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QUEENSLAND AGRICULTURAL JOURNAL

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Event and Comment.

Writing Australia's Name in the Skies—An Epic and a New Epoch.

LIEUTENANT BERT HINKLER'S lone-hand flight from Croydon (England) to Bundaberg represents to date the most remarkable achievement of man in his conquest of the air. Through it this young Queenslander has brought fame to his home city, to his native State, to Australia and the wide-flung British Commonwealth. With Hawker, Ross and Keith Smith, Bennett and Shiers, Parer and McIntosh, he has written the name of Australia across the skies. His single-handed aerial voyage around half the world's circumference constitutes an epic of pluck, determination, endurance, and mechanical genius. His great accomplishment marks the opening of a new epoch in the science of aerial navigation, and the passing of yet another stage along the course of human progress. Australia is proud of Lieutenant Hinkler, D.S.M. (who previously won high distinction as an airman in the Great War) as one of the greatest of her sons, not only for his magnificent feat, but for the characteristically Australian way in which he did it; for the way he tackled the job and carried it through; for his zeal and unflagging cheerfulness under every stress; for his modesty and level-headedness in the hour of triumph. Without any fuss he left England, alone, in his miniature machine, and kept on his journey from day to day, to time and plan, in the same steady, unostentatious way. The flight was not a stunt accompanied by merely lucky circumstance. It was a feat that without a combination of extraordinary coolness, courage, judgment, tenacity, and high mechanical skill would otherwise have been impossible.

When aerial development becomes a theme of history the share of young Australia in the promotion of aviation must make a remarkable chapter. It was an Australian—Hargreaves—who invented one of the first flying machines, now treasured as an exhibit in a German museum. In actual flying, we have the remark-

able record of the Australian Flying Corps in every theatre of the Great War. Other Australians to bring honour to their country were Hawker, whose gallant attempt to fly across the Atlantic is not forgotten; Ross and Keith Smith and their two mechanics, Bennett and Shiers, who were the first to fly from England to Australia; Parer and McIntosh, who essayed the same feat successfully, coming through under every handicap and only after extraordinary adventures that called forth the highest degree of indomitableness, resourcefulness, pluck, and skill. Then there were also those other Australians—Douglas, Ross, Wilkins, Rendle, Williams, Potts, Howell, and Fraser—whose attempts to fly home from Europe, though they all ended in disaster, and some in tragedy, may be classed as splended failures that added greatly to our knowledge of aerial navigation; while at home in Australia we have already established great civil aerial transport services, excellently manned, that are proving one of our greatest developmental factors in inland settlement.

Australia then has reason to be proud of her achievements as a pioneer nation in aviation, and has still greater reason to be intensely proud of her youth whose magnificent flights have captured popular imagination, and of whom one of the greatest is Bert Hinkler, whom the world acclaims to-day, and whom we all delight to honour.

Hinkler's Flight—Its Practical Lesson.

APART from the thrill he has given us as a young Australian who, alone and unassisted, has covered 11,000 miles in a plane that with wings folded fits comfortably into an ordinary garage, the flight of Lieutenant Hinkler has a very practical side to it. Acting as his own navigator, pilot, and mechanic, and without any ground organisation, he has demonstrated the possibilities of a small plane for transport over long distances, and has proved that air travel may be cheaper than other means of voyaging. His outlay on the whole journey was only £57, while the actual flying time from England to Australia was just about six days. Allowing for the full time taken on the way—sixteen days—Hinkler has shown that communication with Britain can be brought within the compass of fourteen days. On the evidence of those facts it is easy to conjure up a vision of the future of aerial navigation. In a country like Australia, where conditions for flying are almost perfect, it is easy to imagine what a place aviation might have in internal development. From this point of view alone Lieutenant Hinkler has performed an inestimable service, not only to his own homeland, but to the whole world. For the moment, however, we like to think more of his achievement as one of the greatest sources of inspiration to the youth of Australia; while we know that in the records of the race his name will remain for all time.

Maize-Growing in Queensland—Southern Appreciation of Departmental Activities.

COMMENTING interestingly and informatively on the expansion of maize-growing in Queensland, the "Australasian" (Melbourne) had this to say in a recent issue:—

> The Department of Agriculture and Stock (Queensland) is doing everything possible to stimulate maize-growing, and farmers are appreciative of the encouragement they receive. Maize-breeding, which is one of its principal activities, is designed—(1) to improve the standard and type of Queensland-grown maize; (2) to increase the average yield and production on individual farms, and similarly of the State; (3) to produce varieties and types to suit the climatic conditions and soils common to different districts. The breeding and propagation of new strains of maize are carried on by the maize specialist of the department (Mr. C. J. McKeon), and strains of the standard varieties are grown under departmental supervision, and specially selected pure seed is distributed to farmers on application. Last season a flat rate of 11s. a bushel, including railage to the nearest railway station, was charged to enable applicants living at long distances to benefit. The use of good seed means bigger and better crops, and helps to reduce the cost of production. Extraordinarily high yields have been obtained from seed of high productivity, notably from T. O. Reid's Yellow Dent and Improved Yellow Dent, of which maximum yields of 116 and 117 bushels an acre respectively (five times the average yield of the State) have been secured under field conditions. Farmers are not slow to realise the value of such seed, which is absorbed long before the planting season arrives. Officers of the department regularly visit the various maize-growing centres, and keep in constant touch with farmers. They advise on all matters appertaining to the cultivation of the crop, and assist those engaged in the industry by every means in their power. A proposal to establish a maize board last year under the provisions of the Primary Producers' Organisation and Marketing Act was defeated. Of the 5,264 votes recorded, 1,924 (37.4 per cent.) were in the

affirmative, and 3,225 (62.6 per cent.) were in the negative. This indicates that the majority of growers are opposed to Government control, although they are not unmindful of what is being done to advance their interests. The Department of Agriculture is performing work of the greatest significance, and its activities are an important factor, not only in expanding maize-growing, but also in placing the industry and the subsidiary industries on a more satisfactory footing, and assuring the prosperity of those engaged in them.

No crop is more easily and rapidly improved by selection and breeding than maize, and the best variety for any locality can be determined only by local variety tests. Such tests have been conducted in many countries in the United States of America through the effort of the local organisations in co-operation with the State Experiment Stations. The number of samples tested in sixteen counties in Iowa was 1,478, of which one-tenth giving the highest yields averaged 62 bushels an acre, while one-tenth giving the lowest yields averaged 44.5 bushels an acre, or only about two-thirds as much as the best yielding samples. Over 100 samples of imported seed averaged less than nearly 1,000 samples of home-grown seed. The results show wide differences in yield, and emphasise the importance of the farmer selecting for his soil and locality the variety that will do best. Such selection will evidently made a great difference in the total yield of maize on a given area. In order to assist farmers in obtaining pure, pedigree seed, the Queensland Department of Agriculture and Stock, by arrangement with certain growers in the principal maize-producing districts, supplies them with selected seed, which is specially grown for the department under the supervision of its officers. These growers are located in isolated areas, where no other variety excepting the one in which they are specialising is grown near the crop, thus eliminating the risk of cross-fertilisation. The farms are periodically inspected, and the inspectors select seed for the following season's planting in the field, and that for sale from the crib. The growers are paid 1s. a bushel above the ruling top market rate on rails at their nearest railway station, and the fact that a number have been growing for the department for upwards of ten years proves that they are satisfied with the arrangement. Before the seed is distributed to farmers it is graded by the department, and the demand is so great that it has been impossible to supply all orders. Early in August stocks of early varieties were exhausted, although planting would not be general for another month. Last year there was sufficient seed to plant 2,000 acres, in addition to the departmental plots, of which there are approximately 200. New varieties are constantly being tried out in different districts to determine their suitability or otherwise for the conditions. This branch of the departmental activities is of the greatest benefit to farmers, as it enables them to secure the best seed at a reasonable price, and to the State by the increased yields of grain and fodder resulting from its use.

Value of Scientific Research—The Futility of Expecting Salvation by Ballot.

GRADUALLY we were recognising that our fundamental problems were production and efficiency, and by those means to be able to send overseas our exportable surplus, and sell it in competition with the open markets of the world, declared Prime Minister Bruce, at Frankston, Victoria, recently. This recognition has grown throughout the world as the basis of the restoration of all nations to the condition of prosperity. Wool was the only commodity in the world for which the buyer sought out the seller. We had to sell in the best markets of the world, but we had run into trouble because in other commodities room for improvement in production methods was greatly to be desired. Science research was beginning to run down lines where we could hope for successful results. The sum of £650,000 had been set aside for the Council of Scientific Research, and of that amount £100,000 was being utilised for the purpose of training our own scientists. There were some people, who generally described themselves as sound, hard-headed business men, who criticised the spending of money in this way, but they merely condemned themselves.

We did not know what was a balanced ration for sheep. We did not know the mineral contents of our grasses, which explained why sheep transferred from one place to another did not thrive; but we were starting to investigate this problem. The reason it had not been done before was because we had such a wonderful country; it did not matter very much how we mismanaged, we got on very well. But we had passed that stage to-day. For years we slung our fruit into cases, and declared that any self-respecting community should be clamouring to buy it. We had sent our butter overseas, but our butter four years ago had brought 10s. a cwt. less than the New Zealand commodity, simply because we had never taken the trouble to keep up our reputation. All that was wanted was a little more vision on the part of the people and a greater recognition of our advantages. It was utter nonsense to look to Parliament for the salvation of the country.

Bureau of Sugar Experiment Stations.

ENTOMOLOGIST'S ADVICE TO CANEGROWERS.

By EDMUND JARVIS.

Keep the Ground Moving.

Continue to work the surface soil at intervals, where possible to do so, between the rows of young cane plants, especially when the surface is caked after rain; going as close to the stools and as deep as can be ventured without risk of material injury to feeding roots. Such treatment, in addition to checking the evaporation of moisture from the ground and promoting plant growth, often disturbs and brings within the reach of ants and other enemies a small percentage of first- and second-stage cane grubs.

A well known and very successful canegrower, recently living at Highleigh, succeeded in beating the grubs on his selection by carrying out systematically the cultural methods advocated above. Although his land and that of his neighbour was of poor quality he was always able to produce a fine stand of healthy cane, while at the same time that of his adjoining neighbour (only eight feet away, on the other side of the dividing fence) was seen to be stunted and falling over as the result of grub injury.

He told me he used very little manure, and attributed his success entirely to cultural methods. Not having too much land, he was able to work it intensively, and keep the soil in well worked condition at all times.

Caterpillars Eating Cane Leaves.

During this month one is likely to meet with infestations of the so-called "Leaf-eating Grass-worm" (*Laphygma exempta* Walk.) which occasionally strips the leaves of cane and maize plants.

This caterpillar is dark brown with three stripes on the back and one on each side pale yellow, the first body segment being brownish black with three white stripes. Head reddish brown, eyes lighter, and indistinctly mottled with yellow; a large V-shaped mark on face. Under surface of body light yellowish green, dotted with white or brownish on the area between legs and lower portion of sides of body. Length of caterpillar about 1 inch.

The first serious outbreak of this pest occurred at Meringa, during February, 1920, when the larvæ were noticed swarming in countless thousands over an area of about 100 acres planted to maize and sugar-cane. ("Queensland Agricultural Journal," Vol. XVI., pp. 276-280.) In cases where the cane is seen to be seriously injured, while the caterpillars are only about half grown, it is advisable to spray the leaves with arsenate of lead (2 lb. in 50 gallons of water). The swarm of advancing caterpillars can be checked by spraying herbage, &c., lying between them and the crop, with a solution consisting of arsenite of soda 1 lb., black sugar 8 lb., water 10 gallons. Fortunately, the species in question is normally well controlled naturally by various predaceous and parasitic insect enemies, chief of which is a small tachnid fly. (For additional control methods see Bull. No. 3, Second Edition, Revised, 1927, pp. 40-42.)

Plant Lice Attacking Cane Leaves.

Many growers are familiar with the appearance of the common cane aphis, a small, soft, yellowish-green insect, which sometimes congregates in great numbers on the under sides of the lower leaves, and more rarely upon the heart-leaves. Such occurrence generally remains unnoticed until such time as the aphides increase sufficiently to favour development of a black fungus, known as fumagine, which grows upon a sweet secretion scattered over the surface of the leaves by these insects while feeding. As a general rule, aphide attack of cane leaves seldom assumes serious proportions unless the heart-leaves become affected. In such cases it becomes advisable at times to spray the stools with tobacco water (1 lb. to about four gallons of water); steep the tobacco in the hot water and apply while warm.

"Mealy Bug" of Sugar-cane.

These pinkish plump soft-bodied insects, which appear to have been dusted over with flour, occur quite commonly at times amongst standing cane. Upon pulling back the older leaf-sheaths, specimens of all sizes (from one thirty-second to three

sixteenths of an inch long) can often be noticed clustering together more or less numerously around the nodes of the sticks. Although kept well in check by various natural enemies, this pest may very easily be introduced into clean plantations by means of infested seed; seeing that portions of the leaf-sheath frequently adhere to cane sets, thus serving to harbour numerous specimens of the tiny larval forms of this mealy bug. By soaking such seed cane in water of ordinary temperature for seventy-two hours before planting, these insects, together with borers, &c., are destroyed, while germination of the cane is stimulated.

How to Combat Cane Hoppers.

Leaf hoppers, or frog hoppers, as they are sometimes termed, are usually of small size (seldom exceeding half an inch in length), and when resting on the leaves may be recognised by their slender wedge-like form, the head end being broadly rounded in front with prominent eyes, and the body tapering towards the end of the folded wing cases. Most of the species, when touched or alarmed, hop with agility to a considerable distance, while others (the larger species) will often seek to evade notice by quietly slipping out of sight, with curious sidling motion behind some leaf or stem.

Many are prettily marked by red, green, or brown stripes, spots, or blotches; such colours being in some cases protective, by harmonising in shade or tint with the surrounding leaves, bark, or twigs, &c.

When chancing to be present in great numbers these insects injure the cane by continuous puncturing of the leaves and feeding on the plant juices.

Control of the nymphal stages, when the wings are in a rudimentary condition, can generally be effected by spraying with kerosene emulsion (10 per cent. strength), with tobacco water, or with strong soap emulsion. The adult winged hoppers should be captured at night time on tarred screens, carried—together with a bright lamp—between the infested rows of cane; the leaves being gently shaken while passing along to disturb the hoppers, which, flying out towards the light, will stick in thousands to the prepared surface.

For fuller information regarding leaf hoppers and their control the reader is referred to my Progress Report for January to February, 1928, published in this month's (March) issue of the "Queensland Agricultural Journal," and "Australian Sugar Journal."

Look Out for Leaf-eating Caterpillars.

The "Army Worm" (*Cirphis unipuncta* Haw. and *C. loreyi* Dup.), and "Grass worms or Caterpillars" (*Laphygma exempta* Walk. and *Mocis frugalis* Fab.) cause more or less damage this month to young leaves of maize, sugar-cane, and other plants. For descriptions of these caterpillars, remedial measures, &c., see "Queensland Agricultural Journal," Vol. XXVII., pp. 275, 276; and Vol. XXVIII., p. 442.

Ordinary outbreaks can usually be controlled by spraying the leaves with lead arsenate, in such manner as to form a poisoned strip or band of about two or three cane rows wide immediately in front of the line of advance. Use 2 lb. lead arsenate in about 50 gallons of water, taking care to keep the mixture well agitated while spraying it over the leaves, in order to ensure and maintain uniform suspension of this arsenical matter in the water. In cases of scattered infestation spray the area affected.

CAIRNS CANE AREAS.

Mr. N. L. Kelly, Assistant to Pathologist, has made the following report (25th January, 1928) to the Director of Sugar Experiment Stations on the Cairns cane areas:—

In a brief survey of the Freshwater area, I found that Leaf Scald is showing up extensively on practically every farm visited, and is to be suspected on those two on which it was not seen because of the past history of their stock and of the different growing conditions. With another fortnight of dry weather every diseased farm should show some phase of the disease. This, the only major cane disease in the district, can only be dealt with efficiently in one way—by the introduction of clean N.G. 15 (Badila) and the use of this by the farmer to plant up a nursery plot or even his whole farm, and at the same time by the more or less speedy elimination of his present infected stock.

It is well known that the girth of Badila is not what it used to be, and it may be that, besides bringing in entirely healthy cane, a reinvigorated stock may be introduced.

With the secretary of the Cairns Cane Growers' Executive (Mr. Curlewis), the cane inspector of the Mulgrave Mill, and others, I proceeded to the Tableland to investigate the possibilities of the area for plant purposes.

The cane already growing there is well separated, and the farmers for the most part are keen, both of which are distinctly advantageous; but, while the N.G. 15 inspected appeared healthy, its past history makes it unwise to recommend it for planting, except after more frequent visits by a Pathologist.

A supplementary scheme which is entirely safe is to bring to the Tableland about 10 to 20 tons of cane from a well-kept farm in the nearest clean and well-controlled district (the Herbert River), and to keep this under observation until it can be sent down to the Leaf Scald areas nearby.

Several farmers on the Tableland have shown their readiness to fall in with this scheme, and Mr. Curlewis assures me it will have the whole-hearted support of many members of his association. The idea is, of course, for every farmer to participate; which they doubtless will do when they see the advantages to be gained by themselves severally and collectively. Seven Tableland farms were inspected, two of which had diseased Mahona. A few other farmers were interviewed. All farmers in the Malanda-Atherton area who are growing cane should notify the secretary of the Cairns Cane Growers' Association or this Bureau, so that the scheme may be properly controlled.

Top Rot is quite extensive in the Freshwater area. As many farmers as possible were shown the symptoms of this disease. It is pleasing to record that the majority were familiar with it. No control measures can be given for this minor disease until after the Pathological Laboratory has been established.

Quite a number of farmers are still growing maize near their cane. Apart from the fact that cowpea or some other leguminous crop is a better green manure, it must be repeated that the maize was in nearly every case found to be infected with Mosaic disease, and infested by its carrier the Corn Aphis. Prevention is better than cure, and farmers should not grow maize within a furlong of cane.

CANE DISEASES IN QUEENSLAND IN 1927.

By E. J. FERGUSON WOOD, B.Sc.

This report is intended to give the results of the inspection of the cane districts of Queensland, made during the year 1927, and to emphasise more fully certain comments made in my report published in the Annual Report of the Bureau. In my monthly reports, the diseases were discussed under the heading of districts, and as few diseases are confined to one district, a considerable amount of repetition was involved, for farmers are not usually interested in areas outside their own immediate vicinity. I shall give a brief description of the symptoms, control, and distribution of the diseases, for I feel that some such record is necessary, especially as the Pathological staff is to be increased and reorganised. It is intended to conclude with a discussion of the varieties, their relation to soil, climate, and disease, as far as observations will permit.

I.—GENERAL POSITION.

Queensland, as a whole, has no characteristic disease such as the Mosaic of Louisiana, but the various districts have their own diseases which probably cause as great a loss as the serious epidemics of other canegrowing countries. These local epidemics are severe in the affected areas, but do not extend over the whole State. This is fortunate for Queensland, as it follows that it is possible to confine these epidemics. Moreover, the scattered centres of production give us natural quarantine areas. I suggest that this matter of district quarantine be given first consideration when the staff is complete and in full working order.

Our first need then is a rigorous quarantine between districts whereby no plants can be sent from one district to another, except through some farmers' association, and after inspection by an officer of the Bureau. It is generally considered amongst farmers that change of soil appears to increase the vitality of cane plants, but farmers are afraid to get plants from outside, owing to the fear of introducing disease, and the pathologists in the past have rightly discouraged the practice. With an efficient quarantine this exchange would be possible, and in many cases of

great benefit, especially in the case of districts such as Bundaberg or Babinda, where no field can be guaranteed free of disease, and where clean plants would be the greatest boon. The farmers could follow the example of the Cairns canegrowers, who have decided to keep a nursery of clean cane on the Atherton Tableland, from which they can buy as they require plants. This nursery is to be supervised by officers of the Bureau, and should provide a store of clean seed cane of known ancestry. With this end in view, I have kept a lookout for suitable places for nurseries, far enough from canegrowing centres, to enable us to hold reasonable hopes that clean cane introduced thereto will not become contaminated. This is the first step in a general direction of improving the varieties by selection and supervision. A visit was made to the Warren State Farm, near Rockhampton, but the climatic conditions appeared unsuitable for the purpose.

The sugar-growing districts of the State divide themselves naturally into well-marked quarantine divisions, as follow:—

(1) Beenleigh to Maryborough.—Here occur Fiji Disease, Mosaic, and Gumming. No Iliau or Leaf Stripe have been seen in these districts. They are already under strict quarantine for Fiji disease.

(2) Bundaberg and Childers.—Fiji disease has lately been reported at Bundaberg. Gum is epidemic there and is bad at Childers. Iliau occurs in both places, and Leaf Stripe at Bundaberg. Little Red Rot is known, but Mosaic is prevalent.

(3) Mackay, Sarina, and Proserpine.—Red Rot and Mosaic are serious. Leaf Stripe and Gumming are present but very slight. No Iliau is known. Leaf Scald is on three farms at Proserpine.

(4) Ayr and Giru.—Leaf Stripe and Mosaic predominate. Gum and Leaf Scald were not seen. Red Rot is very unimportant. Top Rot is serious.

(5) Ingham.—Gumming seems under control, but the weather may influence this. Leaf Scald, Mosaic, and Leaf Stripe are very slight and restricted.

(6) Innisfail, Tully, and Babinda.—Leaf Scald bad. No Mosaic, Gumming, or Leaf Stripe seen. Spindle Top is bad.

(7) Cairns.—Leaf Scald serious; Mosaic, Gumming, and Leaf Stripe present. Will (with sufficient control measures) be merged into the Innisfail area. Top Rot is very bad again here.

(8) Mossman.—Leaf Scald and Leaf Stripe present. No Gum seen and only one stool of Mosaic, but more are suspected.

This list will show the possibility of introducing new diseases into each area along with imported plants, and illustrates the need for some supervision.

II.—DISEASES AND FARMING OPERATIONS.

Few farmers realise the bearing of their operations on diseases. The careless farmer has almost invariably the most disease, and this stands to reason.

1. Preliminary Cultivation.

Ploughing Out and Replanting Immediately.—A large proportion of farmers often do this, which is very injurious for the following reasons:—

(i.) Improper and insufficient cultivation. The soil is insufficiently aerated, becomes the harbour for harmful bacteria and fungi, and for plant poisons, and inhibits the growth of cane. The crop falls off, ratoons become light and less in number, grass and weeds get in and harbour rats and pests and weaken the cane, rendering it more susceptible to disease.

(ii.) Stools from the old crop volunteer, and often these are diseased and carry the trouble over to a plant crop which has possibly been carefully selected, thus rendering somewhat valueless a good piece of work. I have seen farmers actually planting between the old rows which they intended to get rid of later. The old rows were full of disease, which would be transmitted to the plant cane, and the result would be alarming.

(iii.) It tends to perpetuate the occurrence of harmful organisms which would be killed by proper cultivation and fallowing. An instance of this is the Iliau fungus, of which the fruits or spores, as they are called, are killed by the action of sunlight.

2. Green Manuring.

This practice, besides giving the land a rest and a chance of cultivation, restores humus to the ground, alters the soil acidity, and checks the growth of harmful organisms which can only exist on cane and the grasses. By preventing grasses from growing on the field, it checks the diseases which occur on them and which spread to the cane. Such are some of the root diseases and possibly Top Rot. Its value in the case of Root Fungi is great, and it is thought probable that it will have an important bearing on the control of Red Rot. At least, farms which had been green manured in the Mackay district seemed most free from the disease.

3. The Plant.

Plant selection is the most important part of canegrowing, and on it depend—

(*a*) The health of the plant. Diseased canes will, in the case of most diseases, invariably give rise to diseased stools and carry the infection into the fields in which they are planted. This is the way in which new fields become infected, though sometimes secondary infection plays an important part.

(*b*) The vitality of the plant. It seems a rule in Queensland that stock are bred from the best parents, cane from the worst. Farmers fail to see the analogy, and will cut for plants, cane which is too poor to mill. The result after generations is a weak cane of low vitality, subject to disease. It is said that the cane is running out and becoming susceptible to disease, and the Stations are asked for new varieties. What is required, however, is discrimination on the part of the farmer, and it is his everyday job to look after the varieties which he grows. The selection of a clean seed plot should be the aim of every farmer. Most farmers will complain bitterly that they are nearly ruined by diseases, but few of them can tell of any steps they have taken to improve their position.

The procedure would be:—

(i.) Select the best sticks from the best stools and plant them in a plot;

(ii.) From this plot, plant up a paddock as seed cane for next year, choosing the best canes again for a subsequent plot similar to plot (i.). This process repeated from year to year would at least keep the variety up to the standard, and possibly improve it. The expense and time would be little, and the benefits great. New strains could be introduced (under supervision) and treated in the same manner.

4. Planting.

There are two methods employed—

(*a*) Cutting up the plants in the field from which they are to be taken, and planting them by hand or by a planter. This is the correct method, as it gives the farmer a chance to examine the plant. It causes increased handling which enables gumming or borer to be the more easily detected. Many diseases and pests can be recognised by examining the ends of the cuttings, and Gum and Red Rot are most easily detected in this way, whereas if the plants are taken by

(*b*) Whole sticks, thrown straight into the drills, and cut up therein, the chance of detection of disease is small.

In areas where gumming is present, canes should never be planted without being left overnight covered with a moist bag in order to sweat out the gum, so that the gummed sets may be discarded.

By this second method also, the cane is planted end to end, and I hold the opinion that some of our diseases caused by weak parasites gain a strong hold in this way, through too close planting; the root system becomes cramped and insufficient, some of the canes smothered, and susceptible to parasites; too close planting seems to have some bearing on Spindle Top though no definite data are available.

5. After Cultivation.

This is the time for reducing disease infection. During the period while the cane is able to be cultivated, most of the diseases can be recognised, and farmers can easily dig out diseased stools in fields of which the plants have been selected. One method is by carrying a hoe on the cultivator, and the other (more certain) is to give up so much time every day to walking over a field row for row and digging out the stools. In this way several farmers I have met have rid themselves entirely of serious outbreaks of disease. If this practice is repeated in the ratoon crops the field can soon be cleaned up.

6. Harvesting.

It is a good plan to have a kerosene tin of some disinfectant placed near the barracks in cutting time and to have the cutters place their knives therein every night, or when moving from one field to another. It is an inexpensive way to minimise knife infection. Disease is often carried in this way from an old diseased block to a young selected block, and may throw back the work of months in selection and digging out by reinfecting a healthy field.

7. Trash.

Burning trash is only recommended where a disease such as Spindle Top or Red Rot or some bad root rot is present. In such cases the fungus can live over on the trash until the canes are ready for reinfection, and this is one of the important modes of spreading such diseases. In other cases trash restores humus, and is a help to the soil.

8. Disinfection of Plants.

No work has been done on this in Queensland, but it seems probable that it would be of benefit in disease control work in the case of external fungi. Sprindle Top might be somewhat checked in this way, but no definite information can be given.

III.—DISEASES, THEIR SYMPTOMS, DISTRIBUTION, AND CONTROL.

MOSAIC.

The symptoms of this disease are—

(1) Leaf Symptoms.—An irregular mottling of the leaf in shades of green, some lighter and some darker than normal. The mottling tends to run parallel with the length of the leaf, and varies to some extent according to the variety. Q. 813 shows a marked yellowing; Clark's Seedling (H.Q. 426) shows a green and cream mottling, and B. 208 a dark green mottling on a creamy white ground in severe cases. Black Innis, M. 1900 Seedling, H.Q. 285, Badila, the E.K. canes, &c., have light and dark green markings.

(2) Stem Symptoms.—The stem is frequently mottled with white stripes against the natural colour. In severe cases these become shrunken, and the stem is corrugated, and finally cracks. It is usually thinner than the normal canes and is always much lighter in weight. In Q. 813, Q. 970, and Malagache, the stunting of the stool is very conspicuous, and often a stool of Q. 813 which is infected dies. This shows an important fact. A distinction between resistance and tolerance must be made. A resistant cane such as Q. 813 does not readily take on the disease, while a susceptible cane such as Shahjahanpur No. 10 may be 100 per cent. infected wherever found. Now Shahjahanpur No. 10 is very tolerant to the disease, and though it loses in weight, it never appears to succumb to Mosaic. On the other hand Q. 813 does die, and is always badly stunted. It is therefore resistant but intolerant. From the disease control point of view it is resistance that matters and not tolerance; in fact, intolerance is a virtue in that the cane by dying removes a centre of infection. This aspect has been treated in my report on the Nambour and Beenleigh districts.

Transmission.

(1) Primary, by plants. This is a most important way of carrying the disease from one field to another. Every diseased plant produces a Mosaic stool.

(2) Secondary, by insects. There is one known vector, *Aphis maidis*, which, however, does not seem to be sufficiently abundant to carry the disease as it is spread in Queensland. The Leaf Hopper (*Perkinsiella saccharicida*) has been suspected, but no proof obtained. It appears, however, in great abundance when the disease is spreading rapidly, and this spread seems periodic. I inspected one farm, and found two stools per chain in a certain field adjacent to some Shahjahanpur No. 10, and on a subsequent inspection found fifteen stools in the same distance. One inspection took place in March, the next in June.

Control.

(1) Seed selection. This, of course, combats the primary infection.

(2) Digging out, in young plant and ratoon, less than 5 per cent. infected; in cases of higher infection this process does not pay.

(3) Resistant varieties become the only resource in severe cases, and selection follows. Uba is immune to the disease, but has a disease of the Mosaic type. This, however, has never been reported from Australia. Q. 813 is highly resistant but intolerant; it is a good cane to plant where Mosaic is bad. Badila is also resistant. P.O.J. 2714 is reported resistant, but as it is almost a new cane in Australia, it has not been tested here as yet. M. 1900 Seedling, D. 1135, H.Q. 285, the E.K. canes, H.Q. 426, Pompey, Q. 970 are susceptible; B. 147, B. 156, and M. 189 (Black Innis) are highly susceptible; and B. 208, N.G. 47, and Shahjahanpur 10 are still more highly susceptible to the disease.

Distribution.

Mosaic is very prevalent in the south of Queensland as far as Giru; north of Townsville it becomes insignificant. None was seen at Tully, Innisfail, or Babinda; one stool at Ingham, one at Mossman, and a few fields (including the canes Shahjahanpur 10, B. 156, and H. 109) badly infested in the Cairns district. These were duly reported in my report on these canes.

Effect of Corn.

Little corn is grown in canefields north of Mackay, and this is noteworthy when we consider the distribution of the disease. At Ayr and Giru, B. 208, a highly susceptible variety, is grown. In the North, too, the disease does not seem to spread rapidly, and both the corn aphis and the leaf hopper are seldom seen. The introduction of corn (which is taking place in North Queensland) is a dangerous step, and should not occur without careful consideration.

Districts Affected.

Ayr and Giru.—B. 208 is the main variety affected, and infected fields should be ploughed out. It is feared that the disease will spread to H.Q. 426 and E.K. 28, which would be serious. On one farm at Home Hill some Badila was seen seriously affected, and this variety is usually considered resistant. The cause was some badly infected sorghum which had been growing wild since the field had had a crop of B. 208. Some years ago sorghum grown near B. 208 was almost invariably infected.

Proserpine.—Mosaic is very restricted here, and occurs in M. 1900 Seedling and M. 189. Digging out of stools will control the disease here.

Mackay.—Mosaic occurs on every area to a slight extent, but around Farleigh, at Mount Jukes, Habana, Finch Hatton, Netherdale, and Gargett it is serious, and also in parts of the Sarina area. The freest seems to be the Homebush area, judging by the farms visited, and the Carmila and Flaggy Rock end is almost clean. The same applies to Hampden. The canes infected include Shahjahanpur 10 wherever grown, M. 189 in some areas, B. 208, H.Q. 426, E.K. 1, Malagache, M. 1900 Seedling, D. 1135, &c. M. 189 shows itself very susceptible as usual. E.K. 28 and Malagache do not show serious infection as a whole, which is probably due to the fact that the plants have never been contaminated, as they are fairly susceptible varieties. Q. 813 as usual shows high resistance. The Cane Growers' Association in Mackay seems alive to the situation, and is warning the farmers, who are taking suitable measures. It is hoped that by continued diligence, the disease will be overcome without very much effort or expense. Great assistance was received from this body, who are very progressive.

