars should be kept, but when it was realised that they might interfere with the experiment they were operated on.

There is no doubt that given more favourable conditions the cost per pound would be considerably reduced and the time taken shortened.

Much has been heard in Victoria of the quality of the pollard supplied to many pig raisers. In this case, the pollard was obtained from three different sources. The results show plainly the quality of the article supplied. It might be as well

to mention here that although the dam of the litter was able to consume a relatively large amount of bran and to good effect, this is not so with all sows; in fact, many are unable to digest a quarter of the amount quoted.

That the Gloucester Old Spot pig is an ideal one for the farmer is undoubted, and it is certain that when the breed is better known it will become very popular with farmers. Gloucester Old Spot pigs are exceptionally hardy, very quiet, and good feeders, giving a maximum of gain at a minimum of cost. The sows are excellent mothers, producing and rearing large litters of great size. Piglets weighing 6 lb. at birth are quite common. The boars are exceedingly potent, and when used on any of the other breeds the resultant cross is a most taking one. No breed of pigs causes less trouble on the farm, a very poor fence will hold them and the boars cause no trouble. A strong point in favour of either the pure Gloucester Old Spot or the cross is, that if fed right and kept going from birth, they mature very early and consequently are very suitable for the butcher as well as for the curer, and they weigh exceptionally well.

Some critics say that the bone of the Gloucester Old Spot pig is heavy and coarse. This is far from being a fact, and an outstanding feature of the Ton Litter, apart from its conformation, is the quality and fineness of the bone.

That the breed has excellent bacon qualities is borne out by the results in the recent competitions in England. For the second year in succession the Gloucester

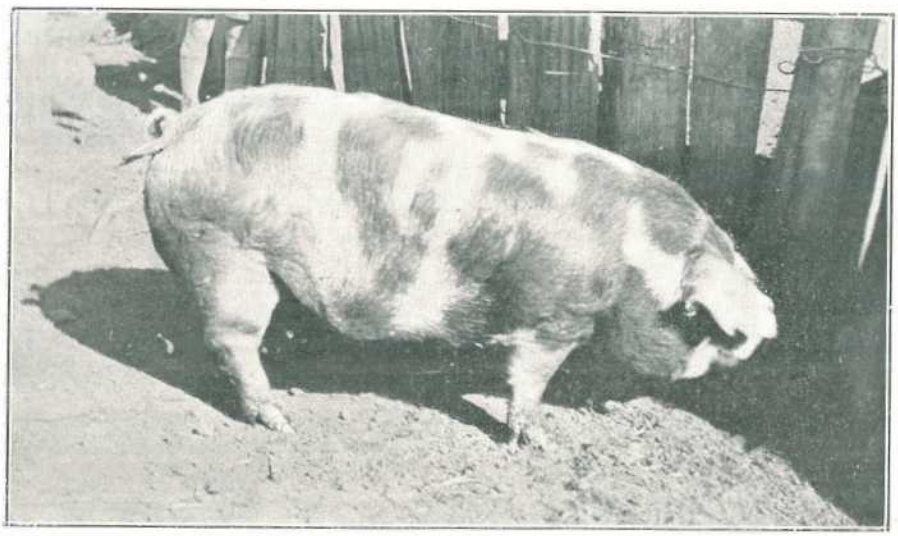


Plate 176.—Gloucester Old Spot Sow, No. 87 in Ton Litter, when Twenty-three Weeks and Three Days' Old. Live Weight, 248 Lb.

Note compact deep body, deep and capacious chest and broad meaty ham. Though less than six months' old she has exceeded prime bacon pig weight by almost 70 lb. It pays to breed and feed the best and the best only. Mongrels would not attain this weight in eighteen months if they attained it at all. The departmental slogan, "Breed more and better pigs on every farm," is strikingly evidenced in this picture.

Old Spot breed won the Whitley Cup for the best bacon from six pigs, with 100 marks. Again, in the Beale Cup, a class for two pedigreed pigs, in which four Large White Yorks, one Berkshire, and two Gloucester Old Spot entries competed, the "Spots" took first and second places with 98 and 86 marks respectively. Surely a breed that can put up a performance such as this must be worthy of a place in helping to build the export bacon trade to England, which we are told is so essential to the pig-raising industry of Australia.

In conclusion, it may be said that if there is one thing more than another to be learnt from raising the Ton Litter, it is that rearing pigs is a payable proposition when they are fed right and kept going from start to finish. The practice of rearing pigs and just letting them grow till they reach bacon stage and then fattening them is, apart from the resultant inferiority of the meat, a most expensive one and must, in most cases, cost more to produce than is realised for the finished article.

PARTICULARS OF RATIONS FED TO G.O.S. (TON) LITTER AND DAM.

Weeks.	——	Pollard.	Bran.	Barley.	Milk.	Remarks.
		Lb.	Lb.	Lb.	Gal.	
1	Sow ..	35	21	..	35	Pollard soaked in water, making with milk one kerosene tin night and morning.
	Litter* ..	..	..	..	..	
2	Sow ..	35	21	..	35	
	Litter* ..	..	..	..	..	
3	Sow ..	35	21	..	35	Suckers commenced sampling sow's ration at 3 weeks old
	Litter ..	..	..	..	..	
4	Sow ..	73	28	..	35	Suckers allowed run in yard, progress not satisfactory, weather exceptionally cold, heavy frosts.
	Litter ..	..	..	..	..	
5	Sow ..	73	28	..	35	Barley brought to boil and allowed to steam, ration mixed with milk and pollard and fed middle day apart from sow.
	Litter ..	10	..	28	7	
6	Sow ..	73	28	..	14	
	Litter ..	21	..	28	14	
7	Sow ..	73	28	..	14	Pollard fed night and morning, barley middle day.
	Litter ..	42	..	42	28	
8	Sow ..	73	14	..	14	
	Litter ..	42	..	42	28	
9	Sow ..	73	14	..	14	Suckers looking for more; benefit of increase is shown in gain for tenth week.
	Litter ..	111	..	56	28	
10	Sow ..	63	..	..	14	Suckers shut off from sow part of day and allowed run in patch of lucerne. Scoured very badly and lost weight so reduced barley and cut out lucerne.
	Litter ..	122	..	70	91	
11	Sow ..	63	..	..	14	
	Litter ..	122	..	70	91	
12	Sow ..	63	..	..	14	Litter only allowed with sow nightly.
	Litter ..	131	..	70	91	
13	Sow ..	63	..	..	14	
	Litter ..	131	..	70	91	
14	Sow ..	..	..	..	..	Weather very hard; frost almost daily; litter weaned.
	Litter ..	192	..	70	98	
15	Sow ..	..	..	..	..	Very wet week; 7½ inches of rain.
	Litter ..	192	..	98	98	
16	Sow ..	..	..	..	..	Litter also receiving half-tin maize cobs middle day.
	Litter ..	245	..	98	98	
17	Sow ..	..	..	..	..	
	Litter ..	270	..	98	110	

* Litter suckling sow only.

Particulars of Rations Fed to G.O.S. (Ton) Litter and Dam—*continued.*

Weeks.	——	Pollard.	Bran.	Barley.	Milk.	Remarks.
		Lb.	Lb.	Lb.	Gal.	
18	Sow ..	..	..	..	..	No. 95 pig died previous week. Pigs unable clean up, so ration reduced.
	Litter ..	251	..	98	101	
19	Sow ..	..	..	..	..	Extra half-tin maize given at night.
	Litter ..	251	..	98	101	
20	Sow ..	..	..	..	..	Pigs could not manage extra maize, so it was cut out of mid-day feed.
	Litter ..	332	..	98	140	
21	Sow ..	..	..	..	..	
	Litter ..	332	..	98	140	
22	Sow ..	..	..	..	..	Several of the sows in litter in season and it was rather a wet week, so results were not quite up to the mark.
	Litter ..	332	..	98	140	
23	Sow ..	..	..	..	..	Ton litter realised.
	Litter ..	332	..	98	140	
24 weeks and 3 days	Sow ..	..	..	..	..	Litter finally weighed 26th September by Mr. Bird and an officer from the Department of Agriculture, Melbourne, Vic.
	Litter ..	141	..	42	62	
25	Sow ..	..	..	..	..	
	Litter ..	..	..	..	..	
	Totals..	4,397	203	1,427	1,947	

Cost of Food Purchased stated at Melbourne Prices.

	£	s.	d.
Pollard, 4,397 lb. at 1s. 9d. per bushel	19	4	9
Bran, 203 lb. at 1s. 8d. per bushel	0	16	11
Barley, 1,427 lb. at 4s. 6d. per bushel	6	8	3
Milk, 1,947 gallons at 1d. per gallon	8	2	3
Maize (cobs), 5 bags at 7s. per bag..	1	15	0
	£36	7	2

Total cost of producing 2,314 lb. of pork (including keep of sow) for 13 weeks £36 7s. 2d., as per figures supplied by Messrs. Russell and Johnston, "Brechin," Bete Bolong, Orbost, Vic.

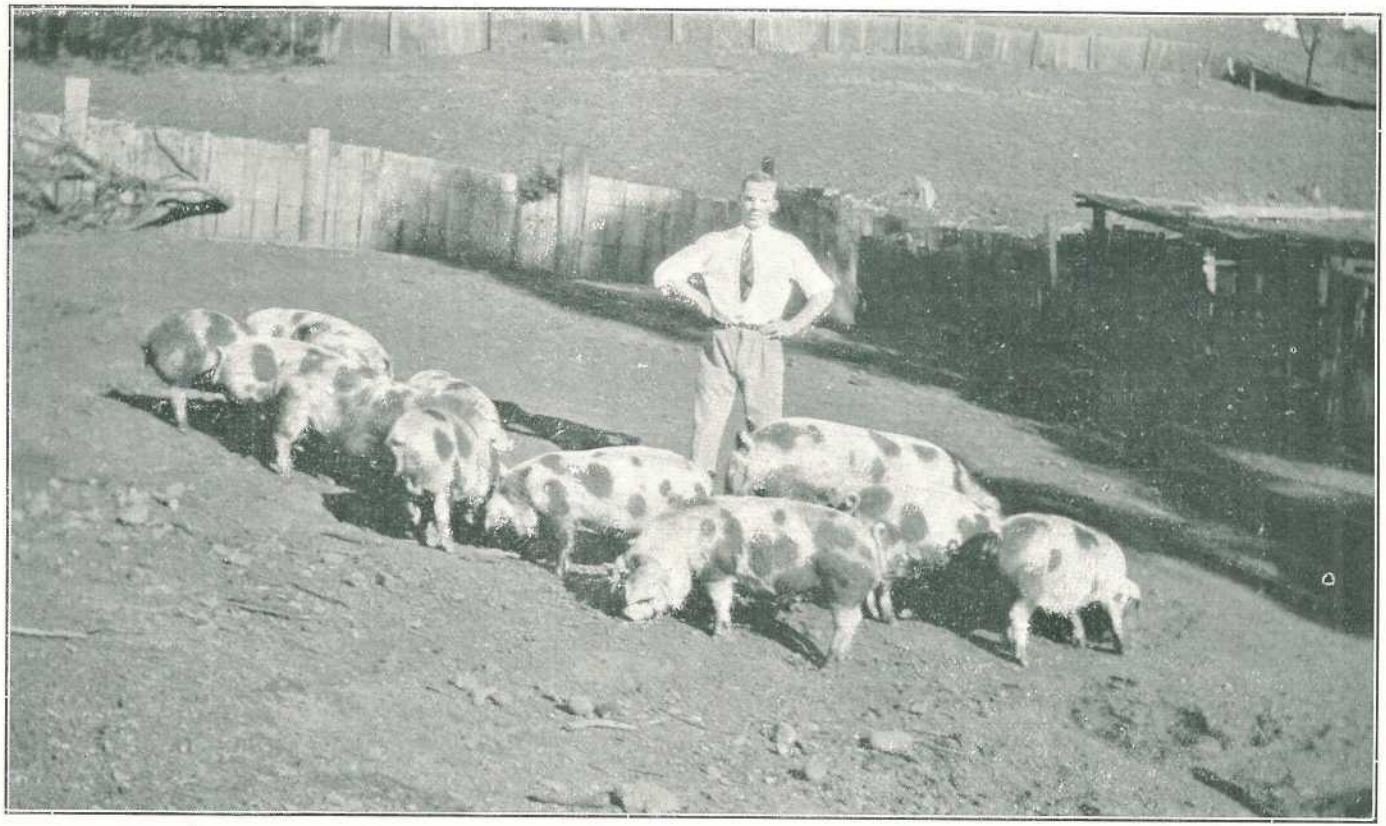


PLATE 177.—THE RECORD-BREAKING LITTER OF GLOUCESTER OLD SPOT PIGS, THE PROPERTY OF MESSRS. RUSSELL AND JOHNSTON, OF "BRECHIN," BETE BOLONG, VICTORIA.

This litter of pigs weighed under Government supervision at twenty-three weeks and three days' old, live weight, 2,314 lb. The photograph, in which the mother of the pigs is shown, was taken when the pigs were sixteen weeks' old or some seven weeks before the completion of the test. This is the first occasion in Australia on which a ton litter has been produced under similar conditions under six months of age.

