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QUEENSLAND AGRICULTURAL JOURNAL

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Event and Comment.

The Current Issue.

Readers will be pleased with the August issue, which covers a wider range than usual. Mr. Brünnich contributes a valuable paper on lime, and the importance of agricultural chemistry to the State is discussed in another special paper by Mr. Gurney. Mr. Cyril White has a valuable contribution on Queensland forests and forest trees. A paper on cream transport will engage the attention of dairymen, while poultrymen have much to interest them in Mr. Rumball's Notes on the Poultry Tick and other phases of their industry. Mr. Ballard has some valuable entomological information for cotton-growers. Recent valuations of certain samples of cotton are also noted. Bean Anthracnose, gumming of fruit trees, and an affection of banana fruit are discussed by Mr. Tryon. Mr. Edmund Jarvis's entomological notes for canegrowers continue as a valuable serial feature. The quality of Queensland ratoon cotton is the subject of an interesting review. What we owe to Farrer, the famous Australian wheat breeder, is made quite plain in a graphic survey of his work. Mr. Pollock's notes on the cultivation of the peanut, for which there has been a big demand, are reprinted in this issue. Owing to unusual pressure on space some other special articles, including an interesting one on goats and their breeding, have been held over for publication in the September number. Pig raisers are, as usual, well supplied with information of interest and value by Mr. Shelton. The August Journal is sure to be welcomed by every reader.

Our Magnetic North.

North Queensland is gradually coming into its own, and is already being described as the California of Australia. The glory of its winter climate is becoming more widely known, and Southerners in greatly increasing number are discovering in our magic North one of Australia's finest assets. The completion of the Great Coastal

Railway is already proving a tremendous factor in the development of tropical Queensland. In the course of the month representatives of the provincial Press of Australia, who had assembled in conference in Brisbane, were given an opportunity to see for themselves every phase of Queensland life and industry north of Capricorn, and among valuable and favourable results of their tour are the upsetting of many preconceived notions of Northern life and industry and the realisation that the agricultural, mineral, and general development of tropical Queensland is not only vital nationally, but is supremely sound as a business proposition.

The Governor's Speech—Sessional Programme.

The Third Session of the Twenty-third Queensland Parliament was opened by His Excellency the Governor, Sir Matthew Nathan, on 28th July. In the course of his Opening Speech the Governor said that, though a large proportion of Queensland is and must remain pastoral, the area at present utilised for the various branches of farming and agriculture could be vastly increased. The urgent need for considerable population in North Queensland, on the shores of the Gulf country, as well as east of the Dividing Range, would, he was convinced, eventually be thus met. While he realised that the marketing of produce from these areas as well as from any other new settlements that were being or might be created was the main difficulty in connection with their occupation, he believed that the overcoming of this difficulty would be greatly assisted by ample agricultural research and study. In those circumstances he was glad to be informed that his advisers were prepared to give consideration to the establishment of that Agricultural Faculty at the University, proposals for which had been recently put before them by the Senate. Another matter requiring research, said His Excellency, was the manner in which a large proportion of the people in the country were housed. The dwellings were often not the best that could be devised either for health, for comfort, or attractiveness. Generally, there was much in the Speech to interest the farmer, and in the course of remarks on the sugar industry the Governor referred to its stability as the result of judicious encouragement by both Commonwealth and State Governments. The surplus production last year, he said, combined with the surplus which was certain to occur this year, constituted a serious problem, but it was confidently expected that the arrangements which had been made for sales overseas and for the reduced prices for and rebates on account of sugar used in jams, canned fruits, and in other manufacturing processes, would result in the disposal to the best advantage of the sugar in excess of Australian requirements. Referring to rural organisation, His Excellency said that advantage was being taken by primary producers throughout Queensland of the comprehensive agricultural legislation recently enacted. Interest in the Queensland plan of rural organisation had also developed in the other Australian States. Among the proposals to be brought before Parliament in the course of the Session, and which are of especial interest to the farmer, are a Bill to amend the Primary Producers Organisation Acts; a Fruit Marketing Act Amendment Bill; a Bill to amend the Primary Products Pools Acts; a Graziers' and Settlers' Protection Bill; a Bill to consolidate and amend the laws relating to the Pastoral Industry; a Bill to amend the Main Roads Acts; an Irrigation and Water Supply Bill; a Forestry Bill; and a Land Act Amendment Bill.

The Prickly-pear Commission.

The First Annual Report of the Prickly-pear Commission has been presented to Parliament and is a most interesting and valuable document. Everyone regards the establishment of a new department, as the Commission points out, as a difficult task, because of the special effort of thought and organisation that is involved. The greatest difficulty in a new formation which public necessity has created lies, however, not so much in framing working systems as in handling the volume of work that must necessarily be encountered in the early months of its existence. The report amounts almost to an epic of energy and enterprise, and its story of practical achievement against tremendous odds has an especial interest and much valuable information for all who are in the centre of attack or along the line of advance of the cactus curse.

Bureau of Sugar Experiment Stations.

The Director of the Bureau of Sugar Experiment Stations has received the following report (6th July, 1925) from Mr. J. C. Murray, Southern Field Assistant:—

Gin Gin.

Growers here are feeling the dry weather. Apparently nothing like the earlier estimates of cane will be cut, and there is no promise of an open winter such as occurred last year to enliven the cane.

It was noticeable that the infection commonly known as mosaic occurred on almost all farms, as well as the fungoid disease ordinary called "Foot Rot" or "Root Rot." The control measures for the former are eradication and selection, whereas to control fungus parasites the growers should realise the importance of crop rotation.

Fungus diseases are spread by seed-like bodies called spores. Each disease has a different kind of spore, which can cause the disease. The longer a certain kind of crop is grown upon the same piece of land the more the soil becomes infected with parts of diseased plants and with spores. A change of crop therefore deprives these fungous parasites of a host and they disappear. For the canegrower the methodical planting of leguminous crops such as cowpea and Mauritius bean will not only have the desired effect in this respect, but will also supply humus and nitrogen to the soil if used as a green manure.

Growers are inclined to be easy-going in regard to these matters. It must be said, however, that many farmers are anxious to carry out soil improvement, but are continually faced with the necessity of taking a maximum crop off each year.

Canes making the best showing in the Gin Gin district at present are M.1900 and Q.813. Farmers continuing to plant D.1135 are recommended to obtain their plants from a different type of soil from which they are planting. A locality where excellent cane of this variety may be seen is Maidavale, about seven miles north of Bundaberg. Plants from this area would be a change for alluvial, black Maroondan soils, or red volcanic soils.

Bundaberg.

At Sharon the cane is showing a very fair crop, but dry. The farms back from the river are fairly healthy, although Leaf Stripe, Mosaic, and "Foot Rot" (*Marasmius sacchari*) are in evidence. This does not mean, however, they are badly affecting the cane. Remarks made about disease do not necessarily mean serious affections, but are for the purpose of letting the growers know they are present so that a careful lookout may be kept when planting. On the river the crops are heavier, although growers have more work ahead of them in regard to the eradication of Mosaic than those back on the forest loams.

The question is often asked, "Is there no cure for Mosaic disease?" There is no actual cure for an affected stool and it is improbable that it is worth while searching for one, seeing that the disease can be readily controlled by growers co-operating in the work of plant selection and the destruction of diseased stools. There would be no need for doctors if humanity could work on the same principle either. Care should be taken not to plant corn near to cane.

Canes that are making a good showing in this area are Badila, N.G.16, H.Q.285 (on the river), and M.1900, D.1135, and Q813 on the higher lands. Growers are strongly recommended to do away with all useless varieties and keep apart from their main crop any new ones they may be trying.

A noteworthy feature of this locality is the fine oranges and mandarins that can be grown. The writer has seen nothing finer in the world than those Sharon oranges. At Branyan the cane looks healthy on the whole, though dry. There is a great deal of land here that would grow good sugar-cane, and which, in the course of time, will no doubt be producing. Cane varieties making good growth here are E.K.28, H.Q.285, Q.813, M.1900 Seedling, D.1135, Q.970, N.G.16, Badila, Q.1098, and M.55.

Very little fertilising is being undertaken in this area. Judging by the texture of the soil and the reaction, lime would be beneficial, as well as green manures. In canegrowing areas at present the average attitude of the grower is, to use a colloquialism, "not to bite off more than he can chew." That is to say that small well-farmed areas are going to pay the best.

At Gooburrum conditions are much the same as at other places mentioned. In places the cane is backward, although along the North Coast road where new forest land has been planted there is cane probably equal to anything in Southern Queensland. Varieties that do very well on this class of land are D.1135 and H.Q.285,

that is why it is recommended earlier in this report to obtain changes of plants from localities such as these.

Crops generally will not be nearly so heavy as was anticipated two months ago. Rain has fallen within the last few days but the weather is cold. The temperature at present is about the minimum at which cane will grow, and by the outlook it is improbable it will begin to rise towards the optima until about August.

ON NORTHERN CANE FIELDS.

On his return to Brisbane, after a visit to the Northern sugar districts, the Director of Sugar Experiment Stations (Mr. H. T. Easterby) stated that his itinerary had embraced Bundaberg, Mackay, Lower Burdekin, Tully, Johnstone River, Babinda, Mulgrave, Cairns, and Mossman, and had occupied some seven weeks.

Bundaberg.

Early in June the Bundaberg area was found to be suffering to some extent from a dry spell. This also applied to the Isis district. The ratoon cane was not looking too well, but the plant cane was much better. The estimates of cane to be crushed for the various Bundaberg and Isis mills had been a good deal reduced. Later in June heavy rain fell, accompanied by gales, which laid some of the cane over. This rain was followed by cold weather which has prevented the cane generally from making much further growth. Extensive improvements have been carried out to the Bundaberg mills during recent years. At Fairymead new electric machinery was being installed, together with new triple effets, largely increasing the heating surface capacity of the mill. A greatly improved water supply had also been added, together with new boilers.

Mackay.

The Mackay district was also somewhat dry at period of visiting, as there had been no rain for some time. The mills in that locality had also reduced their estimates to some extent, though in one instance, North Eton, the expected yield was higher than anticipated in February last. The Mackay mills have nearly all increased their efficiency and capacity in recent years, and are now all capable of dealing with large crops of cane. New lands have been opened up along the North Coast railway line. In spite of reduced estimates, however, it is anticipated that Mackay will produce a record yield of sugar providing everything goes smoothly.

Lower Burdekin.

The Lower Burdekin district was visited in July, and the crops produced this year were in many instances remarkably fine. Some enormous crops of Badila cane were seen, in some instances running up to 60 tons and 70 tons per acre. Good crops of H.Q.426, B.208, N.G.24B, Q.813, Q.903, and E.K.28 were also inspected, some of the latter three varieties on Mr. G. Mackersie's farm at Ayr being exceptionally tall. The variety known as E.K.28 appears to be progressing in favour and is generally well spoken of. The young plant cane looks very promising, but the area planted did not appear as large as at this time last year.

Large stocks of sugar were being stored at Inkerman, Pioneer, and Kalamia, owing to the difficulty in getting the product away. A new Babcock boiler has been installed at Inkerman, with chain feed mechanical stoker for burning coal. This will be watched with considerable interest in view of the possible utilising of megasse in manufacturing celotex. Crushing at Inkerman was proceeding smoothly, a big crop being anticipated, and the mill was putting through 6,300 tons per week. Early in July the c.e.s. was 13.86 per cent. and rising. At Kalamia four additional crushing mills were being installed, which, when complete, will provide eight crushing mills in all—the largest plant of the nature in Queensland. New effets, vacuum pans, superheater, subsider, and two new boilers (Babcock and Wilcox) are being put in, a new chimney is being erected, while a new loco. and 150 additional trucks have been supplied. All these improvements will render the Kalamia mill practically a new one of high efficiency. At Jarvisfield some exceptionally fine crops were inspected, and it may be said that this year's production of Badila on the Lower Burdekin surpasses any cane of the same variety seen elsewhere, even at Innisfail.

Innisfail.

At Innisfail, after a continued spell of dry weather following the ordinary wet season, heavy rains in June were again experienced. Enormous crops of cane were visible in every direction and, for the greater part, of good growth and colour, though the ratoons were not so good as usual and most of the late-cut cane had not attained much growth. The crop, however, will be a heavy one, especially at South Johnstone. Grubs are doing a certain amount of damage, but it was estimated that not more than from 3 per cent. to 5 per cent. of the total crop had been affected. The cane at South Johnstone was being received at the mill in a much cleaner

condition than in previous years. At Mourilyan a new Mirilees-Watson 5 ft. 6 in. mill had been put in for this season's crushing, and this with some other addition, such as new chimney, Torricellian system for effets, together with the improvements carried out during the past two years has made practically a new up-to-date mill of Mourilyan sugar factory. The Goondi sugar mill was crushing smoothly, and dealing with large tonnages per week. A brief visit was paid to the Tully, where the new sugar mill was inspected, which is being erected by Walkers Ltd. for the Queensland Government. This exceptionaly fine plant is now well under way, the crushing mills, evaporating apparatus, electric machinery and boiler house, are completed or nearly so. The crushing and evaporating plants have been manufactured at Walker's, Maryborough, and the Bundaberg Foundry, and reflect the greatest credit on those foundries. The boilers, six in number, were made by Thompson, of Wolverhampton, and are of a different type to those usually found in sugar mills. The erection is in the charge of Mr. Barbat, of Ipswich, who also re-erected the Invicta mill at the Haughton River.

Babinda.

At Babinda, at the end of June, the strike in connection with foreign labour being too largely employed was entering upon its fifth week, and it was thought that a deadlock had been reached, the situation being complex. Happily the strike terminated shortly afterwards, on the 3rd July, the management agreeing to supply forty more British canecutters, and an additional thirty on tramlines, the men agreeing to work overtime in order to deal with more cane per week. The management also promised to employ 75 per cent. British labour in the fields next year if available. The cane on the Russell River, except the late cut, looked very well, but some grub damage was noticed here and there. In one area 31 acres had been eaten out. The northern end of Babinda was poor, the later-cut cane being backward. Grub damage was much in evidence and the original estimate of the Babinda mill is not likely to be reached. Mulgrave mill was doing good work, putting through about 6,400 tons of cane a week, the c.c.s. early in July being 12.4 per cent. Grub damage, however, was rather extensive, it being estimated at 12 per cent.

Mossman.

Great improvements have been carried out at the Mossman sugar mill. A new pan of 15 tons sugar capacity, made by Messrs. A. and W. Smith, has been installed, while a new crushing mill, made by the same firm, has also been erected. New engines, intermediate carriers, pumps, gantry and crane have been put in, and a fine new water service, capable of supplying 200,000 gallons per hour, has been added to the existing supply. The mill management have expended £32,000 this year and an additional £6,000 on tramway extensions. They now possess a plant capable of treating 1,000 tons of cane per day, and are hoping to secure the Daintree country as a further cane supply. This district presented some good cane, and cultivation has greatly improved of recent years. Fertilisers are largely in demand, and last year over 1,000 tons of manure were purchased by the mill and delivered to the cane-growers.

In the way of varieties E.K.28 and H.Q.458 were found to be doing well at Mossman. A great deal of D.1135 is still grown. B.147 shows signs of deterioration.

Field Days.

Highly successful field days were held at the Experiment Stations of Bundaberg, Mackay, and South Johnstone during the month of June. The attendances were large, and the keenest interest in Experiment Station work was displayed by cane-growers and others. The work of raising seedlings at South Johnstone aroused considerable attention.

Summary.

Taking the districts as a whole, some very fine crops were seen, and the yield is sure to be a large one, resulting in a surplus. It was found that the Northern mills with one or two exceptions were still holding to their early estimates, but several of the Southern mills had dropped their earlier estimates materially.

Three factors may be said to contribute to the surplus sugar production:—(*a*) The number of canegrowers has increased by 50 per cent. since 1920; (*b*) the area of land under cane has increased more than 30 per cent. since the same date; and (*c*) the season has, on the whole, been favourable in most parts of the sugar areas, especially the North.

While the surplus at present estimated will not be quite so large as originally anticipated, other factors may enter to still further reduce same, such as the present maritime strike, if continued, frosts, or an early wet season in the North. A good deal of late-cut cane last year has not made much growth so far.

The maritime strike, if it goes on any time, may have the effect of closing some mills up as their storage capacity is very limited.

CANE PEST COMBAT AND CONTROL.

The following report (3rd July, 1925) has been submitted by the Entomologist at Meringa (Mr. E. Jarvis) to the Director of Sugar Experiment Stations:—

Dipterous Larva Attacking Roots of Cane.

Towards the end of February last complaints were received from Mackay regarding what appeared to be a new cane pest, said to be affecting the sets and retarding or preventing development of young shoots of ratoon and plant crops. A grower at Finch Hatton, when examining stools that after cutting had failed to ratoon, found great numbers of small brown maggot-like larvæ adhering to the roots; the head-end being inserted into the living tissue, while the remainder of the body projected from the roots at angles varying from 45 to 80 degrees.

Several of these curious larvæ were sent to our laboratory, and when placed in breeding-cages produced imagines a few weeks later. These proved to be flies belonging to the Stratiomyiidæ, a family that includes many species of more or less economic importance.

The insect in question proved to be *Metoponia rubriceps* Macq.; a small black fly from three-eighths to half an inch in length, with smoky-brown wings, conspicuous red head, and large black, rather prominent eyes. The male, which is less than half the length of the opposite sex, is also black with very large eyes meeting above and occupying the entire upper surface and sides of the head. Its wings are dusky brown and the legs reddish yellow.

Although two broods of this dipteron are said to occur each year, the larval period is believed by Dr. Vera Smith to occupy more than six months, and possibly considerably longer than twelve months.

The perfect insect makes it appearance in Sydney for a few weeks during the spring, and again in the autumn. The flies are said to particularly favour well-cultivated lawns, and may be seen commonly flying over or resting upon the grass in such situations. At Finch Hatton, near Mackay, they were observed towards the end of May last in great numbers, especially, we are informed, over newly planted ground.

The eggs of this insect are laid in irregular masses, of form illustrated on the accompanying plate, and have been described as being "opaque, white in colour, and elongated oval in outline, slightly broader at one end than the other." The fully grown larva is about half an inch long, very sluggish in habit, and of a dirty yellowish-brown colour; each body segment bearing a tranverse row of stout black hairs. (*See* magnified sketch, Fig. 1 on plate.)

With regard to the likelihood of this stratiomyid being included in the near future among our more serious cane pests, I would point out that at present it would be rash to assume that the injuries to cane roots reported from Mackay should necessarily be attributed to the larvæ of *Metoponia rubriceps*. It is possible for such small larvæ to pierce and suck moisture from plant tissue without causing it to die; unless, of course, as happens in the case of certain sap-sucking bugs, some irritating poison be introduced into the punctured portion.

It is interesting to note in this connection that Dr. Vera Smith, when studying the life-cycle and habits of this insect, noticed that even when the larvæ were very numerous the grass harbouring them showed no ill effect from their presence.

Control Measures.—Paradichlor. and carbon bisulphide have been found successful fumigants against soil-frequenting larvæ; the former insecticide being preferable for such work owing to the fumes arising from it being given off during a period of from six to eight weeks or longer. At present, however, paradichlor. is not procurable in Australia, whereas carbon bisulphide can be obtained here.

The latter fumigant could be applied with a Danks Injector in doses of about ¾ oz. placed one foot part on each side of cane rows, at a time when the "strike" has just appeared above ground. These injections should be made about six inches from the centre of stools and three to four inches deep. Growers should bear in mind that such treatment will be thrown away unless the soil at time of injecting be free from excess of moisture. (See Bulletin No. 17 of this Bureau.)