Bundaberg.—Every farm visited in this area was infected with Mosaic to some extent. All the river farms are seriously affected with the disease, and their tonnages must suffer very greatly. The disease is more serious here than elsewhere in Queensland, except perhaps at Bauple. Moreover, the farmers do not seem to be alive to the seriousness of the position. H.Q. 285, M. 1900 Seedling, and M. 189 are the principal canes affected, and Shahjahanpur 10 is affected wherever it is grown. The infection of the two early maturing canes, H.Q. 285 and M. 189, is serious, especially as on the river farms it is almost impossible to cultivate and get rid of the wild sorghum and susceptible grasses, owing to the sodden nature of the ground for months during the wet season and autumn. These grasses carry the disease over to the cane, and lower the prospects of successful control. Q. 813 is strongly recommended for these badly-infected river farms. It is the only safe resistant variety at present in the area, if we exclude Uba which is so objectionable for other reasons.

The red soil farms are on the whole better off, but none the less they require to clean up their farms by seed selection, rogueing, and the use, where possible, of resistant varieties.

Childers.—The position here is similar to that on the red soils at Bundaberg, and Shahjahanpur 10, M. 1900 Seedling, D. 1135, H.Q. 285, M. 55, Rappoe, and Striped Singapore are affected; Q. 813, where it is grown, is resistant, though not immune. The elimination of Shahjahanpur 10 and selection and rogueing are the measures recommended. There is a great deal of wild sorghum growing in the creeks, and this should be dealt with. Too much corn is grown for safety, and the same applies to a greater extent to Bundaberg.

Maryborough.—The disease here and at Pialba is due to the persistance of the farmers in growing Shahjahanpur 10, which they do, despite all recommendations. M. 1900 Seedling, D. 1135, H.Q. 285, M. 189, and Petite Senneville are all affected; efficient selection and digging out are the measures recommended. Shahjahanpur 10 should be immediately ploughed out.

Bauple and Yerra.—The situation at Yerra is very similar to that at Pialba, but that at Bauple is much more serious. Farms show as much as 92 per cent. infection in first ratoons. Shahjahanpur 10, M. 1900 Seedling, D. 1135 are seriously affected, while Q. 813 is slightly so, and shows the marked resistance which characterises it. Farmers with highly-infected fields have been selling cane for plants, and have caused serious infection in other farms. It is hoped that with the gazetting of Mosaic as a disease under the Diseases in Plants Act this practice will be stopped.

Nambour.—Corn and cane are grown together on nearly every farm, and the result is a heavy Mosaic infection. Most farmers disregard the disease, and continue to plant cane without discrimination. I have often seen in this area fields of plant cane badly infected with Mosaic. In such cases as this the farmers deserve the diseases that they so deliberately conserve. M. 1900 Seedling, D. 1135, H.Q. 285, Q. 1098, and M. 189 are commonly infected.

Beenleigh.—Corn is the bane of the industry here also, and Green Baruma—known locally as "Green New Guinea" or "Green Goru"—is often 100 per cent. infected. Purple Top (N.G. 64) is almost as bad. M. 189, D. 1135, M. 1900 Seedling are also affected. The planting of Q. 813 to resist Fiji disease is expected to aid in the solution of the Mosaic problem.

Other Grasses Affected.

As cane is a member of the grass family, it is not surprising that it suffers from the same diseases as other grasses. This is especially the case with the Mosaic family, and we find that cane Mosaic is easily transmissible to grasses, and that the disease can be returned to the cane. The grasses in Queensland which are especially bad from this point of view are Wild Sorghum, Summer Grass, Johnstone Grass, Guinea grass, and, also, among the cultivated crops Sorghum, Imphee, and Corn. Wherever these grasses are present in a cane district we find that Mosaic is very prevalent. Corn is rarely free from Mosaic, and is therefore very dangerous. At Bauple I observed the corn aphis (*Aphis maidis*) on corn and on wild sorghum, and the nearby cane was seriously affected. This is only one instance of many that I could quote.

GUMMING.

This disease, of which the practical control is perhaps as hard as that of any disease affecting cane, is widespread in the areas south of Rockhampton. It occurs to a diminishing extent at Aloomba, and has been seen to a slight extent in Mackay, but a quick control can be effected in these areas by eradication of the diseased fields. Bundaberg has suffered severely this year, and the farmers at Nambour, Beenleigh, and (to a less extent) Maryborough are warned to look to the future and attempt to control the trouble before it reaches such proportions.

It is caused by bacteria (*Bacillus vascularum* Cobb. Greig Smith), and the only definite symptom is the oozing of a bright yellow gum from the cut ends of the cane. The vascular bundles or fibres of the canes are usually red (crimson coloured). These are the stem symptoms. The leaf symptoms are apparent, but not characteristic enough to enable the determination of the disease without the oozing of the gum. At times, however, the gum cannot be obtained from plants which are known to be diseased.

The leaf symptoms are in some cases a yellowish streak lined with red dots running obliquely. Patches within the yellow strip often die and wither. When the disease is bad, as in December, 1927, at Bundaberg and Nambour, the young plant and ratoons, and also some of the standover cane, show whitish leaves, the white shading gradually into the green towards the base of the leaf. In the case of plant cane, the cutting of the plant itself will show the gum. This white leaf stage is very similar to a stage in Leaf Scald known as the chronic stage.

Gumming is transmitted in the following ways:—

By plants.—A plant from a gummed field must be presumed to be gummed, and will probably show the disease sooner or later. In some cases weather conditions inhibit the disease, and it may not show up for several generations.

By knife infection.—Cutting diseased cane will infect the knife, and as the bacteria are so minute, it becomes easy to carry them on dirty knives to clean fields. Knives should therefore be disinfected after cutting diseased cane. Farm implements and horses can also carry the disease if they pick up the juice of a gummed stool.

Mr. North, of the Colonial Sugar Refining Company, puts forth the theory that the disease can be transmitted by windblown rain, and by insects which suck cane leaves on which the gum is exuding with wet weather. By sucking injured portions of healthy plants they can, he thinks, carry the disease.

This probably accounts for the fact that the disease usually occurs during a dry spell following wet weather. The wet would be necessary for the transmission of the disease through the field, and the drought be necessary for the bacteria to obtain ascendancy over the plant.

The control of the disease where it is bad is based on resistant varieties, as owing to the elusive nature of the disease rogueing is of little importance in epidemics. With these varieties seed selection should be practised, and the plants sweated under a bag overnight, and the gummed ones discarded before planting. Of the resistant canes, Q. 813 is a known resister in Queensland, and Uba also seems resistant. B. 147 and H. 227 are thought to be resistant, but very susceptible to Mosaic, and the former cane, at any rate, to Leaf Stripe. On the Herbert River the resisters are Q. 813, Korpi, Oramboo, and Nanemo or "Bogela"—these last two being considered identical. These canes have been introduced into Bundaberg together with some South Johnstone seedlings for trial, and S.C. 12 (4), a cane which is reputed resistant. The Coimbatore seedlings are also to be tried out for resistance. Two show some promise. In the southern areas Badila, M. 1900 Seedling, D. 1135, M. 189 (Black Innis), H. 109, and Q. 970 are very susceptible, and in the North H.Q. 426 is worst infected, while Badila shows some measure of resistance. This is a peculiarity of varietal resistance to disease, which is not easily understood. It seems that locality has a big bearing on this factor. M. 55 has been suggested as resistant in Childers, but confirmation of this is required.

Much research work has been carried out on gumming, but only lately have we had any light thrown on the problem, and the control measures are comparatively new. It is suspected that varietal resistance declines after a cane has been in contact with the disease for some time. I do not know any variety which could be classed as immune to gum—even cow cane suffers.

Extent of the Disease.

The trouble is very prevalent in the southern districts, but was seen to a very limited extent in Mackay, on one farm in H. 109 at Aloomba (Cairns district), and on the Herbert River. This latter district was very badly gummed some years ago, but little was seen during my visit. Weather conditions may have a bearing on this, but the rigid control measures of the C.S.R. Field staff have had a big effect. These are of a drastic nature, and H.Q. 426 is penalised heavily, and has almost disappeared.

In the Bundaberg district in 1927, the crushing rate of the mills was reduced by over 25 per cent., and this has meant a serious loss to both farmers and millers. Crops have been light, the amount of dead cane high, and the results of crushing bad, all due to Gumming. At present the position is not good. Q. 813 is recommended as a late maturing cane, but in the south cannot be cut before the middle of September, or it will not ratoon. As an earlier cane H. 227 is recommended, and B. 147 might also be tried. This variety could be obtained from the Mulgrave area (Cairns district). Other resistant canes are being fostered at the Bundaberg Station, and it is hoped to prove their worth in the near future.

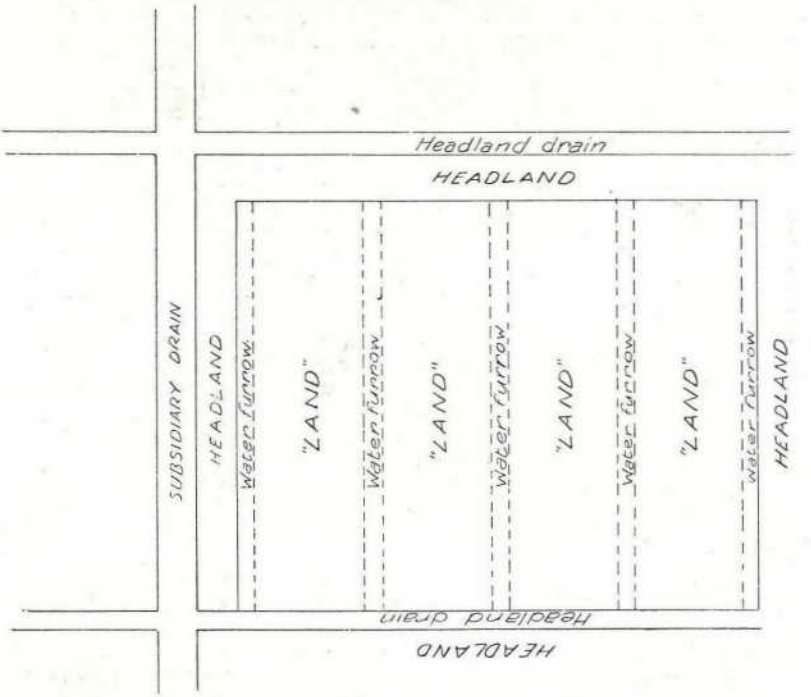
Gum was also showing up in Maryborough in February, in M. 1900 Seedling, D. 1135, Meera, &c., and the farmers there should take note of it, and have Q. 813 on their farms in case of an epidemic.

Nambour.—The position is regarded as serious, for gum is showing up badly, and has been all through the year. It only requires a season such as has been experienced at Bundaberg last year to cause an epidemic in the D. 1135, which is grown far too widely at Nambour. The badly-drained flats along the Maroochy River and at Coolum are worst infected. Q. 813 is proving its worth as a resister there, amongst those farms in which it is grown. It is the only resistant cane at present grown in the area, except Uba.

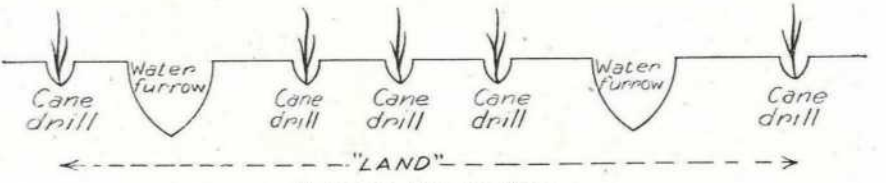
Beenleigh.—Here gum was observed widespread at the beginning of the year, but the substitution of Q. 813 for D. 1135 owing to Fiji disease, will, it is hoped, tend to decrease the infection.

Efficient drainage was found to be of great benefit to farms affected with Gumming on the Richmond River, and this is a feature seldom met with in Queensland. I suggest that an adequate system of main drains should be installed in gummed areas, wide enough to carry off the water that is drowning the farms, and that the farmers should endeavour to put in good subsidiary drains from each field. The method of draining the field is not expensive. The field on its last ploughing could be divided into lands by deep drills made at intervals of, say, a chain (or nearer if the soil is clayey or sour) by a swing plough with raised mouldboards. These lands between the water furrows would be planted in the ordinary way. Better still would be the ploughing into lands during the last ploughing, by a swing plough or disc starting from the centre of the land and working out to what is to be the water furrow, ploughing in a spiral or rather a series of spirals to give a series of lands. A series of field drains could be ploughed by the same means along the headlands at right angles to the lands, to take the water to the subsidiary drains. The size of the drains and their frequency would depend on the water to be removed, the fall of the land, &c., and would have to be determined by the farmer himself.

Tile drains are used on larger estates, but would be too expensive for the average farmer, and the land system forms a good substitute. The lands must be remodelled every time the field is ploughed and planted.



SECTION OF FIELD PLANTED IN "LANDS."



PLAN OF A DRAINED FIELD.

This would be modified, if necessary, to suit local conditions.

LEAF SCALD.

This is, in Queensland, essentially a disease of the tropical sugar areas, though it has been seen in Mahona in the Nambour district. It occurs again to a serious extent on the Northern Rivers of New South Wales.

It is, like Gumming, a bacterial disease, but unlike the former trouble, it does not depend to nearly the same extent on the weather, though it has a latent period, which makes detailed surveys on infected areas very difficult.

Symptoms.

The disease is, at times, very difficult to identify. Most characteristic are the leaf symptoms. The leaf in typical cases shows a white pencil line running obliquely from the midrib to the leaf edge. The line is of constant thickness, and at a later stage turns pinkish. It also spreads, and forms a white irregular streak, finally giving a chlorotic appearance similar to one stage of gumming, where the leaf is white for a good part of its length. The leaves, however, usually curl inwards at the top, and it is this peculiar curling which serves to reveal the disease to the practised eye. Sometimes the leaves appear scorched instead of white.

These white leaves indicate the chronic stage of the disease, and are, if the cane is large enough, accompanied by sideshooting from every joint. The side shoots bear the leaf symptoms.

In the acute stage, the cane dies without any symptoms other than the scorching and curling of the leaves. The side shoots may sprout and die immediately, and the only means of obtaining a definite identification is to search for suckers bearing the white pencil line. This phase is characteristic of H.Q. 426; Badila and Goru have both phases. Usually the fibres of the cane are tinged with crimson, especially at the nodes or joints and in the buds, but this feature may be absent in the acute phase.

The plants, on their emergence, may often be detected through the white leaves.

The control of the disease rests on the elimination of the most susceptible canes, H.Q. 426, Gorus, and Pompey (7 R. 428), and the careful selection and subsequent digging out of diseased stools in the plant and ratoon crops, in the young stages. D. 1135 and Q. 813 seem resistant in the North, and Badila and Nanemo seem rather susceptible. Badila seems susceptible but tolerant. Babinda, Innisfail, Tully, and Cairns are hot-beds of the disease, and few farms in this area could be declared clean. Badila is affected all over the country, and the only stocks of clean seed seem to be on the Atherton Tableland, where the Kairi State Farm, and the seed plot being planted by the Cairns Canegrowers' Association are among the places recommended for seed in the future.

The transmission of the disease occurs in several ways, as in Gumming:—

By Plants.—The disease is easier to identify, so that plant selection is also easier. The existence of a latent period is a difficulty.

By Cane Knives.—This is important in carrying the disease to new fields, and the knives need frequent disinfection.

The insect transmission has never been worked out, but the distribution seems certain, though not so important in North Queensland as is the case with gumming. The Linear Bug is here suggested as a possible carrier of the disease, and should be watched.

All types of soil seem to be affected alike, and the prevalence of the disease seems to depend on the resistance of the varieties grown, and the care of the farmer.

Districts Affected.

Proserpine.—Two farms were seen to show the disease at Conway, in Badila and H.Q. 426. The trouble was slight. Another farm at Proserpine itself was reported affected, but the block (Goru) had been ploughed out.

Mossman.—The disease here is serious in parts, especially the Saltwater and Whyambeel ends, and around the Mossman and Little Mossman Rivers. The Mowbray area was, as far as could be seen, free from the disease, though Spindle Top is present on some farms. Badila, H.Q. 426, and, above all, Goru, are affected, and Pompey is affected where grown. Goru should not be planted in this area.

Cairns and Mulgrave.—This district, especially the Hambledon-Freshwater area, is badly affected. Badila is largely grown, and practically every field of this variety is diseased to some extent. Only on a few farms at Hambledon itself is there Badila that could be regarded as possibly safe to plant.

The Sawmill Pocket, Wright's Creek, Green Hills, and Highleigh areas are freest from the disease.

Babinda.—Every farm visited in this area, except one, had Leaf Scald in every field examined, and some fields were seriously affected, especially in the East Russell and Palma areas, and also in the Cucania-Harvey's Creek section. The losses here were considerable, and difficult to estimate. Exceedingly bad infection was observed in the Deeral-Fishery Creek section, in one case about 40 per cent.; and the loss through death of stools, &c., must have been nearly 25 per cent. of the crop. The difficulty is to get varieties to replace H.Q. 426, and Q. 813 is suggested, for it seems to do well if planted late.

Innisfail.—The position at Goondi is better than that at Mourilyan or at South Johnstone, though it is by no means good. Pompey does not seem a favourable cane to replace H.Q. 426 where Leaf Scald is present, as I can see little difference in their susceptibility. Daradgee, Garradunga, and Eubenangee are affected, and all the farms on the Johnstone River, especially the Innisfail Estate.

At Mourilyan, the whole area is affected, though the situation at Liverpool Creek seems better than it was a year ago, according to Mr. Kelly's reports and those of the farmers and cane inspectors. Seed selection has been practised with good results, and the cleaning of this area should be easy from now on.

South Johnstone is the worst affected area, and the disease is bad in all the sections examined. The Silkwood and Jeppoon branches are especially heavily infected. Badila, Pompey, Goru, and H.Q. 426 are all affected. Several badly diseased plant blocks were seen. This sort of thing is due to nothing but sheer negligence on the part of the farmers, most of whom do not seem to realise the seriousness of the trouble.

The infection extends through Jaffa, El Arish, and Maadi, to

The Tully Area.—Here the infection is widespread, though in most cases not so severe as that in the other districts. On several farms, however, the heaviest infection was seen. The main centre is at Midgenoo, and smaller centres are at Euramo, Lower Tully, the Leasehold areas, and at Feluga. It is reported that Midgenoo was the original source of the infected plant. The disease here is not so serious as in the areas farther north, and farmers have been urged to do all in their power to get rid of the disease.

Clean plants can be obtained, and with rigid selection and subsequent cleaning of fields the problem does not appear difficult.

FIJI DISEASE.

This serious cane disease has not long been discovered in Queensland, and areas are still being found infected. The symptoms are characteristic, and consist of leaf galls which run along the back of the leaf, and are invariably on a vein, and running parallel with the midrib. They do not show on the front surface of the leaf, and thus differ from the crinkles caused by damage to the tops which are so often seen in canefields. They may vary from one-eighth of an inch to about 1½ inches in length, and from one-thirty-secondth to one-sixteenth of an inch in diameter, and are light green or brown. They may be on the midrib or on the blade of the leaf, and are the one sure characteristic of the disease.

The stem is very stunted, though in the case of secondary infection the cane previously formed will mark the stage of infection. Infection always inhibits the growth very soon after the galls first appear. In secondary infection, the subsequent ratoons will be stunted and will die out. The leaves are dark-green in appearance and curl inwards much after the manner of Leaf Scald, though they are much deformed and stunted.

Methods of transmission have not been thoroughly worked out, but it is an invariable rule that a diseased cutting produces a diseased plant. Neither soil nor knives have been found to have any effect on the distribution.

Insects are thought to play a part, but our knowledge on this point is limited. The transmission seems possible over fairly large distances.

The control is based on plant selection, and in badly affected areas on resistant varieties. Digging out diseased stools is essential in lightly infected fields.

Distribution of the Disease.

Bundaberg.—The disease was only reported from here in December, and an investigation points to the fact that it is as yet light, and can be controlled by rogueing or digging out. Those concerned were warned of the seriousness of the disease, and have organised a campaign which should prove efficacious without more drastic measures. The infected cane was brought from the Northern Rivers—some before the war, and some in 1922. Field evidence points to the fact that the disease

was introduced in the last batch of canes, and has spread to two other varieties, within recent times—soon after the importation.

Maryborough.—In this area the disease is severe in some sections, as was outlined in a report published earlier in the year, which it is unnecessary to recapitulate. The district was placed under strict quarantine, and all precautions taken to keep the disease within present limits. Control measures were outlined to the farmers, by circular, and the digging out of infected fields was suggested in severe cases; this was done on the worst affected farms, and Q. 813 and H.Q. 285 are being tried as resistant varieties. It is hoped in the near future to plant out some disease resistance trials.

The area affected is restricted to Maryborough, and, as far as is known, does not extend to Pialba or Yerra. Even in the infected area itself there are sections which are apparently clean.

Beenleigh.—Infection here is widespread, and practically every farm shows the disease. D. 1135 and M. 1900 Seedling are the principal varieties affected, but Q. 813 and H.Q. 285 are practically clean. For this reason they have been recommended to the farmers. The area was thoroughly inspected by Mr. W. Cottrell-Dormer and myself in the early part of the year, and Mr. Dormer published a full account of his investigation.

In the case of farmers suspecting the disease, it is very necessary that they should inform the Bureau as soon as possible, so that measures can be taken to prevent the disease from infecting other fields, for once it is established the disease spreads rapidly.

LEAF STRIPE.

A disease of fungal origin, this trouble is of a serious nature, though at present its distribution is restricted to a few farms, except in the case of the Mossman and Burdekin and Houghton Rivers, where the infection is general.

The symptoms are very similar to those of Mosaic to the casual observer, but they differ in the fact that the leaf stripes are more definite in outline, and correspond well to the description of the name. The stripes, too, are often yellowish, and they differ from Mosaic in the fact that they turn brown and bear on the back of the leaf a whitish down. This gives rise to the alternative name of Downy Mildew, bestowed on this disease. The white down is the fruiting portion of the casual fungus, and the fruits or spores as they are called are blown to other canes by the wind. At certain times of the year the stripes are not well defined, and the disease is easily mistaken for Mosaic unless the white down can be seen.

Sticks are affected by being elongated, and stand well above the surrounding healthy cane, this phase being sometimes known as "Jump Up." In these cases the leaves are sparse and narrow, and they often become shredded in severe cases.

Transmission occurs by means of plants from infected stools and by the wind-blown spores. Since these latter are very numerous on the backs of the leaves, and are very minute, they travel in a short time all over an infected block, and the infection spreads rapidly. Means of transmission by insects have been suggested by field observers, but their theories have not yet been tried out in Queensland. It is very easy, too, to carry the spores on tools and wearing apparel.

Control is effected by means of plant selection, and subsequent digging out, removing, and burning the diseased stools. Their destruction is essential, as the spores are outside the leaf and are not destroyed by the mere digging out of the stools.

The susceptible varieties include B. 208, B. 147, Q. 855, M. 189, D. 1135, 7 R. 428 (Pompey), Garvan's Black, Yellow Caledonia, H.Q. 274, and to a lesser extent Q. 813. Badila, Goru, and H.Q. 426 appear resistant on field evidence.

Distribution.

Bundaberg.—The disease has been observed in the Bingera area in Garvan's Black, M. 189, Yellow Caledonia, and H.Q. 274. It was seen also in plant cane, but is not at present causing serious damage, though it should not be disregarded. It is also on one farm on the Woongarra.

Mackay.—A few farms affected in this area require attention, and on one the infection is serious. Pompey, Cheribon, and D. 1135 are affected. Seriously affected fields should be ploughed out after cutting, and lighter infections rogued.

Mossman.—The Saltwater area and the Mossman River area are the main sources of the trouble, and B. 147, Q. 855, and D. 1135 are the principal canes affected. The introduction of Pompey into this area is dangerous owing to its

susceptibility to the disease. The fields badly infected should be ploughed out, and B. 147 should be temporarily discarded in the affected area. Digging out should be practised in the farms where the infection is light.

Cairns.—Slight infection occurs at Sawmill Pocket on a few farms, and the varieties infected are D. 1135 and Pompey (7 R. 428). The farmers are planting up with clean H.Q. 426. Fortunately, the B. 147, which is a favourite variety in this area, does not seem to be affected so far.

Giru and the Burdekin River.—The infection here is of a serious order, and a majority of the farms visited were heavily infected. A great deal of B. 208 is grown, and this variety is one of the most susceptible to this disease. Few farms growing this cane are apparently clean, and in many cases the losses in this variety are severe. As this cane has elsewhere been wiped out through disease, there seems little hope of cleaning it up, so it appears essential that the cane should be replaced by less susceptible canes. Badila, H.Q. 426, and Goru do not show the infection to any extent; and their planting is advised. The trouble is that B. 208 is a cane with the highest c.c.s., and farmers are loth to realise that the fact that it is diseased and will not ratoon makes it really a more expensive variety to grow than the other canes such as Badila and Clark's Seedling. I observed this factor in the Houghton area, and my idea was confirmed by a cane inspector.

One factor seems to be of importance in the Mossman district in restricting the distribution of the disease, and that is the fact that well over 99 per cent. of the cane sent to the mill is burnt. The fact that the disease does not spread as rapidly as we should expect from its mode of distribution is probably due to this fact. Not that I suggest the burning of trash as a control measure, for I believe that the other measures are sufficient in themselves.

RED ROT.

This disease has usually a minor importance, but which can, under certain conditions, be of the greatest importance. It is caused by a fungus (*Colletotrichum falcatum*) which is normally a very weak parasite, and lives on trash and decaying vegetable matter in the soil. At times, however, when soil conditions are poor and the climate is favourable, the disease assumes a virulent form, and can cause heavy losses to the crop in the district affected. It appears to be a difficult disease to eradicate, and our effective knowledge of it is very limited. Only extensive field experiment will give us the data we require to put forward adequate control measures. The first noticeable symptom is the dying-off of the top, very much as in the case of grub attack, though all the sticks in the stool do not necessarily die. Examination of the stem in severe cases will show that it is withered, especially at the base.

Internal Symptoms.

By cutting the stem lengthwise it is seen that the whole mass is reddish and fermented, but there are definite white pithy areas in the stem, surrounded by a darker red area. There are also greyish patches at the nodes. The white areas are the diagnostic character of the disease.

The fungus (*Colletotrichum falcatum*) is a weak parasite, and usually lives on the organic matter in the soil. It passes into the stem through injured parts, especially skin cracks. Inversion of the sugars takes place, the cane becomes light, the c.c.s. falls, and the juice is refractory. Many sticks die and so considerable losses in crop result, in severe attacks. The disease is usually in patches, and these are shown by a very fluctuating c.c.s.

Transmission.

The fungus is carried on trash, old cane, stools, &c., from crop to crop, and by plants from field to field.

Control.

No evidence concerning resistant varieties is available. Seed selection is necessary, but the main factor is the fallowing, fertilising, and cultivating of the infected fields, without which selection is useless.

Distribution.

The disease occurs slightly in many places, where it attracts little notice. In Mackay, especially at Sarina, the trouble has assumed epidemic proportions. Practically all the Sarina area is more or less affected with the disease, which attacks M. 189 (Black Innis), M. 1900 Seedling, H.Q. 426 (Clark's Seedling), E.K. 28, &c.

At Proserpine the disease occurs at Waterson and Glen Isla, and seems to be inclined to assume epidemic proportions. The soils should be analysed, and green manures planted wherever the disease is occurring.

A special report was published in July concerning Red Rot at Sarina, and suggested methods of control. They were summarised as follow:—

A. Never plant from any field which has suffered from Red Rot; and never allow anyone else to plant from your infected field.

B. (1) All trash and rubbish should be burnt, and the stools broken up.

(2) The addition of lime to the soil, preferably burnt lime, in order that the soil reaction may be upset with the hope that the fungus growth will be inhibited.

(3) The draining of low-lying pockets.

(4) The planting of green manure crops in order to add nitrogen and other elements to the soil, to smother weeds, and to assist the degradation of the old stools.

(5) The anlysis of the soil in order to find out what is lacking, and the restoration of the deficient elements to the soil in the shape of a correct fertiliser.

(6) The interval before replanting a diseased field should be as long as possible. If you have enough ground it will be well to let an infected field go out for some years. Plant your clean field with clean seed or you might as well leave it alone.

TOP ROT.

This disease is of a very insidious nature, thought by Mr. Tryon to be caused by a root fungus, and by Mr. Dormer to be caused by bacteria. I myself have isolated bacteria (not in pure culture) from the leaf streaks, but have not had time to confirm Mr. Dormer's innoculation experiments.

Symptoms.

The lower leaves of the young cane show a series of watery stripes which become chocolate or red in colour, and which run along the leaf parallel with the veinlets, usually from the leaf sheath up for about 6 to 8 inches or less. They occur on each side of the midrib, and are about one-eighth of an inch in breadth, though several stripes may fuse along their sides.

Later the cane may recover, and grow on as though nothing had happened, or the top may forthwith rot, and smell abominably.

On the Burdekin River Badila with four feet of cane is attacked, but the rot does not extend far down the stick below the joint attacked by the bacteria.

The disease occurs between the months of October and March, as a rule. In 1927 it occurred in the Red Streak stage in the Freshwater area in the middle of October—not before then. Many Burdekin farmers believe that it occurs after wet following a drought, and evidence there seemed to point in that direction, but it showed up in Freshwater in the young plant and ratoons during a very dry period, so that a modification of the idea is needed. The humidity of the atmosphere is greater in the Freshwater area than on the Burdekin, and humidity may be one of the controlling factors.

Badila is the principal cane affected, though the disease has been seen in M. 1900 Seedling, E.K. 28, Q. 813, B. 208, S.J.Q. 4, and slightly in Goru and H.Q. 426.

Distribution.

Beenleigh.—The disease was seen here in January, in D.1135, and the cane was recovering.

Nambour.—Suspicious streaks were observed in one or two stools of Q. 813. The identity of the disease in this case is doubtful.

Bundaberg.—Top Rot was seen in one stool of S.J.Q. 4 from Mackay. As Top Rot has not been noticed at Mackay for many years, this fact is interesting, but confirmation of data is required.

Burdekin River.—Here the infection of Badila is very bad, especially on both banks of the river. Much death and even 50 per cent. crop losses have been recorded. M. 1900 Seedling, E.K. 28, B. 208, and Q.813 have been affected, and to a less extent H.Q. 426 and the Gorus.

Herbert River.—Results of Top Rot were hard to distinguish from those of the flood damage this year, and no adequate idea of the infection was gained. The same applies to Giru, though a few cases of undoubted Top Rot were established.

Cairns.—Freshwater and Smithfield are the two areas worst affected, and the river farms are showing most. Badila is the one variety which the disease seems to attack, and the red streaks were plentiful on nearly every farm, in plants and ratoons. Even the red soil hillside farms were affected at Redlynch and the Gap. Wright's Creek, Hambledon, Highleigh, and Little Mulgrave, and all the areas down to Deeral showed the disease to some extent. It was more prevalent, however, on the alluvial flats than on the hillsides.

It must be confessed that the Top Rot problem is baffling at present, and there seems to be no relation between the infected plants and the spread of the disease, so that seed selection appears to be useless. Outbreaks in other areas seem to show that the bacteria are present in most sugar areas, and require merely certain conditions to develop.

SPINDLE TOP, NEEDLE TOP, OR PINK SCLEROTIAL LEAF SHEATH DISEASE.