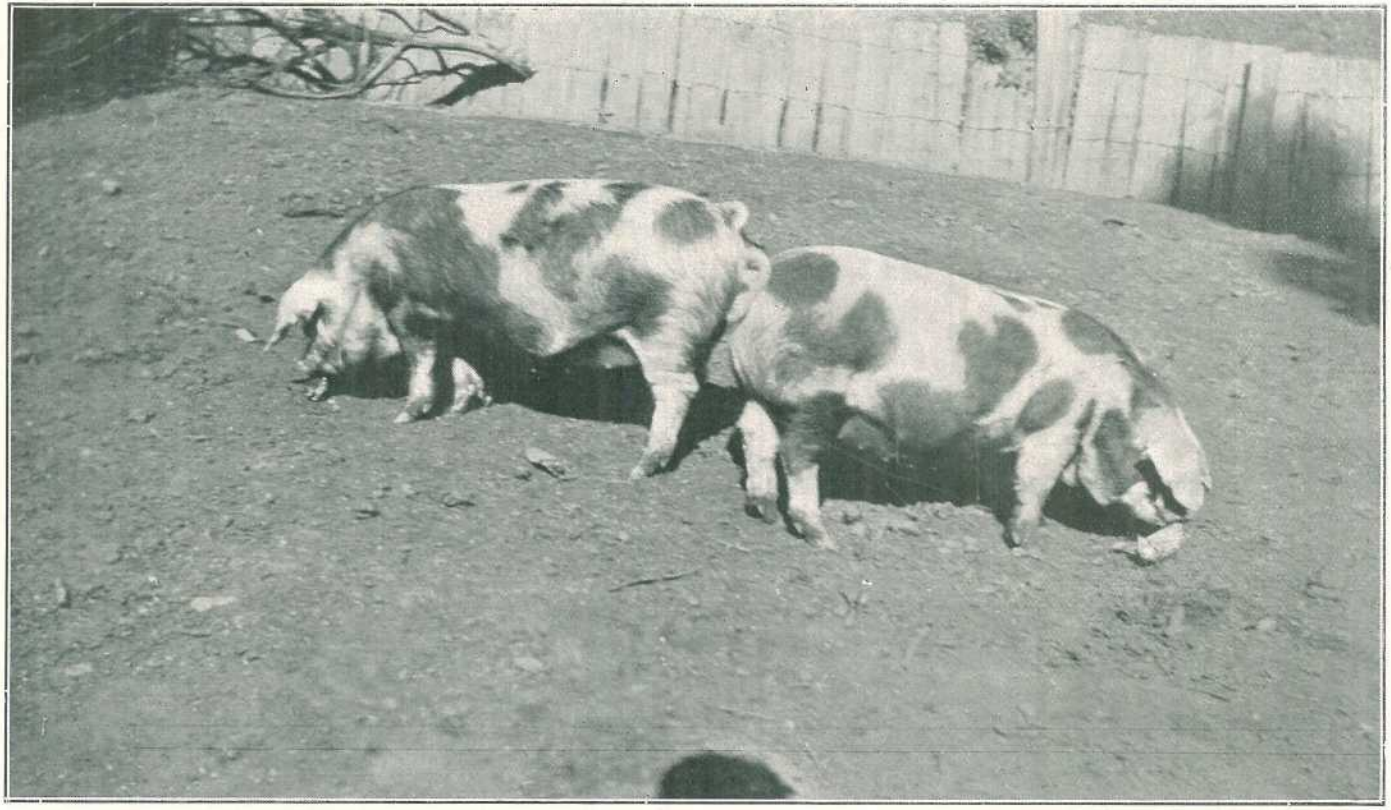


PLATE 178.—GLOUCESTER OLD SPOT SOWS, NOS. 87 AND 90, MEMBERS OF THE TON LITTER, AT SIXTEEN WEEKS OF AGE.

Note exceptional quality, evenness of type, length of body, and plump well-filled hams. Pigs of this quality would realise top prices in any market. They are certainly exceptionally well developed animals for their age.

PARTICULARS AND WEIGHTS OF GLOUCESTER OLD SPOT LITTER.

Farrowed, 14th April, 1927; Number in Litter, 14; Number Reared, 12; Average at one day old, 3·68 lb.
Dam—"Brechin Faith," No. 38. Sire—"Brechin Pride," No. 41 (A.S.P. Herd Book).

Earmark and Sex of Pigs.	Weeks.											
	1	2	3	4	5	6	7	8	9	10	11	12
	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
No. 87 Sow	7·0	13·0	18·5	24·0	31·75	37·5	43·5	54·0	64·75	77·0	88·75	96·5
No. 88 Sow	7·75	12·0	17·5	21·75	29·0	33·5	41·0	45·5	55·5	65·25	73·0	84·25
No. 89 Sow	4·5	8·25	12·0	15·0	18·5	22·5	28·0	35·0	44·5	54·25	63·0	68·5
No. 90 Sow	6·0	10·5	14·0	18·0	25·5	30·5	37·0	42·0	54·0	56·5	72·5	86·5
No. 91 Sow	7·75	8·0	11·5	13·25	18·75	21·0	25·0	31·0	36·5	46·5	57·0	67·0
No. 92 Sow	7·75	13·5	18·0	21·0	27·0	33·0	38·0	44·5	52·0	63·0	74·0	81·5
No. 93 Sow	6·5	9·5	14·0	16·0	22·5	26·0	31·25	36·0	43·0	53·0	59·5	70·5
No. 94 Boar	8·0	12·5	17·5	21·0	27·75	32·5	41·0	44·0	53·75	65·0	77·5	79·5
No. 95 Boar	5·0	9·75	13·0	15·5	21·5	24·0	25·25	35·0	35·0	45·0	53·0	58·5
No. 96 Boar	6·25	11·0	16·0	19·0	24·5	29·5	34·5	36·75	45·5	56·5	65·5	76·5
No. 97 Boar	8·0	12·5	17·0	19·5	26·75	31·5	35·0	33·5	39·0	47·25	62·5	73·0
No. 98 Boar	6·0	10·0	12·5	14·0	18·5	22·0	27·5	32·5	40·75	50·5	61·5	63·0
Total Weight	80·5	130·5	181·5	218·0	292·0	343·0	407·0	469·75	564·25	659·75	807·75	905·25
Average Weight	6·7	10·87	15·12	18·16	24·33	28·6	33·93	39·14	47·02	57·47	67·31	75·43
Average daily Gain in Weight ..	..	4·11	4·29	3·04	6·16	4·29	5·29	5·22	7·57	10·41	9·75	8·12

PARTICULARS AND WEIGHTS OF GLOUCESTER OLD SPOT LITTER—*continued.*

Earmark and Sex of Pigs.	WEEKS.											
	13	14	15	16	17	18	19	20	21	22	23	24 and 3 days.
	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
No. 87 Sow	111·5	125·5	131·5	148·0	159·5	171·0	187·0	200·5	217·0	222·0	235·0	246·0
No. 88 Sow	91·5	99·0	110·5	118·5	128·5	142·0	155·0	167·5	178·0	191·0	207·5	215·0
No. 89 Sow	82·0	92·5	102·5	111·0	121·5	132·5	145·0	157·5	171·0	182·5	196·0	201·0
No. 90 Sow	95·5	112·5	124·5	133·5	150·0	162·5	177·0	186·0	191·0	203·5	211·5	221·0
No. 91 Sow	77·0	87·0	95·0	106·5	115·5	123 0	136·0	149·0	161·0	169·0	180·0	187·0
No. 92 Sow	92·5	103·5	113·5	124·0	136·0	149·0	164·0	173·0	185·0	196·0	210·0	213·0
No. 93 Sow	77·0	89·5	98·5	113·0	123·0	133·5	150·0	163·5	178·0	187·0	203·0	204·0
No. 94 Boar	91·0	107·0	114·5	125·0	136·5	147·0	162·0	177·5	191·0	200·0	213·0	220·0
No. 95 Boar	61·5	52·0	56·0	61·0	..	..	..	..	..	..	..	..
No. 96 Boar	84·0	97·0	104·0	116·0	125·5	135·0	144·5	159·5	172·0	177·0	185·0	192·0
No. 97 Boar	81·5	96·5	104·5	118·5	130·0	141·0	158·0	172·5	187·0	198·5	210·0	215·0
No. 98 Boar	75·0	87·0	96·0	106·5	116·5	128·0	141·0	155·5	172·0	184·0	195·0	200·0
Total Weight	1,020·0	1,146·0	1,251·0	1,382·0	1,442·5	1,564·5	1,716·5	1,862·0	2,003·0	2,110·5	2,246·0	2,314·0
Average Weight	85·0	95·53	104·25	115·18	131·0	142·22	156·04	169·27	182·09	191·86	204·18	210·36
Average daily Gain in Weight ..	9·56	10·5	8·75	10·91	11·04	11·09	13·81	13·22	12·82	9·77	12·31	6·18

DAILY NOTES ON VARIOUS PIGS AS NUMBERED ON EAR TAGS.

1. Piglets allowed out of sty, exceptionally cold week (fourth week).
2. No. 95 showed signs of rupture, third week.
3. No. 97 attack of scours seventh and eighth week.
4. All boars were castrated, tenth week.
5. Suckers shut out from sow part of day from tenth week.
6. Suckers only allowed with sow at night from twelfth week.
7. Suckers weaned fourteenth week.
8. Very wet and cold weather (7½ inches of rain) fifteenth week.
9. No. 95 suffered from attack of worms fourteenth week.
10. No. 95 injured while being weighed, sixteenth week, and died seventeenth week.
11. No. 90 lame twenty-first week.
12. Several sows in season, wet and cold, twenty-second week.
13. Litter was allowed run in patch of lucerne twelve weeks, scoured very badly, in some cases losing weight to extent of 6 lb. in three days. Cut lucerne out and reduced ration.
14. The litter was finally weighed on Monday, 26th September, by Mr. J. Bird, of Messrs. James and Bird, Stock and Station Agents, in the presence of an officer from the Department of Agriculture, the total weight being 2,314 lb., the age 23 weeks and 3 days.

Owners and Breeders: Russell and Johnston, "Brechin," Bete Bolong, Orbost, Victoria.

MAIZE IMPROVEMENT.

FIELD WORK OF THE DEPARTMENT.

By C. J. McKEON, Assistant Instructor in Agriculture.*

Practically the whole of the year was devoted to work connected with the Departmental seed maize improvement scheme. Although the season was somewhat unfavourable for maize-growing, some very good yields were obtained, and large stocks of selected seed were secured for distribution.

The early part of the season was very dry, very little rain being registered until December, and the early sown crops suffered in consequence. During the latter part of December, and practically the whole of January, very heavy rains were experienced throughout the maize-growing districts, and considerable damage was caused by floods and consequent water-logging of certain classes of soil.

The floods also had the effect of delaying the planting of the late crop, which usually takes place during December, and, as a result, many of the crops in some localities were either wholly or partially spoiled for grain purposes by frosts.

It is gratifying to again be able to report on the improvement in type and yield, and also on the increasing popularity of the departmental varieties, which is shown by the increasing demand for seed, and in the number of successful exhibits at the last National Show which were grown from seed purchased from this department.

It is also satisfactory to observe that the departmental maize improvement work is receiving greater interest from growers, both within and without the State. Inquiries from other countries for stud seed have also been received. Some assistance in this latter respect has been given to the New South Wales Department of Agriculture, which secured supplies of seed for two years in succession of one particular variety—Funk's 90-Day; the standard of quality of our strain of seed now being fairly high as a result of successive years of seed selection work.

The Northern seed maize improvement work, which was started this year with the idea of evolving a suitable type of grain for the Atherton Tableland, has created a considerable amount of interest in that district, and the results so far have been more than satisfactory. The new variety (Durum), on which this Department has been working for some years, gave very promising results, and the type and quality of the grain was very favourably commented on by leading maize-growers in that district.

* In the Annual Report, Department of Agriculture and Stock, Q.

SEED MAIZE IMPROVEMENT.

Fairly large areas of the following standard varieties were sown in Southern Queensland—viz., Improved Yellow Dent, Golden Beauty, Star Leaming, Reid's Yellow Dent, Funk's Yellow Dent, and Funk's 90 Day. Although a number of the plots were failures more or less through dry weather, and also later by reason of excessive rain and floods, a large quantity of seed was secured, which, after grading, was sufficient to plant over 3,000 acres. Both type and quality were excellent. During the early part of the season considerable damage was done to several crops by cutworms, and in two instances plots of 3 and 5 acres were completely eaten out.

The damage caused by the maize grub was again very slight. This applies also to weevil, no crop showing damage of any consequence, and it is doubtful if as little damage was done during any previous season. Although the necessity of picking the cobs as soon as possible, particularly those ripening early in the season, has always been impressed on the growers, this could not be altogether responsible for the small amount of damage, for in previous seasons crops have been attacked long before they were fit to harvest. It is thought that the very heavy rains during December and January may have had some effect in checking weevil attack.

Twenty-seven plots, totalling 146½ acres, were sown with varieties named as follows:—

Improved Yellow Dent, 36 acres; Golden Beauty, 19 acres; Star Leaming, 22 acres; Reid's Yellow Dent, 21½ acres; Funk's Yellow Dent, 6 acres; Funk's 90 Day, 36 acres; Eight-row Flint, 4 acres; Cuban Yellow Flint, 2 acres. Total, 146½ acres.

Of these, nine plots totalling 49½ acres were spoiled by floods and excessive rain, two plots totalling 7 acres were completely destroyed by cutworms, and two totalling 20 acres through lack of cultivation and attention on the part of the grower.