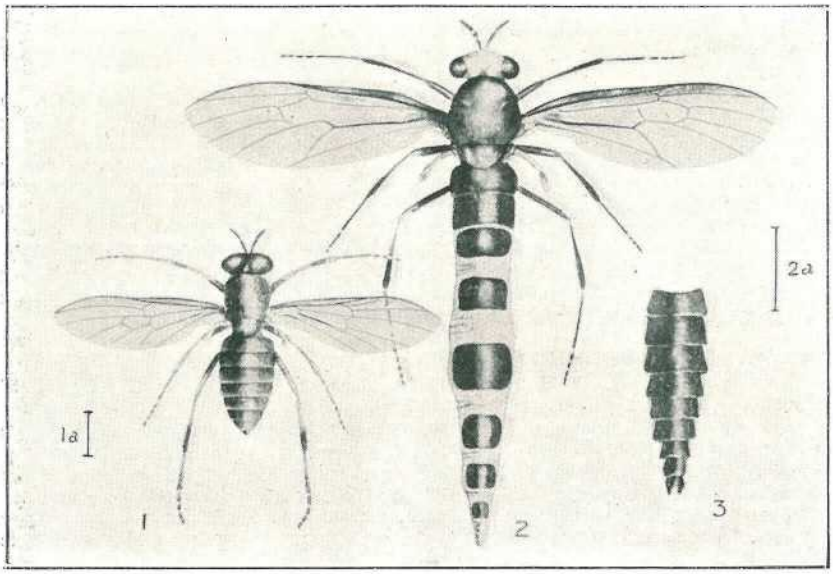
Dehydrated tar would, in my opinion, prove useful as a repellant against larvæ of this pest. It can be applied in the form of some tar-coated material such as coarse sawdust, from which the finer particles have been sifted; or with perfectly dry soil similarly treated. We have found the best proportion for coating the former carrier to be about 56 lb. of sawdust to 42 of tar. When thoroughly mixed, this can be handled and bagged without any risk of the tar subsequently leaking through or making a mess. If sown like manure, in a drill alongside the rows to a depth of about 4½ inches and then covered, and the soil consolidated above the drill, the deterrent odour should gradually penetrate to the sets, probably protecting same and the main roots from attack for several weeks; thus giving the plants a chance

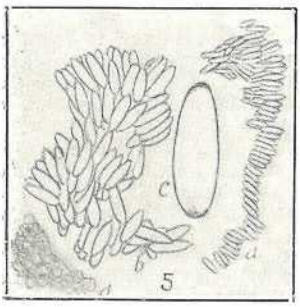
to get ahead and become strong enough to shake off the effect of any subsequent invasion.

Crude naphthalene, applied at the rate of 3 cwt per acre, has been found effective against wireworms, &c., and should also prove a means of controlling larvæ of *Metoponia rubriceps*.

Dehydrated Tar as a Repellant for Cane Grubs.

During the month of May the effect of dehydrated tar on grubs of *Lepidoderma albohirtum* Waterh. was studied in the laboratory. Twenty-four cages were used in this experiment, each containing about 36 cubic inches of soil, and a single third-





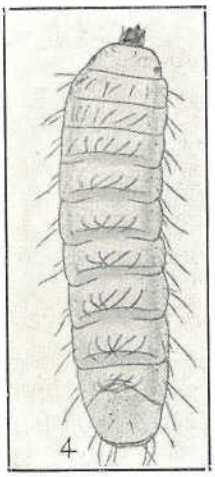


PLATE 26.

Fig. 1. *Metoponia rubriceps* Macq. (male) magnified.
Fig. 1a. The same, natural size.
Fig. 2. *Metoponia rubriceps* Macq. (female) magnified.
Fig. 2a. The same, natural size.
Fig. 3. Abdomen of female, showing the more usual appearance, magnified.
Fig. 4. Larva of *Metoponia rubriceps* Macq. (x 10).
Fig. 5. *a*. Egg cluster of *M. rubriceps* Macq. (x 5); *b*. egg cluster (x 10); *c*. single egg (x 32); *d*. sculpturing on chorion of egg (x 193).

(*Drawings after D. J. Farrell*).

grade grub. Doses varying from ⅛ to ¼ oz. of tar-coated sawdust were placed in these cages, the deterrent in some being mixed with the soil, while in others it was buried in a lump either at the bottom, centre, or close to the surface. When examined a couple of days later, all the grubs placed in bottom of cages with doses of ⅛ oz. in middle of same showed signs of being affected. By the twelfth day they were very sickly, one dying on the nineteenth day, while the remainder, although able to move their legs very feebly, were practically dead, some having assumed a deep brown colour. The repellant odour in the soil was still very strong after a lapse of twenty days, but had lost its sickly smell. In cages containing ¼-oz. doses the grubs turned a brownish yellow in less than a week, and by the end of seventeen days all were dead.

In tests where doses were placed at the top and bottom of cages results very similar to those given above were obtained; indicating that the odour had quickly penetrated through the soil from centres of injection.

As might have been expected, best results were recorded from cages where the deterrent had been uniformly mixed with the soil. Mr. A. N. Burns, Assistant Entomologist, who carried out this experiment, noticed that by the third day all grubs in these cages displayed symptoms of vomiting, indicated in each case by a globule of earthy matter adhering to the mouth parts; and that all these grubs assumed a deep yellowish brown colour before death. In cages containing ⅛-oz. doses all grubs were found to be sickly after a lapse of only one day, while a mortality of 100 per cent. was secured in less than a fortnight after treatment.

We may gather from the foregoing encouraging data that laboratory work with dehydrated tar has proved sufficiently conclusive to warrant the establishment of an experiment plot next season on some grub-infected area of cane land.

Liberation of Parasites of Beetle-Borer.

On 22nd May Mr. R. W. Mungomery, Assistant Entomologist, released 140 specimens of *Coromasia sphenophori* at South Johnstone. These were let go in four separate lots amongst cane near the river, on an area where this pest has occasioned considerable damage in the past.

On the 3rd June a farm at Babinda was visited where he liberated thirty-six tachinid flies in two separate lots at different parts of the same block; and again, a couple of days later (5th June), let go another batch of forty-two parasites at Meerawa. The worst infestation was found to occur, as usual, on blocks near the river bank.

ENTOMOLOGICAL HINTS TO CANEGROWERS.

By EDMUND JARVIS, Entomologist.

Cane Grub Activity.

During the recent spell of dry weather experienced from 16th April to 5th June much cane in the Innisfail, Cairns, and Babinda areas has shown evidence of grub attack; and although no further damage can now be effected, the grubs having ceased feeding, we may expect a big emergence of beetles during November or December next.

Growers would do well to locate the position near headlands of favourite food-plants of these insects, as native figs, such as *Ficus pilosa, nesophila, cunninghamii,* &c., and clear away any undergrowth chancing to surround them in order to stimulate the activity of such trees and render them easily accessible for collecting from during the flighting season. The propagation of young trees of *F. pilosa* is being carried out at present at our laboratory, and we hope to be able to distribute these to growers later on for planting at regular intervals on or close to headlands to attract beetles that may visit or migrate to cane land.

Watch for Evidence of Large Moth-Borer.

During the recent spell of dry weather experienced from 16th April to 5th June expected to appear in localities favoured by this moth-pest. At this time of year the tops of cane sticks nearing maturity are often tunnelled, such injury leading in most cases to death and ultimate browning of the unfolding central leaves. These so-called "dead-hearts" are sometimes mistaken for signs of fungus attack, but upon cutting through such affected cane tops one finds tunnels containing excreta, &c., which if opened up will be seen to harbour a smooth pinkish-yellow caterpillar about an inch long, that upon exposure to the light wriggles vigorously, and endeavours to fall to the ground. The basal and central portions of cane sticks are also frequently bored by this larva, such injury, however, usually remaining unnoticed unless severe enough to cause discolouration of the heart-leaves. When 10 per cent. or more of shoots are affected, all tops of canes showing "dead-hearts" should be cut off below the injury and either crushed or burnt to destroy the caterpillars or their pupæ. The latter are often found behind leaf-sheaths or at the ends of tunnels.

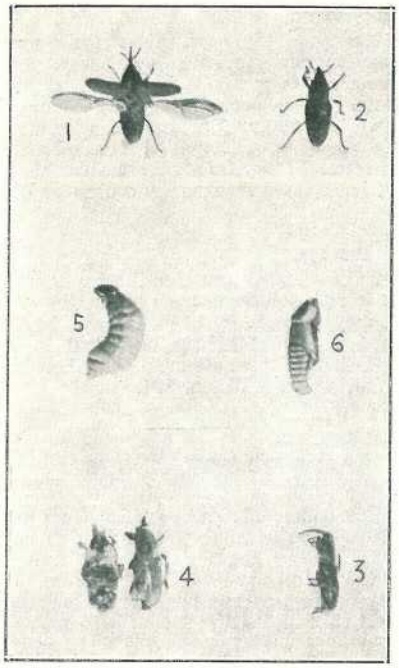


PLATE 27.

Figs. 1, 2, 3—Weevil Borers (about natural size).
Fig. 4—The same, killed by Muscardine fungus.
Fig. 5.—Grub of same.
Fig. 6.—Pupa of same.

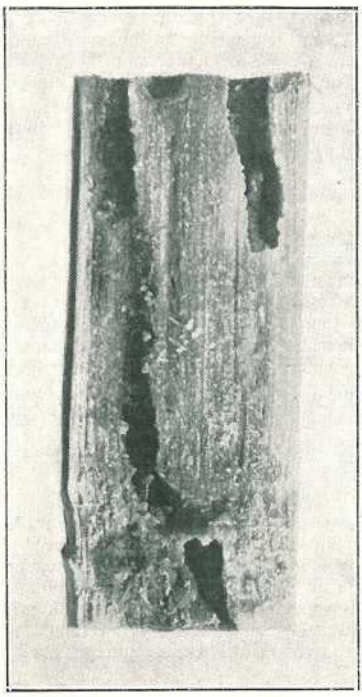


PLATE 28.—PORTION OF CANE STICK WITH TUNNELS MADE BY BORER GRUB.

Keep in Mind the Beetle-Borer.

Mention cannot be made too often of this notorious weevil, seeing that it is second only in importance to our greyback cockchafer. Growers should look out at intervals for indications of its presence in the basal portion of canes situated on low lands or river flats. When such be noticed, communicate at once with the Entomologist at Meringa. The Sugar Bureau will release the tachinid parasite of this destructive weevil (*Ceromasia sphenophori*) free of cost to growers who agree to leave from ¼ to ½ an acre of borer-infested cane for the flies to breed in. This must be left uncut for at least three months from date of liberation of the parasite, and must not be burnt.

Protect your Beneficial Insects.

Continue, as advised last month, to familiarise yourselves with the various parasitic and predaceous insects attacking cane-grubs, the larvæ and pupæ of which, when noticed during ploughing operations, should not be destroyed. Some of the commonest of these are figured and briefly described in Hints for March, 1925, given in the "Queensland Agricultural Journal," Vol. XXIII., pp. 273, 274; and "Australian Sugar Journal," Vol. XVI., p. 831.

ADVICE FOR AUGUST.

Farmers Should Read.

The object of these Entomological Hints—which have been issued regularly each month since November, 1923—has been, *firstly*, to familiarise growers with the more important insect enemies affecting sugar cane; and, *secondly*, to advise them, as the season progresses, of the actual appearance of such on the wing; of the insidious activity of certain grubs of root-eating beetles; or of the presence of larvæ of those species that tunnel in cane-sticks and young ratoons, or feed upon the leaves.

Since these hints deal only with cane-insects of *notable* economic interest, the damage occasioned by which continues in some of the species throughout a period of from two to four months or longer, a certain amount of recapitulation is unavoidable.

Although, perhaps, somewhat tedious to a few growers, such reiteration, however, doubtless serves to help others to memorise the various points of distinction peculiar to the beetles, grubs, caterpillars, &c., attacking their cane.

Fighting the Beetle Borer.

Growers are not likely to forget the efforts made by the Sugar Bureau to help them to combat this pest, by liberating in borer-infested canefields specimens of *Ceromasia sphenophori*, the well-known tachinid fly parasite, which has proved an important controlling factor of this weevil-borer in North Queensland, and also in Hawii, Fiji, and elsewhere.

These parasites are being bred continually at Meringa Laboratory, from which centre the Bureau is prepared to release specimens at any time, free of cost, to farmers who will agree to leave about half an acre of borer-infested cane for the flies to breed in. This should be left standing for at least three months, and must not be burnt.

On low-lying areas grossly infested by this borer good results can be secured from bait-traps. These consist merely of pieces of split cane (stick split once down the centre) about 18 in. long, placed in little heaps of from fifteen to twenty pieces or more on headlands of plantations and covered by trash to retard drying up. We have found it a good plan to lay such heaps in shallow cavities of about 12 by 20 by 8 in. deep cut in the firm soil and lightly covered with trash or other loose debris. In traps so constructed the split cane retains its moisture and gives off an attractive fermenting odour during a much longer period, and, moreover, maintains a conditions that induces these weevils to remain and congregate among the moist sticks.

Visit these traps every second day to collect the beetles attracted to same.

Other Cane Pests.

Owing to cool weather conditions little serious trouble need be anticipated this month from such insects as the "Large Moth-Borer" (*Phragmatiphila truncata* Walk.); the "Army Worm" (*Cirphis unipuncta* Haw.); the Cane Aphis (*Aphis sacchari*); or the so-called "Grass Worm" (*Laphygma exempta*). A look out, however, should be kept for the first indication of such migrating caterpillars, which usually originate on grassland in low-lying situations, from which they eventually travel in vast armies, taking all before them; and at such times are liable to invade canefields..

IN NORTHERN SUGAR LANDS.

SUCCESSFUL FIELD DAY AT SOUTH JOHNSTONE.

INSTRUCTIVE CANE TESTS.

The final of a series of successful field days, under the aegis of the Bureau of Sugar Experiment Stations, was held at South Johnstone. Very large attendances at each demonstration indicated the popularity of this form of practical field instruction in sugar cane breeding and culture in Queensland.

In its beautiful setting on the banks of the South Johnstone River, the Northern Sugar Experiment Station was the rendezvous for over two hundred farmers, representative of cane areas from Goondi to the Tully, on the occasion of the last field day of the annual series. There were present in addition strong contingents of professional, financial, and commercial men of Innisfail and other district business centres. All followed closely and appreciatively the demonstrations in cane planting experiments and the use of fertilisers and tractor power, and listened attentively to the interesting addresses of Mr. H. T. Easterby (Director of Sugar Experiment Stations), Edmund Jarvis (Entomologist), and J. F. F. Reid (Editor, "Queensland Agricultural Journal").

On arrival at the station the visitors were cordially welcomed by Mr. P. H. McWalters (chemist in charge).

In his address of welcome, Mr. Easterby made special reference to the excellent work accomplished by Mr. McWalters at the station, particularly in the work of raising seedling canes, in which excellent and highly valuable results have been obtained.

Value of Subsoiling.

In the course of the subsequent tour of inspection round the experimental plots, Mr. Easterby gave details of several experiments carried out at the station.

These he explained were laid down in 1920, to determine the value of subsoiling, and were carried on to a third ratoon crop last year. The largest yield from the third ratoon crop was that from the plot which had been subsoiled and fertilised, viz., 36.28 tons—a remarkably good tonnage from third ratoons.

The average yield of cane from the four crops was as follows:—

1. Not subsoiled, no fertiliser, 35.05 tons per acre.
2. Subsoiled, no fertiliser, 38.57 tons per acre.
3. Not subsoiled but fertilisers applied, 41.94 tons per acre.
4. Subsoiled and fertilised, 45.32 tons per acre.

Average difference in favour of subsoiling unfertilised plots (four crops), 3.52 tons per acre.

Average difference in favour of subsoiling fertilised plots (four crops), 3.38 tons per acre.

The results of this experiment had been uniform and confirmed the wisdom of subsoiling on suitable lands.

Fertiliser Results.

In experiments carried out with lime and basic superphosphate, and mixed with manure, it had been found, the Director explained, that so far the best results had been obtained from the use of basic superphosphate. From experiments as far as they had gone it had been found that phosphates give very good results on Northern lands, but further trials would be made along these lines.

Close Planting.

Experiments carried out at other stations, continued Mr. Easterby, had always shown the advisability of close planting. In order to find out whether this was the

case at South Johnstone, a series of experiments were undertaken. The results of the plant crop were as follows:—

1. Rows 5 ft. apart, plants spaced 12 in., 41.23 tons per acre.
2. Rows 6 ft. apart, plants spaced 12 in., 37.31 tons per acre.
3. Rows 7 ft. apart, plants spaced 12 in., 37.46 tons per acre.
1. Rows 5 ft. apart, plants spaced 6 in., 40.15 tons per acre.
2. Rows 5 ft. apart, plants spaced 12 in., 36.37 tons per acre.
3. Rows 5 ft. apart, plants spaced 24 in., 32.49 tons per acre.

As in previous trials of this nature, the closer planting had given the highest yields per acre. The variation in distance between the rows, however, had not had on this occasion a more important bearing upon the yield of cane when compared with the yield of the plots in which the distance between plants in the row was varied. These experiments, however, were very interesting, and should discourage those canegrowers who frequently advocate wide planting as a means of securing higher yields.

Seedling Propagation.

It was determined in 1921 to endeavour to raise new seedling canes at the South Johnstone Sugar Experiment Station. With the favourable environment there it was considered that success might be obtained. Accordingly, early in 1921, the chemist in charge was advised to commence work as soon as the arrows were sufficiently mature. Full instructions were sent, proper soil and boxes were prepared, and as soon as the arrows became "fluffy" they were sown separately.

A large number of seedlings had now been raised and field and chemical selection was taking place.

Following are the results, Mr. Easterby explained, of analyses of varieties:—

PLANT CANE, 1923. AGE, THIRTEEN MONTHS.

Tableland Badila	16.45
Tableland Goru	14.67
E.K. 28	14.63
Q. 903	12.5
N.G. 24A	16.02
Oba Badila	16.32
Q. 813	14.21
Q. 116 Sport	11.1
Badila Seedling	15.77
Rose Bamboo	15.26
H.Q. 426	15.19
M.Q. 1	15.68
N.G. 24B	13.8
N.G. 16	13.66

In the course of the tour through the well-kept field an opportunity was given canegrowers to compare the results of canes grown under various conditions. This arrangement was most valuable, for the results were even apparent to the uninitiated, and information respecting the method of cultivation and variety of cane of each plot was exhibited on cards at each headland. Both Messrs. Easterby and McWalters added interesting data.

Luncheon.

A generous luncheon was tastefully served on the verandah and beneath a bower adjoining. Provisions were in abundance, and it was a well satisfied group that faced subsequently the ubiquitous photographer. The catering was in the capable hands of Mrs. and Miss McWalters (mother and sister of the chemist in charge) and other ladies, whose excellent hospitality earned for them three rousing cheers from those assembled.

The Addresses.

After luncheon informal addresses were delivered by Mr. Edmund Jarvis, of the Entomological Station at Meringa, and Mr. J. F. F. Reid, Editor of the "Queensland Agricultural Journal." Mr. Easterby presided.

Mr. Jarvis on Cane Pests.

Not the least interesting item in the day's proceedings was the address on Cane Pests by Mr. Jarvis. He explained that, like most insects, the life of the grub occurs in four stages: the egg, the grub, the chrysalis, and the fly. The eggs are laid at a depth of from 1 to 2 ft., and, unfortunately, cannot be disturbed by cultivation. Under difficult conditions they can be attacked by carbon bisulphide.