This complaint has caused heavy damage round Innisfail, Tully, Babinda, and Cairns districts. It is caused by a weak parasitic fungus (*Sclerotium* sp.), which binds the leaf sheaths and strangles the top. Canes often recover from the trouble, but at times it causes loss. Seasonal conditions seem to play a big part in the destructiveness of the disease, and the fungus is probably incapable of causing damage without favourable conditions for development. Mr. A. P. Gibson, Northern Field Assistant, first drew my attention to the trouble, and I found it to be causing many dead sticks in the stools, and also in a few cases dead patches, where all the stools had died out.

Symptoms.

The first noticeable symptom is the pinkish tinge of the leaves near the leaf sheaths, to about 3 inches from the base, and the fact that the trash is clinging, round the spindle. The leaves appear choked, and the leaf sheaths become bright red and rather slimy. Dark spots appear on the red, which are the sclerotia of the fungus, and aid in its transmission. Finally, in severe cases the top dies and the cane affected decays. In Badila—the main variety affected—the sticks, instead of appearing a glossy black, are rather pale red and unhealthy looking. Usually not every stick in a stool is affected.

Farmers often put the trouble down to overcrowding, and there is probably some truth in this, for in most cases Badila is planted too close and there is not sufficient room for the proper development of the stools. There are other factors, however, which require investigation, and the fungus has not yet been identified with certainty. It bears some resemblance to *S. rolfsii*, but is probably not this species.

Transmission.

The disease is probably carried in the trash, and can live on this decaying organic matter for some time. It can then reappear in the ensuing crop.

Control.

This has not been properly worked out, but it seems rather obvious that the burning of trash in heavy infestations would tend to minimise the chances of infection.

The better spacing of plants needs to be considered, and also the bettering of the soil conditions. I noticed that on one farm which made free use of green manures, and spaced wide apart, that infection seemed very light.

Distribution.

Bundaberg.—The disease was seen in an isolated case in N.G. 16 plant in December, 1927.

Giru.—Spindle Top was causing some damage in B. 208, and was noted also in cane that had been flooded. Top Rot and Spindle Top were flourishing side by side in Badila.

Tully.—In the Lower Tully end the disease was causing some damage, in Badila. Top Rot was also present. Only isolated sticks in stools were dead, but the disease seemed to need attention.

Innisfail.—Throughout this area the disease was rampant, especially on Innisfail Estates, Queensland Estate, and Darradgee. The worst infestation was on two farms in Upper Darradgee on red soil. Here all stages of the disease were encountered, and from the percentage of dead cane, the losses must have been considerable.

Babinda.—Practically every farm here was infected, but the damage was not as great as at Innisfail. On the south bank of the Russell River the worst infection was observed.

Cairns.—The disease was bad all along the Mulgrave River, especially the Upper Mulgrave section. Much of the cane at Freshwater and the Hambledon area was more or less infected. The disease was confined to Badila.

Mossman.—Here the trouble was not seen except on the Mowbray River, where it was quite prevalent.

The Innisfail and Babinda areas were by far the worst affected, and it would be difficult to find a clean farm. Several of my reports dealt with this disease, and these may be referred to.

BANDED SCLEROTIAL DISEASE.

This trouble, which is caused by a fungus of similar type to that causing Spindle Top, was not evident during my visit to the North (from August to the middle of November), and only one or two isolated cases were met with. As no idea was obtained of the prevalence of the disease, nor of the damage that it causes, I shall say nothing concerning it.

ILIAU.

This disease, which also occurs in Hawaii and Louisiana, is caused by a fungus with two stages which are known as *Gnomonia* and *Melanconium iliau*. Only the latter stage has been observed in Queensland. It attacks the young plant or ratoon cane and the fungus binds the leaf sheaths closely, strangling the growing point of the young cane. This endeavours to free itself, and often bends double, and may emerge from the side of the cane through the leaf sheaths. In this case it continues to grow, but may again be strangled. In this way considerable losses are caused in plant cane. A black fruiting body bursts through the leaf sheath, and this is about one-eighth of an inch in circumference.

Evidence of the twisting of the cane shoots can be seen in cane long after it has grown away from the disease.

The fruits of the fungus live over from crop to crop in the soil, and are killed by sunlight, so that efficient tillage is the most efficient method of controlling the disease.

Distribution.

At present the disease is of minor importance, and only occurs on a limited number of farms in the Childers and Bundaberg districts.

At Childers I observed the disease on several farms in plant and ratoon M. 1900 Seedling, and on one farm at Booyal in D. 1135.

In Bundaberg, the disease seems confined to the Bingera area, and is slight in M. 189, H.Q. 274, and M. 1900 Seedling.

PEG LEG OR FOOT ROT.

This trouble is characterised by the base of the cane stalks becoming thin and tapering, so that the stick bends over, and can easily be swayed from side to side, the main cause of damage is that the cane lodges, and the c.c.s. usually drops in fallen cane.

It is worst at Childers in M. 1900 Seedling and D. 1135, but has been seen in other places, notably Bauple, Maryborough, Mackay, and Bundaberg. It is caused by a fungus, of a weak parasitic type, and soil poverty is one of the main factors.

MARASMIUS ROOT DISEASE.

This is also due to a weak parasite, the development of which is due usually to depletion of the plant foods in the soil. It binds the bases of the leaf sheaths together, and the trash sticks to the cane. In this disease the leaves show dark brown spots and subsequently die in severe cases. The fructifications of the fungus

were identified by me as *Marasmius* sp., but I had not the time to work out the species. It causes some damage in plant and ratoon cane of all ages in the Bundaberg district, and on the old lands in the South Isis (Childers). Its occurrence on old land seems to suggest that an addition of potash or phosphate to the red soils would tend to check the disease. Badila, N.G. 16, D. 1135, and M. 1900 Seedling have been seen to be affected.

BROWN ROT.

This was only seen in the new scrub lands in North Queensland, and appears to be confined to a few stools in stump country. It occurs at Tully, Innisfail, Babinda, and Cairns, but does not cause appreciable damage. It appears to be fungal in origin, and the cane merely dies, and is found to be pithy and brown at the base of the stick. A fungus is evident, and it is thought that it is a secondary parasite which comes from an old stump or some such thing.

"X" DISEASE.

This is a trouble which was very evident at Childers in the early part of 1927. Affected sticks grow long and lank, and were chlorotic with yellow leaves. D. 1135 and M. 1900 Seedling were seen to be affected, but infection was reported in M. 55 and Q. 813. The disease seemed to be confined to patches where it occurred year after year, and was not seen except on old farms in the Childers and South Isis areas. This and the nature of the trouble lead to the idea that soil deficiency was the cause, and several manurial trials were instituted. Weather conditions were unfavourable, and little information was gained from them. By sending diseased plants to Rockhampton, however, healthy plants were obtained, and this experiment seems to corroborate the theory. It will need confirmation, however, before it can be vouched for. The soil is known to be lacking in potash and phosphate, and the application of these may help to get rid of the trouble.

CANE-KILLING WEED, WITCH WEED, STRIGA.

This is a weed with a purple flower, and a fleshy leaf which parasitises the cane roots and kills the cane in patches. It is about 18 inches high, and appears rather insignificant. Occurrences were noticed near the Elliott River, Bundaberg; Kelsey Creek, Proserpine; and to a greater extent at Carmila, and at other places in the Mackay district. It is not very widespread in Queensland.

SECTIONAL CHLOROSIS, OR BUTTERFLY.

This is a physiological disease caused by water held in the spindle of the cane becoming chilled overnight and rapidly heated in the morning sun. The result is a band devoid of chlorophyll on each leaf, and these bands are originally opposite, but become alternate by the differential rate of the growth of the leaves. The result is a series of white bands across the leaves which are often mistaken for other diseases. They sometimes ribbon and die, while the rest of the leaf keeps green. As one journeys north they become infrequent, and frosty weather in the sub-tropical districts is the time when the affection is most apparent. D. 1135 and M. 1900 Seedling are the main canes affected, but all varieties can show the affection which has been seen by the writer in Q. 813, Badila, H.Q. 426, Goru, B. 208, M. 189, H. 109, B. 147, &c.

LEAF CRINKLE.

Known among some Bundaberg farmers as "The Disease."

This is a puckering of the leaves, which occurs mainly in young cane, but which also occurs in older canes of the soft-leaved varieties, such as M. 1900 Seedling. Some authorities put it down to the damaging of the leaves by the wind, and this is possibly a factor, though it is not sufficient to explain the trouble adequately. I have made observations on this trouble in the Bundaberg district during the month of December, and I find that it is practically confined to cane which is still being cultivated. Also at this stage, every plant affected has had the older leaves bent over with some implement, and it appears reasonable to suppose that the younger leaves growing against the folded older leaf become compressed, and are thrown into folds as they grow. In all cases examined, where the leaves had been folded, the crinkles were developing in the young tissues just above the growing point. The theory that I should like to advance then is that the trouble is mainly due in young cane to mechanical injury. Soft-leaved canes like M. 1900 Seedling are the principal ones affected, and Q. 813, with a harder leaf, is rarely troubled.

CANE PEST COMBAT AND CONTROL.

The Director of the Bureau of Sugar Experiment Stations, Mr. H. T. Easterby, has received from Mr. E. Jarvis, Entomologist at Meringa, the following report in connection with the investigation of certain orthopterous insects attacking sugar-cane (December to January, 1927-1928):—

Some Grasshoppers Injurious to Sugar-cane.

Although many species of Acridiidæ are known to frequent canefields in the Cairns district, where they doubtless effect damage of a more or less serious nature to the leaves, comparatively few of these have ever been noticed by the average cane farmer. The so-called "Yellow-winged Locust" and the "Australian Locust" (*Locusta danica* Lin. and *L. australis* Brunner), vast numbers of which occasionally swarm over restricted areas of cane land, are naturally better known than our species of *Cyrttacanthacris*, which are not pre-eminently gregarious; or those belonging to such genera as *Atractomorpha* or *Oxya*, some of which instead of taking to wing when disturbed, remain motionless on leaves or stems, seeking rather to escape notice by trusting in their protective coloration.

Species of the former genus (*Atractomorpha*) have been recorded as destructive to leaves of sugar beet, tobacco, mulberry, sugar-cane, and various succulent plants in the Malay Peninsula, Japan, Hawaii, Java, Russia, India, Africa, and Australia.

Atractomorpha crenaticeps, Blanch.

Which was briefly described as a cane pest in Queensland during the year 1916 (Bull. No. 3, Div. of Ent. Bureau Sugar Expt. Stations) is about 1½ inches long with a wing expanse exceeding 2 inches; the male being much the smaller sex. Its tegmina are brown or grass-green, usually harmonising in shade of colour with that of the plant on which it happens to be feeding or resting. The wings are clear, with the nervures bright pink except on apical portion of costal margin, where—together with a narrow strip of membrane against edge of costa—they are pale greenish-yellow.

This grasshopper is destructive to sugar-cane in Java, Australia, and Hawaii.

In Southern India the following poison-bait has been used with great success against *Atractomorpha crenulata* Fab., which sometimes attacks cocoanut seedlings and is a common pest of tobacco:—

Paris green, 1 lb.: palm sugar, 6-10 lb.; bran, 25 lb.

The sugar is first dissolved in water, to which is added the Paris green and bran, previously mixed very thoroughly together, the whole being then mixed until half solid. To this is added one grape fruit to every 3 lb. of bait.

Atractomorpha aberrans Karsch destroys the leaves of tobacco in W. Africa; while *A. bedeli* Bolio attacks those of sugar beet and other economic plants.

Oxya velox, Fab.

This acridiid was recorded as being a minor pest of cane in Queensland in Bulletin No. 3 of this office (Bur. of Sugar Expt. Stations, 1916, pp. 20, 21).

The adult female insect measures about 1½ inches in length by 2 inches across the extended tegmina, which are pale brownish-green, broader on basal than central portions, and rather suddenly expanded on the costa near the base. Wings clear; head, sides of thorax, and femora of legs greenish-yellow; tibiæ and tarsi bluish. Antennæ pale pinkish-brown, darkening towards tips.

This species, together with two others of the same genus, viz., *Oxya bidentata* and *O. multidentata*, have been recorded as injurious to sugar-cane, rice, &c., in parts of India.

The life-cycle stages of *Oxya velox* have been studied at Madras, where this insect feeds commonly on grasses, cotton, pulses, &c. The young hoppers and nymphas forms often attack the leaves of paddy (rice in the husk), the adults being able to effect considerable damage by biting the base of maturing earheads, thus causing them to dry up.

According to Prof. Ramachandra, this grasshopper lays its eggs in masses of ten to twenty-nine among stems and grass clumps in marshy situations, where they are protected from damage by possible submersion by being covered with a reddish-brown gummy substance.

The male of this species moults six times, while about 50 per cent. of females undergo seven moults. The wing pads are noticeable even in the first instar, and in early moults these rudimentary wings overlap the sides of the thorax, becoming turned back after the fourth or fifth moult. This insect breeds in Calcutta throughout the year.

It is interesting to note that in the Malayan region the larvæ of *O. velox* are said to be semi-aquatic, and have been recorded as destructive to rice, sugar-cane, and coffee.

This acridiid has been known to attack cane in Java for the last twenty-five years.

Natural Enemies.

The chief predatory enemies of *O. velox* in India are believed to be birds and frogs. In the grasshopper form they are parasitised by a carcophagid fly, while their egg masses are destroyed by two chalcid parasites—viz., *Fumidiscapus oophagus* Gir., and *Anastatus coimbalorensis* Gir.—as well as by a proctotrypid parasite, *Scelio oxyæ* Gir.

In the Cairns district, *O. velox* appears to be effectively kept in check by such predaceous and parasitic insect and other enemies as those alluded to above. Although more or less sparingly distributed through much of our cangrowing area, this species probably occurs freely on low-lying country that during the wet season is liable to become flooded or submerged.

Emergence of Greyback Cockchafers

Owing to continued drought conditions, *Lepidoderma albohirtum* made a somewhat belated emergence this season, few specimens being observed on the wing until 20th December.

During the five days immediately preceding flight of the beetles (15th to 19th inst.) only 2.14 inches of rain were recorded at Meringa Laboratory, an additional 1.45 inches being obtained from 21st to 31st December; while the precipitation for the entire month was 4.31 inches (3.29 inches below the average). Owing to the adverse weather conditions, coupled with a fall of only 10.51 inches for the period July to December (7.95 inches less than the average), greyback cane beetles are not likely to cause extensive damage to cane during the present season.

At Highleigh, Greenhills, Gordonvale, and elsewhere no heavy flights have been noticed up to the present (10th January), although a fair number of beetles can be found as usual on favourite feeding trees.

Beetles chancing to have pupated at a depth not reached by the showers already experienced will, for the most part, perish in the soil, or be too weakened to emerge later on.

Experiments conducted with two light-traps on 21st December—which resulted in the capture of 177 greyback cockchafers in about half an hour—demonstrated that strongly marked phototropic reaction of a positive nature can be induced in this cane beetle (*L. albohirtum*) by means of an acetylene or powerful oil lamp. Splendid results were obtained by fixing a white sheet, measuring about 8 by 4 feet, behind the light, and about a foot from the lamp, thus illuminating a large glowing area, standing out in sharp contrast with the surrounding blackness of the night.

CANE PESTS AND DISEASES.

Mr. R. W. Mungomery, Assistant Entomologist at the Sugar Experiment Station, Bundaberg, has submitted the following report of investigations for the month of January-February, 1928, to the Director of Sugar Experiment Stations, Mr. H. T. Easterby:—

Influence of the Weather on the Emergence of Greyback Beetles and its Relationship to Subsequent Grub Infestation.

It is a well-known fact that the emergence of "greyback" cane beetles (*L. albohirtum*) from the soil is, to a large extent, governed by the advent of good soaking rains during the months of November and December. Moreover, the time during which, and the manner in which, this rainfall is received are factors which exercise a profound influence on the grub infestation following on the emergence, and in this way weather conditions become of no small value in helping the farmer, or in directing him in his own efforts to keep this pest in subjection.

In the first place, when rain following a droughty spring has long been delayed into the month of January, beetles have often been found dead in their underground pupal cells, being imprisoned by the hard walls compacted by the grub prior to pupation. The remaining living ones represent those with greater powers of resistance, or those that assumed the adult stage at a later date than the others and

did not suffer such great privations. Thus when rain ultimately comes only a small flight eventuates with a correspondingly smaller grub infestation in the succeeding months.

If, however, rain falls in the early part of this vital period (November-December), those beetles which have changed early into the adult stage emerge and commence feeding. Those beetles which have only recently changed from the pupal condition will possess a very soft integument, and, naturally, will remain for some little time longer within their pupal cells. Later, as their body parts harden, and rain follows on, they, too, will emerge. Thus we get a complete emergence with little mortality amongst the beetles, constituting what may be termed a straggling emergence, for at any given time there are always a fair number of beetles to be found on the feeding trees, whilst at the same time they do not appear to be present in exceptionally large numbers. The result is that after a few weeks collecting, and meeting with little encouragement in visiting trees which yield only a few beetles, collectors become apathetic, and disinclined to visit those trees, but seek out those from which they obtain the greatest remuneration for their labours. It is in this that one of the weaknesses of the system lies. Those beetles which have been disregarded or overlooked, then escape to deposit their eggs in the cultivation and destruction ensues unless fumigation be resorted to.

Now, fumigation under these conditions presents problems which, unless understood and tackled by the farmer in an intelligent manner, may bring about inefficiency and a low mortality, with a consequent condemnation of the system or, at least, a subjecting of it to adverse criticism. In the case of an area where beetles have been on the wing for a couple of months, the farmer is confronted with grubs differing in ages from a month to six weeks or more. If he fumigates to kill the oldest of these, the youngest, by then, will not all have migrated to the stools and some will most likely escape the toxic properties of the fumigant. These grubs will later progress towards the stools and attack the cane roots after the fumes have been dispelled, thus conveying to the farmer a wrong impression that the fumigant has been of little value and causing him to lose faith in the process. In such a case it would be wise to delay fumigation with carbon bisulphide as long as possible, say until the oldest was on the point of assuming the third stage, and one fumigation would then suffice to kill a very high percentage of those grubs which were present in the field.

Again, when grubs hatch out early they consequently enter into their third stage at an early date also, and as this represents their very destructive period, the cane becomes damaged much earlier in the year and has a much longer time to remain root-eaten before being harvested. Therefore it is more liable to deterioration through dry weather, fungi, &c. Thus from most points of view an early emergence of beetles is not a happy augury for crops in the following year.

Where rain delays until towards the middle of December, usually only one big emergence of the beetles takes place. Collecting is entered into with great enthusiasm, and great numbers are destroyed. This apparently is what took place this year at West Plane Creek, where over 30 inches of rain were recorded for December. The thorough collection of beetles, as well as the systematic destruction by some growers of feeding trees adjacent to their canefields have both been really honest attempts made to reduce the pest this year, and judging by some of the farms recently inspected, a reduction in grub infestation has certainly taken place.

It now remains for them to make a survey of their farms for grubs, and where these are found in alarming numbers the judicious use of soil fumigants will be a wise and effective means of insuring their crops.

(*N.B.*—The collection of "greyback" cane beetles *L. albohirtum* here commended should not be confused with previous recommendations made by the writer to discontinue the collection of the Southern cane beetles *P. furfuracea.*)

Weedy Ground Tends Indirectly to Impair Fumigation Work.

In well-kept cane farms "greyback" beetles when about to oviposit tend to dig in under those stools to which they have flown and deposit their batch of eggs at depths of about 8 to 10 inches. The grubs, then, on hatching out find themselves in proximity to a copious food supply and usually remain within the cane stools. If, by any chance, the egg chamber is placed in the interspace the young grubs soon migrate towards the cane roots, and, finally, when they have concentrated in the cane rows, they can be readily destroyed by means of soil fumigants.

Canefields, in which weeds are allowed to grow in great profusion during the flight of the beetles, are more likely to suffer damage than cleaner fields. Beetles alighting in a mass of cane, grass, and weeds burrow at random into the soil and lay their eggs, so that little distinction occurs between the degree of infestation of the rows and that of the interspaces, since the grubs are able to feed equally well

at the grass roots as at the cane roots. In an actual count made by digging in a grubby zone and trenching on both sides of this stool, we found twenty-eight grubs underneath the stool and another sixteen and fourteen underneath the weeds and grasses on each half side of the interspaces adjacent to this stool. Provided this area were fumigated, the twenty-eight grubs underneath the stool would be accounted for, if conditions were favourable for fumigation; but what of the other thirty grubs on the sides of the stool? They would not come within the destructive radius of the deadly fumes, and later, as described in a previous paragraph in the case of younger grubs, they would gradually work inwards towards the rows, lay waste the crop, and completely negative fumigation work; and so, as a preliminary precaution when aiming at grub control, growers would be well advised to adopt the golden rule of keeping their cane reasonably free from weed growth.

A CANE GRUB SURVEY.

Mr. A. N. Burns, the Assistant Entomologist at Mackay, has forwarded the following report for the period 23rd January, 1928, to 11th February, 1928, to the Director of Sugar Experiment Stations (Mr. H. T. Easterby):—

In company with Mr. Mungomery a grub survey was carried out on farms that were usually subjected to greyback (*Lepidoderma albohirtum* Waterh.) grub injury. On one farm thirty very young first-stage grubs were unearthed from under one stool, and a similar number from the two interspaces on either side of the same plant. Other stools in the same "patch" gave numbers varying from two up to nine; there were also many grubs in the interspaces between the rows. As these latter were feeding on the grass roots, it was considered undesirable to fumigate the cane stools there at that time, as only the grubs at the cane roots would be affected; those between the rows could later, after the fumigant had exhausted its qualities, and the grubs their supply of grass roots, direct their attentions to the cane stools.

It was therefore decided to wait for a few days before making another inspection of this field. Several other farms inspected gave from their affected areas an average of from two to seven grubs per stool, and in each case the grubs were very young first-stage. Later, on finding eggs beneath one plant, it was decided on account of the apparent scarcity of grubs, that it would be wise to wait for a few days in order that eggs deposited by the latest emerged beetles should hatch and the young grubs have commenced feeding. The eggs found were taken to the Laboratory, where the young grubs hatched out two days later.

At the time of carrying out this inspection, a good many greyback beetles were observed on the feeding trees; they were, however, mostly in a "wasted" condition. Several specimens of the Christmas Beetle (*Anoplognathus boisduvali* Boisd.) were collected from the young foliage of a eucalyptus tree. At the time of writing a few greyback beetles may still be collected from feeding trees in the vicinity of the Experiment Station; and a few days ago a number were observed on feeding trees adjoining a cane field on the Farleigh road.

Beetles Collection.

Growers at West Plane Creek who usually suffer damage from grubs of the greyback (*L. albohirtum* Waterh.) have been judiciously co-operating in collecting the beetles, especially during the last flighting season. Much attention also has been given to the cutting down of feeding trees, consideration having specially been given to the position of these trees in relation to the affected cane, and direction of the prevailing winds. Several growers state that they feel assured that through this practice they have considerably reduced their percentage of grub attack.

Occurrence of *"frenchi"* Grubs. (*Lepidiota frenchi*, Blackb.)

Damage by grubs of this species is showing up in one or two places on the Experiment Station, also in isolated patches on several farms near Racecourse Mill. Examination of affected stools at the Station gave an average of three third-stage grubs per stool. First-stage grubs were also present, but not in any number. As soon as the weather takes up again (the precipitation during the last four days has been 6 inches) and the soil is dry enough for fumigation, a couple of plots will be laid down at the Station.

Occurrence of Other Grubs.

Whilst digging for greyback grubs in sandy loam soil on a creek flat at West Plane Creek, a newly changed third-stage grub, presumably that of the "Anomala" beetle (*Anomala australasiæ* Blackb.) was found amongst cane roots. The soil in this field was rich in silt and organic matter, which components are much favoured by grubs of that species.

A good number of the same species of grub have also been unearthed during scarifying operations on the headlands of some of the blocks of cane at the Experiment Station. They appear to be feeding on grass roots only, so far none have been detected actually amongst the cane roots. The soil in this instance also is a heavy loam with a fairly high percentage of organic matter, which again seems to indicate that they may be "Anomala" grubs. These grubs are very active, and move on their ventral surface, a characteristic of *A. austra'asiæ*. Specimens are being bred through in cages at the Laboratory.

Condition of Cane.

The cane in Plane Creek Mill area, as well as round the Experiment Station and Racecourse Mill, at present looks particularly well, due, no doubt, to the beneficial falls of rain combined with warm temperatures, thus producing ideal conditions for growth. In one instance only was a field of cane observed to be poor, then it was due to much of the cane (plant) having been partially submerged by water during the recent heavy rains.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF JANUARY IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING JANUARY, 1928 AND 1927, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Jan.	No. of Years' Records.	Jan., 1928.	Jan., 1927.		Jan.	No. of Years' Records.	Jan., 1928	Jan., 1927.
North Coast.	In.		In.	In.	*South Coast*—continued:	In.		In.	In.
Atherton	11·52	26	7·73	13·28	Nambour	9·26	31	8·21	32·38
Cairns	16·17	45	5·84	18·78	Nanango	4·54	45	4·33	10 04
Cardwell	16·18	55	5·18	31·75	Rockhampton ...	8·55	40	3·40	9·56
Cooktown	14·35	51	2·08	10·07	Woodford ...	7·28	40	5·19	22·19
Herberton	9·52	40	5·31	13·39					
Ingham	15·32	35	7·29	31·11					
Innisfail	19·86	46	14·80	17·31	*Darling Downs.*				
Mossman	14·24	14	8·81	12·19					
Townsville	11·14	56	7·41	18 63	Dalby	3·36	57	0 73	4·19
					Emu Vale ...	3·22	31	2·90	7·61
					Jimbour	3·74	39	1·49	4·14
Central Coast.					Miles	3·85	42	1·46	5·96
					Stanthorpe ...	3 62	54	3·95	4·91
Ayr	11·17	40	3·82	16·04	Toowoomba ...	4 89	55	4·15	13·74
Bowen	9·83	56	4·38	13·46	Warwick	3·59	62	2·76	4·40
Charters Towers ...	5·68	45	1·54	5·88					
Mackay	14·41	56	4·41	11·00					
Proserpine	15·48	24	7·31	17·42					
St. Lawrence ...	9·67	56	8·64	9·46	*Maranoa.*				
					Roma	3·31	53	1·79	4·42
South Coast.									
Biggenden	5·30	28	4·04	8·49					
Bundaberg	8 93	44	2·77	25·80	*State Farms, &c.*				
Brisbane	6 50	77	6·15	22·43					
Caboolture	7·39	40	6·26	25·76	Bungeworgorai ...	2·25	12	0·92	1·59
Childers	7·53	32	4·45	6·24	Gatton College ...	4·07	27	3·52	9 39
Crohamhurst ...	12·70	35	10.59	34·77	Gindie	3·91	27	4·34	1·61
Esk	5·52	40	4·53	14·99	Hermitage ...	3·11	20	3·18	4·80
Gayndah	4 64	56	3·25	13 92	Kairi	7 24	12	4·33	6·42
Gympie	6·63	57	3·50	14·21	Sugar Experiment Station, Mackay	15·22	29	3·48	8·32
Kilkivan	5·44	48	5·64	7·58					
Maryborough ...	7·45	55	6·41	17·18	Warren	5 46	12	2·74	6·91

NOTE.—The averages have been compiled from official data during the periods indicated; but the totals for January this year, and for the same period of 1927, having been compiled from telegraphic reports, are subject to revision.

GEORGE G. BOND,
Divisional Meteorologist.

CUTWORMS AND ARMY WORMS.

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

The larvæ of many moths belonging to the family Noctuidæ have long been known as very destructive enemies of a wide range of economic plants. The feeding habits of certain of these larvæ or caterpillars have earned for their species the name of cutworms, on account of their habit of feeding on the stems of their host plants at or near ground level, and thus severing the above-ground portion of the plant from its root system. Other closely allied species of Noctuidæ have acquired in a most marked degree the habit of frequently migrating in great numbers in their larval stages from field to field, and when that is the case they are commonly referred to as army worms.

Important Queensland Species of Cutworms and Army Worms.

Among the more important species that may be worthy of mention in these notes, is the cutworm that was so destructive in the spring of 1926—namely, *Euxoa radians* Guer. In its life history and feeding habits it may be regarded as a typical cutworm, and it has accordingly been selected for brief description as a representative of this class of pest.

Euxoa radians was responsible for nearly all the losses sustained in the spring epidemic of 1926; fortunately, losses in 1927 were very slight.

The army worms are well represented in Queensland by such species as *Cirphis unipuncta* Haw. and *Cirphis loreyi* Dup., both of which have developed very pronounced army worm habits.

Life History and Feeding Habits of *Euxoa radians*.

Comparatively few details have been published with respect to the life history and feeding habits of this species. It is, however, at present the subject of an intensive investigation by an officer of this Department, and it is hoped that much additional information thereon will shortly be available. In the meantime, the following brief outline will probably suffice.

The small, circular, pearly-white eggs have been found in moist soil under low-growing weeds. They hatch after a brief incubation period, and the observations to date indicate that the young larvæ hatching from these eggs, generally but not invariably, feed on the delicate foliage of the weeds under which the eggs were laid—e.g., pigweed and bullhead. As the larvæ grow older they turn their attention to economic plants, and these are frequently destroyed or seriously injured in large numbers.

The larvæ of cutworm moths generally shelter in the soil during the day at a depth of 1 to 2 inches, and in this respect *Euxoa radians* is typical. The cutworms come out to feed shortly after or about sunset, and in the case of well-grown plants they will climb up into the foliage and, if unchecked and in large numbers, the cutworms may completely defoliate the plants on which they are feeding. When young plants or seedlings are attacked the base of the stem is a favourite point of attack, and it is frequently nibbled through or ring-barked, thus causing the seedlings to topple over or wither off.

FIG 1 × 1½

FIG 2 × 1½

FIG 3 × 1½

FIG 4 × 1½

FIG 6 × 1½

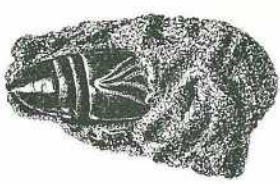


FIG 5 × 1½

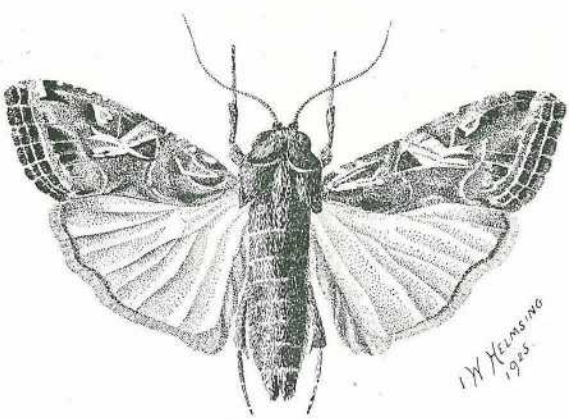


FIG 7 × 2

PLATE 59.

Prodenia litura F.

Fig. 1. Larva, lateral view x 1½. Fig. 2. Larva, dorsal view x 1½. Fig. 3. Pupa, ventral view x 1½. Fig. 4. Pupa, lateral view x 1½. Fig. 5. Pupa within earthen cocoon x 1½. Fig. 6. Imago, wings closed x 1½. Fig. 7. Imago, wings expanded x 2.

The nocturnal feeding habits of these cutworms frequently lead to failure to detect the cause of the loss just described. Hence, whenever seedlings are falling over in the manner mentioned or extensive defoliation of plants is taking place without any ostensible reason, it is well to scratch away the soil at the base of the attacked plants to see if the presence of cutworms is the explanation.