Funk's 90 Day.

This is an extremely popular variety and has proved to be a splendid yielder. Five plots were sown, but only one plot of 11 acres and another of 2 acres were harvested, the balance being destroyed by floods and cutworms. The large plot of 11 acres was sown in two areas, one of 9 acres and another sowing of 2 acres a fortnight later. The former received a check from dry weather and rain fell when tasselling was nearly finished. The yield was slightly over 60 bushels per acre. The later sowing received the rain at the right time and gave the very fine yield of 85 bushels per acre.

The field characteristics were very good and continue to show improvement, particularly in the husk covering and evenness in ripening. The type and colour of grain were excellent, and it would appear that as a result of careful selection of stud seed the small percentage of reddish-tinted grain has been practically eliminated. Large stocks of very nice quality seed were secured.

An ear-to-row test plot was planted with the first sowing of the propagation plots and, considering the weather conditions, the results were good. The lowest yield recorded was 47.3 bushels per acre, whilst the highest yield reached 79.3 bushels per acre.

Star Leaming.

Most of the plots of this variety suffered from dry weather during the tasselling period, and although none of the yields was heavy, all gave fairly good results and some very good quality seed was secured. The best yield was between 65 and 70 bushels per acre. The yields of the other plots were not taken owing to damage by cutworms and parrots. The type of grain was very even and the field characteristics were also very good.

An ear-to-row test plot was sown twice, but was destroyed by kangaroo rats on each occasion.

Reid's Yellow Dent.

Four plots were sown with this variety and only small portions of two of these were harvested, the balance, including the ear-to-row test plot, being destroyed by flood waters. These were all well advanced and were very promising looking, one plot in particular which was nearly ready to harvest would have given an exceptionally heavy yield. About 2 acres in one plot and 1 acre in another were on higher land and were only partly damaged. These were harvested and a fair quantity of seed was selected. Owing to the amount of damage done, no yield records were obtainable.

Funk's Yellow Dent.

Both plots of this variety were also practically destroyed by floods and only about 20 lb. of seed for further plot work was secured.

Improved Yellow Dent.

Owing to being sown later in the season the crops of this variety were not so far advanced and therefore did not suffer so severely from floods as the earlier maturing varieties. Two small plots were washed out, but the balance did very well, and although some of them were completely covered with water for some days they soon recovered. Two plots in particular developed very well and yielded in the vicinity of 85 bushels per acre. The type and colour of the grain were very good, and it is considered that the seed of this variety was the best so far selected from the standpoint of quantity and evenness of type. Field characteristics, with the exception of the height of the ears, were very good. With regard to the latter there is still room for improvement. Ears on the whole were very large, and a considerable number of particularly good ears were secured for show purposes. The results from the car-to-row test were very satisfactory, the highest yield recorded being 94.4 bushels per acre and the lowest 67.3 bushels per acre. The average yield for the sixteen rows was 81.57 bushels per acre.

Golden Beauty.

Only one plot was good enough for seed purposes, the others being too poor because of the heavy rains; only a limited quantity of seed was therefore available. This, as is usual with this variety, was very even in type and colour. Portion of the crop yielded very well, but the yield for the plot was only about 60 bushels per acre owing to a portion of the land being very rough at the time of planting and the crop made poor growth on this portion. The ear-to-row test plot was completely destroyed by inundation of the land on which it was sown.

Other Varieties.

Two small areas were sown with Flint varieties, and a quantity of seed was selected from one of these for further trial. The other plot was a failure owing to being sown too late in the season.

Northern Seed Maize Improvement Scheme.

This scheme was initiated last season at Burnside, Tolga, the variety used being Durum—a variety on which the Department has been working for some years with a view to producing a type of grain to suit the climatic conditions existing on the Atherton Tableland. A large area was sown, and the results so far are very pleasing. The crop was badly flattened by a cyclone when out in tassel, but made a very good recovery and developed a good yield. The husk covering and position and direction of the ears were splendid, the type of grain being very good.

"EAR TO ROW" TESTS—IMPROVED YELLOW DENT.

Row No.	Yield per Acre. Bushels.	Row No.	Yield per Acre. Bushels.
401 x 283	92.25	401 x 290	92.25
401 x 284	71.75	401 x 291	78.30
401 x 285	74.67	401 x 292	81.26
401 x 286	74.67	401 x 293	77.60
401 x 287	84.10	401 x 294	75.41
401 x 288	84.10	401 x 295	93.71
401 x 289	67.35	401 x 296	92.98
Check	70.28	401 x 297	94.44

Sown, 8-12-26; germinated, 13-12-26; tasselled, 10-2-27; ripened, 22-6-27; period of maturity, 191 days; highest yield, 94.44 bushels; lowest yield, 67.35 bushels; yield from check row, 70.28 bushels; average for plot, 81.57 bushels.

FUNK'S 90 DAY—1926-27 SEASON.

Row No.	Yield per Acre. Bushels.	Row No.	Yields per Acre. Bushels.
413 x 51	61.8	413 x 61	61.03
413 x 52	55.69	413 x 62	70.19
413 x 53	57.95	413 x 63	47.30
413 x 54	56.46	413 x 64	58.74
413 x 55	63.32	413 x 65	61.03
413 x 56	72.48	413 x 66	68.66
413 x 57	67.90	413 x 67	68.66
413 x 58	55.69	413 x 68	54.93
413 x 59	79.34	413 x 69	63.32
413 x 60	63.32	413 x 70	70.19
Check	57.98		

Sown, 6-10-26; germinated, 11-10-26; tasselled, 26-11-26; ripened, 31-1-27; period of maturity, 112 days; highest yield, 79.34 bushels; lowest yield, 47.30 bushels; yield from check row, 57.98 bushels; average for plot, 62.66 bushels.

PLATE 179—LOCAL FARMERS AND OTHERS PRESENT AT THE MCCORMICK-DEERING TRACTOR SCHOOL, HELD RECENTLY AT MILLMERRAN.

FARM TRACTORS.

By E. T. BROWN.*

The majority of tractors are fitted with two or three forward speeds and reverse. When ploughing on heavy land, it is advisable, as a general rule, to run the outfit on low gear, but when performing other land work, such as harrowing, discing, rolling, &c., the second gear can be used profitably. It is only when running on the road that the top gear is employed. Whenever starting away from rest, however, the low gear must be engaged first; a change is then made to second, and, finally, to top gear if required. To start from rest, the clutch must be disengaged and held in this position until the pinion wheels in the transmission gear have come to rest. Then the gear lever is pushed or drawn into the correct position for the intermeshing of the first speed pinions. The clutch is then allowed to engage slowly. Changing low to second or second to top must be done when the pinion wheels are in motion. Declutch, then bring the gear lever into neutral, pause a moment, then place into second or top position. Come down in the same way. Before reversing, the engine must be brought to a standstill.

Accelerating.

The speed of the tractor outfit is governed by the amount of combustible mixture supplied to the cylinders. This is regulated by a throttle. When starting away from rest, the throttle must be opened enough to enable the machine to get away, but so soon as a movement is made the throttle should be opened until the desired speed is attained. The practice of accelerating quickly, which is so common, is a bad one, especially when the ground is heavy or the load considerable. The throttle should always be opened slowly, since the sudden increase in the supply of the mixture is bound to put an additional strain on the engine and transmission. I do not mean to infer that any considerable length of time should elapse before the throttle is fully opened, but that all jerky movements should be avoided.

The Speed to Travel.

Taking the life of the tractor into consideration, the question of speed is a very important one. There is always a great tendency for a driver to try to get as much speed out of his engine as possible, especially when that engine is a powerful one. It is difficult to conceive of a greater mistake. There is nothing that damages a tractor more, eventually ruining it, than over-driving. When ploughing, it is quite sufficient to work at 1½ m.p.h. to 2½ m.p.h., according to the nature of the soil, depth of ploughing, and power of the outfit. To run at a speed greater than that intended by the designer means incalculable damage to the outfit. The added strain will show itself by rapid wear and tear of the working parts, even if it does not result in the direct breaking of some vital part of the machine.

Don't Stint the Oil.

It seems to be more or less customary among a great many farmers not to use oil until the squeak becomes penetrating. But this trait will have to be overcome if the tractor is to be maintained in good working order. True economy in tractor running lies in the constant use of oil on all working parts, not forgetting that the base of the engine requires attention as well. Purchase the best oil procurable, see that it is especially prepared for internal-combustion engines, and without wasting it, use it liberally. This will save pounds on depreciation in the course of a year.

The Oil Level in the Gear-Box.

The transmission gear in the majority of tractors is enclosed in a special case, and the gear wheels run in an oil bath. It is not necessary to inspect the gear-box frequently, but a point should be made of doing so, say, every three months. If it be noticed, however, that the oil is leaking out of the casing, it should be examined more often. To obtain the best results—that is, silent and easy running—the level of the oil should be sufficiently high to reach to the centre of the highest shaft in the box. Special gear oil should always be employed, but even this in very hot weather may be found to run rather on the thin side. It is a simple matter to thicken it, since all that is required is the addition of a little grease. Only a small quantity is needed.

* In the "Farmer and Settler."

COMPARATIVE POTATO TRIALS IN THE NORTH.

During the past season comparative trials with sixty-one varieties of potatoes were undertaken on the coastal area, the sixty-one varieties being planted at Woodstock, forty-one varieties at Pentland, twenty-four varieties at Bowen, and fifteen varieties at Ayr.

Unfortunately, an unprecedently heavy frost at Pentland and at Woodstock, and an attack of late blight at Bowen, rendered these trials of no comparative value, seed only being obtained therefrom.

At Ayr, where fifteen varieties were grown on the farm of G. S. McKersie, an excellent season was experienced, the following yields being obtained calculated as for one acre:—

Variety.	Smalls.				Saleable.				Total.			
	T.	C.	Q.	Lb.	T.	C.	Q.	Lb.	T.	C.	Q.	Lb.
Up-to-Date	1	10	1	5	7	5	0	26	8	15	2	23
Cook's Favourite	0	17	3	14	7	12	0	0	8	9	3	14
Arran's Comrade	1	9	1	0	6	16	3	23	8	6	0	23
Clark's Main Crop ..	2	5	2	26	5	18	3	16	8	4	2	14
Tasma	0	19	2	23	6	16	2	24	7	16	0	19
Scottish Triumph ..	1	15	0	7	5	17	0	0	7	12	0	7
Carmen	1	15	0	20	5	16	2	26	7	11	3	8
Trafalgar Carmen ..	2	7	2	8	4	18	0	5	7	5	2	13
Gold Coin	0	11	3	4	5	15	0	26	6	7	0	2
Arran Chief	1	2	3	5	4	17	3	8	6	0	2	13
Dalhousie	0	14	1	17	5	0	3	9	5	15	0	26
Templar	0	17	3	21	4	16	0	23	5	14	0	16
White Albino	1	1	0	12	4	2	1	17	5	3	2	1
Lochar	1	4	2	21	3	17	0	18	5	1	3	12
Queen of the Valley ..	1	5	3	20	3	9	0	16	4	15	0	8

With the exception of Queen of the Valley, the tubers of all the varieties were well shaped, free from blemish, and proved of good cooking quality. Samples of each, together with a table showing the yields of each were exhibited in a shop window in Ayr, attracting a great measure of attention.

The seed of these varieties was originally secured at Brisbane in 1925, sown on the Tableland as a summer crop in 1926, seed from this sown on the coast the same year, seed being returned to the Tableland for the summer crop in 1927, from which the seed was secured for this crop.

Seed from the coastal crops is to be tried again on the Tableland this summer, the seed of the best yielding varieties being brought to the coast for trial next year.

So far the yielding capacity of the potato has not been seriously affected when the seed has been saved in the tropics.—N. A. R. Pollock, Northern Instructor in Agriculture.

THE JOURNAL APPRECIATED.

B.M., Wynnum, writes (7/11/27):—"*Your monthly Journal is very much appreciated; in fact, I put other reading matter aside until I have studied it.*"

FERTILISER EXPERIMENTS WITH PEANUTS.

By C. S. CLYDESDALE, Assistant Instructor in Agriculture.*

In the course of the past few years peanut-growing has become an important industry in Queensland, and large areas, in the Kingaroy district mainly, are now being cultivated for the raising of this crop. With a view to obtaining data necessary to effectively carry on the industry, arrangements were respectively made with Messrs. B. Young, Memerambi, and J. Cavanagh, Wooroolin, for an area of land to carry out variety trials; also fertiliser and spacing tests. The soil is of red volcanic nature, the former plots being on forest, and the latter on scrub land. Both areas were typical of the class of country used for peanut-growing. Samples of soils were taken and submitted to the Agricultural Chemist.

Field Trials.

Experiments with fertilisers and the spacing tests were carried out with the variety Red Spanish; and the variety trials with Red Spanish, White Spanish, and Virginia Bunch.

Spacing Tests (Two Plots).—Each plot one-tenth of an acre. Distance between rows, viz.:—2 feet 4 inches, 2 feet 8 inches, 3 feet, with a single spacing between each plant of 12 inches.

Variety Trials (One Plot).—Each plot one-tenth of an acre. Distance between rows, viz.:—2 feet 8 inches, with a single spacing between each plant of 12 inches.

A separate plot of Virginia Bunch was also sown, seed of which was obtained from E. Vesburg, Adelaide River, via Darwin, Northern Territory.