The same fumigation is more successful in the grub stage. Paradichlor. may be also used. Hand collecting is recommended, as one beetle will produce twenty-four grubs. Then native enemies might be encouraged, such as the digger wasp, the ibis, and green fungus. In the winged or beetle stage they are particularly attracted to fig trees, and will feed readily on the poisoned leaves. Paris green can be used as a spray for the poisoning.

Continuing, he said that the next pest to be considered was the borer, which did considerable damage in every cane district. The liberation of certain flies was the best remedy against the borer. Then the pest could be extensively trapped on the headlands, and destroyed in the burning of the cane trash. It had been noted that some seed canes were unattractive to the borers. Mr. Jarvis's remarks were keenly appreciated.

Tribute to the Agricultural Press.

Mr. Reid, in the course of his remarks, said that, while Mr. Jarvis and other agricultural scientists were able to get at the facts of any particular scientific problem and suggest solutions, he was faced with the difficulty of getting the farmer's ear and impressing him with the economical importance of the scientist's investigations and discoveries. To aid him in this, departmental publications were brought into service. In this desirable publicity they had also to acknowledge the assistance to the industry of the Agricultural Press, which was an excellent medium for bringing before the farmer the results of agricultural research, and Queensland, he said, was very fortunate in that respect. In no capital in Australia was so much space allotted to rural matters by metropolitan dailies, while the general standard of the country Press, from a farmer's point of view, was a very high one. Results of experiments and notes on current agricultural problems and topics always found ready publication in full with wise and intelligent comment. This active and valuable form of agricultural extension merited their appreciation. In healthy and progressive agricultural development, experimental work was essential, but if its results were not conveyed to the farmer in readable and digestible form it was of little real service to the community. The importance to the farmer of publications like the "Queensland Agricultural Journal" and the general agricultural Press was therefore quite obvious.

Higher Agricultural Education.

In commending the educational policy on which Sugar and Stock Experiment Stations and the Queensland Agricultural College were based, Mr. Reid said that it was the function of higher agricultural education not only to train students who will ultimately enter into the practice of agriculture on their own holdings, but also instructors, research workers, and the moulders of their agricultural future. With this object in view the courses at Gatton should develop still further the scientific side, and the College, he thought, should definitely take its place as an auxiliary to the Queensland University.

Science, as applied to agriculture, was receiving every encouragement under a far-sighted rural policy which aimed to bring agriculture within range, if not of a distinct profession, at least of a sound and well regulated business. Agriculture, it was recognised, was evolving into a complex and scientific industry, showing at each step the marks of the direct influence of pure science. It was believed that pure science constituted the active source from which true, practical progress—sometimes, it was admitted, along winding paths—was being made. The testing of new theories and their advance to the stage of practical experiment, and then the general diffusion of the newly acquired knowledge, was, as was evident at the annual field days, engaging the attention of the scientific and field staffs of the Department of Agriculture.

As was also in some measure evident that day, the whole available forces of modern science and invention were being brought into focus by the Department in field work and efforts to solve their farming problems. (Applause.)

On the motion of Mr. Percy Pease, M.L.A., cordial votes of thanks were accorded Mr. Easterby and the other speakers. A similar compliment was paid to Mr. McWalters and the staff of the station.

Tractor Demonstration.

Part of the afternoon was devoted to a tractor demonstration, when two firms handling farm machinery gave excellent displays of their tractors, the working of both machines—a Cletrac and a Rumley—being followed with great interest.

The outing was a social and practical success, and served to show the leading part the scientist takes in assisting the grower to get the very best results. The South Johnstone Sugar Experiment Station is fulfilling its good purpose of guiding the canegrowers in the practical part of the business, and growers have good reason to appreciate the assistance accorded them in this direction.

THE CULTIVATION OF THE PEANUT.

BY N. A. R. POLLOCK, Northern Instructor in Agriculture.*

Description.

The Peanut, "*Arachis Hypogeia,*" also known frequently as the earth or ground nut, is a plant of annual habit, belonging to the natural order Leguminoseæ or pod-bearers, and in common with most other members of the pea family has the power of obtaining its nitrogen supply from the atmosphere and storing it up in nodules on the roots.

Unlike other legumes, excepting the Bombarra ground nut, "*Voandzeia Subterranea,*" this plant, while blooming above ground, matures its pod or fruit under the surface of the soil. The yellow flowers are borne at the joints where the leaves are attached to the stem, in the bunch or upright varieties at the base of the plant, and in creeper or procumbent varieties right along the stems. Upon pollination taking place the flower fades, and falling off leaves the stalk with a thickened pointed end called the "peg" or "point," which grows down into the soil, where it matures into the pod or so-called nut. It is apparent from this that the soil on which the crop is grown should be of a soft or friable nature or such that a loose surface can be easily maintained.

Range.

The peanut can be grown over the whole of Queensland, and while in the cooler parts it only succeeds in summer, in the tropical portions it may be grown at any period of the year where a sufficiency of rain falls.

The period of growth ranges according to variety and climate from fifteen to twenty weeks, the longest period being taken up by the creeper or procumbent varieties.

A moderate rainfall, plenty of sunshine, and a comparatively high temperature best suit the crop, and departures from these may result in a more lengthened period of growth. The crop can also be grown under irrigation.

Soils.

The nature of the soil on which the crop is grown, besides its fertility, is the main factor in a profitable crop. A loose texture is desirable to allow the pegs to easily penetrate and expand to form the pods and mature evenly, as well as to permit of easy harvesting in freeing the nuts from the soil. Good drainage is also essential, more especially when a heavy rainfall is liable to occur during the growing period.

Light sandy loams are best adapted for the production of peanuts for market as edible nuts, since the shells are clean and bright. Soils inclined to be clayey are apt to stain the shells, and though the berries or peas may be of equal quality, the clean, bright shell, being more inviting, will naturally command a better price. Ill-drained or sour soils are not desirable. Peanuts may be grown on most soils except a heavy or puggy clay, but except in the loose, friable soils they should only be grown for feeding off.

Rotation.

Peanuts should always be grown in a rotation, as though owing to the roots being harvested the same quantity of nitrogen is not left in the soil as with other legumes, where the whole root system is available, a sufficient quantity of the nodule-bearing rootlets are left to exert an influence on the following crop. At Tolga, in a comparison with potatoes grown on land on which the previous crops were maize and peanuts, the yield on the portion previously cropped with peanuts was estimated by an official of the Department to be 9 tons of tubers as against 6 tons on that previously cropped with maize. In the rotation, however, the peanut, when harvested, should not take the place of the legume or other crop that is ploughed under to restore the organic matter in the soil, and should only be looked upon as adding a quantity of nitrogen. Where the whole growing plant is ploughed under it answers the same purpose as cowpeas, Mauritius, and velvet beans, &c.

In orchards, either as a crop to be ploughed under or to be harvested, the peanut is commended.

Fertilisers and Lime.

In common with other legumes, the peanut thrives best in a soil in which there is a sufficiency of lime. Not all soils require the addition of lime, but most soils in districts subject to heavy rainfall, and which give an acid reaction, will benefit by

* Reprinted from "Queensland Agricultural Journal" for June, 1922.

an application of from 5 to 10 cwt. of stone lime or 10 to 20 cwt. of earthy lime or pulverised limestone to the acre, broadcasted (not ploughed in), preferably a week or more before applying commercial fertiliser and sowing the seed. The cultivation of the crop will sufficiently work this lime into the soil. Where any doubt exists as to the necessity of applying lime to the soil, a portion should be limed and the resultant crop compared with a similar area unlimed.

In applying manures for the crop, care should be taken to only apply organic manure is a well rotted condition, and then only in small quantities and thoroughly mixed with the soil. Larger quantities or fresh manures will result in many of the pods being poorly filled. These poorly-filled pods are known as "pops" or "duds."

Organic manures should be applied to a previous crop to get the best results.

As the peanut is a legume and draws nitrogen from the air, this element is not called for in quantity in the fertiliser, but its presence in small quantity, say, 2 per cent. or 3 per cent., will be beneficial. Phosphoric acid and potash will be the chief elements in the fertiliser, and the quantities will be dependent on the soil content. In general, a fertiliser containing from 10 to 12 per cent. phosphoric acid, 2 to 3 per cent. nitrogen, and 6 to 8 per cent. potash will be a good mixture, and may be applied in quantities of from 1 cwt. to 5 cwt. per acre. Such a mixture can be obtained with 1 part sulphate ammonia, 7 parts superphosphate, and 1½ parts sulphate of potash.

The most suitable application will be discovered by applying varying quantities over a small area and noting results, but usually 2 cwt. is sufficient.

Commercial fertilisers are usually applied immediately prior to planting a crop, and as the roots of the peanut do not spread to any distance, the application in the drill with a fertiliser distributor having one or two tines at the back will greatly aid in mixing the fertiliser with the soil.

Ashes from the forest hardwoods, which contain lime and potash, are useful, and may be applied to the soil broadcast in a similar manner to lime at the rate of about 10 cwt. to the acre. These ashes, however, should not previously have been exposed to rain, as then a great deal of their value will have been lost. The ashes of soft woods growing in the scrubs are not considered so good.

Selection of Seed.

As with other crops, in order to secure the best results it is essential that the seed of the peanut should be of the highest grade. Poor seed cannot be expected to yield a good return. In the first planting, seed should be secured from a heavy producing crop and subsequently carefully selected in the field from the heaviest producing plant of the required type. A good plan is to select the nuts from the best producing plants and sow these in a special seed patch, each year selecting the best of this area for next year's seed patch. Nuts harvested for seed should be fully matured, handled carefully, and not picked from the plants for several weeks after curing; they should then be picked by hand and the selected ones thoroughly dried and stored in a dry place free from mice or insect attack. Storage in tanks in a similar manner to maize is most satisfactory.

Methods of Planting.

The seed can either be planted whole or shelled. Whole nuts may be soaked in cold water twelve to twenty-four hours, drained, dried for an hour or two to assist handling, and then planted. This accelerates germination. Shelled seed should not be soaked.

Where shelled seed is used the shelling should be done by hand, though hand shellers carefully handled are sometimes used. All shelled seed in which the thin skin covering the seed is broken should not be sown, as this injury is liable to affect germination.

Breaking the pods in two answers the same purpose as shelling. Where the seed after planting may be subject to attack by vermin, the seed may be treated by springling with a solution of equal parts of stockholm tar and kerosene. In this case, however, to protect the maturing crop it is advisable to destroy, by poisoning, the vermin beforehand.

Whether planted whole or shelled the operation may be effected by hand or with planters especially designed for the purpose.

Amount of Seed.

The amount of seed required to plant an acre is about 40 lb. of the whole nuts and from 25 to 30 lb. of whole nuts shelled, varying slightly according to the weight of the nut and the distance apart they are planted. Some growers use as much as 60 lb. per acre of the large podded varieties. It is interesting to note that the whole nut, when planted, provides but one plant, but if shelled and the kernels planted apart, two plants will result.

Time of Sowing.

According to the climates of the various districts, so will the time for planting vary.

In the cooler districts, sowings may be made when all danger of frosts is over and the soil can be expected to be reasonably warm, September, October, November, and December being suitable months. In the tropics the crop can be grown practically throughout the year, but consideration must be given to climate and rainfall—*i.e.*, sufficient rainfall should be obtained to grow the crop and fine weather be expected at harvest time.

In the tropical portions of the State, where the monsoonal rain or wet season commences in December, the main crop is sown in January, February, and March, according to the likelihood of reasonably fine weather in the months of April, May, and June or July, when harvesting should occur.

In planting large areas it is recommended to spread the sowings over such a time as will allow of harvesting one lot before the next is over-ripe. Peanuts left too long in the ground are easily detached from the plant and consequently more difficult to harvest, while some varieties are liable to sprout.

Length of Crop.

The large nuts or creeper varieties require a longer time for growth to maturity than do the bunch or upright varieties, the time varying from fifteen to seventeen weeks for the bunch varieties and from seventeen to twenty weeks frequently for the creeper variety.

Preparation of Land.

In preparing the land for peanuts the first ploughing may be deep, but the second should not be deeper than 6 in., preferably 5 in. This top 5 in. should be brought to a fine tilth and be free from weeds and trash.

Where lime or ashes have been applied the land is harrowed and drills drawn out, in which the fertiliser, if any, is mixed and the peanuts sown either by hand or with the planter. The drawing of drills may be done with the fertiliser distributor, or the whole operation can be done with a seed drill and fertiliser distributor combined.

Where no seed drill or fertiliser distributor is obtainable, the drills could be drawn out with a cultivator having a wide shovel attachment in the rear, the fertiliser dusted along this by hand, the cultivator then run along the drill with tines set close in front to mix the fertiliser with the soil, and the shovel attachment set at the back to reopen the drill for the reception of the seed to be dropped by hand; this drill should not be deeper than 4 in. from the levelled surface of the soil, and the seed should be covered to a depth of 2 to 3 in., according to the texture of the soil and its moisture content. In light soils where evaporation is great the deeper planting is preferable, but in stiffer soils the shallower covering should be adopted.

A light firming of the soil over the seed is desirable, and this is obtained in the seed drill by a wheel at the rear. When planted by hand the area may be covered with the harrow, or preferably by the cultivator, with tines straddling the drill and set so as to throw the soil inwards.

Time of Germination.

Germination usually occurs with shelled nuts in five days, but is subject to the amount of moisture and heat in the soil. The whole nuts take longer unless first soaked in water, as the moisture has to penetrate the shell to affect the berry or pea which contains the germ.

Spacing.

The intervals between drills and the spacings between seeds in the drills vary somewhat, according to the richness of the soil and the variety planted.

The bunch or upright varieties take up much less room than the creeper or procumbent kinds, and the growth of both is correspondingly greater on the richer soil.

In general, the drills are drawn out from 30 in. to 42 in. apart, the distance being influenced by the space required by the cultivating implement.

The spacing of the seed in the bunch varieties may be from 6 to 12 in. apart, and of the creeper varieties from 12 to 24 in. apart in the drill. An instance of success with close planting is noted from an experiment in which, in a light sandy loam, the bunch varieties were planted 3 in. apart in drills 30 in. wide. It is thought, however, in richer soils this crowding of the plants would be detrimental.

Cultivation.

Where close planting has been adopted the land may be harrowed with a light harrow shortly after the plants appear through the surface. Otherwise it will be better to use the cultivator between the rows and the hand hoe, where necessary, between the plants. The first one or two cultivations should be done with fine points, as in the strawberry cultivator or the 1¼-in. or narrowest shovel points supplied with the usual 5-tooth cultivator; after this the broader points can be used and later the hilling attachments. In early cultivations the cultivator can work close to the roots, but not deeper than 2 in.; but later, after flowering, when the pegs enter the soil care should be taken that the plant is not disturbed.

In most soils it is desirable to draw a little of the soil in towards the plant to provide a bed of fine earth in which later the pods may form, and this can be done at each cultivation, finally leaving a flat bed in which the plants are growing with a water furrow between each drill. The height to which hilling may be practised depends largely on the soil. Usually, the heavier the soil the more necessity for hilling.

Soil should not be thrown on the centre of the plant, the object of hilling being to provide fine soil for the pegs to enter and mature evenly and for ease in harvesting. As a rule, in the creeping varieties the pegs easily reach the soil, but in certain cases a light roller run over the crop will facilitate this operation. In the bunch or erect growing varieties no rolling should be attempted, but a final higher hilling made if it is noticed the points have some distance to go to reach the soil.

Harvesting.

The time for harvesting is noted in the appearance of the foliage, which starts to yellow or lose colour, and by examination of the nuts. If the majority of the berries or peas are full grown and the inside of the shell has begun to colour and show darkened veins, the crop is mature and harvesting should not be delayed.

If the crop is harvested too early the proportion of "duds" is very great, while if deferred too long some of the nuts may germinate and others become detached from the plant when lifting, while the tops, having lost most of the leaves, will be of much less value for fodder. In some soils, notably the friable chocolate volcanic loams, the plants may be lifted by hand, when most of the nodule-bearing rootlets are left behind and only the root stock with the nuts are lifted. In other cases it is necessary to loosen the soil before lifting out. In small areas this is sometimes done with the digging fork inserted under the plant, which is lifted while the fork is worked underneath. In large areas a potato digger with an endless belt elevator from the shovel point is found very effective where the soil is dry enough to fall through the slats of the elevator and the crop is free from weeds.

A very satisfactory digger could, however, be made on the farm or by a local blacksmith by attaching to an ordinary wooden plough beam a knife edge to go under the plant and cut the roots just below the nuts; finger bars at the rear of this knife edge would lift the plants and loosen the earth, thus facilitating the lifting by hand. The width of the knife edge should be sufficient between the attaching portions to the beam to allow of the whole plant passing through, and the depth should be regulated by the wheel or wheels in front. Perhaps a better idea might be given by taking the back off an ordinary earth scoop, together with all the bottom excepting 6 in. in front, and substituting finger bars slightly elevated to carry the plants and attaching the whole to a plough beam with handles. In a digger of this description, where one horse is used, the digging attachment would be to one side of the beam, while with two horses it would be in the centre, the operator straddling the row and the depth regulating wheels being preferably two, one on each side of the line of plants.

Where an ordinary plough is used the share should cut 10 or 12 in. wide and the mould board removed and some rods substituted to prevent the tops being mixed with the soil.

It should always be remembered that the cutting of the roots as close to the pods as possible results in the greater quantity of nitrogen being returned to the soil.

Harvesting should not begin until the dew is off and the tops are dry, and the operation should be regarded as a hay-making of the tops, and not more than can be handled should be lifted in any one day.

Curing.

After the plants are lifted and the soil shaken from the nuts they are allowed to lie either spread on the ground on in small bunches until the leaves are wilted, but not curled or brittle. They are then bound in small sheaves or taken separately and stacked until cured. The time in which the plants are allowed to wilt varies according to the weather, and in some cases stacking may be necessary within an hour of lifting.

The usual method of curing peanuts where the quantity is large is to place them in small stacks around a pole. From twenty to thirty poles will be required for an acre.

These poles should be reasonably stout, from 2 to 3 in. of hardwood in diameter at the bottom end, which should be sharpened. When erecting, holes are made in the soil with a crowbar, post-hole digger, or earth auger, and the pole inserted or driven down with a mall to a depth that will ensure their not being blown over with the weight of the stack upon them. Crosspieces about 3 ft. in length are now nailed across the post at right angles, one immediately above the other, 9 to 10 in. above the level of the ground; 3 by 1-in. hardwood battens answer the purpose admirably. According to the crop, six or seven rows are taken on each side of the poles, and the plants, when wilted, forked into one row on either side of the pole. When stacking, a few vines are placed across the crosspieces, which keep them off the ground, to form the foundation. The vines are then stacked by hand with the nuts next to the pole and tops outward, pressing down each layer and building evenly around the pole. From time to time a bunch should be divided and hung around the pole to bind the mass and to assist in keeping the centre high.

This latter is important in that it allows any rain falling to run off. When the stack is approaching 3 ft. high the vines should be drawn closer round the top and finished off with a cap of grass as a thatch to run rain off. It is important that free circulation of air should obtain through the stack in order to facilitate curing. The building of thick or high stacks or pressing them too tight will tend to cause heating, with consequent damage to both fodder and nuts.

After about two weeks in the stack the peanuts may be stored in the barn, but the nuts should not be picked from the vines until preferably six weeks from the date of harvesting, as if picked too soon they are liable to shrivel, and there is danger of fermenting or moulding after picking.

Picking.