The cutworms attain full size in about four weeks during the late spring and early summer months, and in the process of growth they moult several times. The full-grown cutworms of this species are about 1½ inches in length and are stout, fleshy grubs that are only very sparsely clad with extremely small hairs. When dug out of the soil their colour varies to some considerable extent, for while some specimens may be aptly described as being of a dirty grey-green colour, others might more appropriately be called dirty brown suffused with pink. The cutworms possess eight pairs of legs, three of which are jointed legs on the thoracic segments, the other five pairs being fleshy unjointed legs that are situated on the abdomen.

Having attained full size the cutworms now form earthen cells in the soil at a depth of 1 or 2 inches below the surface, and in these cells they transform to pupæ. The pupæ, which are about three-quarters of an inch in length, are light-brown in colour when first formed, but there is a very appreciable darkening as the pupal period advances. The duration of the pupal period is about a fortnight during the late spring and summer months. No feeding takes place during this stage, and it functions entirely for the reorganisation of the internal tissues, as a result of which reorganisation the moth, which is the reproductive stage in the insect's life cycle, is produced.

The moth is a stout-bodied, unattractive looking insect with a wing spread of 1½ inches, the body length being about two-thirds of an inch. The fore wings are brown with conspicuous darker brown or blackish brown spots and streaks, while the hind wings are much lighter in colour, being almost white except for a small brownish marginal area.

It is believed that the life cycle of *Euxoa radians*—i.e., from the laying of the egg to the emergence of the moth—occupies about seven weeks in the summer months. The number of generations that may occur each year in Queensland has not been ascertained, but it would appear that the spring generation is the one most to be feared.

The life cycles of the army worm species, *Cirphis unipuncta* Haw. and *Cirphis loreyi* Dup., are somewhat similar in their fundamental details.

Illustrations of the various life history stages of *Euxoa radians* are not yet available. On plate 59, however, the larva, pupa, pupal cell, and moth of an allied leaf-eating species, *Prodenia litura* F., are figured, and from these figures the reader can form some rough idea of the general appearance of the life cycle stages of Noctuid moths.

Plants Attacked.

An extremely large range of plants are subject to attack by cutworms and army worms, and it may be said that hardly any cultivated crop escapes an attack of some varying degree of severity at least in certain seasons.

In Departmental records of cutworm and army worm attack, mention is made of the following cultivated host plants:—Cabbage, cotton, grape vine, grasses in general, lucerne, maize, millet, oats, onions, potato, tomato, strawberry, sugar-cane, and wheat.

Control Measures.

When an outbreak commences it is well to take immediate steps to deal therewith, because very heavy losses may be sustained in a comparatively brief space of time.

Fortunately, there are distinctly effective means available for handling these cutworm pests, perhaps the most satisfactory of which is the use of poison bran baits.

Poison baits may be prepared in accordance with the following formula:—

Bran	25 lb.
Paris Green	1 lb.
Molasses	1 quart
Oranges	2 fruits
Water	2 gallons (about)

The Paris green and bran should first of all be mixed together in a thorough manner and while still dry. The molasses and the finely chopped up fruit and its juice should then be added to some of the water. The water containing the molasses and fruit should next be mixed with the bran and Paris green and the whole should then be well stirred up, enough water being added to produce the right consistency.

It is highly desirable that the poison bait should be of the right consistency, and only sufficient water should be added to permit of it being in a crumbly state and thus capable of being easily scattered broadcast on the ground. It should at the same time be sufficiently moist to permit of each flake of bran taking up its quota of the Paris green and molasses.

Neither the fruit juice nor the molasses are essential in this bait although they are usually considered desirable. Horse dung and sawdust have been substituted for the bran in certain formulæ and smaller percentages of Paris green have also been used, but it is desirable to adhere to the formula given until such time as experiments have demonstrated the equal efficiency of the cheaper formulæ when used in this State.

The bait prepared in the manner described is best applied late in the afternoon so that it may be fresh and palatable when the cutworms come out to feed at night. The bait may be broadcasted over the infested area, or it may be applied by dropping about half a teaspoonful of the mixture near to but not touching each plant to be protected. The amount of bait to be used per acre will vary to some extent with the degree of infestation and also with respect to the number of plants to be protected per acre, but generally some 40 or 50 lb. of the bait will suffice for the treatment of one acre if broadcasted.

It should hardly be necessary to emphasise the fact that caution should be exercised in the application of the bait, because the Paris green contained therein is a very poisonous substance. Before it is applied steps should be taken to ensure that no domestic animals, e.g., poultry can obtain access to the bait.

As an alternative to the use of poison bran baits, attacked plants may be sprayed with arsenate of lead, but the former method is more satisfactory as it kills the cutworms without sacrificing some of the plant tissue in doing so. When spraying is adopted, a certain proportion of the plants may be destroyed before the cutworms are poisoned, and furthermore, it is not safe to spray attacked plants which may shortly be used for foodstuffs.

If these pests are on the march in army worm fashion, and are moving from one cultivated area to another, it will generally be found that poison bran bait scattered a few yards in front of the line of advance will be effective in checking the migration.

A further measure that is frequently adopted when these pests are on the move is to plough a furrow a short distance in front of the line of advance, the steep straight side of the furrow being the one that is most distant from the marching army worms. A little poison bran bait is scattered in the foot of the furrow, or in some cases small holes are dug in the bottom of the furrow at intervals of 10 or 12 feet. The advancing caterpillars will fall into this furrow, feed on the poison bran bait and die or, where bait is not used, they will wander up and down the furrow in search of a means of escape and fall into the small holes where they can be killed either mechanically or by the use of a little kerosene. It is obviously essential that the furrow should be so prepared that there is no chance of the caterpillars crossing it.

Natural Enemies.

A number of natural enemies of the cutworm *Euxoa radians* have been recorded in Queensland, these being a very small wasp parasitic on the eggs, namely, *Schedius euxoæ* Gir., a Braconid wasp parasitic on the caterpillars themselves, a predatory Sphegid wasp, *Ammophila suspiciosa* Sm., also attacking the caterpillars, and finally a Tachinid fly parasitic on the larvæ. Birds also doubtless take a heavy toll of these pests.

OBITUARY—HON. W. N. GILLIES.

END OF A NOTABLE CAREER.

With the death of Mr. W. N. Gillies, formerly Premier of Queensland, and member of the Board of Trade and Arbitration, on 9th February, a distinguished and very busy life ended with tragic suddenness. Mr. Gillies was only in his sixtieth year, and the news of his collapse and sudden death at his home at Toowong occasioned widespread regret and deep sense of a great community loss. As Minister for Agriculture and Stock for just on five years of the immediate post-war period, when primary industry was confronted with all the perplexing phenomena arising from a lack of a complete system of ordered marketing and organised distribution, no other leader, with the exception, perhaps, of the late Hon. A. J. Thynne, left a deeper impress on the fortunes of agriculture in this State. A farmer himself, and the son of a farmer, he brought to his office a sound practical training in land matters, an abiding comradeship with the primary producer, a deep sympathy with him in his economic problems, and a wide, wise, and comprehending vision. Added to this was a tremendous earnestness of purpose, an intense devotion to duty, and untiring industry in carrying it faithfully out.

A pioneer son of pioneer parents, and in every sense a big Australian, was the first farmer Premier of Queensland, William Neale Gillies. Coming from Scotland his parents settled on the land in the Hunter River district of New South Wales, and it was there that Mr. Gillies was born. When a lad of thirteen his parents trekked northward to the Richmond River, and soon after the resourceful young Australian, who was destined to achieve distinction in the service of the people, started farming for himself. At sixteen he was managing a local creamery and, later, filling the role of postmaster. Sticking to the land he engaged in sugar-growing. It was the day of indentured coloured labour from the South Seas, and from his father, who was the originator of the Anti-Alien League of New South Wales, which had for its aim the abolition of kanaka labour in the sugar industry, young Gillies absorbed his democratic ideas and faith in the national ideal of White Australia. Following a strong paternal lead Mr. Gillies became, later, president of the New South Wales Sugar Defence League, an outgrowth of the earlier successful organisation founded by his father, a position which he retained until 1911.

The present generation has, perhaps, very little appreciation of the strenuous efforts of the farmers of that time to make and maintain sugar-growing as a white man's industry. The fine national spirit, strength of character, and foresight of

PLATE 60.—THE LATE HON. W. N. GILLIES.

"He was one of those who cannot but be in earnest; whom Nature herself has appointed to be sincere."—*Carlyle.*

these hard-fighting farmers on the Northern Rivers were big factors in forcing a general acceptance of the Australian Monroe Doctrine, which, to-day, is the nation's slogan.

Attracted to the new and fertile lands of the North, Mr. Gillies came to Queensland in 1911 and settled on virgin scrub country on the Atherton Tableland, a region rivalling in richness the Big Scrub of his native State. As a leader among the new settlers and workers his worth was quickly recognised and, within a year of his driving in his tent pegs on his new selection, they sent him down to Brisbane to represent them in the Parliament of the State. In 1916 the Public Works Commission was appointed, with Mr. Gillies as its first chairman. The Brisbane-Kyogle Railway proposal, the building of which Mr. Gillies advocated on both sides of the border, was the subject of the Commission's first inquiry. In 1918 Mr. Gillies entered the State Cabinet as Assistant Minister for Justice, and in the following year attained full Ministerial rank as holder of that portfolio. When the Hon. William Lennon was appointed Lieutenant-Governor, Mr. Gillies succeeded him as Minister for Agriculture and Stock. In 1921 he was chosen by his colleagues to fill the chair of Deputy Premier when Mr. E. G. Theodore assumed the Premiership in succession to the late Mr. T. J. Ryan, K.C.

Agriculture is still Australia's basic industry and rural prosperity is of vital importance to the country and it was with these ideas in view that Mr. Gillies, both as Deputy Premier and Minister for Agriculture and Stock, performed notable service to the industry both in State and Federal Councils. And these ideas were crystallised in measures introduced and piloted through Parliament by Mr. Gillies in the course of a record term as Minister for Agriculture and Stock, a period of legislative and administrative activity and achievement that in Australia, it may be fairly said, has no parallel.

On his entry into the Agriculture Office Mr. Gillies found twenty-two Acts of Parliament to administer. In the course of his Ministerial term he had seven of these amended or consolidated and added fourteen new agricultural and related measures. The whole period was marked by phenomenal departmental activity.

The establishment of the cotton industry, stabilisation of the sugar and other farming industries, systematic agricultural organisation, formation of wheat and other pools, the placing of the farmers' co-operative movement on a sound basis, the protection of banana-growing and its preservation as a white man's industry, the Sugar Agreement with the Commonwealth—all required special legislation or regulation, and in these enactments the general benefit of agriculture, and therefore of the nation, was the basic idea. The administrative acts of Mr. Gillies during this period also covered a very wide field. Among other practical measures the system of advances to settlers was liberalised, schemes for grain and fodder conservation were initiated, native birds and animals were protected more closely, the scientific services of the department were extended, and publicity in respect to rural enterprises, conditions, and problems by motion pictures and otherwise was greatly improved. Behind it all Mr. Gillies was a driving force. In 1925, Mr. Gillies resigned the Premiership of Queensland, and later accepted a seat on the Board of Trade and Arbitration.

TRIBUTES.

Many tributes were paid to the late Mr. Gillies' life, character, and great public service by every section of the Press and leading citizens representative of every phase of our community life. The deep respect in which he was held was manifested in immense crowds that gathered in the streets during the passage of the cortege through the city. There was another large gathering at the graveside in Toowong Cemetery. In performing the last sad rites the Rev. Norman Millar, B.A., of St. Andrew's Presbyterian Church, said—"We are gathered to pay our last tribute of respect and honour to one who, as head of the State Government and occupant of important and arduous offices, brought to each position he occupied a certain real competence and a certain real integrity of soul that won for him not only the real friendship of a wide circle of admirers, but also the respect of many of those who differed most widely in opinion. We gather round the grave to pay our last respect to his memory, his service, and his character. We are reminded how unseemly it is that one who has given pleasure and service to the State and displayed affection and friendship to his dear ones should pass away so tragically. I take the opportunity in the name of those present to convey their sincerest and profoundest sympathy to the wife and members of the bereaved family."

Every section of the community was represented, including His Excellency the Governor (Lieutenant-General Sir John Goodwin), the Lieutenant-Governor (Hon. William Lennon), the Premier (Hon. W. McCormack), the Speaker and Members of the Legislature, the Judiciary, the Chancellor, Senate, and Faculties of the Queensland University, State and Federal Public Services, Naval and Military Forces, Foreign Consular bodies, City Council, Public bodies, and National Societies, and Professions and Commerce.

PIG RAISING—SCHOOL OF INSTRUCTION.

Arrangements have been made to hold a school of instruction in pig raising at the Queensland Agricultural High School and College, Gatton, over the period Monday, 11th June, to Saturday, 23rd June (inclusive), 1928.

Applications are now being invited from farmers, their sons, and daughters who are anxious to improve their knowledge of the subject of pig raising, for at this school both practical and theoretical instruction will be given; the practical work including a study of breeding, cross breeding, feeding, marketing, judging, diseases, care and management.

Lectures will be given on all these subjects as well as on others associated with the handling of several classes of pigs, while it is proposed, if possible, to arrange for visits to bacon factories during the progress of this school in order that students would have the opportunity of studying the various processes consequent upon the treatment of bacon pigs of varying ages and weights.

The college fees for the complete course, including board, lodging, and tuition, will be £2 13s. 6d. each student.

It is intended that the school should be open both to men and women.

In holding the school officers of the Department of Agriculture and Stock will co-operate with the Principal of the College and officers of the Department of Public Instruction.

Applications from those desirous of attending should be made to the Principal of the Queensland Agricultural High School and College, T.P.O., South Queensland, as early as convenient so that arrangements may be made for accommodation for the period of the school.

It is anticipated that the holding of the school will be highly appreciated by many engaged in the pig-raising industry, for the school will be thoroughly practical and should prove interesting and instructive to all who are able to attend.

Further particulars in connection with the school and with accommodation, &c., may be had on application to the Principal.

The Instructor in Pig Raising, Mr. Shelton, will be in attendance throughout the school, and will be included in the list of lecturers dealing with both practical and theoretical sides of the business.

It is advised that those who would like to attend should make early application for information or for accommodation, for already quite a number of inquiries have been received indicating that the school is creating a keen interest among the farming community.

There will be some slight additional expense associated with the visits to the bacon factories, details of which can be had on application to the Principal at the time other information is being sought.

FARM TRACTORS—CORRECT COUPLINGS.

Driving Small Machines.

It is not always possible to follow the suggestion I made recently—namely, that all of the small stationary machines should be driven off a main shaft. When it is found that this cannot be done, the question arises as to how it is possible to regulate the speed at which the driven machine is made to revolve. The solution of the difficulty that I have found most satisfactory is to employ a set of pulley wheels, one wheel of the correct size for each stationary machine. The exact size for each wheel must be worked out carefully—a simple sum in arithmetic—in accordance with the type of machine to be operated and the size of its pulley wheel. Such wheels can generally be obtained from the local stores. Remember, though, that a pulley wheel must have a slightly crowned face. A pulley wheel can be changed very quickly, since, as a rule, it is merely keyed to the shaft.

Weight Distribution.

A well-balanced tractor gives very much better results than one that is badly balanced. The whole question of the correct distribution of the weight of the tractor has been thoroughly considered, and many experiments have been conducted to determine the right solution. The weight of the tractor is brought together into one point. This point is termed the "weight centre." If this weight centre is too much in front of the rear axle the front wheels will be carrying too much weight; on the other hand, if it lies too close to rear axle the work of steering is rendered very difficult. It has been determined that the best distribution is to have the weight centre one-third of the distance between the rear and the front axles. This gives sufficient weight on the rear wheels for conserving the power and sufficient on the front wheels to make steering easy.

Tractor Hitches.

A number of tractor operators appear to be under the impression that, given an efficient tractor and a suitable implement, it makes no appreciable difference how the two are coupled together. An improperly regulated hitch, or a hitch of bad design, means that considerably more power is used up for propelling the whole outfit. The result of this is that inferior work is performed and the speed is reduced. A hitch causing unnecessary side draft will greatly increase the load, and to such an extent is this noticeable at times that at least one-third more power is required than would otherwise be the case. In addition to loss of power, ragged furrows, faulty pulverisation, and poor furrow slice are also the direct result. Manufacturers of both tractors and implements have studied this question in all its bearings, and therefore the sensible operator employs a coupling recommended by one or the other.—E. T. BROWN, in "The Farmer and Settler."

ON THE OPEN ROAD.

The Downhill Drive.

Motorists have often been warned against attempting to overtake other cars without being able to see clearly that this can be done with safety and without inconveniencing any motorist or other person that may happen to be coming in the opposite direction. Evidence is, however, daily accumulating that such warnings are still necessary. Now, it is not possible to see what may be approaching on a blind corner or at cross roads or on steep humpbacked bridges. A sudden, steep fall of gradient may also prove to be dangerous for the unskilled driver.

Dash Through the Creek.

We recall having a nasty experience about a year or two ago when motoring to Newcastle, simply because we took too much for granted and anticipated good roads all the way, because they had been excellent up to Wiseman's Ferry. It was after leaving St. Albans and making over very rough and hilly country for Wollombi that we finally struck a nice patch of road and immediately got up a solid speed. We must have been doing 40 miles an hour, as there was no traffic or very little of it, when, without warning, we ran into a deep creek in the road. By the speedy application of brakes we averted an accident, as the culvert must have been 2 or 3 feet deep. As it was, we had a thorough drenching and threw out a sheet of water such as one would expect when a whale does its spouting at sea. The incident we experienced, though it happily turned out all right, might have been serious, and goes to show that all motorists should be specially careful when touring over roads on which they have never previously travelled.

When the Brakes Failed.

A friend of ours once had a curious experience when touring one of the mountain roads. He was not an experienced driver, though he had learned the lesson "get into second" when negotiating a very stiff gradient in case the brakes do not hold properly. Well, he had never been over this particular country and was climbing up a not-too-steep gradient "all out," when, without warning, in taking a turning, he found himself going down a very steep gradient. So far as he could see, the road ahead was straight. That was one good thing, he thought, as he applied his brakes, but found that they only partially held the car. At the rate he was travelling he had no idea how to get into second gear, so, with the "safety first" idea in his head, he began looking ahead to see if there was anything soft about into which he could bump. Not a thing could be seen but the road and the hedges or fences each side. By the time he had been careering like this for a minute or two he came to the conclusion that this particular road was "all" down gradient, and then, like a flash, he dashed through a wide gateway that fortunately was open and entered a paddock on two wheels. By the greatest good luck he kept his seat, though the pace still held as the paddock sloped just as much as the road. Still looking for something soft into which he could fall he spotted a hayrick right in the extreme corner. Straight for this he made like a cat after a mouse, and Don Quixote's charge on the windmill was nothing to the light brigade charge he made on that stack of hay. He hit it with such force that some local wits said it swung backwards and forwards like a pendulum for a week, while the motorist in the recoil went back about 10 yards after very nearly doing a double somersault. Needless to say, my friend went carefully ever afterwards on strange roads, and before doing any touring saw to it that the brakes would hold the car, even if it were going down the side of a cliff.—"Magneto," in "The Farmer and Settler."

FARM TRACTORS AND THEIR MANAGEMENT.

THE GEARING OF THE MACHINE.

By E. T. BROWN.*

Many present-day tractors are fitted with either two or three forward speeds, thus giving varying rates of travelling. When ploughing on heavy land it is better, as a general rule, to run the outfit on low gear, but when the tractor is performing other work, such as harrowing, discing, rolling, &c., a higher gear can be used advantageously. The third gear, when such is fitted, is but seldom employed on the land; its use is for road haulage, since the possible speed with this gear may be from 4 miles to 6 miles an hour. When starting away from rest, the clutch must be disengaged and held in this position until the pinion wheels in the transmission have come to rest, when the gear lever should be pushed or drawn into the correct position for the intermeshing of the first speed pinions. The clutch is then allowed to engage slowly. To change from low to second gear a different set of gear wheels must be brought into mesh, and this change must be effected when both the first and second shafts are in motion. Declutching is first of all necessary, then the gear lever is brought into neutral position, held there a moment, then placed into the second speed position. The exact actions to be taken to obtain a silent change varies with different makes of machine. In some the change should be made quickly; in others a pause in neutral for some few moments may be necessary. Practice alone will indicate the correct method. For changing down—that is, from a higher to a lower gear—the change is carried out in exactly the same manner. To engage the reverse gear the machine must be brought to a standstill before the reverse pinions are brought into action.

Retard when Starting Up.

Whenever you are going to start up your tractor make certain that the ignition is retarded. If you fail to do so there is every likelihood that the engine will "kick," with serious results to your wrist. When the engine is running normally in advanced ignition the spark occurs in the cylinder a fraction of a second before the piston has reached the end of the compression stroke. The reason for this timing is that the explosion does not take place instantaneously, and therefore the full force of the explosion does not strike the piston head until it is ready for the downward movement. When the engine is being rotated slowly, however, as it is when it is turned over by hand, the piston head would be subjected to the blow resulting from the explosion while still on the upward stroke. This tends to make the engine work the reverse way. Safety lies in retarding the spark so that all danger of "kicking" is obviated.

When Starting the Engine.

It is not altogether an easy thing to start up a large tractor at any time, but the job is rendered more laborious when the weather is cold. The majority of tractors, however, are fitted with some device to make starting up easier, such as an impulse starter or a decompressor. There is a lot, though, in knowing how to swing the engine properly. As a rule, with kerosene-burning engines a second tank is provided for petrol, on which liquid the tractor is started. The reason, of course, is that petrol is a much more volatile liquid than kerosene, and therefore vaporises more readily. As has been explained before, the spark must be retarded, since otherwise the engine may backfire with serious results to the operator. In this connection reference may be made to a new safety device that has recently been introduced. It is constructed so that in the event of a backfire the tendency of the starting handle to rotate in the opposite direction is checked.

Priming and Swinging.

It is a usual practice to inject a little petrol into the cylinders by means of the compression taps on the cylinder heads. This ensures the cylinders receiving a charge of explosive mixture. Only a small quantity of petrol should be used for priming, and it is an excellent plan to inject this spirit into the cylinders some minutes before starting up. The amount of swinging that is required depends on two things—namely, the efficiency of the engine, and the way the engine is turned over. The former, of course, is dependent on the nicety of adjustment of the various parts. The first action should be to turn the engine over twice slowly, since in this way one cylinder will be filled with compressed gas and be ready for firing. Then a sudden jerk upwards of the handle or a rapid swing will start the engine. Run on petrol for a few minutes—until the engine gets warm—before turning on the kerosene fuel.

* In the "Farmer and Settler" (Sydney).

LUPIN AS A FODDER IN WESTERN AUSTRALIA.

By "SUB-CLOVER."*

The blue flowering lupin has firmly established itself in the coastal regions of the northern agricultural areas of Western Australia in recent years, and has proved of inestimable feeding value during the dry pinch in the summer months from February to the end of April, when the natural feed is as a rule scanty.

So well do conditions suit this plant on the light lands at the top end of the Midland line, Geraldton, Mullewa, and Northampton districts that it is only a matter of a few years ago that farmers became alarmed at the rapid rate at which the plant had spread, and it was feared that it would have to be declared a noxious weed.

However, the fear that the growth of the lupin would interfere with harvesting operations no longer exists, as it took but a short time to discover that the plant was very easily eradicated by cultivation and heavy stocking. In the very young stages sheep will eat the plant and thus its spread is under control, but once the plant becomes well rooted it seems to become unpalatable to stock, which will not touch it unless starved to it. At this time of the year, however, there is an abundance of natural feed, clovers and the like, so that the lupin remains untouched and goes to seed. Thus, although stock may be running in the paddock all the time, a splendid supply of nutritious feed is being conserved for the scanty period. Further, the vigorous growth made by the plants provides a considerable amount of vegetable matter, which, when trampled down, naturally increases the quantity of organic matter in the soil, while, the lupin being a leguminous plant, nitrogen also is added.

The quantity of vegetable matter grown in a lupin field can be realised by those who have had no experience of the legume when I state that last year I saw a paddock of lupins on Mr. A. E. Grant's property, Yanget, where the average height was quite 5 feet 6 inches, whilst in many places 6 feet was more than reached. This was in August, and, as the growing period extends from May to October, I was not at all surprised to hear later that in places the plants grew to a height of nearly 8 feet. However, 1927 was a particularly good year in those parts, and really this abnormal growth is not at all desirable, as the lupin seems to carry a considerably heavier harvest of pods, with more nutriment in the seeds, when the growth of the plant is normal, ranging, say, from 3 feet to 4 feet 6 inches.

The fact that leguminous plants and sheep are destined to play an important part in the improvement of the lighter lands, of which there are such vast areas in Western Australia, is apparent. On these lands the dry summer months are the great disadvantage, and here lupins must play an important part. A good lupin field, having shed its seeds, will fatten up to as many as six sheep to the acre in the driest months, and this statement is backed by the experiences of leading growers in Western Australia, prominent amongst whom are Messrs. A. E. Grant, of Yanget, Geraldton; C. H. Rowan, of Wooree, Geraldton; C. C. Maley, M.L.A., of Parakalia, Three Springs; the Chapman Experimental Farm, and others too numerous to mention.

So readily had the lupin adapted itself to light lands that it was decided by the Department of Agriculture to conduct a series of experiments in order to ascertain which of modern farming methods was likely to prove most beneficial in the successful production of this plant. Of the three experiments conducted, the first was designed to ascertain the most satisfactory depth for planting. The tests were carried out, sowing at depths of 3 inches, 1 inch, and finally on the surface with a bare covering of soil. Germination was most disappointing in the case of the deepest sowing, but an improvement was noticeable in the second plot, whilst the surface sowing was by far the most successful of the three.

The second experiment was intended to ascertain the effects of potash or lime, in addition to the customary dressing of superphosphates. The result was decidedly in favour of the more economical method of sowing, as neither the potash nor the lime made any visible difference either to the germination or to the subsequent growth.

The final experiment was designed to ascertain whether the local soil contained the necessary bacteria for successful germination. In conducting this test some of the plots were liberally inoculated with soil obtained from an old lupin bed. Again the result was most satisfactory, as apparently the inoculated soil produced no better results than the other, showing that our light lands contain the necessary bacteria.

In all three experiments early sowing produced the best results. Perhaps the most important point discovered was that of shallow sowing, as this has an important bearing on farm practice, indicating, as it does, that the seed may be sown in stubble

* In "The Pastoral Review" for February.

paddocks during the summer months, when the surface is too hard for the drill to penetrate. Also, it shows that good results will be obtained from the natural spreading of the seeds. As a matter of fact, more recently this has proved a most successful way to spread the lupin. In a lupin field, when the pods are shedding the seed, there is a continuous series of sharp explosions as the pods open and fling the seeds for several yards all round.

In the summer months, when sheep are running in the paddock, they gather up a large quantity of the seed, but at the same time a large proportion is trampled under foot into the ground, where it remains to seed the next crop. From experiments made and the experience of reliable men, it would appear that the lupin does best when sown shallowly with a normal dressing of superphosphate on light, friable soil. Heavy sowing is not recommended, and the best results have been obtained by sowing at the rate of 10/12 up to 15 lb. to the acre. It is concluded that better results would be obtained from specially prepared land, but so good have been the results otherwise that this additional labour and expense are not warranted. Should it be desired to plant lupins with crops it is better that oats should be sown, as the feeders on the drill are bigger, and so less damage is done to the seed than with wheat.

The necessary rainfall for a successful germination and growth has not yet really been ascertained. It is generally known that the best results have been obtained in the Geraldton, Nabawa, and Northampton districts. Here the rainfalls average from 17 to 20 inches annually, with from 15 to 18 inches falling from May to October, which is the growing period. Lupins have also thrived in the light sandy soil of the heavily watered metropolitan area, so that apparently it can stand a great deal of moisture. On the other hand, at the Merredin Experimental Farm, with an average rainfall of some 12½ inches, with only 8½ inches during the growing period, results have been most disappointing. Here, in addition to the lighter rainfall, the soil is heavier and harder, but apparently the lupin favours a heavier rainfall and lighter soil.

WHEAT CULTURE IN QUEENSLAND.

By J. C. BRUNNICH.

Wheat is one of the most important crops of the world, and is the principal foodstuff of the white race. From the figures published in the official year books we learn that in 1925 the world produced and consumed 165,000,000 tons of potatoes, 113,000,000 tons of maize, 104,000,000 tons of wheat, and 90,000,000 tons of rice.

In Australia wheat is the principal crop raised, as in the year 1925-26 of a total cultivated area of 16,793,600 acres, 10,250,000 acres, or 60¾ per cent. of the cultivated area, were under wheat.

In Queensland, in the same year, we find that, of the total cultivated area amounting to a little over 1,000,000 acres, 166,000 acres were under wheat (16 per cent. of area); 154,000 acres were under maize (14.9 per cent.); 247,000 acres were under green fodder crops (23.9 per cent.); 190,000 acres were under sugar-cane (18.4 per cent.); and 40,000 acres were under cotton (3.9 per cent of area).

In the world's production of wheat, Australia's crop of wheat plays a very insignificant part, being only about 3 per cent. of the total crop in 1925, and only 2½ per cent. in 1913, as seen in the following table, which gives the world's production for the year 1925 as compared with the pre-war period 1912-13.

Although the actual percentage of our wheat crop as compared with the world's production is so small, it is, however, of the greatest importance to us, as our export of wheat amounted to 125,000,000 bushels in 1924-25, and 78,250,000 bushels in 1925-26, the latter export valued at £24,500,000 sterling.

We are able to export this large amount of wheat because our production per head of population is fairly high, and only exceeded by Canada and Argentine. The amount of wheat available to export depends on the difference between the consumption of wheat and the amount of wheat produced per head of population. In Australia the consumption of wheat for human food amounts to a little over 5 bushels per head, the average for ten years ending 1925-26 being 5.16 bushels, while the minimum amount was 4.8 bushels in 1919-20 and the maximum 5.78 bushels in 1917-18. Including the amount of wheat used as poultry food and other stock and required for seed purposes, the total consumption of wheat in Australia is about 7½ bushels per head.

It is interesting to note the influence of the great war on the consumption, and we find the following consumption of wheat per head of population in:—

	1913. Bushels.		1922. Bushels.
France	9.5		6.9
Italy	8.0		6.6
Canada	7.6		5.4
U.S. America	6.6		6.1
Australia (average of 9 years)	5.58	(10-year average)	5.16
United Kingdom	6.0		5.7
Russia (European)	5.1		1.4
Germany	3.6		2.0
India	1.6		0.9

The United Kingdom is the chief importer of wheat in Europe, as it produces only 1.2 bushels per head and consumes 5¾ bushels. From all parts of the world a stream of wheat flows to England, and Australia contributes about one-third of the United Kingdom's requirements by sending 40 per cent. of its export wheat to England.

India, although its production per head is so small—only 1.3 bushels—is able to export large quantities, because wheat plays only a minor part as a food of the natives, who consume only about nine-tenths of a bushel of wheat per head.

WORLD'S PRODUCTION OF WHEAT.