Fertiliser Tests (One Plot).—Each plot one-tenth of an acre. These plots were planted according to the local district standard, 2 feet 8 inches between the rows, with the plants spaced 12 inches apart. Ten plots, viz.:—

1. Unfertilised.
2. 200 lb. Nauru super mixture per acre.
3. 200 lb. Nauru super mixture per acre.
   80 lb. Muriate of Potash per acre.
   1,000 lb. Lime per acre.
4. 400 lb. Nauru super mixture per acre.
   160 lb. Muriate of Potash per acre.
   1,000 lb. Lime per acre.
5. 1,000 lb. Lime per acre.
6. Unfertilised.
7. 80 lb. of Muriate of Potash per acre.
8. 200 lb. of Nauru super mixture per acre.
   80 lb. of Muriate of Potash per acre.
9. 65 lb. of Nitrate of Soda per acre.
   200 lb. of Nauru super mixture per acre.
   80 lb. of Muriate of Potash per acre.
10. Unfertilised.

Previous to planting the lime was slacked and applied, followed by the broadcasting of the respective fertilisers allotted to each individual plot.

Planting.

The planting was carried out on the 27th November on Mr. B. Young's farm, and 28th and 29th December on Mr. J. Cavanagh's, with the ordinary two-row planter, and seed sown at the rate of 25 lb. per acre. The Virginian Bunch variety, which was low in germination and was sown at the rate of 35 lb. per acre, had to be planted by hand owing to the kernels being too large for the plates in the machine.

Germination throughout all plots was very fair, with the exception of the Virginia Bunch variety which was poor, and necessitated replanting in the missed spaces.

The plots generally made good growth, and compared very favourably with other crops in the immediate vicinity.

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*In the Annual Report, Department of Agriculture and Stock, Q.

Harvesting and Threshing.

Harvesting of the plots was carried out on the 9th and 10th May. All plots at both centres did remarkably well, producing a good quality nut.

Threshing was carried out at Mr. B. Young's farm, and the following yields were obtained:—

Fertilisers Tests (Red Spanish).

Plot No.	Yield per Acre.		
	Cwt.	qr.	lb.
1	5	3	26
2	7	1	18
3	7	2	0
4	8	0	4
5	7	0	6
6	7	0	26
7	7	2	10
8	8	0	4
9	8	3	20
10	7	0	16

Spacing Tests (Red Spanish).

Plot No.	Distance between Rows.	Yield per Acre.		
		Cwt.	qr.	lb.
1	2 ft. 4 in.	7	1	18
2	2 ft. 8 in	6	3	4
3	3 ft. 0 in.	5	1	2
4	2 ft. 4 in.	7	3	2
5	2 ft. 8 in.	7	0	26
6	3 ft. 0 in.	6	0	18

Variety Tests.

Plot No. X.	Variety.			
1	Red Spanish	6	2	12
2	White Spanish	6	2	2
3	Virginia Bunch	8	1	16
Virginia Bunch (Darwin)		9	3	0

The plot of Mr. J. Cavanagh had not been threshed at the time of writing.

WHEAT IMPROVEMENT.

FIELD WORK OF THE DEPARTMENT.

By C. S. CLYDESDALE, Assistant Instructor in Agriculture.*

The wheat improvement work of the Department in relation to the breeding and evolving of new varieties to suit Queensland conditions is gradually exerting a beneficial effect; there is also a slight increase in the area cropped this season.

Growers generally have also kept themselves right up to date in the matter of modern labour-saving machinery, and a marked improvement has taken place in methods of cultivation and in varieties now cultivated.

Notwithstanding certain disabilities which farmers in different localities experienced in the course of the past season, there is every reason for optimism as to the future of wheat-growing in Queensland.

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* In the Annual Report of the Department of Agriculture and Stock, Q.

It is pleasing to note that several varieties raised at Roma State Farm have again shown out prominently. A crossbred Cx B2d x Gluyas No. 2, now named "Duke of York," did remarkably well in the Cunningham district, when grown under similar condition, alongside of standard varieties.

This variety was first tried out in the Allora district three years ago, in single drills, and gave excellent promise in the way of resistance to rust, toughness of straw, power to hold grain, and high-yielding capacity; it should, therefore, become very popular. The following year this variety was tried out again on a small field area, and once more gave good promise. Last season, a propagation plot of 5 acres was planted, and yielded a good return of fair quality grain.

Wheat propagation plots and variety trials were carried out on the farms of Messrs. H. C. Murray, Southbrook; W. A. Lyell, Bony Mountain; E. Rowlings, Inglewood; and Geitz Brothers, Allora.

These trials represent a continuity of the work carried out each year. The system in vogue is the testing out of Roma crossbred wheats, under field conditions, the elimination of any undesirable varieties from the small plots, and extending suitable and proved varieties.

The results obtained from the variety trials and propagation plots were generally very satisfactory, and additional supplies of seed which complied with the Department's somewhat exacting requirements were secured.

Seed Wheat Improvement Scheme, 1926 Season.

In connection with the seed wheat improvement scheme which was introduced by the Department of Agriculture, and accepted by the State Wheat Board for the purpose of raising pure supplies of seed wheat (which include 60 per cent. of Departmental varieties), an active campaign has been initiated in association with the Wheat Board. An itinerary of the principal wheat-growing districts, with the view to locating reliable growers to undertake the raising of pure strains of seed was arranged.

Special attention was given, when choosing sites for these plots, to the selection of individual varieties to meet the varying conditions of soil and environment under which wheat is produced. Observations made over an extended period point to the necessity on the part of the grower of selecting a limited range of varieties to permit of development under normal seasonal growth; and additionally, to ensure that the kinds chosen should be suitable in every way for the situation and particular class of soil on the farm where the respective varieties are to be grown. Depreciated yields are too often met with through inattention to factors of this character, which have a very direct bearing on the State's production. In a number of localities in the course of the past two seasons more land was brought under the plough. On the Oakey-Mount Russell line attention is being paid to the heavy black soil of the plains, which are very extensive; here one of the Roma crossbred wheats, "Warrior," did very well when grown under similar conditions to other varieties, and it is satisfactory to note that several growers in the immediate locality secured seed from last year's plot, with the intention of planting it this season. Similar instances may be cited respecting other wheat-growing areas where the Departmental wheats have come into favour.

At Acland, on rich friable scrub soil, "Cedric" has proved very reliable, and has taken the place of other varieties. These instances could be added to, and are recorded as illustrations of the effective functioning of the wheat-improvement scheme.

In the course of the present season (1927) arrangements were made for twenty-nine plots, comprising 240 acres with eleven varieties, viz:—Bunge No. 1, Pilot, Florida, Flora, Watchman, Waterman, Warrior, Cedric, Beewar, Noro, Amby.

Departmental Wheat Propagation Plots, 1927.

Further arrangements have been made with Messrs. Geitz Brothers, Allora; W. A. Lyell, Bony Mountain; E. C. Stewart, Jandowae; and E. Rowlings, Inglewood; for the continuation of the variety trials during the coming season. At each centre 150 Roma crossbred wheats and a few standard varieties, also several varieties of barley were planted. Sowing was carried out as follows:—Jandowae and Allora, 8th and 9th June; Bony Mountain, 10th June; Inglewood, 13th June.

Good rain was experienced on the 3rd and 4th June at all centres, ranging from 70 points to 210 points. Satisfactory germination was assured. Further rain again fell on the 17th June, which gave the young plants an excellent start.

In addition to these trials, an extension of the wheat propagation plots was arranged for the purpose of increasing the area under the new "Duke of York" variety. Plots were established in the following districts:—

Name of Grower.	Area.	Date Sown.
	Acres.	1927.
Noller Bros., Oakey	5	10th June
E. Rowlings, Inglewood	10	25th May
W. A. Lyell, Bony Mountain	11	11th June
E. C. Stewart, Jandowae	6	10th June
J. and F. Noller, Kumbia	5	24th June

PASPALUM PASTURE RENOVATION.

PROGRESSIVE REPORT ON EXPERIMENTS.

By C. S. CLYDESDALE, Assistant Instructor in Agriculture.*

The two plots which have been established at Maleny and Cooroy go to prove that the ploughing-up of the old root-bound paspalum pastures is undoubtedly the quickest way of giving them new life.

This was very noticeable when cuttings were made, by the quantity and quality of grass harvested. In addition to the enclosed squares established in the centre of each plot, control areas B and C were marked out, and cuttings were made at the same time as the enclosed squares for comparison purposes. Cutting commenced on the 11th November, 1926, and continued each month until April, 1927.

Following are the rainfall figures for both localities:—

Month.	Cooroy.		Maleny.	
	Wet Days.	Points.	Wet Days.	Points.
1926.				
July	6	83	2	133
August	3	16	..	..
September	30	774	8	584
October	3	152	2	108
November	3	162	1	38
December	18	2,033	15	2,631
1927.				
January	22	2,839	17	3,877
February	12	553	6	390
March	23	1794	22	2,239
April	8	504	8	785
May	1	19	1	12
June	7	297	5	364
Totals	136	9,226	87	11,161

* In the Annual Report of the Department of Agriculture and Stock, Q.

The following list gives details of the individual and aggregate weights of green grass cut from each individual plot:—

Cooroy.

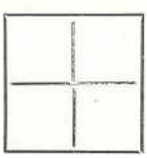
Plot No. Ploughed Area.	Plot No. Unploughed Area.	1924–1925. Date of Cuttings—	1925–1926. Date of Cuttings— 19-11-25, 21-12-25, 18-1-26, 17-2-26, 23-3-26, 22-4-26, 25-5-26.		1926–1927. Date of Cuttings— 9-11-26, 9-12-26, 12-1-27, 10-2-27, 17-3-27, 29-4-27.		CONTROL AREAS.		1926–1927. Date of Cuttings— 9-12-26, 12-1-27, 10-2-27.	
			Aggregate Weight per Cutting per Acre.	Total Weight of Grass.	Aggregate Weight per Cutting per Acre.	Total Weight of Grass.	Plot No. Ploughed.	Plot No. Unploughed.	Aggregate Weight per Cutting per Acre.	Total Weight of Grass.
			Tons.	Tons.	Tons.	Tons.			Tons.	Tons.
..	1	No cutting was made during the season	·929	6·502	·91	5·49	1B	..	3·46	1·15
1A	..		·62	4·33	·87	5·23	..	1C	3·25	1·08
..	2		·745	5·21	1·33	7·99	2B	..	3·35	1·12
2A	..		·73	5·11	·97	5·83	..	2C	2·62	·87
..	3		·95	6·68	1·27	7·66	3B	..	5·20	1·37
3A	..		1·17	8·21	1·22	7·31	..	3C	4·19	1·39
..	4		·92	6·49	1·01	6·07	4B	..	2·45	·82
4A	..		·69	·69	1·28	7·70	..	4C	2·39	·79
..	5		1·54	10·78	1·20	7·21	5B	..	2·62	·87
5A	..		1·19	8·35	1·97	10·74	..	5C	2·81	·93
..	6		1·90	13·33	1·65	9·89	6B	..	3·87	1·29
6A	..		1·55	10·82	2·25	13·48	..	6C	4·55	1·52
..	7		1·54	10·78	1·05	6·33	7B	..	3·80	1·27
7A	..		·91	6·36	1·55	9·30	..	7C	3·31	1·10
..	8		1·25	8·75	·68	4·08	8B	..	4·05	1·35
8A	..		·69	4·86	1·40	8·42	..	8C	2·86	·95

Maleny.

Plot No. Ploughed Area.	Plot No. Unploughed Area.	1924–1925. Date of Cuttings— 25-2-25, 15-6-25.		1925–1926. Date of Cuttings— 20-10-25, 23-11-25, 17-12-25, 18-1-26, 18-2-26, 23-3-26, 22-4-26.		1926–1927. Date of Cuttings— 12-11-26, 10-12-26, 13-1-27, 11-2-27, 16-3-27, 27-4-27.		Control Areas.		1927. Date of Cuttings— 13-1-27, 11-2-27, 27-4-27.	
		Aggregate Weight per Cutting per Acre.	Total Weight of Grass.	Aggregate Weight per Cutting per Acre.	Total Weight of Grass.	Aggregate Weight per Cutting per Acre.	Total Weight of Grass.	Plot No. Ploughed.	Plot No. Unploughed.	Aggregate Weight per Cutting per Acre.	Total Weight of Grass.
		Tons.	Tons.	Tons.	Tons.	Tons.	Tons.			Tons.	Tons.
1	..	2·13	4·26	1·65	11·57	1·74	10·44	1B	..	1·28	3·85
..	1A	1·40	2·81	·65	4·58	1·23	7·38	..	1C	·83	2·50
2	..	2·23	4·47	2·03	14·19	2·04	12·27	2B	..	1·32	3·96
..	2A	1·91	3·82	·51	4·19	1·30	7·81	..	2C	1·16	3·47
3	..	3·11	Only one cutting was made.	1·79	12·42	1·32	7·59	3B	..	1·11	3·32
..	3A	3·87	Second	·81	5·70	·92	5·50	..	3C	·95	2·86
4	..	2·48	cutting not	1·84	12·91	1·12	6·76	4B	..	1·74	5·23
..	4A	3·14	recorded owing to damage by stock	·99	6·99	·78	4·67	..	4C	1·49	4·46
5	..	2·62	5·25	1·81	12·65	1·56	9·35	5B	..	1·24	3·71
..	5A	2·60	5·21	·96	6·72	1·07	6·43	..	5C	1·20	3·61
6	..	2·73	5·47	2·29	16·00	2·04	12·27	6B	..	1·64	4·92
..	6A	3·50	7·00	1·35	9·42	1·28	7·70	..	6C	1·52	4·55
7	..	3·04	6·09	1·89	13·20	1·66	9·94	7B	..	1·81	5·44
..	7A	2·90	5·81	·80	5·59	·73	4·41	..	7C	1·46	4·39
8	..	4·24	8·48	2·09	14·61	1·76	10·57	8B	..	2·49	7·48
..	8A	2·36	4·73	·72	5·08	1·37	8·25	..	8C	2·02	6·07
7BB	..	..	..	2·27	15·93	2·73	10·92	..	..	..	..
8BB	..	..	..	2·33	16·31	2·31	9·25	..	..	..	..