The usual practice in this State has been to pick the nuts from the cured plants by hand—a tedious process, the cost of which, if the ruling rate of wages were paid, would be prohibitive, since 60 lb. is considered a fair day's work. This practice of hand picking has been followed for ages, and is still the usual method adopted in countries such as India, China, Japan, &c., where labour is plentiful and cheap. In certain cases, too, the nuts are washed by agitation in frequently changed water and dried in the sun to obtain a clean inviting article for edible purposes. This is necessarily a costly undertaking, and would need a much higher price for washed nuts to compensate.

Other methods adopted in North Queensland with a lessening of expense have been, in the case of the bunch nuts, to hold the stems in the hand and thresh the nuts off by beating across tightly-drawn wires or the edge of a board placed midway across a box or other receptacle to hold the huts, and with both bunch and creeper to rub the whole plant over a wire netting drawn tight until the nuts fall through. Subsequent winnowings remove trash and light pods, and it is stated thoroughly drying the resultant nuts in the sun will cause the stems or tails to break off in the bags, resulting in a clean sample when it reaches the market.

In other lands, however, labour and time saving machinery has been evolved which does very satisfactory work in picking, stemming, cleaning, grading, and bagging for market, without breaking or damaging any appreciable quantity of the pods.

Two types of pickers are on the market in the United States of America—one working on the principle of a cylinder grain-thresher and the other one in which the plants are drawn between spring points over a wire mesh in such a manner that the nuts are pulled off and fall through on to a conveyor, which carries them through a winnowing process to a stemming apparatus, after which they go through a further winnowing and a cleaning and grading process. Two machines of the latter type are in use in the Cooktown and Tableland districts respectively.

The cost of machines of this description is too great for the individual in most cases, and it would be advantageous, where any considerable area was under crop, for farmers to co-operate in the purchase, when the machine, which is on wheels, could be transported from farm to farm.

Contract picking is a feature in the United States just as contract chaffcutting is in Australia. The picking crew, working day after day, naturally become expert; so that a greater average quantity is handled daily with less damage than when novices or hands out of practice are engaged.

When a power-driven picker is in use it is advantageous to place it in a central position in the field where the poles with the stacked peanuts can be transported

bodily to the machine, resulting in less handling. With suitable uprights with a cross bar attached to the dray a lever with a grip attached to the top of the pole and passed over the cross bar would use it as a fulcrum, when the long end of the lever being lowered to the shaft would lift the pole entirely clear of the ground, allowing of its quick and easy transport to the picker.

The stems or vines of the plant, after the nuts are detached by the picker, can be stacked, baled, or chaffed and used for forage purposes, while the "dud" nuts (small or immature) can be fed to stock.

Marketing.

The nuts are usually bagged whole and shipped to the buyer, but where freights are high it is sometimes more remunerative to market the kernels only.

Special machinery is available to shell peanuts with a minimum of damage to the kernels. Bruising of the kernel at shelling or during transport is injurious, as decomposition is liable to set in and rancidity occur.

Shelled kernels should also be absolutely dry before packing for the same reason. Each variety should be kept distinct, whether shelled or unshelled, as oil millers are understood to give lower prices when the kernels are of different colours.

Diseases.

The peanut is seldom subject to disease when grown under proper conditions of soil and drainage. The most common disease noticed in Queensland is a form of leaf spot (*Cercospora* sp.) which appears as brownish spots on the leaves and is most frequent on sour or poorly drained land. When this appears late it will be possible with the upright growers to mow the tops and make hay before they are too far gone. Another disease that has been noticed on occasion is a kind of fungus attacking the stem where it enters the ground and is characterised by a cobwebby appearance, due to the mycelial threads of the fungus on the stem just below the surface, together with the appearance of minute round white or brown bodies the size of mustard seeds, which are the spore cases of the fungus. A proper system of drainage, together with liming and a rotation of crops, will minimise disease in the peanut as with other crops.

Pests.

Insect pests are of infrequent occurrence, so far the only attack noticed in the State being odd instances of mealy bugs on occasional roots.

Vermin are very partial to the nuts, as are many birds outside those domesticated.

The duty recently imposed by the Commonwealth on peanuts and peanut oil is as follows:—On peanuts from the United Kingdom, 2d. per lb.; other British countries, 3d.; foreign countries, 4d. On edible oils, which include peanut oil:—From United Kingdom, 2s. per gallon; other British countries, 2s. 6d.; foreign countries, 3s.

The protection afforded by this tariff should compensate for the additional costs in growing under white labour conditions in Australia, and peanuts should become a staple crop in North Queensland.

Yield.

The yield of the peanut crop will, of course, depend on the fertility of the soil, amount of rainfall, and attention bestowed.

While it will bear a satisfactory crop under a small rainfall, showing to an extent that it is drought resisting, it is not injured by excessive rains provided the soil is well drained. An instance of this was observed at Banyan in 1921, where a perfect sample of the Red Cross variety was seen which had experienced a fall of 120 in. of rain in the growing period.

Crops on a small scale have been estimated to produce 3 tons to the acre, and in the North field crops averaging 1 ton and over are not uncommon; but as a general rule, in satisfactory soils and under ordinary conditions with proper cultivation, 15 cwt. per acre might be expected as a fair average yield.

Where the crop grows to perfection, as at Cooktown and the Tableland, there is a fine opportunity for the institution of a co-operative oil mill and the purchase co-operatively of labour-saving machinery in picking, &c. In the growing of peanuts for marketing as whole nuts, it frequently happens that the product is not readily saleable owing to stained shells, glutted market, or other causes, when the presence of an oil mill will be advantageous.

The districts mentioned are in a particularly good position for the establishment of an oil mill, since freight on the whole nuts to the Southern parts is high and a ready market for the cake is to be obtained from the dairymen and pig-raisers near at hand.

FARRER'S METHODS.

SOME RESULTS OF HIS WORK.

J. P. SHELTON, M.Sc., B.Sc. Agr., Plant Breeder.*

No excuse is needed for drawing attention to the work and results of the Australian wheat-breeder, W. J. Farrer. The development of this country as a factor in the civilised life of the world and its growing importance in the international problems involved is largely based upon his work. The introduction of what are always known as "Farrer varieties" has greatly facilitated the transition from the pastoral to the agricultural phase in those vast regions of eastern Australia which constitute the present wheat belt. In 1890 New South Wales produced 3,649,216 bushels of wheat; by 1920 this had been increased to 53,715,840 bushels, while for Australia the total production had increased from 27,118,259 to 144,243,734 bushels. These enormous increases have been due to two factors—Farrer varieties, and the improvement in cultivation methods, including fallowing. These have brought under the plough large areas in which low rainfalls had previously been a limiting—almost an inhibiting factor.

A few biographical notes will be of interest, and will emphasise on what slender threads the fortune and progress of nations may hang. William James Farrer was born in 1845 in Westmoreland, England, his father being a country gentleman. Educated at Christ's Hospital Blue Coat School, he proceeded to Cambridge University where, after obtaining honours in the Mathematical Tripos, he studied medicine for a year. Ill health caused him to abandon medicine, and he sailed for Australia in 1870. There can be no doubt that Farrer's ultimate success in wheat-breeding was, to a large extent, the outcome of his early scientific training, which developed in him a logical clarity of thought that later enabled him to place his breeding work upon a systematised and logical basis. In Australia, financial reverses caused him to abandon sheep raising for work as a licensed surveyor. In 1886, Farrer retired to him farm home at Lambrigg, near Queanbeyan, where he engaged in wheat-breeding as a hobby until 1898, when he joined the New South Wales Department of Agriculture as Wheat Experimentalist at the age of fifty-three years, solely that he might have additional facilities for that work in which he had become so engrossed. He died in 1906, by which time many of his productions had come into general cultivation.

In 1890 wheat production in New South Wales was practically limited to the tablelands and the immediate western slopes of the main dividing range. The varieties in general cultivation were the so-called Purple Straw varieties, whose exact origin is unknown, but which were most probably local selections from English varieties originally introduced. Factors limiting production in these districts were:—

1. Loss due to Black Stem Rust. The varieties in cultivation were very susceptible to attack. The general conditions in the regions involved favour rust development, and at that time climatic conditions for a number of years were extremely favourable to the rust fungus.
2. The Purple Straw varieties were late maturing in their habit, which rendered them liable to suffer heavily in grain yield and quality when attacked by rust, since the disease usually developed at a critical stage in grain maturation. The long season, moreover, rendered the varieties particularly liable to suffer from the hot dry spells so frequent in November and December, which cause a shrivelling and pinching of the grain of varieties not far enough advanced in grain formation.

The spread of what-growing into the more arid western districts was limited, so far as the prevailing varieties in cultivation in 1890 were concerned, by their long season of growth; for the more extreme climatic conditions rendered all the more serious the liability to drying off of grain (and even of entire plants) in November and December. Moreover, the general absence of resistance to drought of the Purple Straws renderd them unsuitable for general cultivation except in very favourable seasons.

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The Rust Problem.

Farrer was first attracted to wheat-breeding by a controversy in regard to rust. His aims and methods can well be told in his own words in letters written to Mr. M. A. Carleton, of the United States Department of Agriculture, about 1894. These letters form a part of a complete file of the correspondence Farrer conducted with the cerealists of the United States Department which has been generously presented to New South Wales by the Secretary of Agriculture of that country, and which now is deposited in the Mitchell Library:—

> "Few farmers who have had experience in growing different kinds of wheat will deny that they differ in the resistance they offer to rust. In order to be able to improve a plant in any given direction it is only necessary that it should possess a tendency to vary in that direction. Variability being given by means of selection and by expedients in breeding man can work wonders (these are almost Darwin's own words). It is solely in consequence of the fact that the wild species from which they have been derived possessed a tendency to vary in the directions in which they have been improved, that we have succeeded in getting most of our beautiful garden flowers, of our luscious fruits, of our succulent vegetables, and of our excellent and most promising grains from unpromising individuals. It is by selection, either natural or intentional, or both, that we have become possessed of our blight-proof or blight-resistant apples; of varieties of the grape which are not affected by oidium, which resist mildew, and which possess roots that the phylloxera cannot injure. What is to stand in the way of our taking advantage of the variability as regards the amount of resistance they offer to rust that our wheats exhibit? In effecting this improvement we have everything on our side, since wheat is a plant which reproduces itself at an early age and at short intervals, since a single individual produces a large number of offspring at a time, since our chances of selection are much enlarged by our being able to grow a large number of individual plants to select from, and since the chances of spontaneous crossing between different individuals are remote and little likely to interfere with us in our work of hybridisation and selection. We have also on our side to help us the general principle that a quality which is being cultivated or secured through its variability tends to go on varying in the direction in which it has already varied. It is not in the direction alone of getting varieties possessing increased resistance to rust that I consider the improvement of wheat possible or desirable. It is possible to effect other improvements. Varieties, for instance, differ largely in the content of the grain in gluten. In that respect, also, they are variable and are therefore capable of improvement. We have an example in the sugar beet that an improvement of this character can be effected."

> "In regard to the next part your Department will be able to effectually take in providing the different sections of your territory with improved varieties, I would suggest that you should give your main strength to studying the physical qualities that are associated with resistance to rust, and most probably help largely to give that quality; and that you should make crosses with the object of combining in each variety made by you as many as possible of the qualities you observe to be rust-resistance-giving, combined of course in the highest degree, with richness of the grain in gluten and with other qualities which are wanted in a wheat. But as the possession alone of physical resistance-giving qualities is not sufficient to give resistance to rust everywhere and must be accompanied by constitutional fitness in the variety for the climate of the section in which it is grown, it is necessary that the fixing of varieties be done in the sections where the varieties are to be grown on a large scale."

In passing, it is of interest to note that the Minnesota researches, which have indicated the existence of extreme biologic specialisation within *Puccinia graminis tritici*, furnish the explanation of the apparently promiscuous variations in resistance of any one variety from district to district observed by Farrer.

The Extension Westward of the Wheat Belt.

From the rust problem Farrer was led on to general improvement and the production of varieties adapted to the more arid regions beyond the wheat experience line of that period. He early realised the value of early maturity as the *sine qua non* which was fundamental to the improvement and expansion he sought. Success in this direction, and the consequent spread of cultivation into drier areas, has reduced the rust problems to a very great degree—a reduction which has been accentuated by a run of dryer seasons. Farrer himself lost touch with rust work completely in the last ten years of his career, through the vagaries of climate. Rust liability has

been largely decreased by the use of Farrer's improved varieties, because they are early maturing. Thus, when rust does become prevalent, the varieties have usually reached a point sufficiently late in the process of maturation so that they do not suffer in grain yield or quality to any extent.

A detailed account of the crosses Farrer made cannot be given here. In his time he made many hundreds of crosses of greatly varied parentage. However, the varieties which have come into most general cultivation were largely the outcome of crosses made between varieties of the New South Wales Purple Straws, the Fife wheats, and the Indian wheats. A general statement will give some idea of the principles involved in this tripartite system of crossing, and the recombination of desirable characters likely to result therefrom.

The first line of systematic crossing was between Fife and Indian wheats. The characteristics of Fife wheat were strength of flour, long season, good straw, and liability to shelling. The characteristics of Indian wheats were drought resistance, early maturity, weak straw, but short and sparse, though holding the grain firmly. Neither Fife nor Indian wheats were suitable for general cultivation in New South Wales. The crossing of these varieties produced the following wheats:—Jonathan, Early Jonathan, Comeback, Cedar, John Brown, &c. These wheats combined in general the following characteristics:—From Fife parent, strength of flour, strong straw; from Indian parent, early maturity, sparseness of straw, drought resistance, and non-shelling of grain.

For a time these wheats were very popular. They were distinctly more profitable than the old Purple Straws in most districts on a run of seasons. Farrer used these "Fife-Indians" in breeding further new varieties, which displaced them from general cultivation. The Fife-Indians were crossed with Purple Straw varieties and other selected varieties to evolve varieties which, compared with the Purple Straw parents, were earlier in maturity and more drought-resistant, with sparser straw and non-shelling. The strength of straw was also increased. The quality of flour strength was decreased to a fair extent, however. These new varieties are now almost exclusively cultivated, if there be included in the list those bred on similar lines since Farrer's time. Varieties of such breeding were:—Federation, Yandilla King, Hard Federation, Major, Bunyip, Genoa, Florence, Firbank, Warren, Thew, and Canberra.

The simplest example of this tripartite crossing, and one which is free from the back crossing and composite crossing, to which reference is made later, and which marred much of Farrer's work from the view-point of modern genetics, is that which gave rise to the variety Federation, so popular to-day. Improved Fife and the Indian variety Etawah were first mated to produce the Fife-Indian variety called Yandilla. The common Purple Straw was then mated with Yandilla, and from the progeny Federation was selected.

Farrer produced thirty-three varieties which at some time were recommended for, and were in general cultivation. Of these, fourteen are not now grown, and five are grown only to a limited extent. The remaining thirteen include most of our standard New South Wales varieties of the present day.

Bunt-Resistance another Objective.

Bunt-resistance was a character for which Farrer largely worked at one period, and he succeeded in obtaining it in a large degree in breeding Florence. His work in this problem was detailed and extensive, and all his selections were made from trials of fixed and unfixed strains in which the seed was thoroughly inoculated with bunt spores. For detailed investigation this work compares well with the rust-breeding work being carried on at Minnesota.

Farrer's Work and Modern Genetics.

The analysis of Farrer's work on a basis of modern genetic knowledge is of great interest. It can, however, be done only in a general way, for the notes left are very meagre. He himself made only three references to Mendelism to my knowledge, and these occur in his letters to Professor R. H. Biffen, of England, who first applied the Mendelian theory to practical breeding. He wrote, 8th March, 1905:—

> "In your letter you speak of the old bugbear of fixing varieties. This work for the last twelve or fourteen years has given me no trouble whatever. It seems to me from what I can see of Mendel's theory of heredity, that the consideration I then gave to the matter of fixing varieties led me to adopt the system, which, for all practical purposes, Mendel's theory indicates as being the best. The practice was adopted from what appeared to me to be common-sense considerations. I certainly had not Mendel's theory to work upon."

In writing to Mr. Carleton, of the United States Department of Agriculture, on 18th March, 1905, he said:—

> "I am just now in the throes of mastering Mendel's laws, the practical application of which I have been following for about a dozen years; if selecting a number of plants, planting the seeds from each in separate drills, and selecting the drill which produces a uniform type constitutes a practical application of this theory."

It may be said that Farrer possessed a knowledge, gained by experience, of some of the main generalisations of Mendel's theory, and that his work was based upon such a system. The main generalisations of the theory from the point of view of the plant breeder are stated by H. K. Hayes, "The Breeding of Crop Plants," to be—

1. Plants breed true for certain characters when all factors necessary for the development of the character are in a homozygous condition.
2. There is independent segregation of certain factors.
3. Partial coupling of certain determiners sometimes is found. The degree of linkage in transmission is quite constant.
4. Perfect coupling of certain factors occurs, *i.e.*, constant association of characters in inheritance.

In 1896 Farrer wrote the following statement in his report to the Fourth Rust in Wheat Conference, which indicates that he was quite well acquainted with the phenomena of segregation and recombination of characters in crossing, though he had no knowledge of the exactness of the recombination nor of the definite basis on which new types could be looked for:—

> "In order to combine the qualities of earliness of maturity and resistance to rust in one variety by means of cross-breeding, late rust-resistant and early rust-liable sorts, as I have already pointed out, have to be mated. It will be well to pause for a moment and consider what we ought to expect from the union of types which differ so widely in these two qualities, as well as in others, such as the relative hardness, size, character of the grain, &c. What we generally see in the analogous case of the animal kingdom, with which we are more familiar, is that when parents, which are not closely similar, are united, if the progeny be numerous, certain individuals inherit some of their characteristics almost entirely from one parent combined with other characteristics which they have inherited almost entirely from the other parent; whilst as regards a majority of their characteristics they are intermediate in various degrees between both parents; and when this happens in different degrees and in a different manner with all the progeny, it will be seen how it comes that no two individuals of the same parentage are ever exactly alike, and that the greater the dissimilarity of the parents the greater will be the difference between the offspring of the same union. I will attempt to illustrate briefly what I mean, and for this purpose will make the case as simple as I can, and apply it to the subject we are actually dealing with.
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> "Suppose I have mated a rust-resistant-late with a rust-liable-early variety of wheat. The greatest diversity of types will be shown by the offspring which grows from seed of the first generation of the cross from such seed as I am distributing. Suppose we have 100 plants growing from such seeds, which are of the same parentage. Out of this number I would expect there might be one or two—say one—which has inherited in a very high degree, possibly in as high a degree as the parents themselves possessed them, the qualities we are seeking to secure from both parents. A few more—five—I would expect to inherit high rust-resistant power from one parent, associated with moderate earliness from the other; and five more to inherit a high degree of earliness with fair rust-resisting power. The remaining eighty-nine I would expect to inherit these qualities in various degrees intermediate between the two parents; and something of this sort is what I find actually to occur in most cases. The work, then, of the person whose business it is to make use of these 100 plants is essentially the work of selecting as many of these eleven plants as promise to fill our requirements, and that work, as I have found out from actual experience, requires for its successful performance a close attention, care, patience, thoroughness, and system."

Professor R. D. Watt, of Sydney University, in commenting upon this statement, has drawn attention to a concrete example of recombination of characters obtained by Farrer. The comment is quoted from Science Bulletin No. 22 of the Department of Agriculture, New South Wales, "William J. Farrer, and the Results of His Work," by F. B. Guthrie.