	1912-13.			1925.		
	MILLIONS OF—		Bushels per Acre.	Millions of Bushels Produced.	BUSHELS PER—	
	Bushels Produced.	Acres Cultivated.			Acre.	Head of Population.
United States	708·0	45·8	15·5	666·5	12·8	5·7
Russia, Europe, and Asia	779·0	78·0	10·3	661·1	12·4	5·0
Canada	199·2	9·8	20·4	411·4	18·7	43·3
India	358·4	29·4	12·1	324·9	10·2	1·3
France	325·1	16·2	20·0	330·8	23·9	8·1
Argentine	198·4	17·1	11·6	191·1	10·0	19·3
Italy	165·7	13·2	14·1	240·8	20·6	5·9
Spain	109·8	9·6	11·4	162·6	15·2	7·4
Australia	92·0	7·3	12·5	114·5	11·2	18·8
Germany	160·2	4·8	33·7	118·2	30·8	1·9
Roumania	86·2	5·1	16·9	104·7	12·8	6·0
United Kingdom	57·4	1·9	29·1	52·9	34·1	1·2
Hungary	184·6	9·5	19·3	71·6	23·3	8·6
Servia	15·3	0·9	16·0	..	..	..
Jugo-Slavia	..	..	..	78·6	17·9	6·5
Poland	..	..	..	57·9	21·4	2·0
Egypt	30·9	1·4	21·7	36·2	26·3	2·6
Czecho-Slovakia	..	..	..	39·3	25·8	2·7
Bulgaria	63·7	2·8	23·0	49·6	19·6	9·0
Japan	25·7	1·2	21·1	29·5	25·7	0·3
Chili	..	..	..	27·6	18·4	7·0
Algeria	27·2	3·6	7·5	32·7	..	5·9
French Morocco	..	..	..	23·9	9·1	4·5
Belguim	15·3	0·4	38·7	14·5	36·7	1·9
Greece	..	..	..	11·2	12·5	1·8
Mexico	..	..	..	9·4	..	0·7
Portugal	11·8	1·2	9·8	11·5	9·1	1·9
Uruguay	8·8	0·8	11·0	9·6	9·5	5·7
Sweden	7·6	0·2	32·5	13·8	38·0	2·3
Korea	..	..	..	10·5	11·9	..
Austria	67·6	3·1	21·7	10·7	22·0	1·6
Denmark	3·5	0·13	26·9	9·7	49·3	2·8
Syria	..	..	..	7·5	..	2·5
Union of South Africa	..	..	..	8·3	7·9	1·2
Tunis	3·6	1·5	2·4	11·8	..	5·5
New Zealand	5·2	0·17	30·1	4·6	28·8	3·2
Netherlands	5·5	0·14	38·6	5·6	42·2	0·8
Total for World	3,676	..	..	3,891	..	..

Other countries producing less than five million bushels are not listed.

The actual production of wheat per acre is also of interest, but it must not be overlooked, however, that the figures given are not in all cases strictly comparable, as the yield may actually represent two seasons, if the wheat crop follows a bare fallow as practised in dry areas. The average yield of wheat in the world is 14 bushels per acre, varying from about 8 bushels produced in the Union of South Africa to over 49 bushels harvested in Denmark. Great fluctuations in the yield will be found in most countries according to seasons, and the yields are very erratic in Argentine and Soviet Russia.

In a ten-years period ending 1916, we find the recorded yields of a few countries as follows:—

—	Average.	Maximum.	Minimum.
Canada	19·5	23·7	15·2
United States	16·4	16·6	12·4
India	12·6	12·8	9·7
Australia	11·5	13·8	8·2
Argentine	10·4	13·5	7·0
Russia	10·0	13·5	7·0

In India, where a large proportion of the wheat is grown under irrigation, the variation of the yield is less marked. Very remarkable are the high yields obtained in Denmark, Netherlands, Belgium, and Sweden. In most European countries the yield increased during the last sixty or seventy years, and we find, for instance, the yield in Netherlands to be, in bushels per acre, as follows:—

1851-60	1891-1900.	1906-1908.	1912-13.	1925.
21.5 ..	27.7 ..	36.0 ..	38.6 ..	42.2

In the United Kingdom the variation in the yield is much smaller than out here in Australia, as we find an average yield of 31.5 bushels in the ten years ending 1913, with a maximum of 34.8 bushels and a minimum of 26.3 bushels per acre, as compared with the yield of 34.1 bushels in 1925. Scotland's average yield is 41.2 bushels, varying between 36 and 42½ bushels.

We will now look at some of our Australian records, and we find for the ten years 1916-1926 the following results in the various States:—

—	New South Wales.	Victoria.	Queensland.	South Australia.	West Australia.	Tasmania.	Australia.
Bushels per acre ..	11·8	14·4	13·3	12·4	10·1	18·1	12·4
Maximum and minimum	17·8–3·0	17·5–7·8	20·9–4·8	16·5–7·8	12·8–7·4	22·6–11·6	16·1–7·2
Bushels per head ..	16·7	23·6	2·3 (?)	59·8	43·9	17·2	21·6
Maximum and minimum	26·5–2·1	28·6–9·9	4·9–0·1	103·5–31·1	65·6–28·6	2·7–0·9	31·0–8·7

The low yields in bushels per acre were obtained in the disastrous years 1918-1919 and part of 1919-1920. The phenomenal yield of 103.5 bushels per head in South Australia was obtained in 1916-1917, and the high yield of 65.6 bushels per head in Western Australia in the year 1924-1925. A record yield in our State was obtained last year (1927) with a yield of 66⅔ bushels per acre at Massie, Darling Downs.

In the year 1915-1916 the highest production of wheat with 179,000,000 bushels was recorded, and the annual average production for the ten years ending 1926 was 117,750,000 bushels. The great improvement noticed during the last years in getting a succession of good yields is largely due to improved methods of cultivation, bare fallowing, and application of fertilisers.

The keeping up of the yield and the increase of the acres under wheat are of the utmost importance, as already at the present time the world's consumption of wheat is barely covered by the production, a fact which was already predicted years ago by Professor Sylvanus P. Thompson. When production and consumption are so closely balanced, it follows that failure of crop in one or more of the exporting countries must have a serious effect and raise the price of the wheat in the world's market, whereas over-production must naturally lower it. The price of wheat in the British market is a fair index of the world's supply, and these prices are of the greatest importance to our wheatgrowers.

AVERAGE PRICES PER IMPERIAL QUARTER OF WHEAT IN THE UNITED KINGDOM FOR BRITISH-GROWN WHEAT.

Year.	s.	d.	Year.	s.	d.
1861	55	4	1919	72	11
1871	56	8	1920	80	10
1881	45	4	1921	71	6
1891	37	0	1922	47	10
1901	26	9	1923	42	2
1911	31	8	1924	49	3
1913	31	8	1925	52	2
1917	75	9	1926	53	3
1918	72	10			

The effects and after effects of the great war are clearly shown, and only in 1922 prices became more or less normal again. The average prices of wheat per bushel in the Australian market were 1921-22, 5s. 9d.; 1923-24, 4s. 8d.; 1925-26, 6s. 4d.; 1926-27, 5s. 7d. The price of wheat appears to be now fairly stable, and should keep within the limits of the prices realised the last five or six years.

The Agricultural Experiment Station of the University of Illinois addressed some years ago a circular letter to the leading agricultural investigators of Europe to ascertain the causes of the large and steady increase in the yield of wheat and other cereal crops during the past century, and more particularly the relative proportion of the increase attributed to each of the following four factors:—

(1) To the use of improved seed;

(2) To the use of plant food in commercial fertilisers and stable and green manure;

(3) To better rotation of crops;

(4) To more thorough tillage.

The answers to this circular were fairly unanimous, and may be summarised as follows:—

To the improvement of seed an increase of 10 to 15 per cent. may be attributed.

The largest part of the increase, estimated from 50 to 70 per cent., is due to the proper use of artificial fertilisers.

Thorough tillage and particularly deep cultivation are estimated to increase the yield from 15 to 30 per cent.

Rotation of crops, in connection with throwing out of cultivation lands unsuitable for wheat culture, may be the cause of an increase from 10 to 12 per cent. in the average yield.

The increase in the actual yield, which amounts in many of the countries to an actual doubling of the crop, is therefore due to factors well known and as old as agriculture itself. The lessons learned from these facts should be extensively applied to our local conditions, and should help to arouse the interest of our wheat-growers to strive for a larger yield, general improvements in cultural methods, and lead to a considerable increase of the areas under cultivation.

In accordance with our own experiences we could amplify or add to these factors the following:—

(*a*) Practising a system of cultivation which retains and conserves soil moisture.

(*b*) Breeding and selection of varieties of wheat to suit the soil and environments found in different localities.

With regard to the system of cultivation to conserve moisture, good results have been obtained by bare fallowing, which will be referred to later on.

The breeding of rust-resistant and early maturing rust-escaping varieties of wheat, for Queensland conditions, possessing improved field characteristics, has been successfully carried on for a number of years at the Roma State Farm by the Manager, Mr. R. E. Soutter. Our Director of Agriculture, Mr. H. C. Quodling, reports that several excellent varieties are now in general cultivation, and a marked improvement in the crop yield was in evidence in the 1927 harvest. It is interesting to notice that the wheat breeder referred to has combined the two important factors —rust resistant and prolificness—in one of his new varieties, "Three Seas." Grown as a summer crop it resisted black rust (*Puccinia graminis*) and gave a return of 24 bushels per acre of medium hard, round, plump grains of good milling quality. The same variety gave the rather exceptional yield of 50 bushels per acre at Allora

in November, 1927. An accomplishment of this character is full of significance, and serves to demonstrate the value of plant-breeding work as an economic factor in production.

In order to get some understanding of the bearing of the various factors on wheat culture, I shall now proceed to give a short outline of the composition of a wheat plant, and describe briefly "How a Wheat Crop Grows":—

A wheat plant consists of complex organic matter, which may be destroyed by burning, and of mineral matter left after burning in the form of an ash. Of the eighty odd elements, which are known to exist in Nature, only a small number—some twelve or fourteen—are found in a plant.

In the formation of organic or combustible matter, the elements carbon, oxygen, hydrogen, nitrogen, and traces of sulphur and phosphorus take part.

In the ash we find, besides small amounts of the last two elements already mentioned, other non-metallic elements silicon, chlorine, and the metallic elements potassium, sodium, calcium (lime), magnesium, iron, and aluminium.

The green wheat plant will contain from three-fourths to four-fifths of its weight of water, which in wheat straw amounts only to about one-seventh. Now, in the actual dry matter remaining, carbon forms about one-half by weight; oxygen, a little more than a third; nitrogen in the straw from ½ to 1 per cent., and in the grain from 2 to 3 per cent.; the ash in the straw amounting to about 5 to 6 per cent., and in the seed about 2 per cent. The composition of the ash of the straw and of the seed is totally different, the former containing about 70 per cent. of silica, the latter only about 2 to 5 per cent; we find only about 15 per cent. of potash in the ash of the straw, and about 30 per cent. in the ash of the seeds.

Now, let us ask,—Where does all the building material required in the growth come from?

The carbon, the principal constituent, is entirely obtained from the minute quantities found in our atmosphere. The air contains only about 3 parts of carbonic acid in 10,000 parts; or in a cubic yard of air, which weighs about 2¼ lb., we find only 7 grains of carbonic acid. All the absorption of the carbonic acid, and subsequent transformatiaon into sugars and starch and tissue, is carried out by the leaves; and we can form some idea of the immensity of the work done when we consider that a crop of wheat collects during its growth in three or four months on an acre of ground over 2 tons of carbon from over 7 tons of carbonic acid.

The air enters into the leaves through the very small openings (stomata) found on the surface, and the actual change is carried on by the aid of sunlight absorbed by the green colouring matter (chlorophyll) in the leaf cells. The actual work done by the sun in the production of our crops is enormously large, and is estimated to be at least 3,000-horse power per day per acre, corresponding to the work of 15,000 men. During this assimilation free oxygen is given off by the leaves. The leaf openings also serve for transpiration or evaporation of part of the water absorbed by the roots and carried through the stem to the leaves. If the transpiration is too quick, the plant wilts; but the plant is able to control this evaporation to a large extent by a more or less closing of these openings.

The products of the carbon assimilation are the carbohydrates—compounds formed, as the name implies, from carbon and water. Well-known carbohydrates thus formed at various periods of growth are—sugars, starch, and cellulose. The carbohydrates, when consumed as foods by men or animals, produce heat.

Of great importance are the organic nitrogen compounds—proteins or albuminoids—to which the wheat grain owes its value as one of the most nutritious cereals, and makes it particularly suited for the manufacture of bread.

An inexhaustible supply of nitrogen exists in the atmosphere, four-fifths being pure nitrogen; but it has always been accepted as a law that this atmospheric nitrogen is not directly available to higher plant life. Small amounts of nitrogen combine with the oxygen under the influence of electric discharges, and the compounds formed are collected by the rain water. The amount of nitrogen in form of soluble compounds thus collected in the soil amounts to 3 to 4 lb. per acre annually—a quantity quite insufficient to supply the needs of a wheat crop.

The soil, however, in each of its smallest particles, is alive with millions of bacteria; and some of these have the power to utilise and assimilate the atmospheric nitrogen, which then indirectly becomes available to the higher plants.

The mineral constituents found in the wheat plant are all derived from the soil, and the amounts removed are very considerable. The most important of these plant foods are potash and phosphoric acid, and also lime; and it is the duty of every farmer to guard against the exhaustion of these compounds in their lands under cultivation.

Each constituent plays its own important part in plant nutrition; and if one is missing, even an abundance of the others would not produce a vigorous and healthy plant. This fact was first made known by Baron von Liebig, who formulated it as his Law of Minimum, in which he states that the quality and quantity of a crop rise and fall according to the quantity of an essential factor of plant growth, which is available in a minimum amount. This law has been modified in modern time, and Wollny adds that also an excess of any constituent must be taken into consideration, and each factor of plant growth plays an important part in accordance with being present in mimimum, optimum, or maximum amounts.

Nolte, in his recent work, states that for plant growth not the actual quantity of any nutrient is the deciding factor, but rather that all the factors necessary for plant growth must be available in amounts in a natural harmonic proportion to each other.

The small amount of available mineral plant foods in the soil are absorbed by the aid of the fine feeding roots and utilised by the plant in the production of various organic compounds in the leaves. Some years ago it was shown by Prof. Wilfarth that the amounts of mineral foods varied at different periods of growth, and that certain amounts of these substances were returned to the ground as the plants reached maturity. A heavy crop of wheat, grown at the Experimental Station at Bernburg, was cut at four different periods, on the 22nd June, 14th July, 5th August, and 28th August, when the crop was 8½, 11½, 15, and 18 weeks old, after the first appearance of leaves above the ground, with the following composition:—

	Pounds per Acre.					
	Dry Substance.	Starch.	Nitrogen.	Phosphoric Acid.	Potash.	Soda.
			N.	P_2O_5.	K_2O.	Na_2O.
First cut	2,618	92	79·9	19·5	88·6	16·3
Second cut	6,860	661	87·4	31·5	123·5	27·7
Third cut	8,983	1,058	114·3	42·1	122·2	18·6
Fourth cut	9,274	2,018	92·4	43·6	72·7	12·8

The amount of potash reached its maximum at the second stage, with 123.5 lb. per acre, and at the time of absolute ripeness of the grain, at the fourth cut, only 72.7 lb. were found in the plant, so that 50 lb. were returned to the soil, after having done their share of work in the building up of organic substances.

In the case of phosphoric acid there was no decrease, and of the 43.6 lb. of phosphoric acid in the plant about 30 lb. were found in the grain.

From actual experiments carried out on our State farms we found that a 15 bushel per acre crop of wheat removed from the soil 25 lb. nitrogen, 12 lb. phosphoric acid, and 15 lb. potash. These amounts appear very small, but it will be a surprise to learn that a 2,000,000 bushel wheat crop in Queensland removes from the ground 1,500 tons of nitrogen, 720 tons of phosphoric acid, and 900 tons of potash, which, if they had to be supplied by artificial fertilisers, would cost £200,000.

Nitrogen is supplied by the soil, and potash also is generally found in sufficient amounts, but phosphoric acid is frequently deficient, and this important fertilising constituent must be supplied to ensure good wheat crops. Unfortunately we pay too high a price for our superphosphate, and the cost of superphosphate alone, if it had to be purchased, for this 2,000,000 bushel crop comes to about £20,000.

But not only the mineral plant foods are factors of growth, but of equal importance are light, heat, and moisture. The importance of moisture is well known to our wheatgrowers, and the result of droughts is clearly indicated by poor crops; but the necessity of water will become more apparent when I state that for the production of every pound of dry substance in a crop from 300 to 400 lb. of water have to circulate through the plant, and that for the production of a wheat crop at least 1,000 tons of water, corresponding to 10 inches of rain, are required.

The conservation of rain water lies again largely in the hand of the farmer. A series of experiments, in which the amount of moisture in soil was determined at various depths and with various methods of cultivation, were carried out at the Roma State Farm for several years, and showed clearly how the system of bare fallowing not only leads to a quicker absorption of any falling rain but almost completely prevents any loss by evaporation, provided the surface is tilled as soon as it is dry enough for the purpose. The results of these experiments are of such value that a summary of the results published in the annual reports is here repeated.

SOIL MOISTURES AT ROMA STATE FARM.

Averages for Twelve Months.

—	1910-11.				1911-12.				1912-13.			
	Per Cent. Moisture at the Depth of—				Per Cent. Moisture at the Depth of—				Per Cent. Moisture at the Depth of—			
	6″	1′ 6″	2′ 6″	3′ 6″	6″	1′ 6″	2′ 6″	3′ 6″	6″	1′ 6″	2′ 6″	3′ 6″
Uncultivated ..	7·52	11·28	10·72	9·98	4·79	6·57	7·24	7·89	7·37	8·30	8·08	8·30
Cultivated ..	7·36	14·44	12·04	12·57	6·41	10·67	10·35	10·56	7·31	9·18	8·26	9·48
Bare fallow ..	11·42	12·97	12·79	13·86	9·08	12·43	11·88	13·76	9·24	12·56	11·15	12·93
Rainfall—Inches	28·26				20·97				21·63			

This brings us to the importance of thorough cultivation, the want of which is largely the cause of small yields on some of our farms. Deep cultivation is also a necessity, and allows the roots to get deeper into the ground and draw on fresh supplies of mineral plant foods. Deep cultivation does not by any means necessitate the turning up of the soil and bringing the subsoil to the top, which in most cases would ruin any farm, but rather a stirring up of the subsoil and the breaking up of any pan which may form if the ground is always ploughed to the same depth for years.* The continual breaking up of the surface soil, as long as the crop permits such working, will keep the soil cool, allows free entrance of air, prevents evaporation, hinders the growth of weeds, and will minimise the effects of adverse dry seasons.

There is, however, one serious drawback with the system of bare fallow cultivation—that it leads to a considerable loss of humus in the soil, which can only be remedied by ploughing in a green manure crop from time to time.

Wheat can be grown on a wide range of soil types, but as a rule silty and clayey loams, with a light clayey porous subsoil, are best suited to wheat culture. Sandy soils are not so satisfactory, as they generally lack in plant foods; again, stiff clayey soils are not suitable. Wheat is grown in almost all countries, but does best in temperate, warm, and rather dry climates. The climate, again, has an important influence on the quality of the wheat grain. There can be no doubt that most of the land at present under wheat in Queensland is eminently suitable for wheat culture, and that very large areas quite as good are still available and will be utilised later on as our population increases.

Professor Shelton, the first Principal of the Gatton Agricultural College, with his world-wide experience on wheat culture, estimated years ago the area of land in Queensland suitable for wheat at about 50,000,000 acres. In 1925-26, out of an area of 1,033,765 acres of cultivated land, only 166,000 acres were under wheat, and, in consequence, Queensland, in spite of its huge area of good agricultural land, does not produce enough breadstuff for its own requirements, and even this year's exceptionally good crop of nearly 4,000,000 bushels will leave us 2,500,000 bushels short for our own requirement for food and seed.

Although a large majority of the soils of the huge area of agricultural land in Queensland are fit for wheat culture, our climatic conditions are such that an exclusive growing of wheat, as practised extensively in South Australia and Western Australia, is not advisable here in Queensland. Experienced wheatgrowers from other States who have settled in Queensland, attracted by the good soils and promising conditions, found out that their expectations in regard to wheat were not always realised, as the variation in climatic conditions had to be provided for and their usual system of cultivation required some modifications.

There is no doubt that a possible increase of wheat culture in Queensland lies in a carefully planned system of mixed farming. Attempts of such have already been made, on the lines of combining wheatgrowing with dairying, with more or less success, but it may be safely stated that much better results can be expected by combining wheat culture with sheep breeding and lamb raising, and this system is

* This, of course, does not necessarily apply to the heavy black soils common to many districts of the Darling Downs, where shallow, thorough cultivation has proved the more dependable practice.—Ed. Q.A.J.

now gradually extending. Large numbers of sheep are already kept on many wheat farms in New South Wales, and wheat crops are frequently planted early, to be fed off two or more times by sheep before being allowed to mature. Of course, such feeding off may lower the yield of grain, unless judgment is used.

Sheep grazing on wheat lands improves the condition of the soil, and a large percentage of the food consumed is returned as fertiliser to the ground. The farmer gets a good return from the sheep, even if the wheat crop should fail. The raising of fat lambs is probably the best paying proposition for wheatgrowers, but it is necessary to have always an ample supply of food, and fodder crops must be grown in addition to wheat, and rotation of crops should be practised.

With regard to application of fertiliser to increase the wheat crop, we have to be guided largely by the experiences gained elsewhere.

In the celebrated English Experiment Station on Rothamsted tests have been carried out continuously for sixty-five years, and in a block which has been kept permanently unmanured the average yield for forty years was 14 bushels per acre, showing, however, a steady decline from year to year. Particularly remarkable are the results with continuous application of farmyard manure—14 tons per acre annually—the block yielding, as an average of thirty-two years, 33½ bushels of dressed grain. An almost equally good result was obtained with a complete artificial fertiliser, supplying every year 140 lb. of phosphate of lime, 100 lb. of potash, and 86 lb. of nitrogen in the form of ammonia salts; this plot yielding, as an average of thirty-two years, 32¾ bushels per acre.

The effects of nitrogenous manures are particularly striking, and nitrogen in the form of nitrates produced slightly more growth than when supplied in the form of ammonia salt.

As a rule, it is a well-known fact that wheat in general requires a nitrogenous manure to stimulate its growth, and that the plant is then quite able to get a sufficiency of phosphoric acid and potash. These laws apply unquestionably to wheat-growing in colder climates; but, with us, our climatic conditions modify them to some extent. Experience gained in our Sister States, Victoria and South Australia, and extending now over a good number of years, show clearly that our wheat crops require generally a small application of phosphoric acid in a water soluble form. and slight dressings with, say, 30 to 60 lb. of superphosphate per acre in the plant drills may be justified, even if the soil in itself does not appear to be deficient in phosphoric acid. The small amount of phosphoric acid appears to stimulate an early and vigorous growth of the roots of the young seedling plants, so that they are enabled to reach quickly the cooler and moister layers of subsoil.

This improvement in the root system of wheat plants grown with superphosphate application persists throughout the life of the plants, and in the mature plants roots down to 4 and more feet have been found, fully 1 foot longer than the roots of wheat plants grown on unfertilised soil.

The application of superphosphate to wheat is quite general in our principal wheat-growing States; in Victoria 97.5 per cent. of the cultivated area is fertilised, South Australia 89.4 per cent., Western Australia 98.6 per cent, and in Queensland only 6.6 per cent. of the cultivated area is fertilised, which is chiefly sugar land. Victoria used, in 1925-26, 195,000 tons of artificial fertiliser and Western Australia 130,000 tons, and the phenomenal increase of the wheat crop in Western Australia from 13,000,000 bushels in 1921 to 30,000,000 bushels in 1926-27 is chiefly due to the use of fertilisers and highly favourable climatic conditions.

A light application of nitrogenous manure, in addition to the phosphatic fertiliser, also generally increases the yields; and in soils which have been under cultivation for a long period an addition of a small quantity of sulphate of potash may also be necessary in order to get maximum yields.

Very complete field experiments, in which the Agricultural Department co-operates with farmers, were instituted years back in Victoria by Dr. Howell, and more recently similar experiments have been started in New South Wales. In New South Wales farmers' experiment plots have been established in four divisions of the State; in each division from fifteen to twenty farmers are carrying out such trials; and in most cases the experiments are made on half-acre plots. Varieties favoured by the farmers are grown side by side with varieties supplied by the Department; and a few of the trials are manured with light dressings of superphosphate, and superphosphate in combination with sulphate of potash.

The results so far showed distinctly heavier yields of the departmental varieties as compared with the farmers' varieties; and the manured plots, with very few exceptions, gave increased yields, well paying for the increased expenditure. Finally, it may be stated that heavy applications of artificial fertilisers do not pay in wheat culture.

OVERSEA MEAT MARKET PROSPECTS.

The German Market.

Interesting information in connection with a visit to Germany in September last by Mr. Ross Grant, Commonwealth Veterinary Officer attached to the High Commissioner's Office, London, for the purpose of observing the conditions ruling and the future prospect of the frozen meat industry, is contained in a report furnished to the Minister for Markets (Mr. Paterson).

The quantity of frozen meat permitted importation duty free into Germany is about 10,000 tons per month, or 120,000 tons per annum. While the general opinion in the trade is that this quantity is insufficient, and should be increased to 200,000 tons per annum, the opposition of the agricultural interests is too powerful to permit of this being done, and it is extremely unlikely, Mr. Grant considers, that the quantity will be increased above the present limit of 120,000 tons per annum, of which about one-seventh to one-sixth (15,000 to 20,000 tons) is contributed by Australia.

As to the future prospects of the trade, Mr. Grant expressed the view that there is no chance of expansion while the present restriction of imports continues, and in addition to this it may safely be assumed that there is a definite limit to price in Continental markets; in other words, if the price of frozen beef rises above 4½d. per lb. c.i.f. Hamburg or Antwerp, there is a corresponding fall in demand and consumption.

Agricultural Conditions in Northern Germany.

While in Germany, Mr. Grant visited the provinces of East Friesland, Oldenburg, and Hanover, where the fullest courtesy and assistance were extended to him by the officials.

Mr. Grant found that the black and white Friesian type of cattle is the almost universal breed in this part of Germany, and while it is, of course, a dairy breed, and efforts are mainly directed towards increased milk production, yet it also provides a considerable amount of the home-produced meat supply.

A very considerable degree of general excellence has been obtained by the establishment of Herd Book Societies throughout the country. To these societies stock raisers, both large and small, belong, and all animals must qualify by pedigree and individual performance in order to be admitted to the district herd book. Inspection and approval of animals for admission to the herd book is carried out by specially qualified officials, the majority of whom hold University degrees in agriculture. All animals are subjected to the tuberculin test twice yearly, and Mr. Grant was very much impressed by the general high standard of health of all the herds inspected.

Serradella—A Useful Catch and Green-Manuring Crop.

A point which may be of use to Australian agriculture is the wide use which is made in Germany of Serradella (*Ornithopus sativus*) as a catch crop for feeding purposes and for ploughing-in to improve the percentage of humus and nitrogen content of light, sandy soils.

This plant (Serradella) should succeed in the cooler districts of Australia, especially on sandy soils, and if found suitable to the climatic conditions of the Commonwealth may prove of considerable value in increasing fertility by the addition of organic matter and nitrogen to the poorer classes of land, as well as for feeding purposes.

Frozen Lamb.

In his report Mr. Ross Grant stated that there had been a general setback in the United Kingdom in the demand and price for plain quality frozen lamb, due to heavy supplies of this class of lamb by Scotland, the Argentine, and Australia.

Frozen Beef.

That the demand for Australian frozen beef in the United Kingdom is practically non-existent is not surprising when it is considered that for the first ten months of 1927 the importations of South American chilled beef into that country exceeded those for the corresponding period of 1926 by approximately 820,000 quarters. The total quantity of frozen beef exported to the United Kingdom by Australia during the same period of 1927 was 301,290 quarters. In the circumstances it is not a matter for wonder that frozen beef is practically forced off the market; and in addition to this the British farmer is finding the fattening of cattle an unprofitable business.

With regard to the settlement of the "Meat War" between South American firms, Mr. Grant remarks that the effects of this settlement remain to be seen. Assuming, however, that the total production of beef of chilled quality in South America is 1,750,000 head of cattle per annum, and that Great Britain is the only market for this meat—as it was in October last—then the finding of an outlet for such of this annual production as may be surplus to British requirements becomes the problem. If the surplus is frozen, then the price immediately falls to world's parity of frozen meat. Until such time as fresh markets can be found for the chilled article, or there is a reduction in the number of cattle of chilling quality produced in South America, it is difficult to see what effect the settlement of the differences among the large importing firms will produce.

Bacon and Pork.

One of the results of the embargo imposed in June, 1926, on the importation into Great Britain of fresh pork and veal from the Continent has been increased imports and lower prices for bacon in the United Kingdom. The prices ruling in October last were unremunerative, and it would not then have paid Australian farmers to export to the United Kingdom. The best Irish bacon was then realising only from 76s. to 87s., Danish 72s. to 74s., and Canadian 68s. to 72s. per cwt., with even lower prices for that from other European countries.

One very surprising feature, however, Mr. Grant states, has been the rapidity with which the shortage of fresh pork, due to the cutting off of Continental supplies, has been made up from other sources. During the few weeks preceding the date of his report, the supply of pork on Smithfield market had been more than sufficient for requirements and prices had been low. English pigs under 80 lb. weight had been worth from 6s. 4d. to 7s., and from 80 to 120 lb. 5s. to 6s. 4d. per stone.

Mr. Grant expressed the view that probably prices would improve somewhat during the winter months; but it certainly would not be profitable to forward either frozen pork or bacon from Australia while the abovementioned prices were ruling.

QUEENSLAND SHOW DATES.

The following show dates have been listed by the Queensland Chamber of Agricultural Societies for the present year:—

MARCH.	
Goombungee	23-24
Goondiwindi	21-22
Killarney	27-28
Chinchilla	27-28
Milmerran	29
APRIL.	
Pittsworth	3
Clifton	11-12
Toowoomba	16-19
Kingaroy	19-20
Dalby	26-27
Nanango	26-27
MAY.	
Beaudesert	2-5
Taroom	2
Maleny	2-3
Kalbar	2
Charleville	2-3
Wondai	3-5
Oakey	4
Mitchell	8-9
Mundubbera	9-10
Boonah	9-10
Murgon	10-12
Blackall	8-10
Roma	15-16
Gayndah	16-17
Ipswich	16-18
Springsure	16-17
Wallumbilla	22-23
Biggenden	24-25
Toogoolawah	25-26
JUNE.	
Marburg	2-4
Childers	2-6
Lowood	8-9
Bundaberg	7-9
Wowan	7-8
Miriam Vale	13-14
Gladstone	20-21
Gatton	28-29
Rockhampton	27-30
JULY.	
Mackay	3-5
Kilcoy	5-6
Esk	13-14
Townsville	10-12
Woodford	12-13
Nundah	14
Charters Towers	18-19
Caboolture	19-20
Ingham	20-21
Rosewood	20-21
Charters Towers	18-19
Laidley	25-26
AUGUST.	
Bowen	1-2
Royal National	6-11
Crow's Nest	22-23
Coorparoo	25

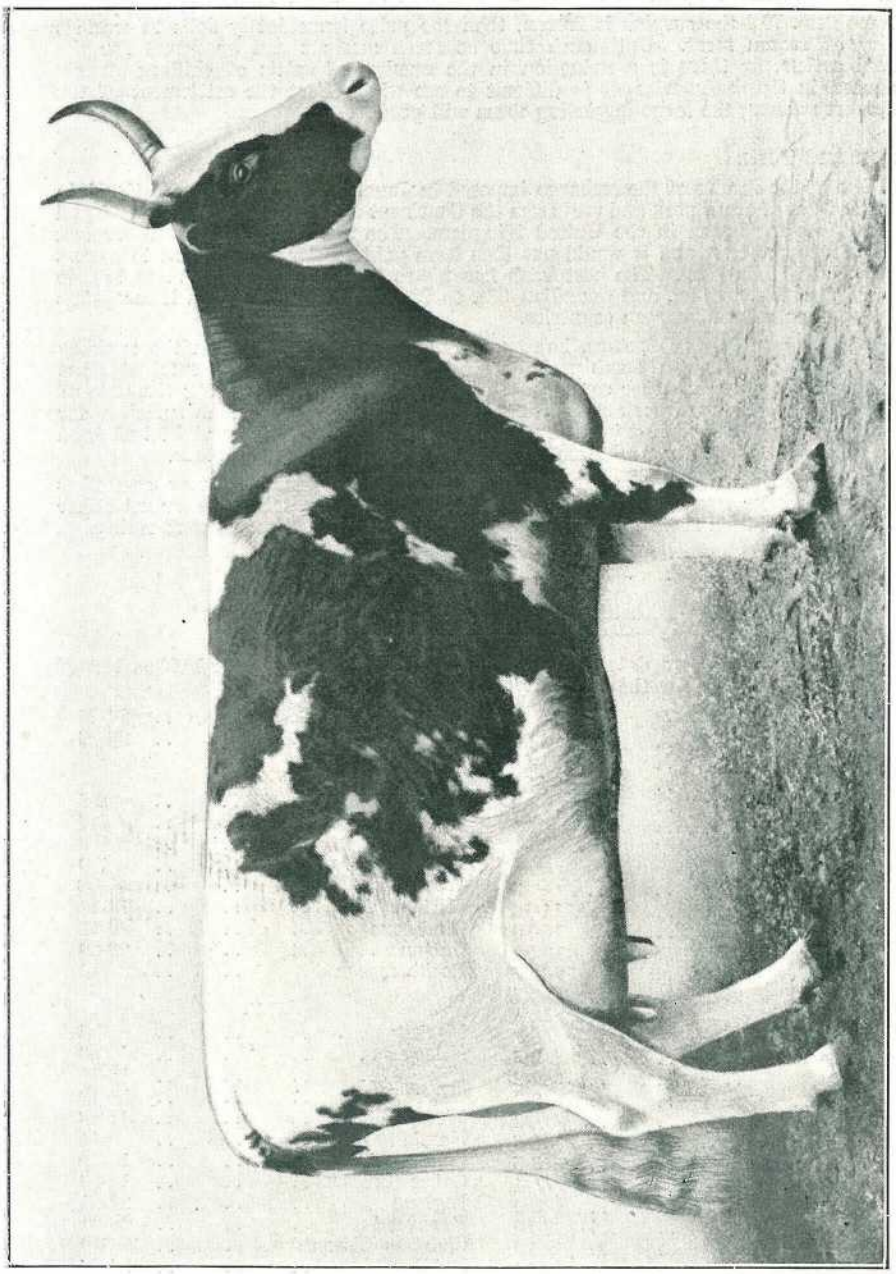


PLATE 61.—BRITISH BREEDS OF LIVESTOCK—AYRSHIRE.
Representing the type embodied in the aims of British breeders. (Reproduced from "Farming," an English publication.)