SKECTCH PLAN AND DETAILS OF MALENY PLOTS.—AREA, 2 ACRES.

Unploughed, 1A to 8A inclusive.		Ploughed, 1 to 8 inclusive.	
8A Basic Super. 1½ cwt. per ac.		Basic super. 1½ cwt. per ac.	8
7A Nitrate of soda 1½ cwt. per ac. Nauru phosphate 1 cwt per ac. Sulphate af potash 1½ cwt. per ac.		Nauru phasphate 1 cwt. per ac. Sulphate of potash 1½ cwt. per ac. Nitrate of soda 1½ cwt. per ac.	7
6A Nauru phosphate ¾-cwt. per ac. Superphosphate 3 cwt. per ac.		Nauru phosphate ¾-cwt per ac. Superphosphate ¾-cwt. per cwt.	6
5A Control. No manure.		Control. No manure.	5
4A Nauru phosphate 1 cwt. per ac.		Nauru phosphate 1 cwt. per ac.	4
3A Slacked lime ½-ton per ac.		Slacked lime ½-ton per ac.	3
2A Pulverised lime ¾-ton per ac.		Pulverised lime ¾-ton per ac.	2
1A Control No Manure.		Control. No manure.	1



Intersections of plots enclosed with wire-netting-covered stock-proof hurdles.

Answers to Correspondents.

Sensitive Plant.

Inquirer (Aitape, New Guinea)—

Mr. H. T. Easterby, the Director of the Bureau of Sugar Experiment Stations, advises that arsenical sprays have been used with some measure of success on the Sensitive Plant in Queensland. As, however, this plant makes an excellent green manure for sugar-cane, it is very often ploughed under. In some analyses that were carried out at the Mackay Sugar Experiment Station it was found to contain 276.86 lb. of nitrogen per acre in a 15-ton crop, which was equivalent to a dressing of 1,384 lb. of sulphate of ammonia. It also contains large quantities of lime potash and phosphoric acid.

The Use of Sulphate of Iron.

H.F.S. (Dalveen)—The Senior Analyst advises as follows with reference to your inquiry regarding the use of sulphate of iron:—

Sulphate of iron, upon decomposing, liberates sulphuric acid, which produces scorching; for this reason lime is usually used at the same time when spraying with ferrous sulphate. I have no record of spraying apple-trees with ferrous sulphate alone, but one European authority states that young vine leaves must not be sprayed with strong solution of this substance. Therefore in this hotter climate it certainly would be safer to experiment with a weak solution, and it is suggested that you try spraying (not heavily) one tree or portion of one tree with a solution of iron sulphate in the proportion of 1 lb. sulphate to 40 gallons of water and note the effect whether harmful or otherwise.

Weeds on Lawn and Garden Paths.

J.S.C. (Brisbane)—The Senior Analyst advises:—

(*a*) *Clover on Lawn.*—The best means of eradicating clover without appreciably damaging the lawn grass. *Reply:* Sulphate of Ammonia is effective, besides acting as a tonic to the grass.

(*b*) *Weeds in Garden Paths.*—The best means of extirpating weeds on a gently sloping garden path with a brick border on either side. A bouganvillea hedge flanks the pathway. *Reply:* Strong brine solution made with common butcher's salt. It is safer than arsenic.

(*c*) *Nut Grass in Garden Paths.*—Is it possible to check appreciably this growth by the application of the specific recommended for (*b*)? *Reply:* Yes, but not permanently.

BOTANY.

The following replies have been selected from the outgoing mail of the Government Botanist, Mr. Cyril White, F.L.S.:—

Native Quinine.

T.A.P. (Toowoomba)—

Your specimen of small tree from the Warwick district is a native Quinine or Bitter Bark, *Alstonia constricta.* The bark contains the alkaloids alstonine, alstonidine, porphyrine, and porphyrosine. The bark is (or was) included in the Pharmacopœia.

Erythraea australis*—*Monstera deliciosa.

T.H.B. (Kinleymore, via Murgon)—

The plant you enclose is *Erythræa australis.* A decoction made from it is sometimes used as a tonic. The fruit you mention is *Monstera deliciosa* (Mon-stera de-lici-osa).

Nut Grass.

W.B. (Yarraman)—

The specimen is the common Nut Grass, *Cyperus rotundus.* It is a very serious pest in cultivation, and if there are only a few plants in your ploughed paddocks it would be advisable to dig them out and destroy them.

The following reply has been selected from the outgoing mail of the Assistant Botanist, Mr. W. D. Francis:—

"Red Head" or "Red Cotton Bush."

A.J.G. (Inkerman, N.Q.)—

Your specimen is known as Redhead or Red Cotton Bush, *Asclepias curassavica*. It is reputed to be poisonous to stock, and may be the cause of the death of your cattle. In many cases we have noticed that cattle in ordinary seasons avoid this plant. If you find that your cattle are eating the plant to any extent it would be advisable for you to cut it down or dig it out if practicable.

PIG RAISING.

Replies selected from the outward correspondence of the Instructor in Pig Raising, Mr. E. J. Shelton:—

Paralysis in Pigs.

W.B. (Mapleton)—

Tick ("bush" tick) paralysis in pigs is not uncommon. The first thing to do is to cut the ticks away with a sharp razor. Do not attempt to pull or tear the tick out, for, by so doing, you may force more of the poison into the pig's body. Follow the advice contained in the leaflets forwarded. It is not usual for cattle ticks to infest pigs, but the common bush tick will fasten itself on to pigs in much the same way as it does on to dogs, and results are much the same. Some of the Pig Club children have noticed that bush ticks are more plentiful in paddocks where blady grass and similar growths exist. Blady grass, as you are aware, is of little or no value as stock feed, hence no loss would be incurred in burning off patches of this grass.

Sick Pigs.

H.W.H. (Nikenbah)—

It is evident that the sow died from pneumonia. The fact that she suffered from severe spasms of pain and had great difficulty in breathing, indicates clearly that her lungs were badly affected. Your references to the post-mortem examination also confirms the above statements, and we agree it was evident the trouble was not due to improper foods.

If the boar is still sick we advise a good course of opening (purgative) medicine. Give a good bran mash fed warm as the first feed of the day after he has been without food for twelve hours or more. Add just sufficient salt to this mash to give it a very slight flavour and give at about the consistency of thick cream. To the mash prepared as per details given in pamphlet on "Administration of Medicines to Pigs" (page 276), add 4 fluid ounces of castor oil. Repeat this the following day if his bowels have not been relieved, and compel him to take regular exercise even if it means driving him about for a while each day.

Fresh green food such as green lucerne, clover, succulent grasses, &c., might tempt his appetite, while he should have an abundant supply of drinking water. It is useless attempting treatment unless this is followed by a general improvement in the conditions under which the pigs are kept. One would be inclined to think your pig sty accommodation is at fault.

Making Pigs Pay.

T.B. (Finch Hatton, Mackay)—

1. You are correct. In order to make pigs a payable proposition, it is necessary to utilise such farm-grown foods as is possible, for there is little or no profit in the business if the food has to be purchased from outside sources; although it is agreed that there are times when it pays to purchase a certain quantity of concentrates which cannot be produced profitably on the farm.
2. As to the yield of pumpkins per acre, it is difficult to state definitely the weight per acre that might be expected from any given area. A really good crop might produce from 20 to 30 tons per acre, while if conditions are generally unfavourable, the return might be very small.
3. It is not a commercial proposition to store pumpkins in underground pits, the same way as turnips, &c., are pitted in other countries, for they will not keep for any great length of time in that condition. Storing them in a

clean, dry barn in which there is a fairly good draught of cool air, giving them plenty of room, and regularly inspecting them and picking out any that are decaying, appears to be the only way in which they can be successfully stored. Even then, careful handling is very necessary.

4. No definite experiments have been carried out in Australia, as far as we are aware, on feeding pigs entirely on ensilage made from the crops to which you refer. Ensilage may, however, be fed satisfactorily to bacon pigs, breeding stock and so on, in just the same way as lucerne hay may be fed. Under ordinary farm conditions, it would not pay to go to the expense of preparing ensilage especially for the pigs, for the reason that they much prefer fresh, succulent green foods and root crops. It certainly pays to feed ensilage if the crop is being prepared for other stock as well as for the pigs. It also pays to store lucerne hay, particularly for the breeding sows. It also pays to grow as many crops as it is possible to grow and to store grain for use during winter time and during other periods when milk and similar foods are in short supply. Fish meal is not available on the markets of Australia, for the reason that there has been no call for this particular meal here. We are, of course, aware that it is used extensively in England and in many other countries overseas. Several brands of meat meal, protein meal, &c., are, however, available, and we send you particulars of some of these. The firms manufacturing these products advertise extensively. You will find several advertisements in the "Queensland Agricultural Journal" that are well worth your study.

5. Price per pound live and dressed weight which one might expect for the pigs when they are ready for the butcher or bacon factory—we are forwarding current price lists, from which you will note that the general average on a dressed weight basis at the present time is about 7d. to 7½d. per lb., with 8d. per lb. as the top price for prime quality pigs of correct weight. These matters have all been dealt with in this Journal, extracts from which have been posted. It is our aim to render all the assistance possible to those who are interested in the industry.

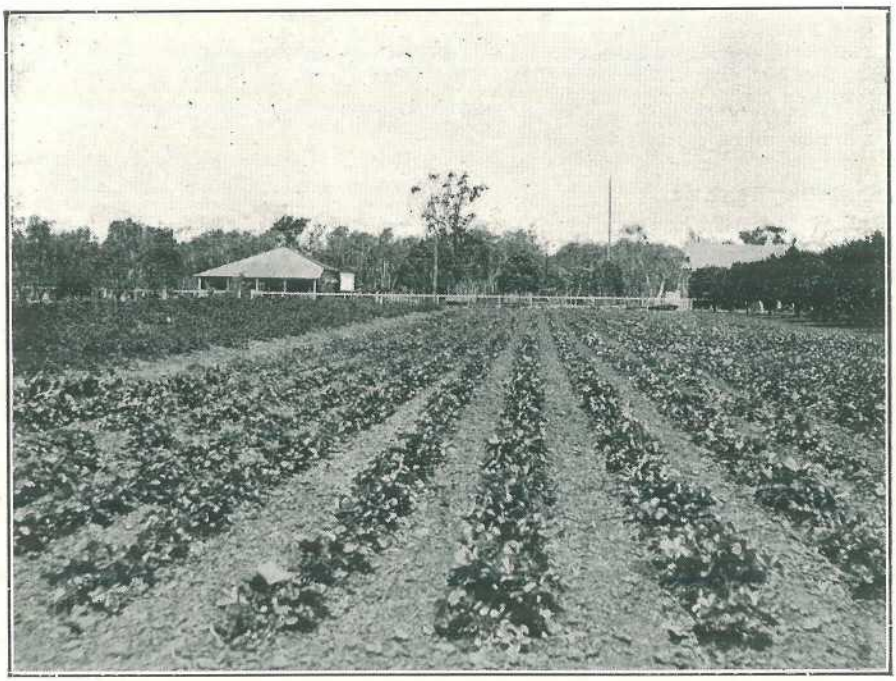


Plate 180.—Strawberry and Tomato Experimental Plots on Mr. F. W. Wort's Farm, Raby Bay, Cleveland.

Both plots were top-dressed with Nitrate of Soda before the first of the Spring rains.

General Notes.

Staff Changes and Appointments.

The Officer in Charge of Police at Richmond has been appointed Acting Inspector of Stock, as from 1st November, 1927.

The Armistice Anniversary.

The ninth anniversary of the signing of the Armistice was commemorated appropriately throughout the State on 11th November. In the capital a great concourse assembled in front of the Post Office, where occasional addresses were delivered. His Excellency the Governor (Sir John Goodwin), in addressing the gathering, said the fact that they were present on the occasion was due to the self-sacrifice and heroism of those men whose memory they were honouring. The bodies of those men lay all over the world, but their memories remained for all time. "It is an honour for us to meet on this day of the year," added His Excellency, "in order to pay a short tribute of reverence and respect to the memories of those gallant men who gave everything they had, and to whom we owe all that we possess—our lives, our prosperity, our country, and our Empire. That is the debt we owe them, and we respect and reverence their memory."