This quotation shows that, although Farrer was at that time in ignorance of Mendel's historic experiments, he was working more or less along Mendelian lines—

for the main practical lesson of Mendelism is that, if two varieties of any crop, each of which possesses one desirable and one undesirable character, are crossed, there will appear among the progeny one or more individuals possessing the two desirable characters, and that some or all of them will breed true to both these desirable characters. The proportions mentioned by Farrer do not agree with Mendel's figures, probably because resistance to rust (*Puccinia graminis*) is not a simple Mendelian factor in inerritance:—

> "Two instances of Farrer wheats may be quoted to show how Farrer used something very closely akin to the Mendelian method. Of the many varieties he had at his disposal, a crossbred called Maffra was noted for its early maturity, which was its main asset; Zealand was one of the best late maturing wheats for hay, and Rymer one of the best late maturing prolific grain yielders. Farrer desired to get a variety of wheat suitable for hay which would mature sufficiently early to enable the farmer to have his hay in the stack before the grain harvest commenced. He therefore crossed Zealand with Maffra, and among the progeny he found a few plants which combined the excellent hay qualities of Zealand with the early maturity of Maffra. From these few plants he saved the grain and sowed it in small plots, found that it bred true, and thus he evolved the variety Firbank, which is still perhaps the best early-maturing hay wheat for New South Wales conditions.
>
> "His second objective was to get a prolific grain-yielding early-maturing variety; and so he crossed Rymer with Maffra. The result was Bunyip, which for a time was the most prolific grain yielder of all the early-maturing varieties, although it has been recently surpassed by newer varieties like Canberra."

Farrer's system of handling crossbred generations on a single-plant basis is the natural outcome of the first Mendelian generalisation quoted above—that plants breed true for certain characters when all factors necessary for the development of the characters are present in a homozygous or pure condition. Of homeozygosity, however, Farrer knew nothing.

The most striking points which the modern geneticist will notice in examining the pedigrees of the many varieties of which Genoa is representative are:—

1. The complicated nature of the pedigree and the frequent double use of a variety as a parent.
2. The frequent use as parents of unfixed crossbreds, often of the first generation, as stated by Farrer himself in writing to Professor Biffen. The pedigree of the variety Genoa is as follows:—White Naples was crossed with Improved Fife and an unnamed, probably unfixed, individual derived therefrom was then back-crossed with White Naples; an unnamed, probably unfixed, type resulting from the back cross was then mated with another unnamed, possibly unfixed, type derived from a cross between Improved Fife and Eden. The mating of the two unnamed types gave the well-known variety Genoa. Such a pedigree makes it apparent that Farrer had not a really clear conception of the definite segregation and recombination of characters as separate entities based on genetic factors. His concept in this direction was undoubtedly obscured by the prevalent idea that the double use of a variety as a parent, *i.e.*, a system of back-crossing, emphasised or increased the final development of these characters individually in the ultimate progeny. This idea is usually expressed in such terms as half blood, three-quarter blood, &c., of one particular parent being present in the ultimate progeny. Both the idea and the terminology are contrary to the present-day Mendelian concept.

Complicated composite crossing, particularly of unfixed types, is a practice quite opposed to those based on modern genetics, and indeed is in strange contrast to Farrer's own knowledge of the segregation of unit characters. It is largely based on the nineteenth century conception that crossing was of value mainly as a physiological stimulus that promoted variation of a quite promiscuous and ungoverned nature. Composite crossing aimed at inducing maximum variation in order to obtain a wide range of types for selection.

It is not suggested that Farrer could not obtain recombinations of characters by crossing F1 plants. The pedigrees of some of his best productions show that such recombinations were obtained—fortunately for Australia. But the mathematical aspect of Mendelism, based on the laws of chance, shows that Farrer undoubtedly reduced, in a very large degree, the chances of obtaining any desired recombination by crossing F1 plants, as compared with the crossing of fixed strains or pure lines possessing the necessary characters. On the other hand, when no fixed or pure line strains were available, any success resulting from Farrer's system saved several

years of patient labour, and expedited results by so much time as would have been necessary first to create and fix such varieties.

Perhaps the most interesting reference to Mendel's law made by Farrer occurs in a letter to Professor Biffen written in 1905. It contains a criticism of the theory which was later advanced by many critics, and which remained unanswered for a considerable period. Farrer's statement is here given in his own words:—

> "There is one point in connection with Mendel's law that it seems to me not to provide for. It is that when varieties, which differ sufficiently in type, are crossed, the variable generation seems to produce individuals which differ in all the qualities in which varieties differ, *e.g.*, by crossing two late sorts of different types it is quite possible to get early sorts. I cannot recall just now an instance in which I have got a very early variety in this manner, but I have made from such crosses varieties which are distinctly earlier than either parent. Mendel's law, I fear, is not likely to be of great use to me in enabling me to improve my methods, because, in nearly all the crosses I make, one of the parents is an unfixed crossbred, and frequently a plant of the first generation from the cross."

The statement that Mendel's law does not provide for cases in which the progeny of a cross includes individuals which possess characters not found in either parent was undoubtedly true as Mendel's law was then stated and understood. Subsequent research, however, has shown that some characters depend, for their full expression, upon the presence of more than one Mendelian factor. Thus late varieties are differentiated from early varieties by several factors. Where two late varieties are crossed, it is evident that different recombinations of the several factors for lateness may occur in the variable generation. Some plants will then contain less than the full number of factors for lateness, and will show a degree of earliness in correspondence with the decrease in the factors.

Farrer's case of the appearance of early wheats as the result of crossing two late wheats of different type is therefore not really at variance with Mendel's theory as now understood, although at the time his objection was perfectly valid.

Future Possibilities.

Any review of Farrer's work naturally leads on to a discussion of future development, and it is in this regard that discussion might well be engaged upon. At the present time it may be taken that we have in Federation, Canberra, Yandilla King, Clarendon, and several other varieties, wheats which are fairly well adapted in general habit to the climatic and soil conditions of a great area of wheat land, as yet only very partially exploited. They are also fairly well suited to the commercial requirements of our local and overseas markets.

Improvement, however, will result in the building up of these varieties on a single character basis. Characters may be added, such as resistance to prevalent diseases—flag-smut, take-all, foot-rot, and rust in certain districts. The question of yield, particularly in relation to earliness of maturity, has by no means been solved, but it is a problem fundamental to the breeding of wheats for the drier regions beyond the present wheat belt. Also, yield in combination with superior grain quality is a matter for further investigation. Particularly bound up with the inheritance of disease resistance is the problem of the linkage of resistance factors with those which give expression to commercially or agronomically undesirable characters. Such linkage may be complete or partial. Only genetic experiments can give the answer, yet on the answer depends the possibility of future progress. This is well illustrated in the Minnesota work on rust-resistance, where the linkage between resistance and Durum type was proved to be not absolute, as at first thought, and thus not a bar to the breeding of rust-resistant bread wheats. Again, the problem of partial sterility in species crosses in one which must be investigated before improvement in certain desirable directions is completely possible. Sterility of this kind has undoubtedly a genetic basis, and investigation may indicate systems of crossing which will overcome the difficulty.

These matters, being briefly given, indicate the necessity for a genetic analysis of the genus *Triticum* before the best progress may be expected. We must know what the genus really contains in the way of inheritable or genetic characters, and the behaviour of these characters in regard to inheritance, before we can visualise what improvements are possible, or be in a position to combat the difficulties that nature throws in our way in seeking that improvement. For instance, we do not yet know what varieties or species show any resistance to take-all or foot-rot, and only partially so in regard to flag-smut.

Yield, as an expression of complex genetic factors in relation to the environment, seems a hopeless problem to attack in an experimental way. Yet all breeders are

convinced that they have discarded what would have been valuable strains, simply through an inability to see beyond the temporary effects of a reaction between a valuable complex of factors and a temporary unfavourable environment. Something more definite as a selection index is needed than is obtained by eye-inspection and arbitrary evaluation, even by men with the so-called "eye" for a good wheat. Such a standard has been sought from time to time, and there is great need for further work in correlating potential yield with individual characters or groups of characters of a morphological or physiological nature.

The migration ratio of Beaven, which has some experimental basis in regard to the behaviour of pure lines or fixed varieties, may eventually prove applicable on a modified basis to individual plants of an unfixed crossbred generation.

Again, the relation of transpiration ratio to yield has not yet been investigated sufficiently in regard to different varieties of any one crop. In this country, Dr. Richardson, of Victoria, has done valuable preliminary work upon the differences in transpiration radio of various crop plants. To be valuable to the breeder, this work must be carried out with many varieties of one crop, such as wheat, so that definite correlations may be found, should they exist. There may thus be provided some experimental basis for using the transpiration ratio as a partial index of potential yield with individual plants.

I am well aware of the immense experimental difficulties that lie ahead in such work, and the great amount of experimental error involved in applying general principles to individual plants. These problems are, however, worthy of investigation if plant-breeding is to evolve as a more exact science. The handling of the third generation of crossbreds in pots in the glass house at Minnesota in regard to rust-resistance work is an example of progress that may be looked for. It has placed the testing for resistance in a variable generation upon a definite laboratory basis.

The extracts from Farrer's own letters, which have been presented in this paper, show that his work was based upon an immense amount of preliminary observation and speculation. Breeders of this generation must attack their problems in the same way.

GUMMING OF DRUPACEOUS FRUIT TREES.*

By HENRY TRYON, Government Entomologist and Vegetable Pathologist.

This malady is one that affects alike the plum, peach, apricot, nectarine, and almond, and also cherry amongst deciduous fruit trees, and although what is now written has been suggested by inquiries regarding gumming in the plum it applies also with minor qualifications to this affection in the others also.

Gum Formation.

It occurs under two forms, that are alone distinguishable by the history and sites of its occurrence on the tree victimised, one of which is of parasitic origin, and the other simply due to chemical change, independent of the occurrence of micro-organisms generally, and that may be termed physiological. At the base of the old fruiting spurs, on which earlier "Brown Rot" affected fruits have occurred, and where gum that has issued in droplets may be met with, this is to be attributed to the fungus occasioning this malady; and other forms of gumming of parasitic origin too may also be encountered. Usually, however, it is gumming of non-parasitic origin that is met with; but the gum itself being a good medium for the growth of micro-fungi and bacteria and readily imprisoning their air-borne "germs," one form may readily pass into the other.

The gum itself is really a product of a chemical change undergone by the cellulose component of the cell-walls of the woody tissues—those of the vessels and fibre as well as of the cells proper. This transformation is due to the action of bodies, named enzymes, and particular kinds of those (pentoses) that may be secreted by living parasite organisms, or even by the plant itself growing under normal as well as under abnormal conditions. In fact, in the former case we have what is termed "gummification," in the latter "gummosis." The ordinary mechanical wounding of the tree gives rise to a form of gumification, the gum production under this circumstance being the first act in a spontaneous reparative process. The gum itself simply consists of carbohydrates named pentosans that accompany sugars when celluloses are broken down.

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* *Note.*—This memorandum originated in reference to the occurrences of serious gumming of plum trees in the Broadwater district of the Stanthorpe area—a not uncommon incident elsewhere in the district however—by Mr. Hubert Jarvis, Official Entomologist, in a communication dated 22nd June, 1925.

The Plum.

The gum production in this (as is shown in the specimens submitted) forms pockets beneath the outer bark of branches of almost all ages giving rise to swellings that yield to pressure and are quite evident even before the gum itself issues in the form of drops and masses that darken and harden.

On cutting downwards through them, not only is the presence of this body, now in a fluid condition, brought to light, but distinct discoloration with other noticeable features of change are discernable, this extending to the fibro-vascular bundles and wood-cells beneath, that have become first yellow then reddish-brown in colour, at the same time being both infiltrated with the gum alluded to, the alteration between sound and affected tissues being quite remarkable.

As these changes have proceeded it is evident, especially when the microscope is used, that the cambium has become involved, and that this through its activity has formed special developments of wood-cells, that in turn have gradually become transformed into gum by the dissolution of their walls, and that the new material not only produced the swelling but that also the gum is filling channels passing through the discoloured but still intact tissue beneath.

The principal mass of this so-constituted stem swelling in each case has, it will be seen, emanated from the under bark, the secondary cortex, and is evidently formed not only from the newly laid down thin walled wood-cells, but also by the gumification of the thick-walled bast fibres, both of which undergo the destructive modifications alluded to. In fact, only the outer bark, the periderm, is spared, although this may soon become fissured by pressure from beneath.

At first there are dark borders isolating the sound from the altered tissues, but the latter may become more and more extensive until the branch or branches implicated succumb. Commonly, however, if an outlet can be made for the gum as it forms and the conditions are favourable to growth, the cambium will produce wound tissue and so bring the destructive changes to a standstill, with the result that tree-growth is resumed, the injuries being healed.

The distinction between the disease presenting these symptoms, *i.e.*, gummosis, and mere gummification, is that in this we have new tissue formed by the active cambium that may become transformed to gum, whereas in the latter a mere change in that alone forming portion of the ordinary tissue, and that may arise suddenly and may even spontaneously disappear in course of time.

Conditions of Occurrence.

There are three conditions governing the occurrence of plum trees gummosis in the Stanthorpe district, all of which, however, may have some connection, one with another. These relate to—

(1) Meterological factors,
(2) Soil factors,
(3) Trees, grafted or otherwise,
(4) Nature of plum stocks, and
(5) Plum variety.

(1) Meterological factors.—Warm wet weather succeeded by sudden coldness may be regarded as contributory factors, whether operating through the medium of the soil or otherwise (*vide* 2).

(2) A soil derived from the disintegration of granite and near where it has originated seems to be most favourable in the Stanthorpe area for plum-tree raising. This is, however, very conducive to gum disease (a remark that applies to other soils) where it is liable to become water-logged, or exhibit features of ill-drainage implying bad subsoil aeration generally.

(*Note.*—Owing to the character of the base formation of the orchard lands, that is often characterised by underlying rock in which shallow depressions occur or bars that hold back water are present, both masked commonly by the circumstance that the surface contour is level or even evenly sloping, ill-drained areas occur that are very conducive to gumming in the orchard and will continue to be so until the conditions are ameliorated by tile drains.)

(3) It is usually found that plums, many of which can be grown directly from their own wood without detriment to the quality (and quantity) of the fruit yielded, are less liable to gum disease when grown on their own roots than when worked. This fact has been especially recognised in Italy, where the trees are commonly raised from *polloni* or root suckers (that as is well known arise from the main roots some distance from the tree trunks) and used in orchard work where conditions generally favour the presence of disease.

(4) The character of the stock.—Plums worked on peach stocks are much more liable to gumming generally than are those raised on plum stocks in the Stanthorpe area. This may be due to the more exacting special soil conditions of the peach, that cannot thrive in wet or ill-drained subsoils. Some strong growing varieties, such as Black Diamond and Denison's Superb, however, are less liable to develop gumming when grown on peach stock there than are others. Again, trees on American plum stocks (such as a Red Plum) seem again to be characterised by greater freedom from gumming than are others.

(5) The early Orleans plum seems to be very susceptible whether worked on peach or English plum, but does better when worked on Red Plum, and this remark applies also to the Yellow Magnum Bonum variety.

(*Note.*—These remarks relating to nature of stocks are, however, not a generalisation based on a sufficiency of local data.)

Remedies.

Preventive.—These may be concluded from the foregoing remarks made under 1 to 5.

Direct Treatment.—(1) When the disease is first appearing and it is commonly evinced very early by a yellowing or mottling and partial shedding of the foliage, benefit will be derived from deeply working the soil, and exposing the root system to some extent, and a general endeavour to aerate, sweeten, and generally drain the soil from which it is drawing its soil-yielding water supply nutriment. (2) Then freely slashing longitudinally the bark with a special knife, so as to reach the cambium layer. This will secure the prompt issue of the gum that is forming and so stay its further increase and pernicious action.

BANANA—INTERNAL FRUIT DISCOLORATION.

Mr. Henry Tryon, Government Entomologist and Vegetable Pathologist, supplies the following answer to an inquiry from a North Coast correspondent:—

The banana trouble illustrated by the specimens sent down, and that show—in comparison with perfect and sound fruit—its injurious features, is one that I am already familiar with, although of late it has not come under my notice.

Nature.

It is characterised by an arrested development of each banana fruit affected, those evincing it being distributed amongst different hands in a bunch, being even restricted—as often as not—to one or more fruits in a hand, and by those bananas showing it being characterised by the persistence of the angular ridges of unfully developed fruit, their somewhat compressed shape, and a slightly paler cast of colour, features that distinguish them from the surrounding sound fully developed fruits amongst which they occur. Not only all the bananas of a hand may be affected at times, but even a large proportion of a bunch. A more noteworthy feature, again, is found in the fact that on cutting such fruit through lengthwise or across, or even breaking it through, a band of reddish discoloration extends through the centre from the tip towards the base, passing outwards and involving more or less of the substance of the fruit then beneath the skin. This change is, however, not only this conspicuous one of colour, but a more or less breaking-down of tissue may occur, the firm axis of the fruit being transformed to an almost liquid dark reddish-brown substance now occupying a channel or cavity.

An occurrence of such fruit I have found formerly, in the North, to extend almost through a plantation, but there and elsewhere to be prevalent principally during the winter months—June, July.

Proximate Cause.

This cannot be fully explained without going into some technical details, using too certain special illustrative figures, both of which must be for the present withheld. It may, however, be now remarked as follows:—

The commencement of the trouble must be looked for already when the banana is blossoming, and when the blossoms with the parts that are to become the fruit

are being uncovered, hand by hand, with the opening of the large bracts that have previously protected them.

Then will be observed towards the base of each flower tube (perianth) on its external surface little globules or blebs of a yellowish tourbid gum-like exudation of different sizes that seem to be issuing from minute coloured fissures. Later the droplets of gum—at first quite limpid—thicken and will be seen to have changed to a dark rust-red colour, or further still have become black, eventually hardening. Meanwhile the flower itself at the place where these occurrences are happening also gradually prematurely darkens, as if burned, and shrivels up. Meanwhile, too, there has been a similar but reduced issue of gum in the inner face of the flower tube involving the slender pistil that extends throughout its centre and ends in the oval stigma above. So also is the top of the young fruit involved, that may become brown and shallowly fissured.

In spite of these changes, the fruit goes on growing to perhaps nearly full size, but the dry shrivelled blackened flower seems to remain attached always longer than when it does this and is not at all affected. Moreover, in some banana fingers this may be the case without further changes being undergone.

The further phenomena that the fruit witnesses and that constitute the injurious features above described result from the following circumstances:—In the banana fruit a narrow channel passing down along the centre of the columnar pistil—and that needs a microscope to discover—is continued through its swollen base, through the tip of the fruit, after which it widens out, and then narrows again, and so continues along the middle of this to its base. Usually the portion of the channel in the fruit closes and obliterates as the starch-laden tissue of the fruit develops inwards towards the centre; soft yellowish and gelatinous at first, then firm and whiter eventually. However, with the slower fruit growth of winter it remains longer open. Meanwhile the thin gum, or the active principles entering into its composition, find their way from the flower along this channel and not only prevent internal growth, but also cause destructive changes, accompanied by discoloration of and some breaking down of tissue. At the same time, the central channel being connected with three narrow fissures that pass outwards from it towards the rind, the outer parts of the firm substance beneath this also become involved in the trouble. It has been remarked above that the central channel widens out at a point just behind the end of the finger. Here the walls of it, and of their three radiatory connections, are thickened and puckered and seem to reinforce the active principles as they proceed downwards along this line of communication.

Even when the fruit is only partly grown a series of cross section may disclose the fact that its tissues are already injured.

Primary Cause.

The explanation of the origin of the gum exudation from the flower, and so of the prime cause of the trouble, is somewhat a matter of conjecture.