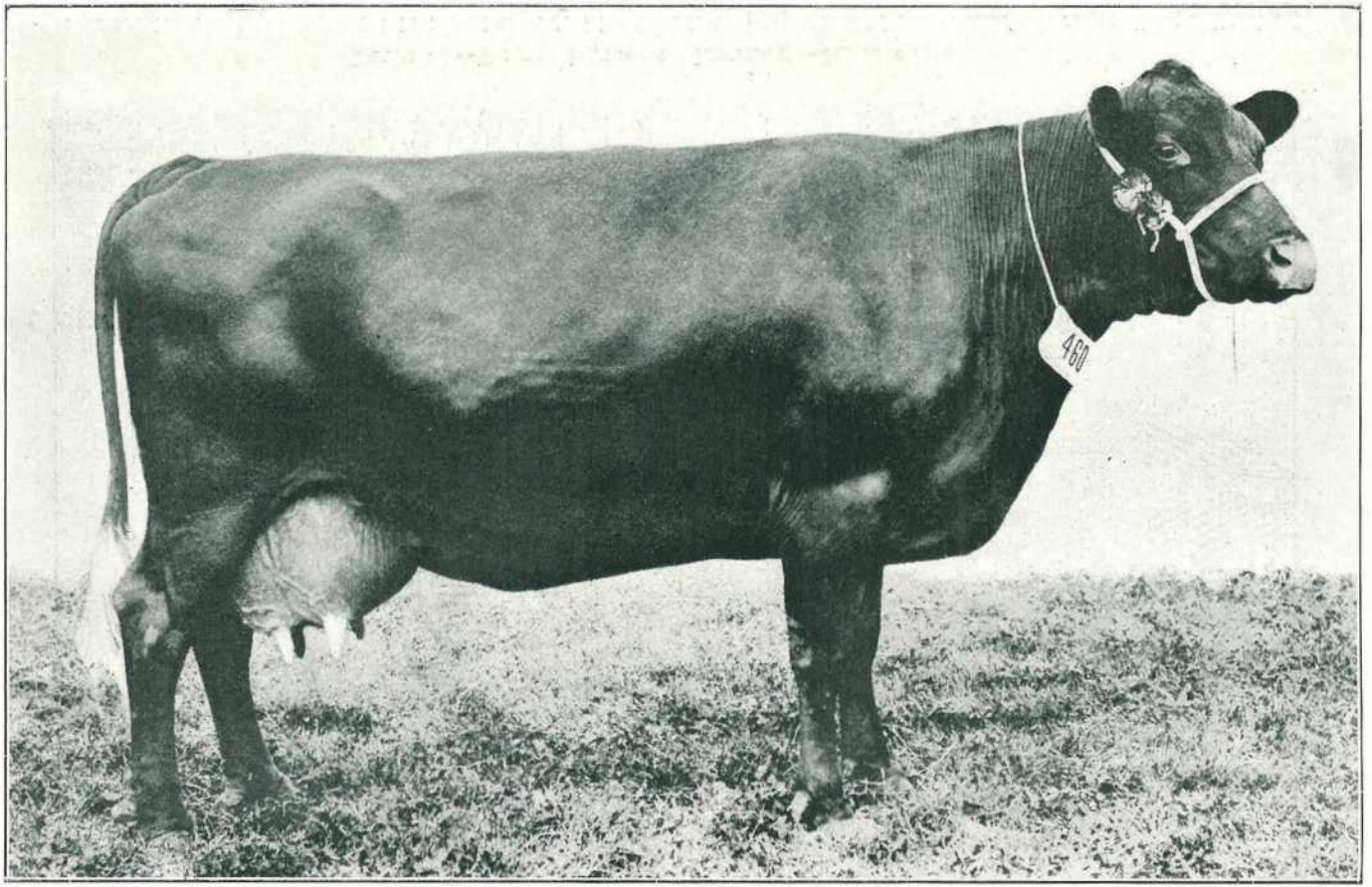


Plate 62.—British Breeds of Livestock—Red Poll Cow.
Representing the type embodied in the aims of British Breeders. (Reproduced from "Farming," an English publication.)

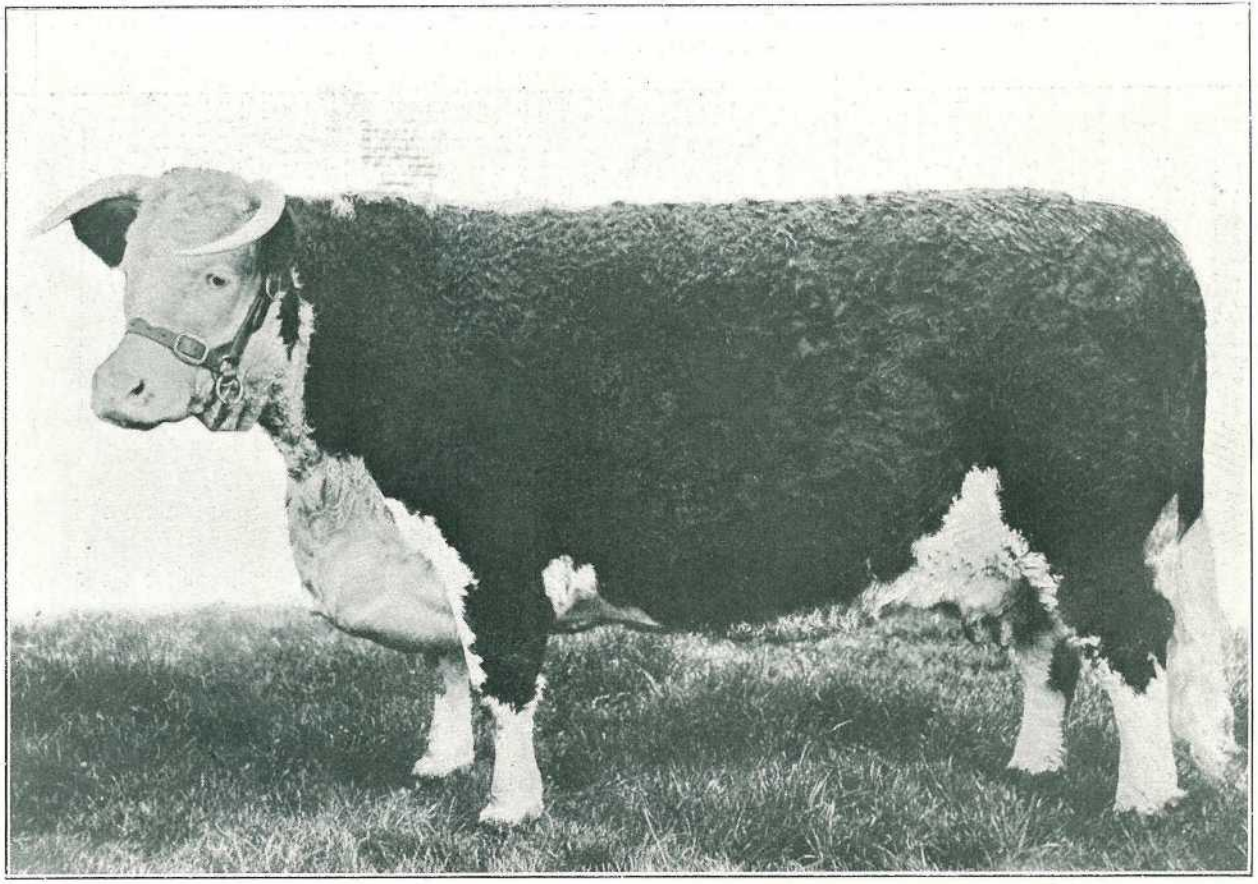


PLATE 63.—BRITISH BREEDS OF LIVESTOCK—HEREFORD COW.

Representing the type embodied in the aims of British Breeders. (Reproduced from "Farming" an English publication.)

PLATE 64.—BRITISH BREEDS OF LIVESTOCK—LINCOLN RED COW.

Representing the type embodied in the aims of British breeders. (Reproduced from "Farming," an English publication.)

THE ANCIENT AND MODERN SHORTHORN.

AN INTERESTING COMPARISON.

Mr. J. L. Wilson, of Calliope, near Gladstone, has courteously supplied us with the following figures giving comparative measurements of typical specimens of the ancient and modern Shorthorn. They were originally given to him by Mr. Duthie Webster, of Collynie, probably the leading stud Shorthorn breeder of Scotland.

The photo shows "King William," 173110, the present stock bull at Collynie. He is a red roan, calved 13th November, 1921, bred by Duthie Webster, sire Balcairn White Eagle 153591; dam Eliza Lass, by Masterstroke 126820. King William was measured at Collynie in 1927, but his weight is unknown. His dam is the fine breeding red cow, dam of so many famous sires. His breeding is well represented in Messrs. Wilson and McDoual's herd on Calliope, Queensland.

"Billy," 3151, light roan, calved 12th January, 1837, was bred by Captain Barclay, sire Monarch 4495, dam Red Ears. "Billy" weighed 25 cwt. when exhibited at the Highland Show in Aberdeen in July, 1840, when the following measurements were made.

It will be noted how marked has been the improvement made as regards the highest price cuts of beef:—

DIMENSIONS.

	Bull Billy.		King William.	
	Ft.	In.	Ft.	In.
1. From crown of head to top of shoulder	3	0	2	5
2. From top of shoulder to a point in the back in a line between the hook bones	3	2	3	6
3. From that point to tail head	1	11	1	8
4. Total length from crown of head to tail head	8	1	7	7
5. Length of tail, exclusive of tuft	2	7	2	7
6. Length of face from crown of head to point of nose	1	11	1	11
7. From a point in a line between the eyes to point of nose	1	2	1	1
8. Length of ear	0	8	0	9
9. Breadth of head between the ears	1	1	1	2
10. Breadth of face in a line across the eyes	0	10	1	2
11. Breadth across the hook bones	2	4	2	4
12. Breadth across the shoulders	1	4	1	4
13. Girth of muzzle	1	11	2	0
14. Girth of neck at onset of head	4	0	4	1
15. Girth behind the shoulders	8	4	8	8
16. Height from ground to fore elbow	1	3	1	2
17. From fore elbow to top of shoulders	3	10	4	1
18. Height of back at hooks from ground	4	11	4	9
19. Height of hind hook from ground	1	8	1	7
20. Depth from hook bone to bottom of flank	2	5	2	9
21. Depth between bottom of brisket and fore knee	0	3	0	1
22. Distance between the two hind feet when standing	0	10	1	2
23. Distance between the two fore feet when standing	1	0	1	3
24. Girth of bone below the knee	0	9	0	10
25. Girth before the hooks	8	6	9	1
26. Length from point of shoulder to hip	5	11	6	2
27. Length of quarter diagonally from hook bone to hip point	2	2	2	6
28. Girth of shank	1	10	2	3
29. Girth of forearm	1	8	1	11
30. Height from ground to bottom of flank	2	3	2	3
31. From ground to bottom of dewlap	1	6	1	1

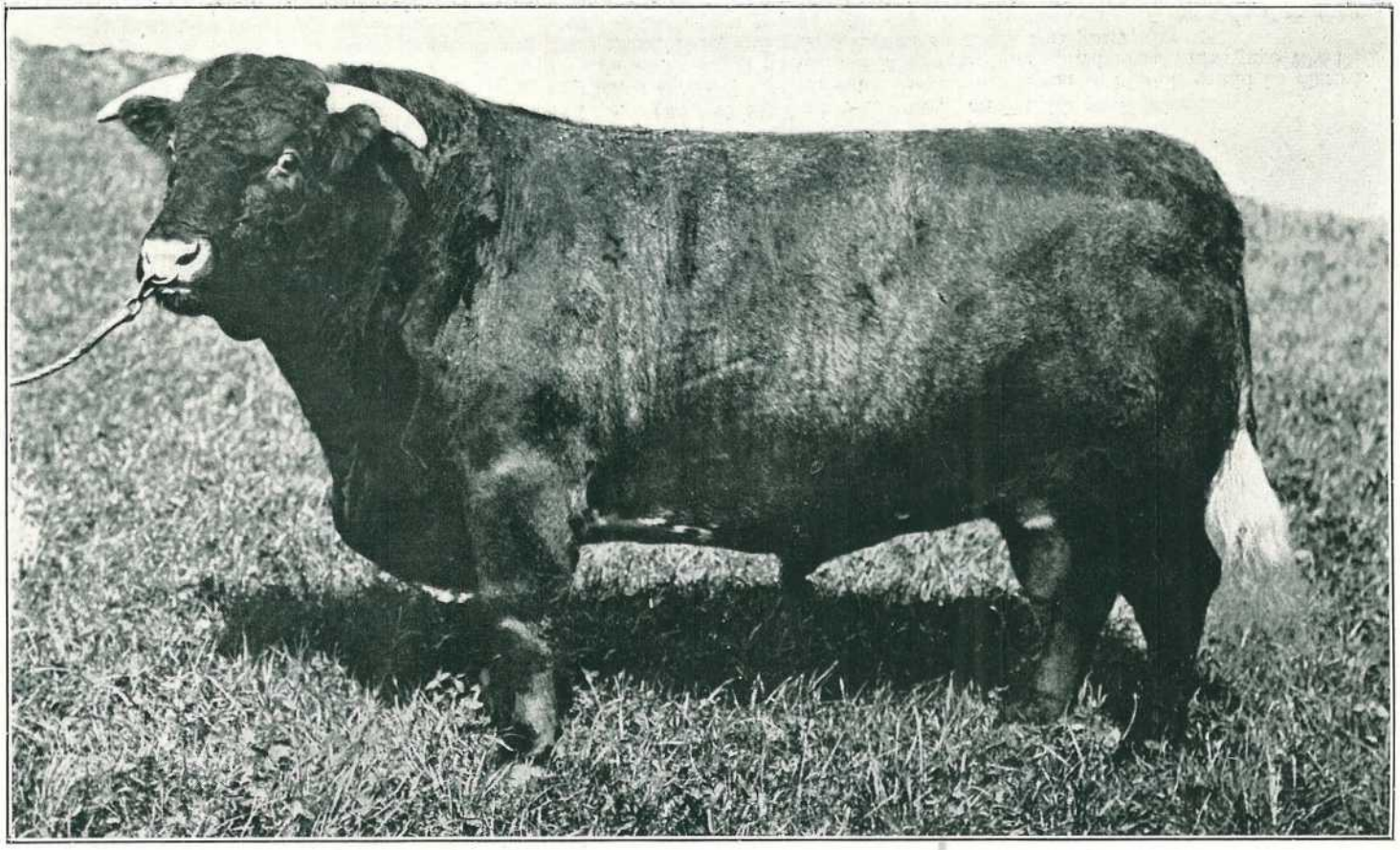


Photo. by courtesy of Mr. J. L. Wilson, Calliope.]

PLATE 65.—STUD SHORTHORN BULL "KING WILLIAM" (173110). BRED AND OWNED BY DUTHIE WEBSTER, COLLYNIE, SCOTLAND.

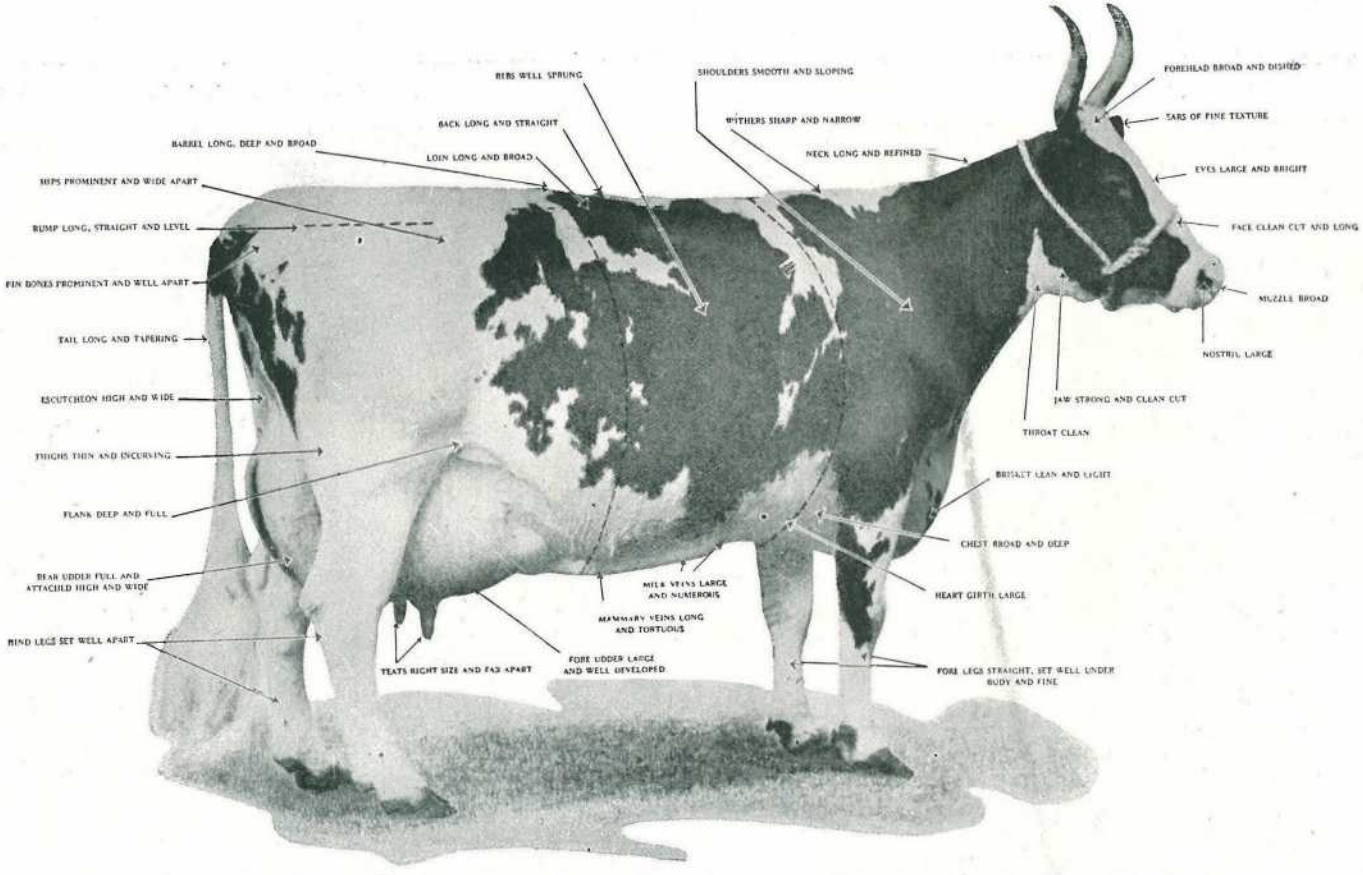


PLATE 66.—HOW TO JUDGE A DAIRY COW. (Reproduced from "Farming," an English publication.)

The above is an illustration of the points of an ideal dairy cow. As no dairy cow ever reaches the ideal it would be absurd to suggest that this cow is ideal, but she is not very far off. She is "Millantae Mayflower," the Ayrshire cow which gave 79·4 lb. of milk per day and won the Gold Medal at the Dairy Show, 1925, and gained further successes this year.

It is difficult to explain the various points verbally alone, and it is only with the help of a diagram such as this that they can really be made clear. Such expressions as "well-sprung ribs" have little meaning without a picture before one. We hope, therefore, that our diagram will be a help to our readers in obtaining a more exact idea of the points of the ideal dairy cow.

PLANT PROPAGATION.

By GEORGE WILLIAMS, Director of Fruit Culture.

Among cultivated plants, more particularly those prized for their fruit or flowers, other means than raising from seeds are employed so that an exact counterpart of the parent may be reproduced. Various methods are employed—layering, cuttings, divisions, but principally budding and grafting. The general tendency amongst plants which have been improved by cultivation and selection, particularly with hardwooded varieties, is reversion towards the original, but by adopting the usual available means improved features can be definitely perpetuated. This is particularly applicable to fruit trees, some of which produce a very limited number of seeds, whilst others are entirely seedless.

Among flowering plants the rose takes precedence, and it is invariably found that amongst the few new varieties catalogued each year that but a very small percentage show the least improvement on those previously existing, while the majority are inferior.

STOCKS.

In raising a supply of worked plants, the propagation of stocks is the first consideration. As applied to fruit trees, these are almost invariably raised from seeds of hardy kinds of the particular variety required. Exceptions are noted in grape vines and apples, though, so far as this State is concerned, it should also be rigidly applied to the latter. With roses, cuttings of various rampant growers which strike readily are utilised, attention being given almost entirely to a variety erroneously called Manetti.

The selection of stocks and their influence upon the graft or bud growth offers an extensive field for investigation. The influence of such growth upon the stock is an important aspect which has received very little consideration. It is also recognised that the influences of different soils affect very materially the development of trees and plants, and that better results may be obtained in particular soils by trees worked upon particular stocks suited to the immediate local conditions. Stocks for citrus trees has been a contentious subject for many years, various advocates favouring orange seedlings for orange and mandarin, others preferring rough lemon, sour orange, or shaddock, each advocate basing his opinion on experience, omitting, through lack of opportunity or the faculty of observation, to note results on different soils and under varied conditions. The analogy of cells between stock and scion is the basis upon which successful budding or grafting is effected and a permanent union assured. The apple and pear may coalesce for a time, but as the union is imperfect the graft will succumb within a short time. The pear on a quince stock will make further headway, but a very stunted tree will result, and usually amongst ligneous trees the diameter of the stock eventually much exceeds that of the graft, an order which can be reversed by working a vigorous grower upon a weak stock. A lemon on a seedling thorny mandarin affords a typical specimen; the cherrimoyer on sweet sop may also be cited. A dwarf peach worked on a common seedling affords the most striking influence of the scion upon the stock. The bud makes little more headway in inches than would be in feet if a bud from an ordinary type of peach had been substituted. Much has been written of bud selection; the occasion for which is obvious and the selection is a simple matter, but discrimination in stock selection has received little attention, though much is warranted.

Seedling Stocks.

In raising seedling stocks for fruit trees the first consideration is that seeds should be selected from matured fruit produced on hardy and reasonably vigorous trees, free from indications of disease and, in the case of evergreens, planted in seed-beds as early after taking from the fruit as can be managed. The resultant plants should be allowed upwards of twelve months in which to develop before planting in nursery rows. With stone fruits the seeds should be buried in slightly moist sand until the following spring, when they may be either planted direct in nursery rows or in a seed-bed and allowed to make a season's growth. Seeds of the custard apple are usually kept dry until spring and then planted; from the better quality fruits a high percentage of seeds are infertile. In growing cuttings for rose stocks hard wood is selected, and with a little shading during midsummer cuttings may be struck at any period of the year, provided the wood is sufficiently hardened. The selected canes are cut into lengths of about 12 inches, the lower leaves (if present) and thorns being removed by drawing through the hand containing a piece of coarse hessian or other suitable material; all buds (or eyes) with the exception of two or three at the top of the cutting are then cut clean out from their bases. If buds are completely removed no suckers will follow, but where partially removed growth will

sooner or later make its appearance. The cuttings are then planted in position where to be budded, or very closely in a small bed to be transplanted after having made a growth into such a position. The depth to which the case of cuttings would be inserted in the soil would average 5 to 6 inches. The advantage in transplanting stocks after having become rooted is that their bases can be placed much nearer the surface, and the object in removing buds to within a short distance of their tops is that a clear stem is available for budding operation.

Budding.

Grafting is now seldom practised, and to the average propagator budding will meet all requirements. Several important features must be considered in connection with this operation, the principal being that the stock is vigorous and both it and the budwood are in a suitable stage; generally the younger the stock, within reasonable limits, the less chance of failure. As trees become older their bark thickens and their growth is made at seasonable intervals, whilst in earlier stages growth is fairly regular. On this account, deciduous trees offer the widest facilities, the growth being practically constant throughout the warmer months, and budding may be performed throughout the summer without fear of failure. Citrus stocks may be treated in early spring or autumn (for various reasons the latter is usually selected by nurserymen). Midsummer budding is also practised when weather conditions and growth are favourable. Roses may be budded at almost any time, though the heat of midsummer is often responsible for failures. Buds inserted just prior to or during the early ascent of sap have, if evenly cut and properly placed and fastened, every chance of success. During its ascent the sap traverses beneath the bark, depositing additions to the cambium layer, and it is only whilst this is in progress than an increase of the diameter of the plant is being effected. In its descent the sap flows through the previous layer (sap wood) converting this into hard wood, and, though the bark may be most readily detached from its base, there is no possibility of a union being effected during this process. The sap must be either down or in the early stages of rising. If superficial observation is insufficient, the actual position may be disclosed by raising a piece of bark and noting whether the exposed wood shows a decided green tinge; if a yellow tinge is disclosed it may be assumed that the time is not opportune. This applies not only to nursery plants but also to trees which have been headed back in the orchard for reworking.

Selection of Budwood.

The selection of budwood in deciduous trees is confined to the current year's growth, and will be gauged partly by the size of the stocks but mainly upon condition or stage of development. The bases only of suitable shoots can be used, and on no account should the softer parts extending towards terminals be used. The question of inserting the bud as cut from the stock or first removing the thin layer of wood cut with it may be a debatable one, but with deciduous trees as generally understood the removal of the wood layer is considered advisable, using what is known as a bark bud. In selecting budwood for citrus, the terminal growth is invariably omitted. Successive growths are determinable for some time by their markings, a joint apparently existing where each terminated. Soft, ill-formed shoots are discarded. Good, sound wood with prominent buds (in some varieties the prominence is less noticeable than in others) of the right size is selected. The diameter of the bud sticks may vary from three-sixteenths to a-quarter of an inch or even more, according to the variety and also the size of the stocks.

Budding Roses.

In budding roses, if fairly hard wood is used there is no occasion to remove the wood, but in some varieties it is almost indispensable to use half-matured shoots which have flowered (those with soft terminals are generally unsatisfactory), when the bark bud is much preferable. With citrus the removal from the cut bud of its layer of wood is rarely possible and in effect distinctly disadvantageous. In using wood buds, the occasion for maintaining a particularly keen edge on the knife blade is more pronounced. A thin blade of the best steel should be specially kept for the purpose. The average budding knife is almost superfluous. The material is seldom of the highest quality, and the blade, particularly in the hands of an amateur, too wide to ensure the necessary curve effected in starting and finishing the cut. The bud should be completely removed with one drawn cut, the heel of the knife being held at an angle of upwards of 45 degrees towards the operator. A highly tempered blade 2 inches or slightly less in length by ¾ inch in width, thinly ground and finished on a fine oilstone, will reasonably meet requirements on ordinary stock. For heavy stocks the reverse end of a budding knife is useful in dislodging the bark and assisting in the insertion of the bud. A detached bone substitute can readily be

made if required. Where a large number of stocks are to be handled, the addition of an extra knife is an encumbrance, but its use for incising the bark of the stock, which carries small sand and earth particles, is recommended.

The pressure of the thumb against the bud, the lower end of which is inserted by raising the bark of the stock (which has previously been cut transversely and perpendicularly, forming a letter T) alternately on either side by pressure of the knife blade without its being in actual contact with the cambium, is generally sufficient to allow its being forced into position. Where a bark bud is used, it is customary to allow that part from about a-quarter to one-third of an inch above the "eye" to protrude and this cut off evenly at the transverse section of the T. Where a wood bud is used, it must be pushed well down until its upper extremity just reaches the actual position of the cross cut and not allowed to protrude. Tying is most satisfactorily managed with slightly damp rafia, commencing from the base of the inserted bud and working upwards, so that no air cavities are allowed to remain. Under a dry atmosphere in warm weather some advantage is derived from waxing over the tie completely with heated parawax. The tie is removed in from two to two and a-half weeks, by which time a junction is effected. The heading back of the stock should be effected when it is in a dormant stage; attempting it during a growing period will generally result in destroying the plants.

LEGISLATION REGULATING THE SALE OF SEEDS FOR PLANTING OR SOWING.

By F. F. COLEMAN, Officer in Charge, Seeds, Stock, Food, and Fertiliser Investigation Branch.

Definition of Vendor.

A vendor under the Pure Seeds Acts is any person who sells or offers or exposes for sale or contracts or agrees to sell or deliver any seeds.

Invoice to be Given by Vendor.

The Acts require that on the sale of any such seed of not less than 1s. in value, the vendor shall at the time of the sale give to the buyer, or, if the buyer is not present at the time of sale, forward to him an invoice containing the statements required by the Acts.

The wording of the invoice should be to the following effect:—

> "The seeds mentioned in this invoice are for planting or sowing. Such seeds are of the kind or kinds specified, and contain no greater proportion or amount of foreign ingredients than is prescribed with respect to such seeds."

Seeds Sold in Made-up Packets to have Year of Growing Marked.

In the case of seeds in pictorial or other made-up packets, the year in which such seeds were grown must be clearly and indelibly marked upon the outside of each packet.

Definition of Foreign Ingredients.

"Foreign ingredients" shall include inert matter, seeds of weeds, and seeds of any kind other than the seeds in question; or dead, diseased, insect infested, non-germinable, or hard seeds.

"Inert matter"—Broken seeds less in size than one-half of a complete seed; or chaff, dust, stones, or any material other than seeds.

"Hard seeds"—Any seeds whose seed coats are so impervious to water as to delay germination.

Prohibited Seeds.

The following seeds are totally prohibited:—Seeds of *Cuscuta* spp. (Dodder), *Datura* spp. (Thorn Apple), *Ricinus communis* (Castor Oil plant), and diseased or insect infested seeds.

The Amount of Foreign Ingredients Allowed.

The amount of foreign ingredients allowed in the various kinds of seeds are set out in the Regulations, a copy of which can be obtained on application to the Department of Agriculture, Brisbane.

Efficient Seed-cleaning Machinery.