The Acting Premier (Mr. W. Forgan Smith) said he felt it an honour to represent the Government on such an occasion. It was an occasion on which they indulged in some introspection. It was a time when they paid their grateful tribute to those who did so much for the Empire to which they all belonged. They were celebrating the Armistice—the dawn of peace after the greatest war that the civilisation of the world had ever known. It was their duty to hold in grateful remembrance all those men and women who took part in it, and those who sacrificed everything. "It is our duty also," he added, "to consider whether we are worthy of what has been done. The great principles of heroism, service, and sacrifice which constituted the spirit of Anzac are required to deal with the problems of peace. It is our duty to see to it, as citizens of this great Commonwealth, that everything is done that is humanly possible to perpetuate those principles in the life of the community. The problems of peace are always with us, but if we meet them with that spirit of service and self-reliance and courage that was manifested by the men and women who took part in the Great War, then we can say that their sacrifice was worth while, and that posterity will enjoy the benefit of it."

Marketing Tomatoes.

A Regulation has been issued under the Fruit Marketing Organisation Acts to provide for the poll that is to be conducted upon the question of the proposed issue of a Direction that all tomatoes offered for sale or sold at Brisbane or Rockhampton on a wholesale basis (that is, in any other way than from a retailer or grower to a consumer), shall be done only by the Committee of Direction, its agents and servants, and by such other agents as shall observe the conditions set out by the Committee. These conditions provide that any grower of tomatoes may consign his tomatoes to any agent of his own choice for sale by such agent on the growers' behalf. The agent, however, shall, when instructed by the Committee, request growers not to send him consignments of C or B grade tomatoes, but which grades (C or B) if sent to any agent, notwithstanding instructions to the contrary, may be disposed of by the Committee to canners if found in suitable condition; but if not in suitable condition for canners' requirements will be disposed of at growers' expense. In the event of a grower sending C or B grades to an agent the latter to advise the Committee of Direction of Fruit Marketing.

This Direction is to remain in force for twelve months as from the 19th October, 1927.

The ballot-paper to give the growers concerned an opportunity of voting on the matter will be issued by the Committee of Direction, and must be returned to that organisation by not later than noon on the 15th December. Persons who have the right to vote are all growers who, during the twelve months prior to 20th October, 1927, had under cultivation at any one period an acre of tomatoes containing not less than 1,200 plants, and who had consigned tomatoes for sale on a wholesale basis to either the Brisbane or Rockhampton market during those twelve months, and whose intention it is to grow not less than one acre of tomatoes at any period during the ensuing twelve months, and who intend to consign tomatoes for sale on a wholesale basis to either Rockhampton or Brisbane markets during that period.

Canary Seed Board.

The Minister for Agriculture and Stock (Hon. W. Forgan Smith) advises that the following nominations have been received for election as Growers' Representatives on the proposed Canary Seed Board:—Thomas Perse Grimes, Clifton; Thomas Muir, Allora; and Michael Coleman, Nobby. Two members will be required.

Obituary.

The announcement of the death of Jessie Mary, the only daughter and youngest child of the Deputy Premier and Minister for Agriculture, the Hon. W. Forgan Smith, and Mrs. Forgan Smith, on 1st December, was received amid general expressions of profound regret. The little sufferer succumbed only after a brave struggle to live, and, in an effort to save her life, two transfusions of blood from her father were effected. It became sadly evident, however, that not even the father's sacrifice would avail. Little Miss Jessie was an exceptionally bright and winsome child, and the sympathy of the whole community goes out to the bereaved parents in their time of trial and overwhelming sorrow.

The Quality of Queensland Bananas—Activities of "Geographical Protectionists."

When the Minister for Agriculture (Mr. W. Forgan Smith) was explaining in the House, a few days ago, the details of the Primary Produce Experiment Stations Bill, he mentioned that the banana industry is worth a little over £1,000,000 a year to the people of Australia. It is a white man's industry, and is capable of great expansion. Unquestionably Queensland can produce all the bananas that can be consumed in the Commonwealth by many times the present population. It is interesting, therefore, to note that the geographiehal protectionists of Melbourne are strenuously endeavouring to revive the Fiji banana industry. We are told that negotiations have been opened up with the Fiji Government; that the natives are to be encouraged to plant on a large scale; and that special steamers are to be purchased for the carriage of the fruit. To a very large extent the growers in Queensland are responsible for this effort to revive their most dangerous competitor. Mr. Forgan Smith admitted in his speech in the House that inferior bananas had been sent to the Southern markets, and he laid down the sound principal that when a Government gives protection to an industry it is the moral responsibility of those engaged in that industry to provide both quantity and quality of the product as required. Under the new Bill, when it becomes law, the Government will be able to prevent careless and indifferent growers from damaging a market that has been built up with great difficulty, and it is to be hoped it will exercise that power. If we are to retain the duty we must supply the quality of the banana that the Southern markets demand.—A "Brisbane Courier" editorial.

Scientists Needed.

When discussing in the Legislative Assembly the growth of the banana industry, Mr. Frank Bulcock, the representative for Barcoo, paid a well-deserved tribute to the work of the agricultural scientists, claiming that the success of agriculture in the Commonwealth had been due to their assistance. This is an exceedingly important fact, and one too frequently overlooked; it is satisfactory, therefore, to find a member of the Ministerial party, and especially the representative of a pastoral constituency, taking the long national view regarding agriculture, and telling the House that the scientists are deserving of greater recognition. Now that a Chair of Agriculture has been established at the University, under the control of Professor Goddard, who has done so much to bring the results of the researches of the University into the homes of the farmers, we hope that Queensland will be able to train its own plant pathologists at no distant date, and all the other experts whose services will become increasingly important within a few years. In a State like Queensland, where the costs of production are much higher than in most of the other producing countries of the world, it is necessary that every opportunity shall be given to the producers to enable them to keep down the costs and to eliminate unnecessary waste. However much we may hope from the development of our secondary industries, we must keep the national perspective, and realise that Queensland is, essentially and fundamentally, a country of primary production. It is on that that our future prosperity rests.—From a "Brisbane Courier" editorial.

Northern Pig Board.

The Minister for Agriculture and Stock (Mr. W. Forgan Smith) advises that the following nominations have been received for election as members of the Northern Pig Board:—Robert Thomas Croker, Malanda; David Johnston, Malanda; Frederick Henry Hyde, Peeramon; Robert Campbell, Peeramon; and Hugh Quinn, Peeramon. As five members are only required, no election will be neeessary.

The Dutch Egg Industry.

Down to the year 1907 Holland was an egg-importing country, but since then she has entered the ranks of the exporters to England and Germany, and the quality of her eggs has steadily improved year by year. The bulk of the eggs are sold to private dealers at the weekly markets, and one bad consequence of this is that eggs are to some extent held back at certain seasons of the year.

The big egg market at Barneveld, about 10 miles from the town of Amersfoort, is particularly interesting, being in the centre of one of the best egg-producing districts. The number of eggs marketed weekly is often about 3,000,000 at the Roormond market, 2,000,000 at Arnhem, between 25,000 and 500,000 at Barneveld (according to the season), and from 20,000 to 400,000 to Amersfoort. The eggs are candled, sorted, and packed at once; the brown eggs are all sent to England, and the white eggs to Germany. Eggs destined for England are despatched, if possible, on the same day to Rotterdam, and shipped that evening viâ Harwich to London; other consignments go to Hull and Leith.

Much of the credit for the progress made is due to the Dutch Poultry Organisation Society (locally known as the "V.P.N."), which has some 58,000 members, and a branch in every province, embracing some hundreds of local societies. Payment of the subscription entitles members to send eggs and poultry both to the local egg society and to the big egg markets, where 25 per cent. of the entire production is sold. Members stamp their own numbers and that of their society upon the eggs; fines are imposed upon members who send in inferior eggs. The candling apparatus used enables from 5,000 to 6,000 eggs to be tested every hour.

Experimental Consignment of Australian Oranges.

Interest attaches to an experiment made with a cargo of 235 cases of South Australian oranges shipped to Great Britain by the "Bendigo." Excluding six cases in various wrappers, which were sent for special investigation by Dr. Barker, of Cambridge University, half of the cargo was carried in cold chambers, and the balance under ordinary cargo conditions between decks, without even a through draft. In appearance and condition there was no difference between the two lots, but on being tasted, those carried in cold store showed a fuller and finer flavour. The wastage was 1½ per cent. on large fruit, and none on the smaller fruit. The results are considered excellent, and were unexpected, says the "Imperial Food Journal."

The Royal Society of Queensland—Abstract of Proceedings.

The ordinary monthly meeting was held in the Geology Lecture Theatre at the Queensland University on Monday, 31st October, 1927.

The President, Professor E. J. Goddard, was in the chair.

Dr. L. Bagster exhibited two blocks of slag showing large crystals, which were probably a silicate of calcium and iron. The specimens had been presented to the Geology Department by Mr. Boyd, of Mount Morgan. Comments were made by Messrs. F. Bennett and H. Tryon.

Dr. J. V. Duhig demonstrated the hæmolytic action of the venom of the dorsal spines of the common Stone Fish (*Synanceja horrida*), as a preliminary to a paper to be published later on the venom of this species. He showed three tubes—(1) washed guinea-pig red cells + *Synanceja* venom, sedimented, showing a marked zone of hæmolysis; (2) the same as the first, but shaken to show the hæmoglobin in solution; (3) red cells + saline solution showing no hæmolysis. Dr. Duhig also briefly explained the neurotropic action of *Synanceja* venom, and demonstrated the poison sacs *in situ* on a dissected dorsal fin spine. The exhibit was commented on by Mr. F. Bennett and the President.

Mr. E. W. Bick exhibited an egg laid by a cassowary in captivity in the Botanic Gardens. This bird, when first brought to the gardens, had been considered an exceptionally fine specimen of a male by competent ornithologists. The President, in commenting on the exhibit, spoke of the relative frequency of occurrence of sex reversal in birds, and suggested the possibility in this instance. Dr. Duhig said that he had a hen at his home which had developed male characteristics.

Mr. W. D. Francis read a paper entitled, "The Rain-forest Flora of the Eungella Range." The rain-forest flora of the Eungella Range contains constituents of both the Southern and Northern rain-forests of the State. Its species constitution has evidently been influenced by the intermediate position of the area, the heavy rainfall (65 inches), and the elevation. The area contains some species which are identical with or allied to species abounding in mountain areas of Northern New South Wales, Southern and Northern Queensland, Papua, and Malaya. The paper was commented on by Messrs. Bennett, Bick, Tryon, Simmonds, Herbert, and the President.

Mr. D. A. Herbert read a paper on "Nutritional Exchange between Lianas and Trees." Small oval pieces of wood attached to rain-forest trees were found to be fused to the trunks. It was shown that these were the remains of woody vines which had rotted, leaving only small residual pieces of wood. It was contended that this was the result of the rotting away of other parts of the vine, the fungus not attacking the woody button so readily because of the presence of substances derived from the stem with which fusion had taken place. Specimens were exhibited showing stages in the formation of the buttons, one being noteworthy in showing the fusion of a dicotyledonous vine with a palm (*Archontophœnix Alexandræ*). The paper was commented on by Messrs. Tryon and Bennett.

Central Cane Prices Board.

Following on the recent election, the Central Sugar Cane Prices Board has now been constituted for three years as from 13th November, 1927, as follows:—His Honour Mr. Justice W. F. Webb, Chairman; Messrs. T. A. Powell, Canegrowers' Representative; J. Smith, Millowners' Representative; J. M. MacGibbon, Qualified Sugar Chemist; and A. R. Henry, a person experienced in accountancy and audit. The only new member to the Board is Mr. John Smith, who succeeds Mr. B. R. Riley as Millowners' Representative. Mr. Smith, however, has had previous experience as a member of the Board.

Tropical Fruits.

In the course of the debate on the second reading of the Primary Produce Experiment Stations Bill in the Legislative Assembly, the member for Bowen (Mr. C. Collins) complained of the lack of knowledge displayed by most persons with respect to the nutritive value of tropical fruits. One of the splendid fruits that his district was capable of producing in large numbers was the egg fruit, which was very appetising and nutritive if cooked properly. Another fruit which was grown in the North in large numbers was the granadilla, but this also was seldom seen in Brisbane. One of the things the experiment stations would have to do was not only teach the people how to grow fruit profitably, but how to acquire a taste for the locally-grown fruit. Even then it might be necessary, eventually, also to teach consumers how to cook the fruit to the best advantage, so that the dish would be appetising.

The Celotex Industry—Its Potential Importance to Queensland.

It is the opinion of Mr. M. P. Campbell (who was a member of the Australian Industrial Delegation to the United States this year) that the use of celotex in home building will have a material effect on the comfort of homes in the tropical parts of Australia, making them more comfortable, endurable, and cool. Mr. Campbell, who is president of the Queensland Chamber of Manufactures, recently gave the Press an account of what he had seen as a visitor to the celotex factories in the United States. He said he thought the greater use of the product would help to settle the North of Queensland. In Chicago some members of the delegation spent half a day at the celotex laboratory, which was conducted entirely for research and experimental work in connection with the industry. They saw the product treated in thousands of different ways, in order to obtain varying effects. It was made to look like stone, cement, and rough cast, and some of the walls in the laboratory were covered with pictures, which had been painted directly on the celotex. Artists were permanently engaged in this class of work, and many beautiful designs and effects were secured. The laboratory also employed several physicists and research chemists, who were working ahead of requirements and looking towards the future of the industry. After leaving Chicago they discovered that celotex was used largely in every other city of America. They visited theatres, churches, offices, schools, and hospitals, and found they were fitted with acousti-celotex, which had the property of absorbing sound. The Celotex company's engineers undertook to compute how much of this material was required to correct the acoustics of any room or place. Many new offices were installing it to deaden the sound of typewriters, and it was found to be of great

advantage, especially in schools and hospitals. At New Orleans they saw the celotex plant which made a lasting impression on the delegates on account of the way in which the machines were using up a hitherto almost useless waste product and converting it before their eyes into such useful material. The plant could best be described as a huge paper mill. The megas went in at one end, and was converted into pulp, squeezed, rolled, dried, and cut into sheets in a few minutes.