In affected plants that we examined some years since in the Cairns district, the roots showed numerous dark lesions in their course, special nematodes sometimes occurring in the purplish blackened shrunken dead tissue. But any connection between this occurrence and the fruit trouble under notice could only be due to obscure constitutional changes in the plant, since no visible connection was traceable from one trouble to another in its tissue, even in that of the stem of the fruit. However, banana-growers have dwelt upon the fact that the pseudo-stems of affected stools develop black patches on their outsides to an undue extent.

We have also found insects (Thrips) commonly early occurring within the perianth tube of affected flowers, and that in feeding might injure it at its base.

And again the minute skin-cracks through which the gum, when first observed in the recently exposed flower issues, suggest the action of sudden meteorological changes on the tissue, especially as it is in the season when such are experienced that the manifestation of these troubles is most pronuonced. The gum exudate does not appear to correspond to a bacterial slime.

Remedies.

Unfortunately we cannot at present suggest, as the outcome of reasoning or of experience, how this serious fruit trouble is to be prevented.

QUEENSLAND FORESTS AND FOREST TREES.

By C. T. WHITE, F.L.S., Government Botanist.*

Queensland has the most richly endowed tree flora of all the Australian States. Probably more than one-half the Australian species of trees occur in Queensland. Queensland is the only State in the Commonwealth with forests extensive enough to supply practically all local softwood demands.

Queensland Woodlands.

The vegetation of the world has been roughly classified by botanists into the three main divisions of Grassland, Woodland, and Desert. Of these only the first two occur in Queensland. We have, it is true, country popularly called desert, but in reality this is a form of woodland, as it not only contains various species of grasses and herbage, but also a few small trees and shrubs. What is called desert in Queensland is, as a matter of fact, extremely interesting country from the point of view of the botanist.

Natural grasslands of very extensive range are represented in Queensland by the Rolling Downs Formation and covered by Mitchell, Flinders, and other grasses and herbage characteristic of Western parts of the State.

The Woodland areas or forests can be divided along broad lines into several distinct types:—(1) The Littoral or Coastal forests, (2) the Open Eucalyptus forests, (3) the Vine Scrubs or Jungles (known to the botanist as rain forests, (4) the River forests, and (5) the Inland Scrubs.

The Littoral forests are of two main types. The forest below high-water mark (mangrove forests), and those above high-water mark (beach forests). The mangroves are extremely interesting trees, showing a wonderful adaptability to the hard conditions under which they grow. Their roots not only act as a means of anchoring the trees firmly in the muddy substratum in which they grow, but the parts above water also act as breathing organs. They are covered by breathing apertures known as lenticels, are of a spongy nature, and through the lenticels communication with the atmosphere is maintained. This is very essential, as the trees are growing in a very badly aerated soil, and unless communication between the subterranean roots and the atmosphere was established in some way the trees would become suffocated. The fruits are also peculiar from the fact that germination takes place while still on the tree, and the young plant is ready to anchor itself in the mud as soon as it drops from the parent tree; if this did not happen the seeds would become washed about from place to place and difficulty would be found in obtaining a footing.

Common Mangroves of the Queensland coast are the Red Mangrove (*Rhizophora*), the Black Mangrove (*Bruguiera*), the small Mangrove (*Ceriops*), the White Mangrove (*Avicennia*), and the Milky Mangrove (*Excœcaria*). The first two are of some importance as tanning agents, but they have not found general favour amongst tanners in Australia owing to several disadvantages. These disadvantages can be overcome, but the expense in doing so apparently does not compensate tanners for the trouble involved.

The White Mangrove is one of the few species of mangroves that extends outside the tropics, being common all round the Australian coasts, and extending to New Zealand. The bark of this tree has no value for tanning purposes, but the leaves are of great value as a forage, and in times of drought in coastal areas the White Mangrove has saved many head of stock.

An interesting member of the mangrove flora in some parts of North Queensland is the Nipa Palm. The Nipa Palm is at present confined to a few parts of North Queensland, the Pacific Islands, and Tropical Asia, but at one time evidently had a wide range over the regions of the world, as nuts in a good state of preservation are commonly found in the Tertiary deposits at the mouth of the Thames in England. Where it grows the leaves of the Nipa Palm are preferred above all others as thatch for native houses.

The Littoral forests above high-water mark are of two types—those of the dry land, and those of the swamps. Those of the former are again divided into two types—(1) those of the ocean foreshores, and (2) those of the bay foreshores. The

* Résumé of lecture delivered before the Queensland Forestry Association, 10th June, 1925.

two outstanding trees of the ocean foreshores or sand dunes of Eastern Queensland are the Coast Oak (*Casuarina equisetifolia*) and one or two species of Pandanus. The latter show great adaptability to their environment, for they are provided with prop roots, which anchor the trees very firmly in the loose sandy soil in which they grow. These prop roots are essential, as the large leaves and the large heavy heads of nuts are borne at the extreme ends of the branches, and but for these roots the trees would very easily be blown over by the high winds which prevail on the coast.

Another tree often seen on the foreshores immediately behind the dunes is the Sand Cypress (*Callitris arenosa*). When growing in such situations it is usually rather dwarfed, and the tops cut off in an oblique direction by the prevailing winds, giving the crown a sloping appearance.

Common trees on the bay foreshore often just above the mangrove formation are the Cotton Tree (*Hibiscus tiliaceus*), and the Cupania (*C. anacardioides*). The former has a greenish timber, unique in colouring among Australian woods.

The two most abundant trees of the coastal swamps are the common broad-leaved Tea Tree (*Melaleuca leucadendron* vars.), and the Swamp Oak (*Casuarina glauca*); the latter possesses a beautiful timber very suitable for many general purposes, and also for heavy cabinet work. It may be worth mentioning here that the name of the former tree is usually misspelt Ti-tree. The origin of the name is that leaves of an Australian species of Leptospermum were used on Captain Cook's third voyage to Australia as a substitute for ordinary tea, and the name Tea-tree has now become generally applied in Australia to plants of the two closely allied genera Leptospermum and Melaleuca.

Our Eucalyptus Forests.

The Open Eucalyptus forest (Savannah) is the main forest type of Australia. It varies a good deal according to situation, whether coastal or inland, northern or southern, whether occurring on deep and rich soils, or barren silicious ones, &c.

The outstanding trees of the Open Forest are the Eucalypts or gum-trees. The Eucalypts are, practically speaking, confined to Australia. Four or five species are found in New Guinea; of these one species is found in Timor, and another extends to the Southern Philippines. This latter is, however, the only species that is not actually found in Australia.

The leaves on most gum-trees are dimorphic, that is of two distinct types—(*a*) the leaves which occur on young trees and stump shoots commonly referred to as sucker leaves, and (*b*) the leaves on the adult tree. The former are commonly very much larger than the adult forms, they are often opposite and horizontally placed, and are supposed to represent the original type of eucalyptus leaves, the vertically placed leaves on the older trees having arisen in response to the dry conditions prevalent in a good many parts of Australia.

If a floral emblem was adopted for Australia, no better flower could be taken than the gum blossom. It is the flower of our most important group of timber trees: a group characteristic of Australia, and also, what is very important, is well adapted to design.

The Eucalypts can be classified roughly into about six groups: (1) The smooth barked species or Gums proper, (2) the Boxes, (3) the Stringybarks, (4) the ironbarks, (5) the Bloodwoods, and (6) the Mallees.

It is quite impossible to deal with all the species, but a few of the outstanding trees of each group might be briefly noted. Of the first group, one of the largest and most beautiful is the Flooded Gum (*Eucalyptus saligna*). This occurs not only in moist lowlands but is also very abundant in some of the mountain forests, such as Tambourine Mountain, Blackall Range, Atherton Tableland, &c., and its long, clean, straight boles are a characteristic and beautiful feature of the flora. It produces a useful general building timber.

The Queensland Blue Gum.

One of the commonest trees of the Open Forest in Queensland is the Queensland Blue Gum (*Eucalyptus tereticornis*). In Queensland this tree is known as Blue Gum, in New South Wales as the Forest Red Gum, and the name Blue Gum is given to the tree that we call Flooded Gum. This confusion of popular names is very misleading, and it is important that in the near future an attempt should be made to establish a standardised nomenclature for Australian timbers. The present confusion often leads to serious mistakes. For instance, outside of Australia the Australian Blue Gum is generally *Eucalyptus globulus*, one of the sources of commercial eucalyptus oil, and the oil of Queensland Blue Gum has been distilled, but when exported has been found not to come up to the standards required by the British and United States Pharmacopoeias, which require a certain cineol or eucalyptol content.

Spotted Gum.

The Spotted Gum (*Eucalyptus maculata*) is one of our most important hardwoods; it has an interesting geographical distribution. The common Spotted Gum is found in New South Wales and Southern Queensland, but about the Burrum River, in the Burnett district, the ordinary Spotted Gum ceases to exist and its place is taken by the Citron-scented variety (var. *citriodora*); one could almost draw a piece of string across Queensland where the species ends and the variety begins, though apart from the oil the two trees seem quite identical. This is the more strange, as the Citron-scented Spotted Gum, grown in any part of Southern Queensland or even as far south as Sydney or Melbourne from northern seed, always retains the strong citron-scented odour in its leaves.

Eucalyptus Oils.

The eucalyptus oil industry has never assumed the proportions in Queensland that it has in the Southern States. This is probably due to the fact that the cineol or eucalyptol content of the oils of most of our common eucalypts do not come up to the standard required by the British and United States Pharmacopoeia. On the other hand, we have a great number of eucalypts and allied plants which contain very strongly citron-scented or lemon-scented oils worth five or six times as much or more than the average eucalyptus oil produced in the Southern States. It is a remarkable fact that all eucalypts and allied plants yielding citron or lemon scented oils that occur in Australia are found in Queensland, *e.g.*, the Citron-scented Spotted Gum, Lemon-scented Ironbark (*E. Staigeriana* and *Backhousia citriodora*), and the Citron-scented Tea-trees (*Leptospermum citriodorum* and *L. citratum*).

Of the Boxes, the most abundant in Queensland is the ordinary Poplar Box or Bimble Box, which covers large areas of country in the interior parts of Queensland. The oil of this tree has a high cineol content, but occurs in such small quantities that distillation does not pay.

Valuable Hardwoods.

The Stringybarks are a big group, many being among the best of our general hardwoods. The three best known are the Red (*E. resinifera*), the White (*E. eugenioides*), and the Yellow (*E. acmenioides*), respectively. The Blackbutt and Tallowwood might be included in the same group. The last is one of the most durable of Australian hardwoods under exposure.

Of Ironbarks there are a great number of varieties, the two most important from a timber point of view being the Grey Ironbark (*E. paniculata*) and the Narrow-leaved Ironbark (*E. creba*); probably the very best hardwoods that occur in Australia, and that means the best in the world.

The Bloodwoods contain the Red Bloodwood (*E. corymbosa*), the White Bloodwood (*E. trachyphloia*), several species of Yellow-jacket, and other trees. The Bloodwoods are amongst the most durable hardwoods in the State, but owing to the presence of gum veins are rarely sawn. They are, however, very largely used for houseposts, fencing, &c. Their tendency to shell off along the veins considerably shortens their life as railway sleepers, but even with this the Railway Department gives the average life of Bloodwood sleepers at seventeen years.

The Mallees are practically unrepresented in Queensland, only one or two species of mallee-like growth occurring in the southern part of the State, near the New South Wales-Queensland border.

A genus allied to Eucalyptus is Angophora, the two best known members of which are the Rusty Gum (*A. lanceo'ata*) and the Apple-trees (*A. intermedia* and *A. subvelutina*); they are not of much consequence as timber trees.

Two trees common in the forest country belonging to the genus Tristania are the Swamp Mahogany (*T. suaveolens*) and the Scrub Box (*T. conferta*). The former, as its name implies, is usually found in swampy country, but is certainly not confined to it, often being found in the ordinary open forest. It is the timber preferred above all others for piles and fender posts for wharves, being especially resistant to the attacks of the marine worm or Teredo.

The Scrub Box, as its name implies, is often found on scrub edges. Its timber is very little cut in Queensland, due probably to its tendency to warp in small sizes. In the Southern capitals it is very largely used as a street tree, being pollarded about 8 ft. from the ground, when it makes a fine, dense, shapely crown.

The Turpentines (*Syncarpia* spp.) are timbers that are in great demand for piles, and also for fender posts for wharves. They are rarely cut in Queensland, due to their tendency, like the Scrub Box, to warp in small sizes, but are highly useful,

very much under-rated hardwoods. One of the species is the Fraser Island Turpentine (*Syncarpia Hillii*), found in no other part of the State than Fraser Island, where it attains a large size, being one of the largest of Queensland hardwoods. Many hardwoods not cut in Queensland simply suffer in comparison with those of superlative qualities, such as the Grey and Narrow-leaved Ironbarks, whereas they are really excellent timbers, and occurring in any other part of the world would be regarded as hardwoods of extraordinarily high value.

An interesting member of the Open Forest is the Sandalwood (*Santalum lanceolatum*). It is not generally known that this tree is parasitic on the roots of other trees. The Sandalwood is common throughout western New South Wales and Queensland, but it is strange that the peculiar scent which gives it its very high value is only developed in northern parts, such as North Queensland, the Northern Territory, and north-west of Western Australia. The wood of the southern trees is almost or quite scentless. The main port of export for Queensland is Thursday Island. A tree that commonly goes under the name of sandalwood in western New South Wales and Queensland is *Eremophi'a Mitchellii*, also known in the former State as Buddah. The wood is very strongly scented, but is of no value as a "sandalwood." Attempts to get it on the market have always failed. It belongs to a very different family to the true Sandalwoods. When the Sandalwoods were cut out from the Hawaiian Islands, attempts were made to substitute the wood of a tree allied to the Australian Buddah, and like it with a strong scent, but the Chinese buyers would have none of it.

Other trees making up the Open Forest are various Wattles (*Acacia*), Honeysuckles (*Banksia*), She Oaks (*Casuarina*), &c. One of the most interesting of these latter is the Thready Bark Oak (*C. inophloia*), which occurs in many parts of Queensland. A characteristic feature is that a broad band of exposed dead wood runs from top to bottom of most of the trees. The trees are usually of very small size with poor logs, but produce one of the most beautiful of Australian timbers, the beauty of the timber being due to the exceptionally large, broad, and deep medullary rays. Though not occurring in large sizes, it is well adapted for turning into small objects such as clock cases, serviette rings, walking sticks, &c.

Our Rain Forests.

The Vine Scrubs or Jungles reach their greatest development in Australia in Coastal Queensland. They consist of heavily dark foliaged trees, and an abundance of climbers, many of the trees produce huge plank buttresses at the base. It is rather unfortunate that in Queensland the name "scrub" should have become attached to this rich type of jungle, as the term "scrub," not only in other parts of Australia, but in other parts of the world, and also in botanical terminology, refers to low stunted vegetation, the direct opposite to that which occurs in the so-called Vine Scrubs of Queensland. The botanist refers to these Vine Scrubs as rain-forests, because they are mainly dependent on moisture—more dependent on moisture apparently than on soil.

The number of actually Australian types found in the Vine Scrubs is small, the majority of plants belonging to families, a good few to genera, and a few to species that are cosmopolitan in the tropics and subtropics, Asiatic types predominating. Interesting Asiatic types occurring in Queensland are Rhododendron and Garcinia (the mangosteens), which reach their southernmost limit of distribution in North Queensland.

On the other hand, the so-called Antarctic element reaches its northern limit in Queensland Vine Scrubs. An interesting example of this latter is the so-called Antarctic Beech, which is abundant on the Macpherson Range. It belongs to the genus Nothofagus, which is at present confined to South America, New Zealand, and finding its northern limit in Southern Queensland. Fossil evidence would show that at one time it was apparently common in the Antarctic continent, where at the present time only two flowering plants—a grass and a small herb—are found.

It is in the Vine Scrubs that our most important coniferous softwoods occur—the Hoop, Bunya, Kauri, and the She pines. The Hoop and Bunya pines belong to the genus Araucaria, at present confined to the Southern Hemisphere, but in past geological times the ancestors of our Hoop and Bunya and also Kauri pines had a very wide distribution over the world, extending northwards near to the Arctic regions. These trees possess softwoods equal to many and superior to most of the softwoods of the Northern Hemisphere; they fortunately do well under silvicultural conditions and make rapid growth. On Fraser Island recently I saw trees less than eight years old nearly 40 ft. high.

The name Kauri or Kauri Pine is nearly always associated with New Zealand. It is true that the New Zealand species was the first described, but whereas New Zealand only possesses one species, Queensland has no less than three, all attaining

a large size and producing most valuable timber. The Queensland Kauris grow rapidly under plantation conditions, but unfortunately great difficulty is experienced in obtaining a good seed supply.

The She pines or Brown Pines are very common in many of the Vine Scrubs of the coast. They produce excellent timbers, but are not of much consequence from a forestry standpoint, as the supply is limited, the trees are not large and growth under plantation conditions is slow.

The genus Flindersia (commemorating the name of Matthew Flinders, the famous navigator) is a genus of about twenty species, all except a few found in Australia, and all the Australian species are found in Queensland. It is an interesting exception as forming a large Australian group found in the Vine Scrubs. After Eucalyptus and Araucaria, Flindersia is probably the most important genus of Australian timber trees. It contains the Crow's Ash or Teak (*F. australis*), Yellowwood (*F. oxleyana*), or Cudgerie (*F. Schottiana*), Silkwood (*F. Pimenteliana*), Maple (*F. Brayleyana*), Cairns Hickory (*F. Ifflaiana*), and other timber trees.

Other cabinet woods of the Queensland Vine Scrubs are the various species of Silky Oaks, the Red Cedar (*Cedrela*), White Cedar (*Melia*), Rose Wood (*Dysoxylum Fraseranum*), Red Bean (*Dysoxylum Muelleri*), Black Bean (*Castanospermum*), Acacia Cedar (*Albizzia*), Booyongs (*Tarrietia*), Red Carrabin (*Weinmannia*), Yellow Carrabin (*Sloanea*), the Calophyllum, the White Beech (*Gmelina*), and a host of other timbers not yet fully tested as regards their economic uses.

On some parts of the Downs and a few other inland localities there is a type of "scrub" which, in addition to trees that also occur on the coast containing several distinctive ones, the most outstanding is the Bottle Tree (*Brachychiton rupestre*). Trees such as the Lignum-vitae, Crow's Ash, Booyong, &c., are usually much smaller than the same species in the coastal belt.

River Timber.

Along many of the Australian rivers, both inland and coastal, a number of trees occur that always follow the watercourses, being rarely found anywhere else, such as the River Red Gum (*Eucalyptus rostrata*), River Tea-tree (*Melaleuca*), River Oak (*Casuarina Cunninghamii*), Weeping Tea-tree, Weeping Myrtle (*Eugenia*), Gutta-percha (*Excœcaria parvifolia*), &c. Other trees such as the Bean Tree, Blue Gum, Lillypilly, &c., occur along the rivers, but are also found in the Vine Scrubs or Open Forests.

Western Trees.

Many scrubs in the western and northern parts of the State are often formed by particular species of Wattles such as the Brigalow, Mulga, Boree, and Lancewood Scrubs respectively. Another tree forming large inland scrubs and usually associated with the Brigalow is the Beelah (*Casuarina lepidophloia*). Associated with the various species of Wattles and the Beelah are other trees such as the Wilga, Emu Apple, Native Pomegranate or Bumble Tree, Mustard Tree, Myall, Whitewood, &c. A remarkable feature about many of the western trees is the high fodder value of their leaves, cattle being carried over long periods of drought on scrub feed.