The Regulations do not apply to—

Seeds sold by the actual grower direct to any vendor in possession of one or more efficient cleaning machines, for the purpose of the seeds being cleaned and graded before being offered for sale as seed for sowing.

Samples from Bulk in Sender's Possession.

The Regulations provide for the examination of samples at the Seed Laboratory, Brisbane, the cost being the nominal one of 2s. 6d. for each Certificate of Analysis. When sending such samples, it is of the utmost importance that they be drawn by the sender from seeds in his actual possession, care being taken to make them truly representative of the bulk. The weight of each sample and marking should be as hereunder set out:—

Weight of Samples.

PRESCRIBED WEIGHT OF SAMPLES.

Kind of Seed.	Weight Required.
Barley, Beans, Cowpeas, Maize, Oats, Peas, Rice, Rye, Tares, Wheat ..	8 oz.
Canary, French Millet, Japanese Millet, Linseed, Lucerne, Prairie Grass, *Setaria Italica* (Foxtail Millet), *Sorghum Sudanense* (Sudan Grass), Sorghum, White Panicum	4 oz.
Couch, Paspalum, Rhodes	2 oz.
Beet, Cabbage, Carrot, Onion, Parsnip, Radish, Tomato, Turnip, and Vegetable Seeds of like size	½ oz.
Vegetable Seeds in Made-up Packets.	3 packets.
Agricultural and Vegetable Seeds other than those indicated above ..	2 oz.

In the case of seeds containing weed seeds or other foreign ingredients, double the weight above mentioned should be sent.

Marking of Samples.

All samples must be plainly written on in ink, giving the following particulars:—

(1) Kind of seed;
(2) Quantity the sample represents;
(3) Marks on bags or growers' name;
(4) Name and address of sender.

Fee of 2s. 6d.

Each sample, with a covering letter enclosing the prescribed fee of 2s. 6d., should be addressed to the Under Secretary, Department of Agriculture, Brisbane.

Certificates.

Unless the sender is careful to forward a truly representative sample, the certificate is valueless. Under no circumstances is it a guarantee by the Department of Agriculture as to the bulk, but a statement as to the condition of the sample at the time when such sample was examined.

Complaints.

In case of any complaint regarding purity or germination the buyer should at once send a sample of the seed together with the name and address of the person from whom the goods were purchased, together with a covering letter to the Department advising of the despatch of the sample.

Examine Goods on the Day of Delivery.

It cannot be too widely known that the Seed Laboratory at Brisbane examines, free of charge, all samples representing seeds that farmers have purchased for their own sowing. Both buyers and sellers are urged to examine all goods on the day of delivery, and when in doubt regarding any seeds, fertilisers, pest destroyers, or stock foods, to write at once to the Department of Agriculture, Brisbane, in order that the matter may be at once investigated.

HOUSING THE PIG.

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

To be attractive and profitable, pig raising must be carried out on correct lines by people who are interested and efficient at their job, and who are prepared to provide a maximum of comfort for the animals they keep, and in this and other directions aim at keeping costs of production down to a minimum at all seasons of the year.

Climatic conditions in this State, even if they are at times somewhat unreliable and annoying, certainly favour the open-air system of stock raising such as is and has been advocated by us in our educational propaganda among those of the farming community engaged in this branch of agriculture. The open-air system of pig keeping is, however, only profitable provided sufficient and suitable paddock and pen accommodation be arranged for, so that while having plenty of fresh air and sunshine, the pigs may also have ample exercise, clean, fresh succulent pasture, and a liberal water supply.

There is no reason why the pig-sty buildings should be of an expensive or elaborate nature, though the more convenient and substantial they are the better it will be and the longer they will last.

It is far more profitable to spend money on pig fencing and the provision of suitable grazing areas (pig paddocks) than it is to spend it on elaborate sties (in the absence of paddocks), and it is far wiser to spend money in an endeavour to keep the pigs out in the open as much as is possible (consistent with keeping them warm, dry, well fed, and comfortable), than it is to attempt to coop them up in small, poky, ill-lighted pens, even if these are substantial well-built structures.

The pig is, by nature, a grazing animal, his natural habitat is in the forest adjacent to areas of swampy, well-grassed country over which he roamed and rooted by day, returning at nightfall to the higher and drier forest country from which he secured that portion of his food supply consisting of nuts, berries, fruits, and the like. To such an animal, life in a small, poky, ill-lighted, and badly ventilated enclosure is by no means a natural existence, nor can it be expected that under such conditions best results would accrue from a money-making point of view; hence, the objective is, as far as is possible, to provide the pig with conditions approaching his natural habitat whilst still being in domestication and subject to control.

After all, we keep pigs only for the purpose of profit making; anything, therefore, that will tend to enhance the profits and make the business a more payable one is certainly worthy of consideration.

The writer has discussed these matters with farmers in many parts of Australia, and has written articles on the subject matter on many occasions, and is constantly stressing the necessity of the provision of suitable accommodation.

We have, of course, met many farmers whose finances would not allow of the provision of other than very limited accommodation for their pigs, but where good, roomy pig paddocks and sties have been possible and have been arranged for, satisfactory results have been reported; nor have we yet met the farmer who has spent money in this direction who would go back to the days when his pigs were closely confined in a limited area and had not the benefit of grazing and succulent herbage. The supply of mineral matters obtainable where pigs roam over succulent pastures (and which should be supplied if the pigs are penned up) and the increased benefits resultant from exercise in the sunshine, all favour the health and well-being of the animal, and enable him to hunt up portion of his living in a perfectly natural way. Of course, it must not be forgotten that exercise and sunshine in the absence of sufficient nutritious food and good drinking water would not tend to best results, nor is there any great advantage in turning stock out on to bare, hungry ridges and foresty country on which little other than blady grass and bracken ferns grow.

Pigs must have good and abundant supplies of food and water if they are to prove as profitable as they ought to be. It is for this reason that pig-raising is scarcely a profitable undertaking away out in the western country where the sheep farmer holds sway, or where cattle-raising is the principal line of industry. This western country is naturally suited to sheep and cattle, but is quite unsuited to the pig, hence pig-raising as an industry is usually confined to dairying and mixed farming districts, which, in most instances, are situated nearer to the coastal range and to the strips of country adjacent to the seaboard.

No matter where it is attempted, pig raising must be carried out on correct lines, and in any system of pig farming, housing, and accommodation is a big and important item.

The accommodation of pigs whilst on exhibition at agricultural shows and whilst in transit to and from these places is also an important matter; while on their journeys to the pig sales or to the bacon factory or pork butcher's slaughtering establishment the pigs must be temporarily housed in convenient, clean, and roomy railway wagons or other vehicles.

While at the sales or while resting at the factories awaiting slaughter their accommodation is an item not to be overlooked, for unless they are placed before the buyers or reach the slaughterman and the bacon curer in the very best of condition, good results cannot be expected.

Housing and accommodation, therefore, covers a wide range and includes not only pig pens and sties, but also suitable fencing, paddocks, shelter sheds, &c.

Concrete Feeding Floors and Troughs.

Visiting a large suburban piggery recently, the writer drew the attention of the owner to the necessity of constructing a concrete feeding floor on which to feed the pigs that were not kept in sties and that were fed from troughs scattered here and there through the yards. It had rained during the morning of the visit, and the mud was ankle deep in the yard where the pigs were about to be fed. As it happened it was the midday feed (a sort of light sandwich luncheon), and consisted largely of green stuff, cabbage, cauliflower, and lettuce leaves, carrot and parsnip tops, a few potato peelings, &c. The farmer simply walked about the yard emptying the contents of the pig tin on the ground on top of at least three inches of mud, and in the mad scramble that followed as soon as the sows heard the dinner bell, there were soon no green stuffs to be seen; what had not been devoured had been trampled in the mud, and of course the hungry ones were ploughing their noses through the slush and slime in search of some remnants of the midday lunch.

To say that the system was filthy and disgusting did not seem to worry our friend, for he was content to let the sows take their chance; if they survived they were "good 'uns"; if they failed to make good on the menu, well, they were simply thrown out as unprofitable, and some other poor creature got the job.

Now all this filth and stench can be avoided, and it is guaranteed that a concrete feeding floor will pay for itself in a month, and the pigs will benefit in a hundred different ways. There is not only greater gain in weight if the pigs feed on a floor where the food cannot be lost, and where accumulation of filth can easily be prevented, but there is less loss of good food, and a greater profit from that which is consumed. We must also consider sanitation if we expect our pigs to be healthy. Concrete floors are hard, easy to clean, and can be flushed or hosed over in a few minutes after use; a bucket of disinfectant sprayed or thrown across the floor will keep it clean for next feed. The labour of feeding and keeping the yards in order is also considerably reduced, and this is a proposition that must be faced.

The size of the floor will, of course, depend on the number of pigs to be fed, hence no standard size can be recommended. In shape, the floor may be oblong or square. The latter is preferable. Make it big enough to accommodate about thirty sows or fewer than this if need be. Use a 1-2-3 or a 1-2-4 mixture in making the concrete, and in thickness have the floor laid on a good solid foundation, allowing a clear 4 inches of concrete for the floor. The sides should be protected and this is best done by excavating the soil for a depth of, say, 8 inches all round, and about 4 inches wide, and making a shallow foundation and protecting wall all round; this might be levelled off on the surface or formed into a shallow half-round drain. The object of this outside wall is to prevent the pigs from rooting under the floor and heaving it up, as they are liable to if it is left unprotected. The floor should have a fall from the centre to the outside of, say, half an inch per foot. The gutter round the outside could be connected with a drain to carry away the washings and thus enable the whole to be kept clean. If the yards are large enough it is an advantage to fence the feeding floor off; the food can then be scattered over the floor and be all ready for the pigs when the gate is opened, and the meal begins. These concrete feeding floors are a necessity on every pig farm, and their cost is a mere detail when compared with the advantages they offer.

THE CULT OF THE COLT.

By "U 9 L."*

The First Handling.

If you'll take it for granted the youngster is in the yard waiting to be caught, and if you'll also bear with me for a minute or two, I'd like to deliver a little homily on the mental complex of equine psychology.

You'll understand that all horses have an inherent fear of man. Up to the age of about ten days that fear doesn't manifest itself in any way at all. In fact, a youngster of that age would as soon follow a moving man as its mother, and with all the confidence in the world will approach him and nuzzle him. When the little thing's brain begins to function then the instinct handed down by ten thousand times ten thousand generations asserts itself and it looks on man, if not as an enemy, at least as something to be avoided.

At that baby age, if the thing is taken in hand, it may be trained in the ways of man and never learn fear of him. But these youngsters which we are to handle haven't been reared in a creche or trained in a kindergarten. We're starting off scratch with them. In fact, we're commencing from several bits behind scratch. All those youngsters know of man is the inherent fear of him which is theirs, and their experience amounts to painful episodes associated with him. He it is who has inflicted the pain of the knife and the searing brand, and to him may be attributed the unpleasant process of weaning. The colt's mind is a virgin page on which we write his destiny, but as a preface to that volume there are a couple of pages limned with dark blots against us.

Also, and I may be wrong in this, I have an idea when breaking in that it's advisable to cram the colt with as many experiences as you may possibly inflict upon him. When he's meeting new ideas his brain opens, as it were, and it's receptive. It's then out to assimilate new notions, and though the impressions we write on that blank record may not be deep, they're indelible. For instance, though the youngster may never be needed for the buggy, if you put a pair of winkers on him and drive him round during his breaking process he'll never forget that experience. While he's being trained is the time to accustom him to the whip, to a water-bag round his neck, and to a dozen other items. An impression formed while the colt's brain is absorbing experience lasts longer, making a deeper impression in less time than the same lessons repeated a dozen times at later periods in his life when he's set and accustomed to a definite routine of work. I have finished, even though I may have expressed myself imperfectly, and that is my belief.

In the Round Yard.

Our colt is waiting for us in the round yard, and we go to him. If we have a good old breaking-in horse it may make our work easier. But though breaking-in horses may be plentiful, good old ones are so rare that we might as well dispense with the idea. In any case, though the breaking-in horse will shoulder the youngster over and perhaps hold him on the fence while we lean over and handle him, the thing has to be accustomed to us on our own some time, and he may as well begin his lesson now. The only good I could ever see in that traitor to his breed which is known as the breaking-in horse is that it gives confidence. It makes the youngster feel that things aren't too bad when there's another old stager in the yard with it, and it feels a greater reliance and less fearful of man. That, certainly, is a big thing, but it's not everything. Let's gird up our loins, shed the extra sweat which the old coacher would save us, knowing that the added work on the colt will bear its own interest and complete a better job.

Roping-pole, lassoo, or will we catch him with a stick, which? We'll use a stick and then the lassoo. As the colt runs the circle of the round yard you'll stand in the middle of it, facing him all the time as he swings round, and gradually accustom him to your presence. In your hand you've a light stick of the necessary length. The round yard, by the way, should be 21 feet in diameter. When the colt slackens his trotting round—you're talking to him the whole time, of course—you'll reach out with the stick and rest it lightly on him. It doesn't matter where—wither, back, rump, or arch of the neck. It's all the same. As soon as that stick touches him he's off for the lick of his life again, snorting madly and with perhaps an excited plunge and a wild kick as he starts.

Steady, the boy. Steady, there, the old man. Whoa, the boy, w-h-o-a. It's right, old fellow, the stick isn't going to hurt you. See, here, I'll run it right along your back, up along the crest of your neck a bit—that makes you prick your ears, eh!—and then let it slide over your rump. Whoa, the boy. Steady, the little beauty.

* In "The Pastoral Review" for February.

In less than no time at all the colt is used to that stick playing over him, and though he mightn't regard it as harmless, he's got an idea that it doesn't bite without provocation. After a bit, and a very short bit at that, he'll stand still at one spot in the yard while the stick advances to him. He'll shiver just a trifle when it touches him, and perhaps he'll make as though to bound. But he gets used to it, and then he'll permit the thing to rub him all over. By the way, you'll notice, particularly if you've a youngster with any character, that it will select one spot in the yard where it prefers to suffer advances more than at any other place, and if a man's the brains of a black ant he'll take advantage of that knowledge and only attempt to catch the colt there. It saves time, labour, and possible injury to the youngster.

The Laying on of Hands.

After you've reached the stage of being very familiar with the stick, and when the colt has advanced in his education almost to the extent of ignoring it, is the time to think of the laying on of hands. Some people, and some very good breakers at that, too, work along the stick hand over hand, getting nearer and nearer, till they may rub the colt with their hands. It seems a good idea, and it has the advantage of not breaking down the little confidence which you've already built in the animal since it came to the yard. But I never did fancy that idea. You see, it's possible to teach the thing very bad manners in that way. And of all bad manners in a horse which I detest, I especially abhor that of a horse which pulls away just as I'm about to slip the bridle on him. See? We'll use the rope on this fellow. That might startle him a bit when first it sneaks round his neck, but he'll get used to it in less than no time. Anyway, apart from everything else, this colt has to learn that there's a heap of wonderful experiences coming to him, and one more in a multitude doesn't matter much.

We sling the loop of the lassoo over the colt's head and encircle his neck. If we miss our throw a couple of times it really doesn't matter. Of course, we all like to do clean work and capture our objective first time. But we're not all perfect. If we do achieve our purpose, it's so much the better, and if we don't, the mere fact of the rope sliding over him and round him helps to add to the colt's education. Then, with that rope in our hands, when we make our friendly approaches we've something which will aid us to make the colt face towards us and pay attention.

Let me digress a moment, will you, and point out that the human hand, and specially the palm of it, is a wonderful bit of work from a telepathic point of view? With it a man may convey messages in an abstract way, and certainly, though the colt hasn't the least doubt about a man's presence in the yard with him, when that man first lays the palm of his hand on that colt's shoulder or neck in a caressing touch, then does the colt realise positively a man is there and what his intentions are. While the man is rubbing with the back of his hand the colt will suffer that attention, but as soon as the full palm embraces him he's off. That's where the rope comes to our assistance. We snig him round with a run, make him face us, and with our hand extended while we croon lovingly to him we come again. Almost fearfully the youngster extends his nostrils and, sniffing mightily, tastes of the aroma of that hand advanced in friendship.

When He Smells.

When he smells it he may do one of several things. Timidly, shivering with apprehension, he may suffer our further approach. This fellow we take gently, treading gingerly and consolidating every inch of our advance before going further, and with all that in us is we try to make that colt know our intentions are friendly and that, really, there's no need to be afraid. Another joker might take one sniff, proclaim with a loud snort that the odour is distasteful to him, and swing away. This fellow we snap to face us again, and by the familiarity of custom do we overcome his fears. Another dear little thing may smell once tentatively, twice with confidence, and then she may commence to play with the outstretched hand by nibbling at it with her lips. Look, I tell you, when you meet a filly of that sort, then does your heart respond to her, a great feeling of gladness mixed with pride wells up inside you, and verily you believe that life's worth living. And lastly we come to the fellow who takes one sniff, lops his ears, rolls the whites of his eyes, and——Whiff! Bang! Both front feet smite the ground with mighty thuds in an attempt to strike the hand of the master. Steady a second, now. That animosity is prompted by fear more than by anything else. We've got to use tact in unlimited quantities with this fellow else we ruin him. Once we'll allow him to strike at the outstretched hand without taking too much notice of it—that is, always provided he doesn't follow it up with greater violence attempted. We'll tolerate a second smack at us, and if he does it a third time we'll let him know who's boss.

Moral Suasion a Winner Every Time.

After a third shot at us, and with an unabated violence showing in his methods, is the time when we have to rise to the occasion. Moral suasion's a winner every time—it carries further than a stick, and the effect isn't so disastrous. This is the time when we have to carry the white man's prestige, and when we rise in our might and quell insubordination by will alone. Almost you'll feel yourself swelling physically as the power of your will expands and encompasses the colt, and almost you feel a monarch among men as that dumb brute beast of the field wilts before you and acknowledges your superiority. Your crooning lullaby takes a ringing note of passion, your soothing words are a torrent of blasphemy, and you snap that colt to his bearings with a run. If you're man enough to do it, then get to it, and if you haven't the stuff inside you the best thing is to vacate the throne you should never have occupied and leave the round yard.

Once the colt is accustomed to your handling, the rest is easy. The first touch is the only difficult one. After that you keep advancing your approaches till you're handling the thing all over and where you will, and he's yours in readiness for further education.

CANE PRICES BOARDS.

Department of Agriculture and Stock,
Brisbane, 10th February, 1928.

His Excellency the Governor, with the advice of the Executive Council, and in pursuance of the provisions of "*The Regulation of Sugar Cane Prices Acts, 1915 to 1922*," doth, by this notice, appoint the following persons as representatives of the owner or owners of the mill, and as representatives of the canegrowers, to be Members of the respective Boards hereinafter specified, and has been pleased to appoint the person so designated as Chairman thereof, respectively:—

Cattle Creek.

Millowners' Representatives—
P. H. McLean and
C. Simonsen

Canegrowers' Representatives—
H. Wallace and
J. J. Compton

Chairman—
C. B. Buxton.

Childers.

Millowners' Representatives—
C. R. Fletcher and
R. C. McBurney

Canegrowers' Representatives—
J. Wm. Clayton and
J. Broadhurst

Chairman—
H. B. Carney.

Fairymead.

Millowners' Representatives—
W. G. B. Goodchild and
C. A. N. Young

Canegrowers' Representatives—
E. G. C. Eardley and
F. J. Wheeler

Chairman—
C. D. O'Brien.

Farleigh.

Millowners' Representatives—
G. T. Mulherin and
A. McKinnon

Canegrowers' Representatives—
H. C. J. Hansen and
J. McIntyre

Chairman—
M. Gallagher.

Hambledon.

Millowners' Representatives—
J. G. L. Gillett and
L. M. Smith

Canegrowers' Representatives—
E. A. Atherton and
F. C. P. Curlewis

Chairman—
A. H. O'Kelly.

Invicta.

Millowners' Representatives—
H. B. Burstall and
J. L. Mullins

Canegrowers' Representatives—
H. F. Hecht and
P. Hayes

Chairman—
R. A. Tait.

Maryborough.

Millowners' Representatives—
F. Kinne and
T. E. Braddock

Canegrowers' Representatives—
F. F. Bertram and
L. R. Doss

Chairman—
M. J. Bracewell.

Millaquin.

Millowners' Representatives—
G. S. Moore and
E. P. Wyllie

Canegrowers' Representatives—
G. Tesch and
T. Scotney

Chairman—
C. D. O'Brien.

CANE PRICES BOARDS—*continued.*

Moreton.

Millowners' Representatives—
W. M. Whalley and
G. Greathead

Canegrowers' Representatives—
A. E. Williams and
D. McDonald

Chairman—
S. L. Stormonth.

Mount Bauple.

Millowners' Representatives—
T. Beattie and
J. C. Flanagan

Canegrowers' Representatives—
P. B. Scougall and
A. Wm. Messer

Chairman—
M. J. Bracewell.

Mourilyan.

Millowners' Representatives—
L. J. Duffy and
H. G. Selby

Canegrowers' Representatives—
G. F. Hudson and
J. B. Valmadre

Chairman—
A. E. Aitkin.

North Eton.

Millowners' Representatives—
G. Johnson and
S. H. Scougall

Canegrowers' Representatives—
G. N. Laws and
C. H. C. Ross

Chairman—
C. B. Buxton.

Pioneer.

Millowners' Representatives—
W. B. Whitson and
B. C. J. Martin

Canegrowers' Representatives—
J. McB. Walker and
Wm. B. Smith

Chairman—
R. A. Tait.

Plane Creek.

Millowners' Representatives—
Alex. Innes and
D. Greetham

Canegrowers' Representatives—
A. I. McHardie and
H. E. Turner

Chairman—
M. Gallagher.

Pleystowe.

Millowners' Representatives—
A. A. Cook and
P. P. Smith

Canegrowers' Representatives—
M. W. R. Bowman and
C. McKinley

Chairman—
M. Gallagher.

Proserpine.

Millowners' Representatives—
M. R. Gibson and
C. C. Dodd

Canegrowers' Representatives—
H. L. Hall and
R. J. Ruge

Chairman—
C. A. K. Morrison.

Qunaba.

Millowners' Representatives—
G. S. Moore and
W. A. Shield

Canegrowers' Representatives—
A. J. Christensen and
C. F. Mittelheuser

Chairman—
C. D. O'Brien.

Racecourse.

Millowners' Representatives—
J. M. Gibson and
A. S. Hamilton

Canegrowers' Representatives—
T. J. A. Whitcomb and
A. Turner

Chairman—
C. B. Buxton.

South Johnstone.

Millowners' Representatives—
F. Gillan and
F. H. Gilmore

Canegrowers' Representatives—
G. F. Hudson and
R. J. Wright

Chairman—
A. E. Aitkin.

Tully.

Millowners' Representatives—
J. J. Cran and
G. R. Blair

Canegrowers' Representatives—
G. F. Hudson and
J. A. Winter

Chairman—
A. E. Aitken.

Victoria.

Millowners' Representatives—
E. Irving and
J. R. Kerr

Canegrowers' Representatives—
H. E. Hollins and
G. G. Venables

Chairman—
J. A. Murray.

D. A. GLEDSON.

Answers to Correspondents.

BOTANY.

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

Palms.

INQUIRER (Miriam Vale)—

Palms widely chosen for memorial avenue purposes in Queensland are—

Cocos plumosa. Cocos Palm.
Phœnix canariensis. Canary Phœnix.
Washingtonia filifera. Cotton Palm.

None of these are very fastidious as regards soil conditions, and if trees such as the Weeping Fig, Bean Tree, &c., do well, you should have no difficulty with the palms. The second one on the list does well on sandstone country.

"Sensitive Plant."

W.R.P. (Innisfail, N.Q.)—

Your specimen is *Mimosa pudica*, of the family Leguminosæ, and closely allied to the Wattles. It is widely distributed over the tropical parts of the world, and is regarded as somewhat a pest in cultivation. In spite of its prickly nature, however, it has considerable value as a tropical fodder, and is often tolerated on this account.

Nut Grass—Pennywort.

R. McH. (Toowoomba)—The specimens proved to be—

(1) *Cyperus rotundus* or Common Nut Grass. This is one of the worst weeds of cultivation we have in Queensland, though in gardens it may be kept in check by constant forking out or by constantly working the ground with a push hoe and preventing the young shoots from appearing above ground. This eventually exhausts the underground tubers.

(2) A very small specimen consisting of a few leaves only, but we take it to be *Hydrocotyle asiatica*, a species of Pennywort. This plant is a common weed of damp places and gardens, though in wet seasons such as at present it may spread further in cultivation. It is not a particularly aggressive weed, and should be easily kept in check.

When sending specimens for identification, larger specimens than those you sent would be better. For instance, in the second specimen a piece of the stem should have been sent showing the leaf attachment.

Crowsfoot Grass.

M.J.C. (Burrandowan, via Kingaroy)—

Your specimen is *Eleusine indica* or Crowsfoot Grass, a grass more or less of an annual nature often coming up very thickly after the summer rains. It is a grass with a wide distribution outside of Australia and is mostly found here in cultivation paddocks, around cow yards, or in fact anywhere where the ground has been disturbed. Like Sudan grass and some of the sorghums, it contains in its more succulent stages prussic-acid yielding glucoside, but we have never heard of it causing deaths in stock in Queensland.

An Introduced Weed *(Roubieva multifida).*

INQUIRER (Warwick)—

Your specimen has been identified as *Roubevia multifida*, a native of the warmer parts of both North and South America. It is not regarded as a bad weed in those countries, though in the United States such as in lower California it seems to occur mostly as a weed on railway lines and so forth. This is the first record of the plant in Queensland and apparently in Australia. It belongs to the family Chenopodiaceæ which contains the Salt Bush, Fat Hen, and many other plants. It is very similar to some others of the family already in Queensland and will probably become more or less of a pest.

Ringbarking.

E.R.W. (Inglewood)—

(1) There is nothing in the theory of the sap coming down on the outside of the bark. The conducting tissue of the wood transfers water and mineral solutions absorbed by the roots to the leaves; on the other hand the conducting tissue of the inner part of the bark transfers food material manufactured in the leaves to the roots or other parts of the tree which either consume it or store it up for future use. Ringbarking alone, though slower than ringbarking and sapping, should be as effective, though in actual practice this does not seem the case. In the latter case you cut through the conducting tissues of both the wood and the bark.

(2) The fact of bark peeling freely from the trunk is a good indication of the tree being in full growth and represents a good time for ringbarking and sapping.

(3) The chief reason for adding soda to the arsenical solution is to aid in dissolving the arsenic. If caustic soda is used the heat generated does away with the necessity of boiling.

Scrub or Creek Cherry.

INQUIRER (Brisbane)—

Your specimen is not *Rhodomyrtus macrocarpa* but *Eugenia australis*, the Scrub Cherry or Creek Cherry, a small or medium-sized tree fairly common along creek banks in coastal Queensland. The fruit has a pleasant acid flavour and is not known to possess any poisonous character. It and other species of Eugenia are sometimes confused with Rhodomyrtus.

Red Bloodwood—Fringe Lily.

T.G.F. (Brisbane)—

(1) *Eucalyptus corymbosa*, the Red Blood Wood. This tree is at the present time bearing an abundance of flowers and in its younger stages is very handsome.

(2) *Thysanotus tuberosus*, the Fringe Lily. This plant is also commonly known as the Fringe Violet, though it is really a member of the Lily family.

Eucalyptus and Mosquitoes.

L.F. (Pawa, Ugi, British Solomon Islands)—

The effectiveness of Eucalyptus in mosquito control is due largely to the ability of some of the species to grow in swampy land and gradually assist in drying it up, such as *Eucalyptus robusta*, sometimes called the Swamp Mahogany. This species would probably do well in the Solomons. Other species that would probably do well with you are the Flooded Gum (*E. saligna*), the Queensland Blue Gum (*E. tereticornis*) and the Citron-scented Gum (*E. citriodora*). Seeds of all of these should be obtainable from Messrs. A. Murphy and Sons, Seedsmen, Woy Woy, New South Wales. This firm makes a specialty of Australian tree seeds.

A Native Dodder.

INQUIRER (Kingaroy)—

Your specimen is *Cuscuta australia*, a native Dodder that is parasitic on a number of native herbs and weeds, and is also found on cultivated crops.

Carpet Grass.

C.H.C. (Toowong)—

Your specimen is *Paspalum platycaule*, the Carpet Grass. It has a wide distribution over the tropics of practically the whole world, and in Queensland is most abundant in the North, particularly on the coastal areas where it has some value both as a lawn grass and stock food. It is less common in the South, though well established here and there. It spreads readily by both seeds and runners. The only satisfactory method of eradication is to dig it out and plant a smothering, quick-growing grass like Blue Couch (*Panicum didactylum*) in its place. If you can get a good swarth of Blue Couch established it should keep down the Carpet Grass.

PIG RAISING.

The following replies have been selected from the outward mail of the Instructor in Pig Raising, Mr. E. J. Shelton, H.D.A.:—

Large Yorkshire.

F.H.P. (Milmerran)—

It is not possible to secure boars or sows of this breed in Queensland, though good-quality animals in either sex of the Middle (or Medium-sized) Yorkshire are available. So far the Large York has not been introduced, and as quarantine regulations at present prohibit the introduction of pigs from the Southern States (where there are several well-known breeders), you will have to be content to either try the Middle York or some other breed. In any case we doubt whether it would be wise to cross the Large Yorkshire and the Tamworth, for they are both large breeds, and we are sure better results would accrue by crossing the Middle York and the Tamworth or the Berkshire and the Tamworth, or even the Tamworth and Poland-China. The cross Tamworth and Gloucester Old Spot won second prize in the Bacon Pig Carcase contest at last Brisbane Show, but we are afraid that unless given very special care and attention they would be too large and growthy, and when ready for slaughter too heavy for our markets. We could secure really good boars three months old in the Berkshire (and up to four months), Middle Yorkshire (up to two and a-half months), Poland-China, and Duroc-Jersey breeds at about six guineas each, crated on rail at point of despatch. Of these, Berkshires would be the cheapest, though it would depend upon the quotation and from whose stud obtained as to just what price would be charged.

Care of the Sow.

E.D.L. (Maleny)—

We consider it a wise plan to give every breeding sow, prior to farrowing, a good bran mash in which is included three or four fluid ounces of castor oil. If this were done regularly, the lives of many sows would be saved, for, unfortunately, many good breeding sows are lost each year through these troubles. You may have to introduce fresh breeding stock, for it is apparent the strains you have had are running out and losing their constitutional vigour.

To Rid Pigs of Lice.

T.L. (Amamoor, Mary Valley)—

The best mixture for ridding pigs of lice and similar parasites is made up as follows:—

Benzine	½ pint
Kerosene	½ pint
Fish oil	7 pints

If fish oil is not available you could use old separator oil, cotton seed oil, or neatsfoot oil, for the oil is used to carry the benzine and kerosene and to soften the skin more than for the purpose of destroying the lice. It is necessary to have the pigs fairly clean before applying this mixture. It is also necessary to give the animals a second application about three days after the first one and to treat them periodically as the lice appear to become more plentiful. If you make up a gallon of the mixture and keep it in a tin or glass container and periodically treat the animals you will have no difficulty at all in keeping them free from lice. Lice are always more plentiful and more troublesome in a season like the present than at a normal time.

Experience Necessary for Pig Raising.

INQUIRER (Biloela)—

It is necessary to have some experience in order to make a success of pig-raising. It would be better to sell your milk to your neighbours than to go in for pigkeeping unless you understand the business. Pig paddocks are certainly necessary. Good stout posts and K-wire for fencing are quite all right, but it would not be necessary to enclose more than 2 or 3 acres in any one block—that is unless you had the area available and it was not being used

for any other purpose. From a cultivation point of view it is also necessary that the paddocks should be numerous and not too large, for in this way more pigs can be fed on a given area than if they are allowed to roam over a larger area and waste a lot of food. We would be glad to answer specific questions if you care to make out a list of points on which you require advice.