The finished product came out of the rolls at a comparatively fast rate, and was cut by ingenious devices, and then packed and placed aboard the railway trucks for despatch. It was remarkable that although 1,250,000 feet were turned out daily there was no accumulation of stocks, the demand being so great that the celotex was sent direct from the cutting table. The manufacture of celotex was contemplated in Queensland. In addition to converting a practically waste product into profitable material, it would divert the megas of the sugar industry from the furnaces, and thus stimulate the coalmining trade, transport, &c. Mr. Campbell showed a number of interesting photographs and fine examples of worked celotex, which he had brought home, the latter demonstrating the readiness of celotex to take paint, calcimine, and wallpaper, its adaptability to decoration by stencilling, and by a paint which produced a stucco effect, and its adhesive qualites as a base for plaster.

Feeding Tests on Dairy Cows.

To determine the effect of succulent feeds on the flavour and odour of milk, and to ascertain the best methods for feeding such crops, the Department of Agriculture, United States of America, has announced the results of a series of tests conducted at one of its experimental farms. In a statement issued on 3rd August the Department says it used selected cows, whose milk was relatively free from abnormal flavours and odours after being fed on a hay and grain ration. The full text of the statement is as follows:—

"To determine whether dried beet pulp, green oats and peas, pumpkins, carrots, sugar beets, rape, soy beans, and kale when fed to dairy cows impart undesirable flavours and odours to the milk, and to ascertain the best methods of feeding such crops and handling the milk, the United States Department of Agriculture has conducted feeding tests at its experiment farm at Beltsville, Md.

"The cows selected for the investigations were giving milk relatively free from abnormal flavours and odours when fed a basic hay and grain ration, and varied in stage of lactation from those fresh to those nearing end of lactation period.

"Besides the succulent feed the animals received, in proportion to milk produced, varying quantities of the following grain mixture:—100 lb. each of hominy feed, bran, and oats, and 50 lb. each cotton seed meal and linseed-oil meal. In addition, they were given all the alfalfa hay they would readily consume. The cows were divided into groups of four each, and interchanged at intervals of four days.

"Dried beet pulp soaked and fed wet one hour before milking in quantities up to 30 lb. produced but a slightly abnormal flavour and odour in the milk. The same ration immediately after milking had no effect on its flavour or odour. Similar results followed the feeding of a like quantity of green oats and peas one hour before and after milking. Both kale and rape fed in similar quantities one hour prior to milking produced a decidedly abnormal flavour and odour in the milk, but had a negligible effect when fed afterward. Soy beans fed one hour before milking tended to improve the flavour and odour of the milk."

Readers are reminded that a cross in the prescribed square on the first page of this "Journal" is an indication that their Subscription —one shilling—for the current year is now due. The "Journal" is free to farmers and the shilling is merely to cover the cost of postage for twelve months. If your copy is marked with a cross please renew your registration now. Fill in the order form on another page of this issue and mail it immediately, with postage stamps or postal note for one shilling, to the Under Secretary, Department of Agriculture and Stock, Brisbane.

The Home and the Garden.

THE BABY—ITS CARE AND FEEDING.

The subjoined article is one of a series to be issued by the Queensland Baby Clinics, dealing with infant welfare. These notes have been written in the hope of improving the health and happiness of babies, and of reducing infant mortality to a minimum. In this connection it is an interesting fact that Australia's death rate is lower than that of any other country in the world, excepting New Zealand. Queensland's general death rate is below that of the rest of Australia, and in infant mortality both the State and Commonwealth bear very favourable comparison with other countries. Any further effort to save our babies—Australia's best "immigrants"—and keep the death rate down must meet with ready sympathy and arouse a desire to co-operate practically in the good work.—Ed.

On the treatment and training which an infant receives in the first weeks of life depends greatly its progress during the ensuing twelve months. The opinion is frequently expressed that the new-born baby is too young to be trained; this is a mistake. Even very young babies quickly acquire habits, and it is important that they should be of the right kind.

To delay training until he is a few months old may, and probably will, result in giving mother or nurse a great deal of trouble, and the baby much unnecessary distress. So begin as you mean to go on.

The first bath should be performed quickly. The new-born infant is not yet used to his new surroundings, and is very easily chilled. For this reason, oil and bath him as quickly as you can; dress him, and see that he is warm and comfortable. He will probably be very drowsy and inclined to sleep for some hours. Newly-born infants should sleep more than three parts of their time, and, for the first few days, practically all the time they are not occupied with bathing and feeding.

From birth baby should have his own cot; he should never sleep with his mother. Not only is it healthier for him to sleep alone, but he sleeps better so. Some people think that the baby requires to sleep with his mother for warmth. This is a mistake. A healthy baby will, for most of the year, keep comfortably warm without any external heat other than that supplied by the bed-clothes on his cot. For the coldest months, if he is inclined to be chilly, his bed can be warmed with a hot water bag or bottle, carefully placed with the stopper or cork inclined downwards, so that there is no possibility of baby being burnt, even if the stopper or cork should accidentally come out. He should be accustomed from birth to sleep without a light. People who have had much experience with young babies notice that their sleep is more likely to be sound and undisturbed if there is no light in the room.

The Feeding of the Infant.

Now for the feeding of the new baby. This is a most important matter, and probably more mistakes are made on this than any other point in the management of infants.

Most babies when born know how to suck. It is seldom we find one who cannot do so. This is because, for long ages past, babies have been fed at their mother's breasts, and at birth the sucking instinct is present. This instinct must be developed, but care taken that it is done on the right lines. It must not be either under-developed or over-developed. If baby, who very often in these first days of life is very sleepy indeed, is allowed to sleep almost undisturbed, he may, at the end of a day or two, be very unwilling to work for his living. For that is what sucking is to a baby, and there is no more difficult child to manage than the one who has not been trained to suck properly. Feeding him from a feeding bottle, with the hole in the teat so large that the fluid pours down his throat without effort on his part, will also result in disinclination to suck.

The instinct can be over-stimulated by putting baby too frequently to the breast, or by leaving him there for too long a time. Also by giving him a dummy to suck constantly.

Vigorous sucking is necessary for his health, but it should be done regularly, and at proper feeding-time only. In the early months of life it forms a very important part of baby's daily exercise, for not only does it develop jaws and mouth, but it improves the circulation of the whole body.

There is another reason why baby should be trained to correct feeding habits early. We all know that the mother's full milk supply does not come in until the end of the second or the beginning of the third day after baby's birth. But before the milk comes in there is a little creamy-looking fluid in the breasts. This the baby should have, for, although there is very little, it has high food value, and at this time no other food can take its place. In addition, the mother's health also is benefited, and she makes a quicker recovery if baby is put regularly to the breast at this time.

Put baby to the breast within about six hours of birth—as soon as the mother has rested—leaving him only about two minutes at each breast. See that he is actually sucking, and not dozing. It will be sufficient to do this once every six hours for the first day. On the second day, leave him three or four minutes at each breast, and feed him every four hours. On the third day, when the milk supply is usually established, put him to the breast every three hours, and leave him about fifteen minutes. The average baby takes from fifteen to twenty minutes to feed. No baby should be left at the breast for longer than thirty minutes, and it is only delicate babies or those who suck feebly who should require so long.

Alternate the commencing breast; that is, if you begin by giving the baby the right breast for his first feed, commence with the left for the second, the right again for the third, and so on.

Big, strong babies generally do well if fed every four hours; that is, five feeds daily, from the third day. Others are better on three-hourly feeding (six feeds daily) until they are about three months old. After that time, four-hourly feeding suits most infants, but never jump suddenly from three to four-hourly feeding. Increase the intervals by a quarter of an hour every second or third day until a four-hourly interval is reached. This can be done without baby being aware that any change is being made. Give no night feeds from birth. This is most important. If this is done from the start of life, baby learns to take all that he needs in the day-time. This allows him and his mother to get the regular uninterrupted night's sleep which both require.

No Night Feeds.

A baby trained from birth to have no night feeds takes, during the day, all he requires to satisfy his hunger, and for his growth and development. If fed in the day only, he obtains just as much as if he were being fed both day and night. For example, careful weighing of children before and after feeding has shown that a child having, say, 30 ounces of food in the twenty-four hours, and given six feeds a day, takes 5 ounces at each feed, while if he is fed ten times a day, he takes 3 ounces at each feed, thus obtaining exactly the same quantity of food in the twenty-four hours.

But this training must start at birth. A baby accustomed to being fed night and day will protest vigorously if his mother suddenly lengthens his feeding intervals. He has been trained to frequent feedings, so takes only sufficient to satisfy his hunger for that period. But when started from birth on regular three or four-hourly feeds, with no night feeds, he never expects anything else. So keep absolutely to regular feeding times; make no exceptions. To do so one day will almost certainly result in the baby demanding the same concession the next day. Never hesitate to wake baby during the day when feeding-time comes round. Very soon he will learn to wake himself at the right time. If he is allowed to sleep over his feeding-time during the day, he cannot be expected to sleep all night. He will not have had his full supply of food, so will be hungry and restless.

Natural Food only.

One more very important point before closing. Mention has already been made of the fact that the mother's milk does not come in until the second or third day. As a result, many people think it their duty to give baby artificial food during this time. This is a great mistake, which can lead to much trouble, and in many cases has been responsible for the unnecessary weaning of the baby.

If baby required food during the first two days of his life Nature would supply it. The very fact that it is not there proves it to be unnecessary. As previously mentioned, baby needs the little fluid there is in the mother's breasts at that time, and should be put regularly to the breast to obtain it. Beyond this nothing but plain, boiled water should be given. Babies who are fed on sweetened water or condensed milk as their first food not infrequently refuse to take their natural food later. The reason is simple. Cane sugar, which sweetens both sugar and water and condensed milk, is very sweet. Mother's milk contains a different sugar, called sugar of milk; this is only faintly sweet. Babies like sweet things, and show their preference by refusing to take their proper food.

Important points to remember in feeding baby are:—

Commence training at birth.

Feed regularly; give no night feeds.

Wake baby when necessary during the day.

Make no exceptions.

KITCHEN GARDEN.

A first sowing of cabbages, cauliflower, and Brussels sprouts may now be made in covered seed bed, which must be well watered and carefully protected from insect pests. Sow in narrow shallow drills; they will thus grow more sturdy, and will be easier to transplant than if they were sown broadcast. The main points to be attended to in this early sowing are shading and watering. Give the beds a good soaking every evening. Mulching and a slight dressing of salt will be found of great benefit. Mulch may consist of stable litter, straw, grass, or dead leaves. Dig over all unoccupied land, and turn under all green refuse, as this forms a valuable manure. Turn over the heavy land, breaking the lumps roughly to improve the texture of the soil by exposure to the sun, wind, and rain. In favourable weather, sow French beans, cress, cauliflower, mustard, cabbage, celery, radish for autumn and winter use. Sow celery in shallow well-drained boxes or in small beds, which must be shaded till the plants are well up. Parsley may be sown in the same manner. Turnips, carrots, peas, and endive may also be sown, as well as a few cucumber and melon seeds for a late crop. The latter are, however, unlikely to succeed except in very favourable situations. Transplant any cabbages or cauliflowers which may be ready. We do not, however, advise such early planting of these vegetables, because the fly is most troublesome in February. For preference, we should defer sowing until March. Still, as "the early bird catches the worm," it is advisable to try and be first in the field with all vegetables, as prices then rule high. Cucumbers, melons, and marrows will be in full bearing, and all fruit as it ripens should be gathered, whether wanted or not, as the productiveness of the vines is decreased by the ripe fruit being left on them. Gather herbs for drying; also garlic, onions, and eschalots as the tops die down.

FLOWER GARDEN.

To make the flower-beds gay and attractive during the autumn and winter months is not a matter of great difficulty. Prepare a few shallow boxes. Make a compost, a great part of which should consist of rotten leaves. Fill the boxes with the compost; then sow thinly the seeds of annuals. Keep the surface of the soil moist, and when the young seedlings are large enough to handle, lift them gently one by one with a knife or a zinc label—*never pull them up by hand*, as, by so doing, the tender rootlets are broken, and little soil will adhere to the roots. Then prick them out into beds or boxes of very light soil containing plenty of leaf mould. Keep a sharp lookout for slugs and caterpillars.

All kinds of shrubby plants may be propagated by cuttings. Thus, pelargoniums, crotons, coleus, and many kinds of tropical foliage plants can be obtained from cuttings made this month. After putting out cuttings in a propagating frame, shade them with a piece of calico stretched over it. Be careful not to over-water at this season. Propagate verbenas, not forgetting to include the large scarlet Fox hunter. Verbenas require rich soil. Palms may be planted out this month. If the weather prove dry, shade all trees planted out. With seed-boxes, mulch, shade, water, and kerosene spray, all of which imply a certain amount of morning and evening work, the flower garden in autumn and winter will present a charming sight.

Orchard Notes for January.

THE COASTAL DISTRICTS.