The foregoing sketch has necessarily been very brief, for as Queensland possesses approximately 800 species of trees, it is obvious that only a comparative few can be mentioned in the course of a brief lecture.

VALUE OF AGRICULTURAL CHEMISTRY TO THE STATE.

E. H. GURNEY, Senior Analyst, Department of Agriculture and Stock.*

Many of the necessities of modern civilised life have become so familiar that rarely is thought given to the scientific achievement that has been necessary for their development.

The art of agriculture has been in existence since the very early ages, and at the present time the agricultural industry of a country is considered of the utmost importance; particularly so in countries with large areas of arable land still to be exploited.

The agricultural methods of to-day have been established, to a large extent, by the application of facts contributed by the different branches of Science—Chemistry, Physics, Botany, Biology, Engineering, &c.

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* In a paper read before the Australian Chemical Institute (Queensland Branch), June, 1925.

The subject-matter of this paper is a brief account of the manner in which some chemical principles are made use of by the man on the land in his particular industry.

It will be in order to first consider some ways in which Agricultural Chemistry has given assistance in soil management—the soil being the source of all primary products.

It is now recognised that the fertility of the soil depends upon a number of factors, and for this reason the condition of the soil has to be considered from the chemical, physical or mechanical, and biological standpoints.

Recognising then that these conditions are inter-dependent, the chemical analysis of the soil, interpreted in conjunction with the mechanical analysis, gives an indication of the plant food supply therein, deficient or otherwise, and an indication of the particular fertiliser required to be applied to particular crops.

Hall, in his book "The Soil," states:—"In the analysis of soil, without doubt, the most important figure is the proportion of calcium carbonate, for on that must be based the decision, not only whether liming is necessary, but what class of artificial manures should be employed. Where the calcium carbonate is scanty, manures like superphosphate and sulphate of ammonia should never be employed, but basic slag or some neutral phosphate on the one hand, and nitrate of soda as a source of rapidly acting nitrogen on the other. The texture of the soil, the rapidity with which decay and nitrification of organic matter take place, freedom from fungoid diseases, all depend on an adequate proportion of calcium carbonate in the soil, say from ½ to 1 per cent., so that of all the determinations this is the most important."

The application of lime to the soil was practised by the Romans, and since that time to the present, in many countries, has been and is a comomn routine agricultural procedure. The investigations by Agricultural Chemists now show the reason in many cases of the many beneficial effects of an adequate supply of calcium carbonate in the soil.

Queensland Soils.

The analyses of many of the Queensland soils distinctly show a deficiency of lime. A revision of 857 of these analyses was made some years back, and the following figures were obtained:—22.5 per cent. of the soils contained from 0.1 per cent. to 0.24 per cent. lime and 30.5 per cent. contained from 0.25 per cent. to 0.49 per cent. lime.

Research work has been carried out upon a very large scale by the chemist in many countries in connection with the question of soil acidity, and the use of lime as a corrective, an account of this work will be communicated in a paper by Mr. Von Stieglitz, to be read at a later meeting of the Chemical Institute.

Humus derived from decayed organic matter is also a very important soil constituent on account of the very great influence it has upon all soil conditions—chemical, mechanical, and biological. In cultivated land the humus is derived from farmyard manure, green manures, crop and weed residues, which may have been ploughed under. Of particular importance in this State, where somewhat long periods occur at times between rainfalls, is the effect humus has in increasing the soil's power of absorbing and retaining water. And the possibility of the soils organic matter under our hot, dry conditions, being quickly destroyed, must not be forgotten.

Green Manures.

It is now a very well-known fact that the farmer, by ploughing in leguminous crops, which obtain their nitrogen from the air, has the means at his disposal of applying the expensive fertilising ingredient nitrogen to his soil. Green manuring has been practised since ancient times. It is stated the Romans ploughed in their second or third crop of lucerne, but it is at a very much later date that any records are found of investigational work upon the fixation of atmospheric nitrogen by plants.

Boussingault, in 1838, made many laboratory experiments growing seeds of known nitrogen content in *calcined* soil containing no nitrogen, and in other cases the soil was supplied with nitrogenous compounds. Lawes and Gilbert at Rothamsted conducted similar experiments. From the results of these experiments it was concluded that plants were unable to assimilate atmospheric nitrogen. But the field experiments at Rothamsted showed that leguminous crops did accumulate nitrogen to a very large extent. In illustration the following is one of the abovementioned field experiments.

A plot of land, which had been fallowed for five years was analysed and found to contain in the surface 9 in., an average of 2,657 lb. of nitrogen per acre. In the

first year it was sown with barley and clover, the clover being allowed to grow for another two years. The crops harvested and removed from this land during the three years contained 319.5 lb. of nitrogen. Then the soil was again sampled to a depth of 9 in., and upon analysis was found to contain 2,832 lb. of nitrogen per acre. Therefore the soil, notwithstanding the removal of crops, had gained 175 lb. of nitrogen per acre, and this gain, in conjunction with the nitrogen removed in the harvested crops, made a total gain of nearly 500 lb. of nitrogen per acre. As no manure had been used, the question was: From where was this nitrogen obtained? Many similar results from field experiments caused many eminent chemists to investigate this problem. But it was not until 1886, when Hellriegel and Wilfarth made known their researches, that the explanation of this matter was obtained. The conclusion arrived at being that leguminous plants can, by the aid of bacteria, assimilate and fix atmospheric nitrogen.

Green manuring is practised in many of the cultivation systems used in Queensland, but it is thought that the need of maintaining or increasing the humus content of the soils in this State require particular attention. On the subject of humus exhaustion the following paragraph from E. J. Russell's book, "Soil Conditions and Plant Growth," is interesting:—

"The crowding of the population into cities, and the enormous cheapening of transport rates, led during the nineteenth century to the adoption in new countries, particularly in North America, of what is perhaps the most wasteful method of farming known, continuous arable cultivation without periodical spells of leguminous and grass crops. The organic matter was rapidly oxidised away, leaching and erosion increased considerably when the cover of vegetation was removed, while the compound particles, that had been slowly forming through the ages, soon broke down. Nothing was returned to the soil, the grain and other portable products were sold, and the straw burnt. The result has been a rate of exhaustion unparalleled in older countries, and wholly beyond the farmers' power to remedy, consequently he left the land and moved on. The excellent experimental studies of Hopkins at the Illinois Experimental Station, of Whitson at Winconsin, and other American investigators have shown that addition of lime, of phosphate, and sometimes of potassium salts, with the introduction of rotations, including grass and leguminous crops and proper cultivation, will slowly bring about a very marked improvement."

Fertility of Queensland Arable Areas.

Judging from the analyses that have been made of Queensland soils, and from crop results from suitable crops grown upon these soils, it is evident there are some very fertile tracts of country in the State. But the chemical analyses also show that many of our soils have a low phosphoric acid content. This deficiency in phosphoric acid has been noted in a number of soils in other States of the Commonwealth. Again, the analyses of some of the red soils indicate that they contain a good total amount of phosphoric acid, but that the percentage of phosphoric acid that is considered readily available to crops is low, and also that these soils have not a high potash content, but their percentage of available potash is high. Such knowledge of a particular soil type is very valuable and the correct economical application of fertilisers to different crops is determinable. For this reason soil survey work is important, for when the characteristics of a soil type, the results of crop growth and the results of manurial and cultural trials upon that type in any locality are known, information can at once be given in connection with any soil of that type which is forwarded for analysis on account of unsatisfactory crop results.

Artificia Fertilisers.

Although it is essential to always aid the maintenance of a soil's fertility by approved methods of cultivation, it has been found, under modern agricultural conditions, that the addition of artificial fertilisers is also necessary to maintain or increase the soil's capability of economical crop production. Of course, it is to be understood that the application of any farmyard manure whenever obtainable should never be neglected, though it is thought such neglect is far too common, and that in cases where farmyard manure is scarce, the organic matter in the soil must be maintained by green manuring. When the fertilser industry is considered, it will be seen that its development has been dependent upon the research work of the chemist.

Records published about 1653 mention the value of the application of wool, bones, horn shavings, soot, wood-ashes, blood, &c., but the first recognition that the phosphoric acid content of bones was one reason for their value as fertiliser seems to have been made by Lord Dundonald in his "Treatise on the connection of Agriculture with Chemistry," published in 1795.

In 1840 Liebig published a record concerning the treatment of bones with sulphuric acid.

Lawes also treated bones with sulphuric acid, the resulting material, superphosphate, was obtained in which the phosphoric acid exists in a water soluble condition. In 1842 he took out a patent for this process, and with the discovery of mineral phosphate desposits, superphosphate has become a very commonly used phosphatic fertiliser.

An action for infringement of Lawes's patent was taken, and the evidence shows that he had used superphosphate experimentally before Liebig's publication.

Another interesting phosphatic fertiliser is basic slag, or Thomas's phosphate. In 1878 Thomas and Gilchrist made a modification of the Bessemer steel-making process, in order to effect the removal of phosphoric acid from the pig iron. This modification consists in making the lining of the furnace with basic material where formerly it had been siliceous, and adding lime to the molten pig iron. The phosphoric acid in the pig iron combines with the lime and is run off as a slag. The material obtained from the calcium phosphate deposits in different parts of the world, after grinding, is now also applied as a phosphatic fertiliser.

In connection with nitrogenous fertilisers it will be remembered that Sir William Crookes in 1898 drew attention to the ultimate exhaustion of the world's sodium nitrate deposit, and suggested the future supplies of combined nitrogen would be derived from the combination of nitrogen with oxygen, and also suggested how this could be effected by electricity cheaply generated. Since then the economical combination of atmospheric nitrogen has been accomplished, with the result that the nitrogenous fertilisers—calcium cyanamide or nitrolim, and nitrate of lime—are now upon the world's market.

Recognising that a sufficiency of all the plant foods is necessary for plant growth, then, when considering the particular effect of nitrogen, phosphoric acid, and potash upon plant growth, it may be stated generally that nitrogen promotes the growth of the foliage of the plant, that potash effects the production of carbohydrates, and that phosphoric acid induces root growth and influences the production of seed and fruit.

Cotton Crops—Fertiliser Trials.

The Agricultural Chemist, Mr. J. C. Brünnich, in his Annual Report for 1924, makes mention of the excessive vegetative growth, with practically no boll production in some of the cotton crops grown on soils with high humus and nitrogen content, with fair to high amounts of potash, but with rather deficient amounts of lime and low amounts of available phosphoric acid, and states:—

"In many of our cotton fields experiments must be made to find out if phosphatic manure alone, or aided by addition of lime, will produce better crops, as cotton is recognised as one of the lime-loving plants."

It has been shown by many trials that crops well supplied with potash are very much more resistant to disease attacks than are crops not so well supplied.

The statement has been noticed in a nurseryman's catalogue that the application of potash has been beneficial to rose trees in so far as mildew is concerned, but of interest in so far as this paper is concerned are the many extracts from scientific publications in reference to the effect potash has upon plant growth.

Fodder Crops.

Considering now some products of the soil, very extensive chemical examination has been made in connection with fodders and feeding stuffs. The usual analysis of foodstuffs determines the following constituents:—Moisture, protein, fat, carbohydrate, fibre, and ash, and the function of these constituents in the animal body is known. In other countries a very large number of experiments upon the digestibility of different foodstuffs have been conducted, but as far as it is known the only experiments in Australia of this nature were conducted by Professor Perkin, who experimented with horses, and by Brünnich and Rawson, who experimented with sheep. The results of the last-mentioned experiments were published in a paper, "Digestibility of Fodders," read before a meeting of the Australasian Association for the Advancement of Science, in Melbourne, 1921.

Such experiments upon the digestibility of fodders should be conducted in Australia as, owing to a difference in climate, soil, and growth of crops, it is possible somewhat different digestion co-efficients would be observed. Knowing the amount digestible of the different constituents of the different foodstuffs is only the first step towards a knowledge of the relative value of these foodstuffs, for the different constituents therein are not all of the same food value. But now resulting from the large amount of scientific investigation upon this subject, the evaluation of these different food constituents under one standard—viz., starch equivalence—has

been established. When this method is used for comparing different foodstuffs, the fat-producing power of the different constituents is estimated and also recognition is made of the loss of energy in mastication and digestion of the foodstuffs under consideration.

Analyses of all the commonly used foodstuffs, as well as a number of the grasses growing in our pastures, have been published. Standard rations for the feeding of animals for definite purposes have also been published.

Therefore, the feeder has the information necessary for him to compound from the foodstuffs in current use in his district a ration, giving the same feed value required by the particular ration he desires to use. Or in times of scarcity or high prices of the foodstuffs he has been accustomed to use, he can decide which is the cheapest and most suitable feed to be used in place of them.

Again, when the foodstuffs are grown by the farmer he can decide the quantities of the crops to be grown to meet the requirements of the particular ration desired. That economical efficient feeding of stock means increased wealth to the community is a fact of such importance that it should never be under-estimated, and should be more generally recognised.

Lime Deficiency in Soils.

As previously mentioned, the analyses of a number of our soils show a deficiency in lime and phosphoric acid, this deficiency is evidenced also by the bone-chewing habit acquired by cattle feeding on the pasture grown on such soils. Many pastoralists have been forced by reason of this deficiency of mineral matter in the pasture eaten by their stock to supplement this deficiency by means of cattle licks. In connection with this subject a valuable and interesting paper was read at the 1921 meeting of the Australasian Association for the Advancement of Science, by E. Murphy, Dairy Supervisor, Victoria, entitled "The Health of Live Stock. Notes on soils and pastures." Many interesting facts and suggestions are mentioned in this paper, of which the following are quoted:—

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

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

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

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

CHEMIST'S REPORT.

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

In an article appearing in the "Queensland Agricultural Journal," May, 1923, entitled "Impaction Paralysis of Cattle in Queensland," by John Legg, Government Veterinary Surgeon, Townsville, attention is called to a disease occurring in certain areas in North Queensland, which disease the author considers "similar to the condition known as impaction paralysis in Victoria."

It is mentioned that one selector estimates his losses at over 500 head in the last five years. The following is quoted from this paper:—"A further comparison between the two diseases will show that in Queensland as well as in other parts, the disease occurs mostly on poor country, *and where the bone-chewing habit is common among cattle.*"

In Queensland, graziers have stated that although some country looks good sheep country, when sheep are put upon this land they do very badly when compared with sheep upon other country, and information and advice has been asked for in connection with this matter.

The following extracts have been taken from the report of the Queensland Agricultural Chemist dealing with this subject:—

"The three most important elements necessary to sheep are potash, phosphoric acid, and lime, and the two latter are very deficient in many localities. Lime itself is liable to very rapid exhaustion, being washed out by heavy rainfalls.

"The composition of a few soils given below from different localities will speak for itself, and will account for the difference in value of these places for sheep breeding.

	Lime. Per cent.	Phosphoric Acid. Per cent.	Potash. Per cent.
Comet Downs ..	0.23	0.05	0.17
Emerald	0.20 to 1.30	0.04 to 0.10	0.20 to 0.40
Longreach ..	1.2	0.10	0.30
Blackall, Isis Downs	4.00	0.10	0.46
Peak Downs ..	4.40	0.40	0.40
Barcaldine ..	0.08 to 1.00	0.02 to 0.04	0.14 to 0.27

&c., &c. Phosphoric acid, the want of which, I think, is in many cases more pronounced than the want of lime, can only be supplied in the form of lick, and indirectly by using phosphatic fertilsers as top dressing of the grasslands, which is unquestionably the best method wherever practicable. Closer settlement, by cutting up large areas into suitable sizes for mixed farming will make better use of some of the runs at present not eminently suitable for the exclusive raising of sheep."

Need for Chemical Investigation.

All the preceding matter in connection with the ill effects of feeding pasturage deficient in mineral constituents illustrates the need there is for the chemical investigation of our pasture lands and vegetation.

Time will allow only of the mention of the fact that the chemical investigation of milk and its products has been a large factor in the progress of modern dairying. But it is desired to refer to the great benefit the dairy farmer has received from the evolution of quick methods for the determination of fat in milk and cream. The Babcock method was invented in 1890 by Dr. S. Babcock, Chemist of the Wisconsin Experiment Station, and this method enables the quick and easy testing of the fat content in the milk of the individual cow—thus permitting of the culling of the non-paying or less valuable animals from the herd.

It is recognised that the higher the standard of quality of agricultural products the greater is the value obtained by both the agriculturist and the State; for this reason standards for some of these products have been proclaimed by Acts of Parliament.

In a similar manner standards have been proclaimed for many of the commodities used by the agriculturist. It is within the province of agricultural chemistry to determine if the abovementioned standards are obtained, which necessitates the analysis of dairy and other agricultural products, fertilisers, insecticides, stock foods, &c.

In this paper a very brief description of the manner in which agricultural chemistry can be of benefit to agriculturists in connection with soil management, fertilisers, crops, and the feeding of stock has been given, and it is hoped the value of agricultural chemistry to the primary producers of this State has to some little extent been illustrated.

THE POULTRY TICK.

By P. RUMBALL, Poultry Instructor.

Poultry keeping, which is one of the most valuable adjuncts to general farming, is frequently severely handicapped in many parts of Queensland by the presence of the Poultry Tick (*Argas persicus*). Very little good would be done in trying to explain how this pest was introduced. It is here and has gradually spread over a large expanse of country. In many of the infested areas it is not uncommon to meet farmers who have had their flocks almost depleted, and others who have disposed of their one-time profitable flocks on account of the ravages of this pest. A knowledge of the general habit of the tick, precautions necessary to take against its introduction, and methods of eradication are the means by which poultry may be kept successfully.

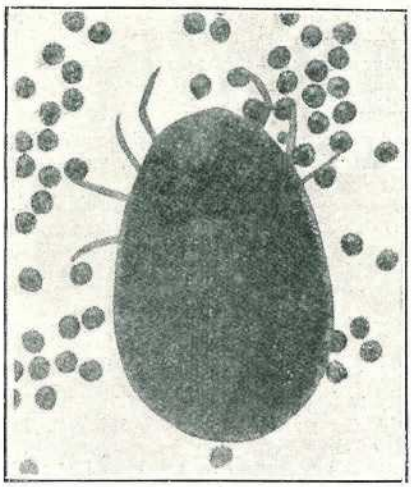
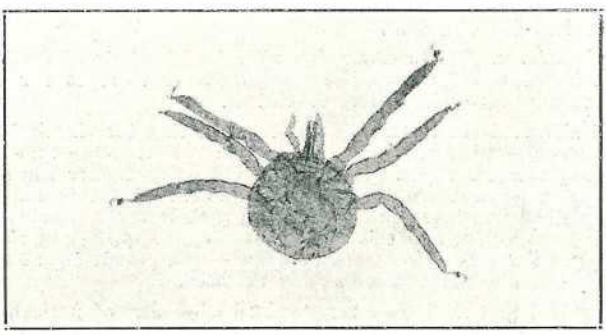


PLATE 29 (Fig. 1).—POULTRY TICK AND EGGS.



Bulletin No. 74, South Australia.]

PLATE 30 (Fig. 2).

Hosts.

Fowls appear to be preferred as hosts by the tick, although turkeys, ducks, geese, and pigeons are also attacked. This preference is probably due to the more restful and regular habits of fowls at night than that of other kinds of poultry. Wild birds are also known to harbour ticks. Such infestation has come, no doubt, by the close association with infested poultry yards.

Life and Habits.