Berkshire pigs or pigs of any other breed from three to four months old would cost between three and five guineas each, crated on rail at point of despatch. The rail freight would not be more than ten shillings per head, unless the animal was transported over a great distance. Sows in pig or at a serviceable age would be worth up to ten guineas each, plus expenses. We think that if you secured one boar and about six unrelated sows these should be quite sufficient for a start. Later on you could probably increase the sows to twenty or more as you had more accommodation available. Water supply, green food, and mineral matters are all necessary in addition to milk and grain. Hence you will see that it is quite a proposition to make the necessary provision for introducing this class of stock on to the farm.

Tomato Preserves.

INQUIRER (Brisbane)—

Whole Tomatoes Canning.—Select small ripe tomatoes that will go into jars. Peel and drop a few at a time into boiling salt water. Dip out when cooked and place in the jars; then fill up the jars with boiling water. Seal hot.

Tomatoe Chillie Sauce.—Take twenty-five large ripe tomatoes, four white onions, three green peppers, with seeds removed. Slice tomatoes so as to take out as many seeds as possible. Chop onions and peppers fine and mix the ingredients together. Heat three cups cider vinegar and dissolve in it two cups white sugar, two small tablespoons salt. Pour over mixture and cook slowly one hour. Seal hot.

Canning Tomatoes.—Have tomatoes of a uniform ripeness. Pour boiling water over them to remove skins. When peeled, place in a granite kettle or pan and heat slowly without adding any water. A sprinkle of salt. Boil half hour and seal hot.

Green Tomato Pickles.—Four quarts green tomatoes, four small onions, four green peppers. Slice tomatoes and onions, sprinkle with half cup salt and leave overnight in a crock. Drain off brine next morning. Put in a preserving kettle one quart vinegar, one level teaspoon each of black pepper, mustard seed, celery seed, cloves, allspice, cinnamon, and quarter cup sugar. Bring to a boil and add prepared tomatoes, onions, and peppers, cook slowly thirty minutes. Fill jars and seal hot.

Green Tomato Sauce.—Boil one and a-half hours the following:—Two dozen large tomatoes, one and a-half dozen apples, quarter lb. salt, four large green sweet peppers, one red pepper, 2 lb. brown sugar, 2 oz. mustard, two tablespoons ground ginger, two pints vinegar, six large onions. Seal hot.

Green Tomato Mince Meat.—One peck green tomatoes, one peck apples, 6 lb. brown sugar, 2 lb. currants, two teaspoons cinnamon, 2 lb. raisins, two teaspoons cloves, two teaspoons allspice. Cook three hours. Seal hot.

Tomato Sauce.—Cut tomatoes in medium size pieces. Add one large onion chopped and one cup chopped fresh pepper to each gallon tomatoes. Cook until tender, put through sieve, add one and a-half teaspoonsful of salt and three teaspoonsful sugar to each gallon of pulp. Cook until consistency of ketchup, stirring constantly. Pack, while boiling hot, into jars and process in water bath or water seal for twenty-five minutes or under 5 lb. steam pressure for fifteen minutes or under 10 lb. for ten minutes. Remove jars from canner and seal hot at once. Tin cans should be plunged immediately in cold water and cooled as quickly as possible. When cool, store in dark, dry, cool place.

Corn and Tomato.—Prepare each vegetable as for canning. Chop tomatoes in medium size pieces or heat to simmering point and put through sieve. Mix thoroughly two parts tomato to three of corn. Pack in hot glass jars or enamelled tin cans. Add one level teaspoonful of salt. Process in water bath or water seal two hours or under 10 lb. steam pressure sixty minutes. Remove jars from canner and seal hot at once. Tin cans should be plunged immediately into cold water and cooled as quickly as possible. When cool, store in a dark, dry, cool place.

General Notes.

Butter Board.

As no petition has been received for a poll on the question of the continuance of the Queensland Butter Board, it will be reconstituted accordingly, to operate as from the 1st March this year to the 30th June, 1931.

Six representatives are to be elected for the full term, and for this purpose the following nominations have been received:—

Division No. 1—
W. Scott, Peeramon;
W. J. Sloan, Malanda.

Divisions Nos. 2, 3, 4, and 5 have returned unopposed—
J. L. Wilson, Calliope;
James McRobert, Maryborough;
James Purcell, Toowoomba; and
C. H. Jamieson, Gatton.

Division No. 6—
E. Brabiner, Gympie;
T. Flood Plunkett, Beaudesert.

The date of the election for the two members to represent Divisions Nos. 1 and 6 has been fixed for the 28th February, 1928. Mr. I. R. Macgregor, Director of Marketing, will act as Government representative on the Board.

Staff Changes and Appointments.

The following Police Constables have been appointed Inspectors of Slaughter-houses as from the 26th January, 1928:—James Norman Mackay, John Lane, and Albert Edward Stevens.

Mr. H. F. Sibley, Inspector of Slaughter-houses at Charters Towers, has been appointed also an Inspector under "*The Diseases in Stock Act of* 1915."

Mr. A. S. Alexander, of Maryborough, has been appointed an Honorary Ranger under and for the purposes of "*The Animals and Birds Acts*, 1921 *to* 1924," as from the 31st January, 1928.

Constables Robert Henry Sabien (Sandgate) and James Duffiey (Chillagoe) have been appointed Inspectors of Slaughter-houses.

Mr. M. H. Campbell, of Albany Creek, Strathpine, has been appointed Chairman of the Egg Board until the 31st December, 1928.

Cane Prices Boards.

As no nominations were received for Representatives on the undermentioned Local Sugar Cane Prices Boards, the following Representatives have been appointed:—

Babinda Local Board—
Millowners' Representatives—F. A. Lamont and W. J. Ryan.

Cattle Creek Local Board (Mackay)—
Canegrowers' Representatives—H. Wallace and J. J. Compton.

Fairymead Local Board (Bundaberg)—
Millowners' Representatives—W. G. B. Goodchild and C. A. N. Young.

Racecourse Local Board (Mackay)—
Canegrowers' Representative—A. Turner.

Arrowroot Board.

An Order in Council has been approved under the Primary Producers' Organisation and Marketing Act, extending the term of office of Members of the Arrowroot Board from one to three years.

Nominations will be received until 5 p.m. on the 10th March, 1928, for election as Growers' Representatives on the Arrowroot Board. Five such representatives will be required to be elected for a term of three years by those growers who, in the 1926-27 season, supplied arrowroot bulbs grown in Queensland to any arrowroot mill in Queensland.

Each nomination is to be signed by at least ten (10) such growers. If more than five nominations are received a postal ballot will be taken.

Valedictory.

Mr. F. Bostock, Assistant Instructor in Pig Raising, has, consequent on his appointment to the position of Instructor in Pig Raising at the Hawkesbury Agricultural College, Richmond, New South Wales, severed his connection with this Department. Mr. Bostock, who is still a young man, proved himself in the Queensland service a capable and enthusiastic officer, and among farmers particularly he made many friends. Queensland is a vast State of great distances, and itineraries carried through by field officers of the Department cover in the course of the year many thousands of miles. Constantly on the job, Mr. Bostock gave good service to the farming industry, with which he maintained an active and useful association. As judge at country shows he won respect for his decisions and practical knowledge of animal husbandry. His skill as a draughtsman was also an advantage when instruction was required in modern farm building design and field lay-out. Mr. Bostock left Queensland with the sincere good wishes of his fellow officers and all engaged in the industry to which he has devoted his talents and energy, together with their belief that he will meet with a full measure of success in his new sphere of interest and action.

Mr. Bostock was Assistant Instructor in the Pig Section at the Hawkesbury College prior to coming here. His appointment to the senior position at Hawkesbury was made possible by the transfer of Mr. A. Gray to the position of Senior Instructor, with headquarters in Sydney, and with work similar to that being carried on in this State by Mr. Shelton.

Tractor School at Gatton.

The Queensland Agricultural College, in conjunction with the Council of Agriculture, will hold its Fifth Queensland Tractor School from the 3rd to the 13th April, inclusive.

The course will cover lectures, demonstrations, and practical work in the care, adjustment, repairs, and driving of many makes of tractors.

At the last school there were present four Fordsons (one crawler-fitted, one fitted with a rototiller, one fitted with a plough between front and back wheels), Case, Fitch, Hart Parr, John Deere, McCormick-Deering, and Twin City. It is expected that later models of tractors will be represented this year.

The cost to each farmer will be £3 8s. 6d., which will cover all instruction costs, board and residence, and recreation fee.

The Railway Department will grant attending farmers one-half excursion rates each way on presentation of a certificate from the College.

The College will provide power kerosene, the railage on tractors from and to Brisbane, and free board and residence for tractor mechanics.

Farmers should book to College Station and ask the guard to stop, previously advising the College of the train by which they will travel.

Farmers will need to bring blankets, sheets, mosquito net, pillowslips, towels, soap, mirror, and other toilet requisites.

No farmer will be allowed to confine his attention to a particular tractor, but must work each in turn. Should he desire more work on a particular tractor, he will have to arrange it in his spare time.

The daily time-table will be as follows:—

Tuesday, 3rd, and Wednesday, 4th, will be devoted to lectures in the morning and practical work in the afternoon.

Thursday, 5th—Practical work all day.

Friday, 6th—Lectures all day.

Saturday, 7th—The morning will be devoted to lectures while the afternoon will be reserved for sport.

Sunday, 8th—Church service and picnic.

Monday, 9th—Lectures all day.

Tuesday, 10th—Practical work all day.

Wednesday, 11th—Practical work all day.

Thursday, 12th—Practical work all day.

Friday morning, 13th—Practical work.

Applications from farmers wishing to attend the School will be received from now onwards; early applications will be given preference. Last year applications had to be closed long before the School opened; the attendance at the School being a record for Farmers' Classes in Queensland.

Any further particulars will be supplied on request.

Dingo Board Elections.

The following have been elected Members of the Western Downs and Kennedy Dingo Boards, respectively:—

Western Downs, Inglewood—
William James Tomkins,
George Frederick William Goodrich,
Arthur Rhodes Lomax, and
William Robert Bracker.

Kennedy, Ingham—
George Christopf Teitzel,
Henry John Atkinson,
William Stanley Collings Warren, and
Leland Edwin Challands.

The Police Magistrate, Ingham, has been appointed Government Representative on the latter Board.

Citrus and Pineapple Levy Regulations.

The period during which the Pineapple Levy Regulations, approved of on the 16th January, 1926, under the Fruitmarketing Organisation Acts, shall continue in force has been extended from the 25th January, 1928, to the 24th January, 1929. This levy is at the rate of one halfpenny per case of pineapples in containers, and, where sold loose, one halfpenny per forty-two rough or Ripley pineapples, or one halfpenny per twenty-four smooth pineapples.

Similarly, the Citrus Levy Regulations, approved of on the 13th February, 1926, have been extended from the 29th February, 1928, to the 28th February, 1929. This levy is at the rate of one penny per bushel case and one halfpenny per half-bushel case of citrus fruit marketed.

The above levies are now to be collected by means of Levy Stamps, which are obtainable at the head office of the Committee of Direction of Fruit Marketing, and which are to be affixed to Account Sales or Credit Notes, or any other document giving evidence of the sale of these fruits.

Pigs at the Ipswich Show.

The increased importance of the breeding of thoroughbred pigs, to the West Moreton area, has been recognised for some time past by the Queensland Pastoral and Agricultural Society, Ipswich, who have made a special effort with this section of their Show to be held on 16th, 17th, and 18th May next. In the first place entries for thoroughbred stock only will be accepted, as the section is conducted under the rules and regulations of the Australian Pig Breeders' Association; further, the prize money has been considerably increased and now ranks equal if not better than most shows. The accommodation has recently been entirely rebuilt on the most modern principles. A section has been added confined to members of School Pig Clubs, where the prizes are on a very liberal scale. Exhibits are carted free to and from the Ipswich Railway Station, and in the case of the latter, exhibits will be attended to by a special committee. A competition has also been provided for young judges. The society is indebted to Mr. E. J. Shelton, Instructor in Pig Raising, for valuable assistance and advice in the classification, and confidently look forward to the active support of the various School Clubs throughout the district.

Floods and Landslides.

The floods and landslides reported as a result of the heavy February rains—which, after all, are only typical of our ordinary wet season—raises the question as to the extent to which the wholesale denudation of forest and jungle from the crests and slopes of the coastal range and on watersheds generally is responsible for those phenomena. It is, of course, well known that the clearing of hillsides of moisture-retaining and soil-holding timber is followed by soil erosion and the silting-up of watercourses. Relevantly, the United States Department of Agriculture says that investigation of the seepage of soil water shows that this was most rapid on the open slopes following a rain, while the seepage was greater in quantity, steadier, and distributed throughout a longer period of time in the area covered with timber. By thus absorbing more water, by holding it longer and allowing it to seep out more gradually, areas covered with forest exert a considerable influence in the regulation of stream flow, tending to prevent high water and flooding periods of heavy rainfall on the one hand and drying up of streams during the dry season on the other.

Mr. Soutter's Work at Roma—Federal Appreciation.

After a visit to the Roma State Farm, said Mr. J. A. J. Hunter, M.H.R., recently, the Minister for Home and Territories, Mr. C. W. Marr, D.S.O., M.C., paid a great tribute to the work of Mr. R. E. Soutter, whom he described as the Luther Burbank of Australia. Mr. Soutter's work had added thousands of pounds to the agricultural wealth of Queensland, Mr. Hunter said, and the Federal Government appreciated the fact.

The Meaning of Existence.

Thus Sir Oliver Lodge:—Man is not fully-developed man as yet, when only a few out-top their fellows; the time will surely come when all will be able to realise their birthright. Much of the present unrest is a groping after higher things, a feeling that this world cannot be all, that education and leisure are objects worth struggling for; that there are prizes beyond the present scope of the average man. Terribly mistaken are some of the efforts; selfishness dogs and damages the ideals; but sooner or later all this can be rectified. Mankind is barely civilised as yet, we have much leeway to make up; but there is plenty of time. For the individual and also for the race there is a magnificent prospect ahead; and if we set our faces firmly towards the right, and seek for the guidance which is certainly forthcoming, if we try to ascertain what is really the meaning of existence, and get our wills right with that effort which seems to us divine, then beyond these voices we shall attain to peace and to the service which is perfect freedom.

The Agricultural Problem.

Secretary of Agriculture Jardine (U.S.A.) told President Coolidge that the showing for agriculture in general for 1927 has been good, but that much remains to be done before the position of the farmers will cease to be a problem. "While farmers themselves are reducing their costs of production through increased efficiency," he says, "public agencies should co-operate with them in effecting a better adjustment of production to demand. Also efforts should be made to diminish waste, to lessen margins between producers' and consumers' prices, to reduce transportation and distribution costs, and to lessen the farmers' overhead charges by lowering or redistributing tax burdens and by improving agricultural credit facilities. Farmers should be encouraged to enhance their bargaining power through co-operative marketing, and the responsibility of the public in helping to reduce price fluctuations due to unavoidable gluts and shortages of agricultural products should be recognised in a practical manner."

Pastoral Research—Weapons in the Armoury of Science.

It would seem unnecessary to argue that research should be brought to the aid of any industry, least of all that of primary production. Yet the fact remains that a large percentage of producers in Australia apparently fail to realise the true position of their industry and of themselves as units of it. The margin of profit is a narrowing one; production costs are increasing, prices are at a level that is not likely to be greatly exceeded, and competition by other countries is becoming steadily keener. There are certain costs which are beyond the power of producers to control, but there are others—on the practical side of stock raising—that offer plenty of scope for reduction. Amongst these may be mentioned the periodical heavy toll of droughts, artificial feeding, losses by pests, diseases, malnutrition, &c. Again, there are the matters of wool quality, carrying capacity, and many others associated with the revenue side of the business that are capable of betterment. It is in these spheres that research is absolutely essential if the industry is to continue and prosper, and the following extract from an article by Secretary W. M. Jardine in "The Country Gentleman" (U.S.A.) of December, 1927, is right to the point:—"Perhaps in the matter of pest prevention the failure to give adequate support to forehanded research has resulted in the most easily obvious national loss. Had we long ago secured financial support for the policy of studying foreign pests on foreign soil, the tremendous ravages which we have suffered from imported insects might to a large extent have been obviated. . . . But the necessity for forehanded research is not confined to the problem of pest prevention and pest control. To hold foreign markets for our surplus products we must meet competition from other lands. We can meet this competition only by the studied development of methods of production which will allow our growers, while still maintaining high American standards of living, to sell at a price which cannot be met by less ingenious peoples." It does not need the ability to see through a brick wall to realise the outcome of an indefinite continuation of more or less easy-going methods in the Australian pastoral industry. It uses, and uses well, what weapons it has at its command, but there are other and more powerful ones in the armoury of science.

Plant Propagation from Cuttings.

Almost any plant can be grown from a cutting if planted and treated in the correct manner. The accepted rule is that the cutting must be carefully cut; that the right portion of the plant must be taken; that it be firmly planted in the correct compost; that the compost be kept in a damp condition; and that the portion of the cutting above ground be protected from excessive evaporation until the roots are formed to supply the loss.

Cuttings may be struck in prepared beds or in pots in bush or glass houses. The soft-wooded plants are generally successful in the shaded houses, and hardy and hard-wooded plants in semi-shaded nursery beds. The starting compost must comprise a fair quantity of sand, and the top layer of soil, say half inch, should be nearly all sand, or at least three-quarters sand. At the bottom of the pots and bed a thorough drainage system is necessary, as stagnation round the end of a cutting is fatal to success.

When planting cuttings, the earth must be thoroughly compacted around the extremity of the cutting. The hole in which a cutting is to be placed must be made with a blunt, flat-ended stick, which is pressed down into the compost, and the surface sand will fall into the hole, and this ensures the drainage; the cutting is then pressed firmly into the hole, and the soil is then pressed firmly around the cutting by ramming with the stick which has been used as a dibbler.

The general rule in selecting a cutting is that it be young wood that is sufficiently matured, and the cutting should have a heel of the previous growth from which it springs. It is essential that the cut should be clean and not damaged in any way at the base. If the cutting is damaged in any way it is advisable to retrim the base with a sharp knife, remove all leaves to as deep as the cutting has to be planted, and the stripping of the leaves must be done carefully, not pulled off, but cut clean with a knife. As a general rule, the smaller the cutting the greater the chance of success.

In planting cuttings it is not of much importance at what angle the plants are inserted in the soil. Some growers claim that cuttings should be planted at an angle of about 45 degrees, and others claim that straight-up planting is the best.

Planting.

Never plant in ground which, since digging, has become dry and lumpy. Sprinkle it well with water, then break it down as finely as possible. Do not put tender seedlings out, however favourable the weather may be, without first hardening off. To harden off plants it is best to transplant the tender seedlings into starting boxes or beds with plenty of space between the plants, so that they may be lifted for transplanting into the open beds with a ball of earth attached to each mass of roots.

Give a thorough watering an hour or two before the actual time of planting, otherwise you are increasing the check to the plants. It is preferable to plant in the evenings or on a dull day, rather than during the heat of the day. It is also necessary to give temporary shade from the sun. Such shading can usually be dispensed with in a few days.

Immediately a bed or border has been transplanted do not fail to give a thorough soaking of water. This will settle the fine soil around the roots. When planting out do not overcrowd. Be careful to avoid flatness in large beds. Water the plants in the evenings as necessary until the plants show signs of having become established.

The Democracy of the Ancients.

"Equal justice; equal opportunity for the service of the State; the spirit of reverence for the laws the people enact and for the unwritten laws founded in human nature; the education that trains men to think before they act, and then to act, that teaches them to enjoy and to know what to enjoy, to love beauty without excess and wisdom without inefficiency, that gives the power to the individual to meet every aspect of life with ready grace, whether wealth or poverty, life or death; the passionate love of country that will inspire a man not only to die for his city, but to live to the utmost for it, developing every faculty nature has given him that he may consecrate all his gifts of speech and sense, taste, wisdom and the open mind, to the good of his fellow-citizens; these are no ideals of the barbarians nor of the half-civilised lands we know. Where is the motive, where the transforming power, to make of our common clay the true citizens of such a Democracy? Nowhere, I think, but in one who talked no politics and drew no Republic, but understood better than Pericles the greatness of man and better than Plato the Kingdom of God."—Mr. T. R. Glover, in "Democracy in the Ancient World."

Farm Notes for April.

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

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

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

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

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

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

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

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

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

Orchard Notes for April.

THE COASTAL DISTRICTS.

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

Southern markets, the percentage depending mainly on the weather conditions, the loss in a wet year being much heavier than that in a dry year.

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

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

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

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

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

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

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

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

Land to be planted with trees should be got ready, as, if possible, it is always advisable to allow newly cleared land time to sweeten before planting.

Strawberries can still be planted, and the earlier plantings must be kept well worked and free from all weeds in order to get a good crop of early fruit.

Scrub land intended for bananas can be felled now, as there will be little more growth, and it will have ample time to dry off properly in time for an early spring burn. Do not rush scrub falling, as it is work that pays for extra care. Lopping will improve prospects of a successful fire.

Keep a keen lookout for fruit flies, and on no account allow any fallen fruit of any kind to lie about on the ground unless you are looking for trouble with the ripening citrus crop. Keep the fly in check, and there will not be any very serious losses; neglect it, and there will not be much fruit to market.

The advice given with respect to the handling and marketing of citrus fruit applies equally to custard apples, pineapples, bananas, and other fruits. In the case of bananas handled by the Committee of Direction of Fruit Marketing, grading is now compulsory, and it will undoubtedly tend to stabilise the market for this fruit.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

Practically the whole of the fruit crop will have been gathered by the end of March, but several of the later-ripening varieties of apples grown in the Granite Belt may be kept for a considerable time, provided they are free from fly or other pests and are stored under proper conditions. Varieties such as Jonathan can be kept for some months at a temperature of 31 to 32 degrees, and later varieties, such as Granny Smith and Sturmer, can be kept till apples come again if stored at the same temperature. At the same time, although storing the fruit at this temperature under artificial conditions enables them to be kept for many months, the fruit can be kept for a considerable period, and marketed from time to time as desired, by storing it in a specially constructed apple-house in or adjacent to the orchard where grown.

Such a store can be cheaply constructed in the side of a hill out of the soil of the district and slabs of timber. The soil will make excellent pisé for walls, and the roof may be constructed of slabs covered with soil. Such a store can be kept at a very even temperature, and if the air is changed during cool nights—not frosty nights—the temperature can be reduced to a low point—low enough to keep the fruit in good condition for many weeks.

All orchards and vineyards not already cleaned up must be put in order, and all weeds destroyed. Keep the surface of the soil stired so as to give birds and insects a chance to get at any fruit fly pupæ, as it is necessary to destroy this pest whenever there is a chance of doing so.

Land intended for planting during the coming season should be got ready in order to expose the soil to the cold of winter, thus rendering it sweeter and more friable.

If there is any slack time in the course of the month, go over all surface and cut-off drains and put them in good order. Also, if during periods of heavy rain, soft or boggy spots have made their appearance in the orchard, do what draining is necessary, as badly drained land is not profitable orchard land, and the sooner it is drained the better for the trees growing upon it. Soft or boggy spots are frequently caused by seepage of water from a higher level. In this case a cut-off drain will be all that is necessary, but where the bad drainage is due to hard pan or an impervious subsoil, then underground drains must be put in. After draining, the land should be limed. Liming can be done now and during the following three months, as autumn and winter are the best times to apply this material.

When the orchard soil is deficient in organic matter (humus) and nitrogen, try the effect of green-crop manuring, planting the grey or partridge pea and manuring the ground for this crop with a good dressing of finely ground island phosphate or basic phosphate.

Where citrus fruits are grown, they should now be ready for marketing. If the land needs it, it should be given an irrigation, but unless the trees are suffering from want of water it is better to stick to the use of the cultivator, as too much water injures the keeping and carrying qualities of the fruit.

The remarks on the handling and packing of citrus fruits in the coast districts apply to the inland districts also, but these districts have an advantage over the coast in that, owing to the drier atmosphere, the skin of the fruit is tougher and thinner, and in consequence the fruit carries better.

The Home and the Garden.

THE TENNIS COURT—CONSTRUCTION HINTS.

The tennis court is perhaps as usual to the homes in Australia to-day as in any other part of the world. Of recent years this game has become so popular that wherever the space within the building allotment is available it is almost certain that a tennis court will be found there, even at the cost of a great deal of excavating and levelling up, for a number of our sloping sites necessitate this.

In many cases our grounds are so limited that little or nothing can be done to make the court attractive. It is then little more than a flat lawn of about 100 feet long by a width of 50 feet, fenced with an ugly arrangements of posts, rails, and galvanised wire netting, but the appearance of these fixtures may be improved.

Choosing the Site.

The most practical enclosure is the wire mesh, carried on an open framing of either hardwood or water piping. Wood posts are subject to rot and to attack from white ant upon that portion which is below ground; and though this latter may be obviated to a large extent by sinking the posts in holes filled with concrete, this does not get over the trouble from rotting.

When piping is used as posts they must be buried in concrete for stalility. These should be galvanised to prevent rust, and of not less than 1½ inch in diameter, all coupled together with screwed reducing unions. Sometimes they are roughly cut to each other and the joints oxy-acetylene welded, but this method of joining is neither as neat nor as rigid as with the screwed T-pieces.

For economy, ordinary galvanised wire netting is generally used for the enclosure.

When there is sufficient area within the home allotment to allow a choice of site for the court to be made, care should be taken to select one that will enable the long axis to run north and south. With this aspect the players will be gest protected from the sun's rays when it is low in the heavens. Play is almost impossible when either side has to stand facing a setting sun.

Our private courts are generally about 50 feet wide by 110 feet long. The latter dimension gives 15 feet or 16 feet behind the back lines. For ordinary play this is quite sufficient, and provides all the run back necessary. But for first-class tennis the ideal size is 60 feet wide and 120 feet long; there is no fear then of the enclosure interfering in any way with a player having to return a fast drive on to the back line.

Having selected the position, much care should be taken in laying down the court.

Drainage.

Thorough drainage is necessary, but the character of the soil must be taken into consideration. When it is of a sandy nature to some depth, and the soakage is able to pass through and get away easily, the problem offers no difficulties. But with a clay subsoil at some 8 or 9 inches below the surface, such as we have in our western and northern suburbs, the conditions are more troublesome. It is then necessary to form some system of drainage beneath the soil to take off the soakage, which may otherwise lie in clay pockets and cause sourness.

Sometimes a reticulation of porous earthenware pipes, known as agricultural pipes, is laid in a packing of loose stone on the clay bed and given a fall to an outlet at a lower point. Sometimes a layer of loose rubble packing or clinker ashes, about 6 inches thick, is laid over the whole area with a fall to carry the moisture away. If this method of drainage is resorted to care must be taken to see that this packing is well blinded with finer stone or ashes so as to prevent the soil from falling through the crevices of the stone and later causing an undulating surface. This blinding will also tend to keep the root action of the grass near the surface, which binds the top soil and gives the necessary hard finish. For this reason, also, top-dressing of a sandy nature should not be used as it will chip up when hit with the tennis balls. A loamy soil which will bind together when watered and rolled is the ideal top-dressing, as this ensures a hard playing surface. A better grass than couch has yet to be found for tennis lawns.

KITCHEN GARDEN.

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

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.

	March, 1928.		April, 1928.		MOONRISE. Mar., 1928.	April, 1928.
Date.	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	p.m.
1	5.47	6.23	6.4	5.49	2.40	3.52
2	5.48	6.22	6.4	5.48	3.38	4.31
3	5.48	6.21	6.5	5.47	4.30	5.2
4	5.49	6.20	6 6	5.45	5.16	5.32
5	5 49	6.19	6.6	5.44	5.54	6.2
6	5.50	6.17	6.7	5.43	6.30	6.32
7	5.50	6.16	6.7	5 42	7.2	8.2
8	5.51	6.15	6 8	5.41	7.31	7.36
9	5.51	6.14	6.8	5.40	8.0	8.11
10	5.52	6.13	6 9	5.39	8 30	8.53
11	5.52	6.12	6.9	5.38	9.4	9.40
12	5.53	6.11	6.10	5.37	9.49	10.30
13	5.54	6.10	6.10	5.36	10.15	11.26
14	5.55	6.9	6 11	5.35	10 58	...
						a.m.
15	5.55	6.7	6.11	5.34	11.48	12.24
					a.m.	
16	5.56	6 6	6.12	5.33	...	1.25
17	5.57	6 5	6.12	5.32	12.41	2.29
18	5 57	6 4	6.13	5.31	1 39	3.33
19	5 58	6.3	6.13	5.30	2.41	4 38
20	5.58	6 2	6 14	5.29	3.45	5.45
21	5.59	6.0	6.14	5.28	4.49	6.53
22	5.59	5.59	6.15	5.27	5.55	8.4
23	6.0	5 58	6 15	5.26	6.59	9.18
24	6.0	5.57	6.16	5.25	8.6	10.20
25	6.1	5 56	6.16	5.24	9 14	11.24
						p.m.
26	6.1	5.55	6.17	5.23	10 24	12.21
27	6.2	5 53	6.17	5.22	11.39	1.12
					p.m.	
28	6.2	5.52	6.18	5.22	12.33	1.54
29	6.3	5.51	6.18	5.21	1.32	2.32
30	6.3	5.50	6.19	5.21	2.26	3 3
31	6.4	5.49			3.13	

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.

6 Mar.	○	Full Moon	9 26 p.m.
16 ,,	☽	Last Quarter	1 20 a.m.
22 ,,	●	New Moon	6 29 a.m.
28 ,,	☾	First Quarter	9 54 p.m.

Apogee 11th March, at 1 6 p.m.
Perigee 23rd March, at 8 36 p.m.

The small star Chi Sagitarii will be occulted by the Moon at the time of rising on the night of the 16th. Its reappearance on the upper edge of the Moon may be observed with telescope or binoculars on the 17th about 1 o'clock a.m.

About 4·30 a.m. on the 18th Mercury and Venus will appear to be only about the width of the Moon apart, neither planet will be at its best, Venus having less than half its greatest brilliancy, and Mercury slightly more than half. With the waning Moon high above them the scene will not be as beautiful as it might have been.

A very interesting spectacle will be afforded on the morning of the 20th about 4.30, soon after the Moon has risen. The nearness to one another of the planets Venus and Mercury, with the crescent Moon not far to the right, should be sufficiently attractive to draw many from their beds at this early hour.

The Equinox will occur this year on the 21st of March instead of the 22nd on account of February having one day more; therefore it should be noted that the Sun will rise on the 21st at a point on the horizon which may be taken as due east, and the places of setting on the 20th and 21st may be taken as due west.

On the 22nd, Mercury will be at its greatest elongation 28 degrees west of the Sun.

On the 24th the Sun will be passing Uranus, which will, of course, be unobservable.

An occultation of a small star in Taurus, about 6.30 p.m. on the 26th, will form an interesting opportunity for telescopic observation although there will be a certain amount of twilight. The Moon will be high up in the north-west, but at a fairly favourable angle for a small telescope without a diagonal.

6 April	○	Full Moon	1 38 p.m.
13 ,,	☽	Last Quarter	6 8 p.m.
20 ,,	●	New Moon	3 24 p.m.
27 ,,	☾	First Quarter	7 41 a.m.

Apogee 8th April, at 10 12 a.m.
Perigee 21st April, at 5 12 a.m.

An occultation of Kappa Virginis by the full moon will take place about 2 a.m. on the 7th. At Townsville it will last about half an hour, but only for a very short time at Warwick and Toowoomba, at which places the occultation will be very near the southern or upper edge of the Moon.

On and about the 8th, Mercury and Venus will be apparently near to one another. They will be best observable about 5 o'clock in the morning. It will be interesting to notice how quickly Mercury will move eastward from Venus and apparently increase the distance between them. The brilliance of Mercury will be only about half of what it was on 3rd February, and will be on 10th May. Venus's brilliancy also will be only about half of what it was last August and at the beginning of this year.