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

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

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

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

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

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

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

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

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

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

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

The fruit must be thoroughly ripe, so that it will peel easily, and it should be laid in a single layer on wooden trays and placed in the sun to dry. If the weather is settled, there is little trouble, but if there is any sign of rain the trays must be

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

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

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

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

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

(1) That the fruit must be fully developed, but yet quite firm when gathered.
(2) That it must be handled like eggs, as a bruised fruit is a spoilt fruit, and, when packed with sound fruit, spoils them also.
(3) That only one-sized fruit, of an even degree of ripeness and colour, must be packed in a case.
(4) That the fruit must be so packed that it will not shift, for if it is loosely packed it will be so bruised when it reaches its destination that it will be of little value. At the same time, it must not be packed so tightly as to crush the fruit.

If these simple rules are borne in mind, growers will find that much of the blame they frequently attribute to the fruit merchants or middlemen is actually the result of their own lack of care. Fruit that opens up in the pink of condition sells itself, whereas any fruit that opens up indifferently is hard to sell on any except a bare market, and on a glutted market is either unsaleable or realises such a poor price that the grower is frequently out of pocket and would have been better off had he not attempted to market it.

If spraying with arsenate of lead, and systematic bandaging, has been properly carried out, there will be comparatively few codlin moths to destroy the later ripening pip fruits; but if these essential operations have been neglected or carelessly carried out, a number of moths will hatch out and the eggs laid by them will turn to larvæ that will do much damage, in some cases even more than that caused by the first broods that attack the fruit as soon as it is formed. Where there is any likelihood, therefore, of a late crop of moths, spraying with arsenate of lead must be continued if the late crop of pip fruits is to be kept free from this serious pest.

Fruit fly must be systematically fought, and on no account must any fly-infected fruit be allowed to lie about on the ground and breed this pest, to do further damage to the later ripening fruits.

Citrus orchards will need to be kept well cultivated in the drier and warmer parts of the State, and, where necessary, the trees should be irrigated. If scale insects are present, the trees should be either sprayed, or, better still, treated with hydrocyanic acid gas.

Western grapes are in full season, and if they are to be sent long distances by rail then they are all the better to be cut some hours before they are packed, as this tends to wilt the stems and keep the berries from falling off in transit. The fruit must be perfectly dry when packed, and should be as cool as possible. It must be firmly packed, as a slack-packed case always carries badly and the fruit opens up in a more or less bruised condition.

Farm Notes for January.

FIELD.—The main business of the field during this month will be ploughing and preparing the land for the potato and other future crops, and keeping all growing crops clean. Great care must be exercised in the selection of seed potatoes to ensure their not being affected by the Irish blight. Never allow weeds to seed. This may be unavoidable in the event of long-continued heavy rains, but every effort should be made to prevent the weeds coming to maturity. A little maize may still be sown for a late crop. Sow sorghum, imphee, Cape barley, vetches, panicum, teosinte, rye, and cowpeas. In some very early localities potatoes may be sown, but there is considerable risk in sowing during this month, and it may be looked upon merely as an experiment. Plant potatoes whole. Early-sown cotton will be in bloom.

On coastal and intercoastal scrub districts, where recently burnt-off scrub lands are ready for the reception of seed of summer-growing grasses, sowing may commence as soon as suitable weather is experienced. Much disappointment may be saved, and subsequent expenditure obviated, by ensuring that only good germinable grass seed is sown, of kinds and in quantities to suit local conditions, the circumstances being kept in mind that a good stand of grass is the principal factor in keeping down weeds and undergrowth.

In all districts where wheat, barley, oats, canary seed, and similar crops have recently been harvested, the practice of breaking up the surface soil on the cropped areas should invariably be adopted. Soil put into fit condition in this way will "trap" moisture and admit of the rains percolating into the subsoil, where the moisture necessary for the production of a succeeding crop can be held, provided attention is given to the maintenance of a surface mulch, and to the removal, by regular cultivation, of volunteer growths of all kinds. If not already seen to, all harvesting machinery should be put under cover, overhauled, and the woodwork painted where required.

Where maize and all summer-growing "hoed" crops are not too far advanced for the purpose, they should be kept in a well-cultivated condition with the horse hoe. Young maize and sorghum crops will derive much benefit by harrowing them, in the same direction as the rows are running, using light lever harrows with the tynes set back at an angle to obviate dragging out of plants, but the work should not be done in the heat of the day.

Quick-maturing varieties of maize and sorghum may still be sown in the early part of the month in coastal areas where early frosts are not expected.

Succession sowings may be made of a number of quick-growing summer fodder crops—Sudan grass, Japanese and French millet, white panicum, and liberty millet (panicum). In favourable situations, both "grain" and "saccharine" sorghums may still be sown; also maize, for fodder purposes.

Fodder conservation should be the aim of everyone who derives a living from stock, particularly the dairyman; the present is an important period to plan cropping arrangements. Exclusive of the main crops for feeding-off (when fodder is suitable for this purpose), ample provision should be made for ensilage crops to be conserved in silo or stack. As natural and summer-growing artificial grasses may be expected to lose some of their succulence in autumn, and more of it in winter and early spring, the cropping "lay-out" to provide a continuity of succulent green fodder throughout the season calls for thorough and deep cultivation and the building up of the fertility and moisure-holding capacity of the soil. Planter's friend (sorghum) may be sown as a broadcast crop at the latter end of the month for cutting and feeding to cattle in the autumn and early winter. Strips of land should be prepared also for a succession sowing about the second week in February, and for winter-growing fodder crops

TENDERS FOR LEASES

of State Farms at Hermitage (Warwick) and Warren (Rockhampton).

TENDERS are invited for the leases, as from the 1st February, 1928, of the Warren and Hermitage State Farms, for a period of five years, with a preference for a further three years.

The WARREN STATE FARM has a total area of 1,128¼ acres (approximately 200 acres under cultivation), is situated 17 miles from Rockhampton, and has a frontage of over a mile to the main railway line.

The area situated between the main line and the Westwood-Stanwell road (590 acres in extent) is divided into seventeen paddocks, watered by the Neerkoll Creek, also by a well from which water is pumped by a windmill to an elevated tank and reticulated to the various buildings, yards, and paddocks.

Improvements consist of the manager's house, men's quarters, reinforced concrete twin silos of 200 tons capacity, implement shed combined with storeroom and workshop, stables, loose-box and feedroom with horse yards attached, engine room, dairy cream room and milking shed, chaff room and large feeding shed filled with stalls, cow yard (portion concreted), and concrete dip with yards. Three bull stalls with exercise yards, substantial piggeries with concrete floors and troughs, exercise yards and shelter sheds, calf house with feeding bails and concrete floors, pig food-preparing shed also with concrete floor.

Additional to the above area there are two large grazing paddocks (approximately 360 and 179 acres) separated by a fenced road, situated on the south side of Westwood-Stanwell road, and watered by a well (40 feet), windmill, and 6,000 gallon tank with distributing pipe lines to three contiguous paddocks.

The whole of this property is substantially fenced and the improvements in a first-class state of preservation. The property generally is well suited for carrying on an up-to-date dairy and stud farm.

The HERMITAGE STUD FARM is 5 miles from the town of Warwick, on the main Killarney Railway. The property has a double frontage to the railway line and the railway station, and has an aggregate area of 430 acres, principally arable land, together with all crops growing thereon.

Improvements.—Manager's house (nine rooms, bath, and storeroom), modern barn silo, implement shed, hay shed, stallion box, stables, cartsheds and feed room with enclosed yards, smithy, dairy, cream room, milking shed with bull and calf stalls, men's cottage, sheep dip, draining yards, and shelter shed. The property is watered by a well, also a bore, from which water is lifted by windmills to elevated tanks and reticulated to the various paddocks, and the property has a frontage on its south side to Swan Creek. The area on the south side of the railway line (230 acres, divided into nine paddocks) is enclosed with a wire-netted boundary fence, whilst the major portion of that on the north (190 acres, divided into seven paddocks) is similarly fenced.

An inspection of both properties can be arranged by communicating direct with the Managers of the Farms concerned.

It is proposed to hold, about the middle of January, an auction sale of the stud and farm stock and the farming implements at both the Farms.

Forms of Tender may be obtained on application to the Managers of the Farms, and from the Department of Agriculture and Stock, Brisbane.

Tenders, which should be marked "State Farm Tenders," will close on 23rd December, 1927, and should be addressed to the Under Secretary, Department of Agriculture and Stock, Brisbane, from whom any further particulars may be obtained.

The highest or any tender not necessarily accepted.

E. GRAHAM, Under Secretary,
Department of Agriculture and Stock, Brisbane.

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON, F.R.A.S., AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	December, 1927.		January, 1928.		MOONRISE. Dec. 1927.	Jan. 1928.
Date.	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					a.m.	p.m.
1	4.50	6.32	5.1	6,49	10.31	12.32
2	4.50	6.32	5.2	6.49	11.34	1.35
					p.m.	
3	4.50	6.33	5.3	6.49	12.35	2.40
4	4.50	6.34	5.3	6.50	1.39	3.47
5	4.50	6.35	5.4	6.50	2.42	4.54
6	4.50	6.35	5.5	6.50	3.49	5.57
7	4.50	6.36	5.6	6.51	4.56	7.0
8	4.50	6.37	5.6	6.51	6.6	7.54
9	4.50	6.37	5.7	6.51	7.15	8.45
10	4.51	6.38	5.8	6.51	8.19	9.25
11	4.51	6.39	5.9	6.51	9.16	10.2
12	4.51	6.40	5.9	6.51	10.8	10.34
13	4.51	6.40	5.10	6.51	10.52	11.3
14	4.52	6.41	5.11	6.51	11.30	11.33
15	4.52	6.41	5.12	6.51	...	...
					a.m.	a.m.
16	4.52	6.42	5.13	6.51	12.4	12.3
17	4.52	6.43	5.13	6.51	12.35	12.34
18	4.53	6.43	5.14	6.51	1.3	1.9
19	4.53	6.44	5.15	6.51	1.33	1.46
20	4.54	6.44	5.16	6.50	2.3	2.30
21	4.54	6.45	5.16	6.50	2.36	3.20
22	4.55	6.46	5.17	6.50	3.13	4.15
23	4.55	6.46	5.18	6.49	3.52	5.13
24	4.56	6.47	5.19	6.49	4.39	6.15
25	4.56	6.47	5.19	6.49	5.30	7.19
26	4.57	6.47	5.20	6.48	6.25	8.22
27	4.57	6.48	5.21	6.48	7.24	9.25
28	4.58	6.48	5.22	6.48	8.25	10.26
29	4.59	6.48	5.23	6.47	9.27	11.29
						p.m.
30	5.0	6.49	5.24	6.47	10.28	12.32
31	5.0	6.49	5.25	6.47	11.30	1.37

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S., add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

Phases of the Moon, Occultations, &c.

The times stated are for Queensland, New South Wales, Victoria, and Tasmania.

2	Dec.	(	First Quarter	12 14 p.m.
9	,,	○	Full Moon	3 32 a.m.
16	,,	)	Last Quarter	10 3 a.m.
24	,,	●	New Moon	2 13 p.m.
31	,,	(	First Quarter	9 22 p.m.

Perigee 7th December, at 7 11 a.m.
Apogee 19th December, at 8 24 a.m.

In the early dawn on the 9th, near the eastern horizon, the planets Mercury and Mars may be observed to be in close conjunction, Mercury being about one degree northward of Mars. Before the Sun rises Saturn will also be over the eastern horizon, but quite unobservable.

On 20th December, about 2 p.m., Venus will be near the southern or upper edge of the Moon as seen from Queensland. A pair of binoculars may be necessary to see Venus at such an hour in the day, but probably many keen eyes may detect it without them. Had it not been for the considerable declension of the brilliancy of Venus since 17th October, the daylight spectacle would have been a much more interesting one.

7	Jan.	○	Full Moon	4 7 p.m.
15	,,	)	Last Quarter	7 13 a.m.
23	,,	●	New Moon	6 18 a.m.
30	,,	(	First Quarter	5 25 a.m.

Perigee 4th January, at 8 36 a.m.
Apogee 16th January, at 4 48 a.m.
Perigee 29th January, 9 30 p.m.

On the 4th, the Earth will reach that part of its orbit which is nearest the Sun. It will then be three million miles nearer to it than on the 4th July.

The occultation of Omega Tauri by the Moon on the 4th soon after 7 p.m. may be fairly well observed in a telescope or binoculars at such positions as Rockhampton, Gympie, Maryborough, Brisbane, Warwick, and Toowoomba, although the twilight will somewhat interfere with the disappearance of the star on the dark edge of the Moon; at the time of reappearance about an hour later, at the bright side, the greater darkness will improve the effect.

On the 8th soon after 4 a.m. it will be interesting to watch the occultation of Kappa Geminorum by the Moon, with telescope or binoculars, at places as far south as Warwick, on account of its nearness to the southern edge of the Moon.

An unusually favourable opportunity to find the planet Neptune will occur on the 8th after about 10 p.m. The planet will be remarkably close to Regulus, the brightest star of Leo, which will rise about 9 p.m. about 12½ degrees (twice the length of the Southern Cross) north of east. Binoculars or telescope will be required to see Neptune, which appears as a very small star, below naked-eye visibility, its distance being over 2,700 million miles.

Mercury will be on the far side of its orbit, nearly behind the Sun on the 9th; two degrees above it at midday.