The egg of the tick, as shown in Fig. 1, is very small and is of a brownish colour. It is found in the crevices of the wood work of the houses, perches, and some-

times adhering to feathers, &c. This egg hatches in the course of two to three weeks. Nuttall states the period at from eleven to thirteen days, but probably in cold weather the period is considerably longer.

The young or seed tick, as shown in Fig. 2, has only six legs, white or greyish in colour and very difficult to see. As soon as their covering has hardened they make their way to a host, generally by crawling up the legs of the birds, and attach themselves as shown in Fig. 3. They remain here for a period varying from four to ten days, swelling considerably and appear as bluish-black spots on the body of the bird.

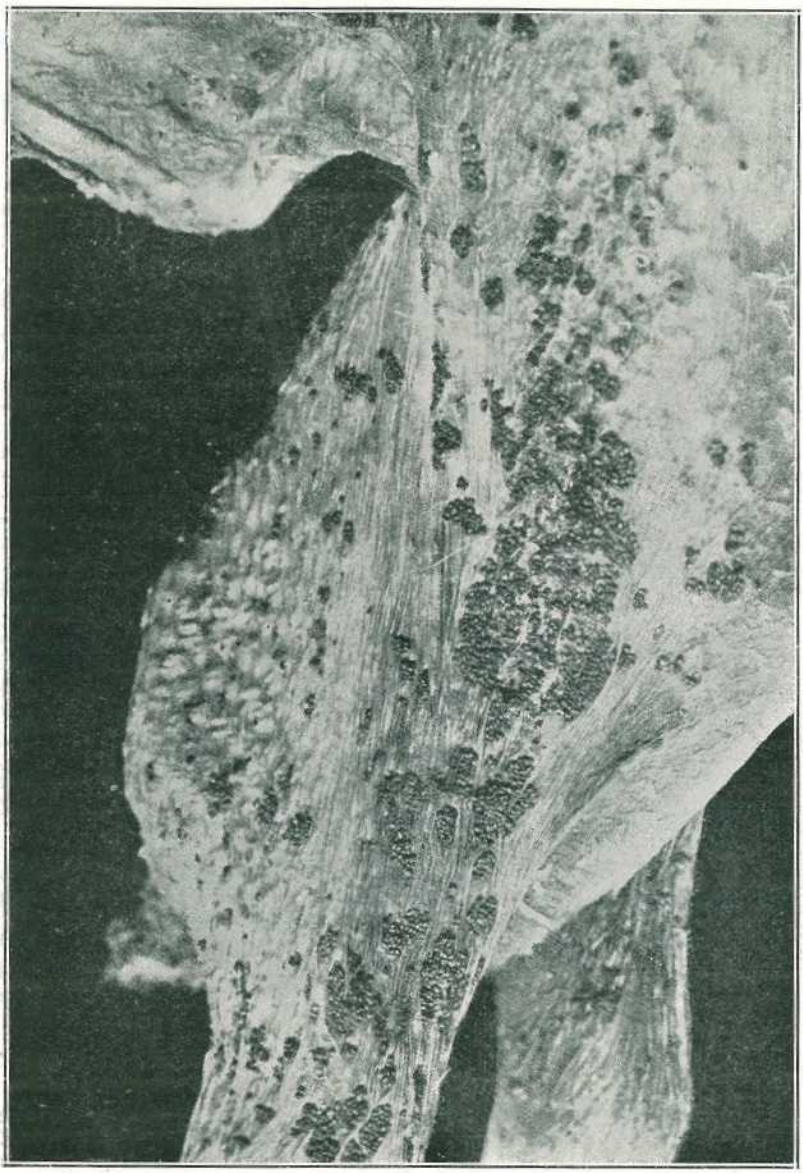


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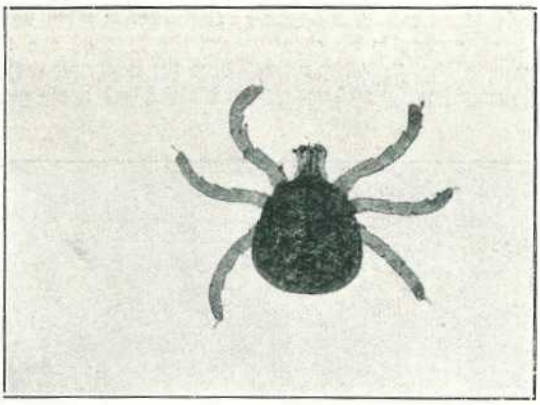
PLATE 31 Fig. 3).

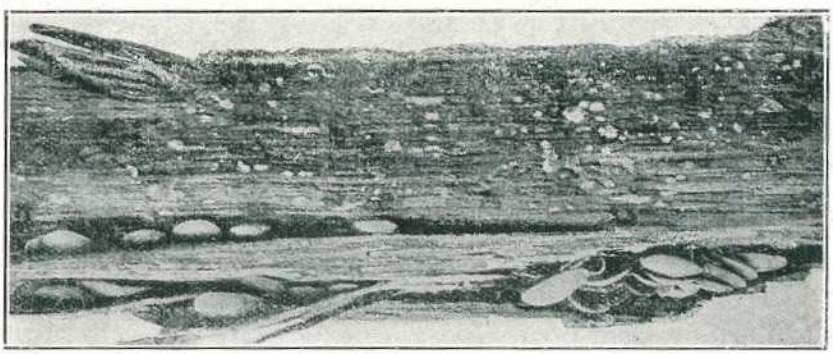
Fig. 4 shows a young seed tick which has fed and left its host. It has altered considerably in appearance. This seed tick then seeks some secluded spot to rest and moult.



Bulletin No. 74, South Australia.]

PLATE 32 (Fig. 4).—A YOUNG TICK WHICH HAS FED AND LEFT ITS HOST.

Fig. 5 shows an ideal home for the tick. They will also be found under the bark of trees, cracks in perches, and any similar spot which offers concealment. In searching for the tick one is guided by the darkish spots around cracks in the wood work of the buildings. These spots are caused by the excreta of the tick. The moulting period takes four to nine days. After moulting the tick presents a somewhat different appearance, having eight legs. It now only feeds at night. The meal is taken rapidly, and long before daylight it is safely hidden away in its retreat. This process is repeated (usually three times) until matured. The adults vary considerably in size, large ones being nearly half an inch in length. After another feed the adult female is ready to lay. The poultry tick varies in this respect to the ordinary tick, as she may lay as many as eight batches of eggs of 20 to 100 before death.



From Poultry Farming in New South Wales.

PLATE 33 (Fig. 5).—PIECE OF OLD SPLINTERED WOOD INFESTED WITH FOWL TICK.

The fowl tick may have a long life, even when separated from its natural host. Newman, F.E.S., in studying this insect found that a single isolated female lived for two years three months, while in a group one female lived four years and five months. The males were comparatively short-lived. I have found ticks thriving in poultry sheds in Queensland where fowls have not been kept for nearly two years. It will, therefore, be seen how impractical it is to merely shut up a fowl house for a year or so with the hope of extermination by starvation.

Effect on Poultry.

From the foregoing, it will be seen that during the day the adult tick is under cover, principally in the roosting quarters, cracks in the timber, nest boxes, old bags, or even between sheets of galvanised iron where it overlaps, and the young or seed tick is attached to the fowl. Its effect on fowls is not confined to the loss of blood. The most serious trouble is caused by the transmission of an actual blood parasite. This parasite induces a fever which either causes the fowl to die or leaves it after a severe illness to recover and become immune to further attacks. This immunity frequently leads farmers to under-estimate the havoc that can be wrought by the poultry tick, and they become indifferent to their presence.

The symptoms of fowls suffering from tick fever are rise in temperature, listlessness, frequently a loss of appetite, restlessness and distress, ruffled plumage, blackness and shrinkage of comb, and some symptoms of paralysis. Diarrhœa is nearly always present, and owners frequently conclude that their birds are suffering from cholera. When these symptoms present themselves, a thorough search should be made for tick.

Combative Measures.

Prevention of infestation should be the aim of poultry keepers who are free of tick. Strict examination and isolation for a period of ten days of all stock purchased assures that when the new birds are placed among the flock they carry no seed tick with them. Burning or spraying will deal with the isolation crate. All crates, egg boxes, or material brought on to the poultry section should be subject to the same rigid examination. Particular care should be given to the examination of crates returned from market, as it is possible that in transit ticks may travel in search of a host from infested crates to clean ones.

The fact that a very little portion of the life of the tick is spent on the fowl while the infestation of the houses may last for years, naturally causes one to direct his efforts to the treatment of the sleeping quarters of the stock.

Many flocks have no shelter other than trees, and the proper treatment of these is almost impossible. Some of the poultry sheds used are also impossible to treat, every piece of timber being a natural home. Good housing accommodation therefore facilitates eradication. Where the trees and existing infested houses are of no value, a fire is the most economical and effective method of treatment. If the trees are valued for shade purposes they can be securely fenced off and the fowls induced to sleep in the quarters provided.

A start should be made in dealing with infested houses by carefully removing any surplus boxes, boards, and other harbourage, and if of little value make a bonfire of them. When the house is thoroughly cleared of rubbish, spray the entire inside, taking care to get into every crack and crevice, also between the iron where it overlaps. Thoroughly treat all fittings in a similar way, and in case any ticks have been dislodged and are lying on the floor, give that a spray as well.

The number of sprayings necessary is largely dependent upon the construction of the buildings, and the thoroughness with which the work is done, but three sprayings should always be given at intervals of about five days. These subsequent sprayings will kill any seed ticks that may drop off infested stock from time to time. Where the stock have been accustomed to roost on various parts of the farm it would be well to keep a look-out for the reappearance of the tick for some years, as certain birds laying or roosting away may collect ticks and bring them home to the regular quarters.

Spraying Mixture.

Various spraying mixtures have been tried from time to time, but probably the handiest and one that is very efficient is kerosene emulsion made in the following way:—Take 1 gallon of water, boil in it 1 lb. of good household soap; while hot add 1 gallon of kerosene, stir well until thorough emulsified, then add another 8 gallons of water. Use this mixture freely, for it is both cheap and effective.

POULTRY FEEDING.

By P. RUMBALL, Poultry Instructor.

To assist in the utilisation of the various foods produced on the farm and to enable the feeder to select those which contain the materials necessary for all the body functions, together with egg production and table requirements, a knowledge of food constituents and their uses is necessary.

In a general analysis foodstuffs are classified as moisture, proteins, carbohydrates, fats and oils, fibre and ash. This analysis can only be taken as a rough guide, as the quality of foods vary in seasons and localities, but it enables the feeder to work upon more or less definite lines.

Experience has taught us that a balanced ration, that is a mixture of foodstuffs having a certain proportion of protein and a certain proportion of carbohydrates, is

necessary to obtain maximum results and that this ration should vary. Variety not only assists us in the correct balancing of food, but adds to the palatability of the ration, stimulates the secretory glands and in many ways helps digestion and assimilation.

This nutritive ratio has been set by some authorities on feeding as 1 part of protein to 5 parts of carbohydrates, but with poultry, although this ration is suited to the more severe winter months, it needs to be narrowed in the summer, and over a period of twelve months a ration of 1 to 4½ has proved most suitable. In its preparation a variety of foods should be used.

The value of foodstuffs depends largely upon their digestibility, and although results of experiments, if any, in this direction are not available in connection with poultry the feeder may base his calculation on the following table of digestible nutrients in a few of the most suited poultry foods.

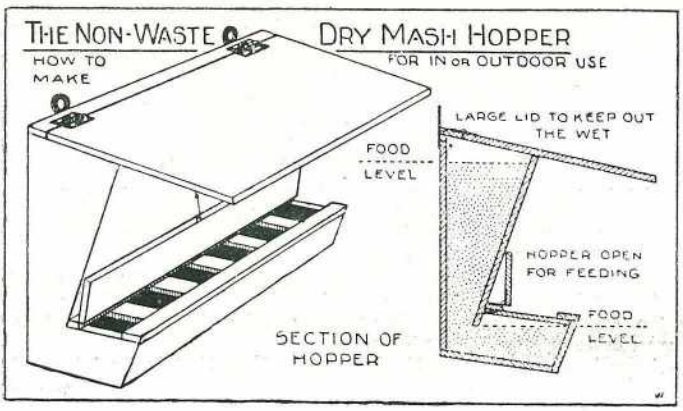
COMPOSITION OF SOME POULTRY FOODS.

DIGESTIBLE NUTRIENTS.

—	True Protein.	Carbohydrate.	Fibre.	Fat.	Nutrit'ous Rat'o.
Barley, Green	1·2	9·0	2·9	0·4	1 to 10·7
Lucerne, Green	3·0	6·1	3·4	0·3	1 to 3·4
Pumpkins	1·1	7·0	2·6	0·7	1 to 10·2
Dry Lucerne Chaff or Meal..	11·1	21·7	11·9	1·4	1 to 3·3
Barley	8·7	64·2	0·7	1·2	1 to 7·8
Maize	10·0	61·2	1·2	4·7	1 to 7·3
Cowpeas	17·3	52·0	1·1	0·8	1 to 3·2
Wheat	11·8	54·0	1·1	1·5	1 to 5·0
Feterita	10·1	65·4	..	2·4	1 to 7·0
Oats, Hulled..	11·4	57·7	..	7·5	1 to 6·5
Bran	11·0	34·5	1·6	1·8	1 to 3·6
Pollard	13·9	47·0	1·7	4·8	1 to 4·3
Peanut Meal	33·8	11·6	0·6	7·2	1 to 9·0
Oil Cake (Sunlight)	15·6	38·6	4·0	10·4	1 to 4·3
Bone Meal, Fresh	18·3	..	..	24·5	1 to 3·0
Meat Meal	54·3	..	..	10·55	1 to 0·½
Buttermilk	3·4	4·9	..	0·1	1 to 1·5
,, Dry	29·3	41·0	..	6·2	1 to 1·9
Milk, Skim	3·6	5·2	..	0·1	1 to 5·0
Blood, Dry	52·4	..	..	2·5	1 to 0·1

Moisture.—Moisture embraces the amount of water in various foods, and even in their driest forms it is always present. Water, although highly essential for both growing and adult stock and a liberal supply is always necessary, is of no value in foods, and according to the quantity present so is the value of the food generally lessened.

Protein.—Protein includes all organic, nitrogenous substances. It is essential for the flesh-forming purposes of growing animals, and the building up of waste tissues which is one of the consequences of active existence, and poultry being very active naturally require a relatively higher percentage of protein food than other live stock. It is also necessary for high egg yield. Foods rich in protein are all forms of animal foods, peas and beans. Hard flinty wheats carry a higher percentage than soft starchy grains. Yellow maize also carries a higher percentage than the majority of the white varieties.



Carbohydrates.—Included in this category are the starches and the sugars. Their principal functions are the production of heat and energy and the formation of body fats.

Fats.—Fats are essentially heat and energy producing, and incidentally assist the building up of the body fats.

Fibre.—Fibres include the least digestible of foods, such as the outer cells of grains and the fibrous matter in plants.

Ash.—This is the residue of burnt foods and represents the mineral matter drawn from the soil by plant life. As a general rule stock that has free range and live on herbage obtain sufficient quantities of mineral matter, but with poultry, more especially those confined, the absence of mineral matter in their food has frequently been noticed. This is due to the fact that the ash content of the grain is generally less than that of the whole plant. Liberal supplies of green feed, especially green lucerne, and, failing green lucerne, lucerne meal or lucerne dust, will largely make good this deficiency. Skim milk is also another excellent food by which the mineral contents of food may be augmented. In compounding a ration we must naturally give consideration to the utilisation of foods locally grown, and even though they may not give the maximum results they may prove economically sound on account of the very much reduced cost of feeding.

The Food Ratio.—To enable readers to test for themselves the ratio of the foods they are using, those consumed by the birds during the last Mount Gravatt competition is given as an illustration. The first column shows the total weight in pounds of food, the second the total protein content, the third the carbohydrates, and the fourth fats and oils. The cost of the various foods used is given also.

To obtain the content of the various constituents the weight of the food is multiplied by the percentage shown in the table of analysis. The total protein content is then divided into the totals of the carbohydrates and fats, after the latter have been multiplied by 2.25 to show their carbohydrate equivalent, as a pound of fat will create as much energy as 2.25 lb. of carbohydrates.

Although the ration used in this test was slightly narrow or carried rather too much protein good results were obtained, owing to the exercise promoted by feeding grain in litter. In the present test slightly more maize is being used and is giving equal if not better results, and incidentally reducing the cost of feeding.

Table of Food Consumed by 270 Birds, Mount Gravatt Competition, 1924-5.

Kind of Food.	Weight in Lb.	Protein.	Carbohydrates.	Oils and Fats.	Cost.
Wheat	9,114	1,075·45	4,921·56	136·71	47 18 7
Maize	5,382	538·20	3,293·78	254·95	18 3 1
Bran	3,390	372·90	152·55	61·02	12 19 2
Pollard	8,760	1,217·00	4,117·20	420·48	36 14 11
Lucerne Meal ..	1,202	133·42	152·65	16·82	7 9 2
Linseed Meal ..	75	22·50	21·15	2·40	0 9 3
Meat Meal	900	342·00	..	72·00	9 19 3
Charcoal	7 bags	..	..	..	2 1 0
Shell Grit	1,680 lb.	..	..	..	6 13 2
Salt	20 lb.	..	..	..	0 4 2
		3,702·17	12,658·89	965·35	142 11 9

Ratio = 965 (fats) x 2·25 + 12658 (carbohydrates) ÷ 3702 (protein) = 1 to 4.

Note.—The meat meal used was low in protein and contained salt, which accounts for the small quantity used. Average cost of feed per bird, 10s. 6·7d. Average number of eggs laid, 204 per bird.

Quantities.—It is not desirable to lay down definite quantities for the feeding of poultry. Growth and egg production can only be maintained when the quantities supplied are in excess of that required to support life, and it is a good maxim to feed to stock all that they will consume. In certain experiments carried out at the New York Experimental Station it was ascertained that it took 3.9 lb. of digestible dry matter to maintain in good health 100 lb. of live poultry weighing 3 to 5 lb., while those in full lay require 5.5 lb. This illustrates the necessity for liberal feeding to laying birds, and the same remarks apply equally as well to

growing stock. Experience has shown us that a ration consisting of 1 part protein to 4.5 parts carbohydrates gives satisfactory results as an egg producer, while the ration for the growing chicken should be a trifle narrower, and that for fattening a fowl which is nearly mature considerably wider.

Grain Feeding.

It is futile to expect good results from grain feeding alone, for it will be seen from their analysis that they are more or less deficient in protein. There are, however, times when a good egg yield is obtained from birds fed on grain only, but this is generally in the spring months, when fowls at liberty obtain food rich in protein, in the form of insect life. Grains are by no means depreciated as a poultry food, and Queensland's staple grain, maize, is worthy of notice. Maize is generally procurable at reasonable prices and, although as yet not extensively used by commercial poultry farmers, it is coming more into favour. It is deficient in protein and fairly rich in fats and has a tendency to lay on internal fat, but when used in conjunction with other nitrogenous foods this difficulty is largely overcome. One third of the grain used in the last egg laying test consisted of maize; the laying was excellent and the general health of the stock all that could be desired. Breeders who are using maize more extensively also report in its favour. Apart from its feeding value it materially assists in giving that rich orange colour to the yolk of the egg.

Feterita, one of the grain sorghum family, should also be of value to the poultry industry. It is a prolific cropper and resistant to drought, two features which should permit of its being produced at prices that would encourage its use as a poultry food. Poultry consume it readily, and breeders who are using it speak in its favour, even though the percentage of carbohydrates are high.

Feeding of Laying Stock.

There are two methods of feeding in common use, wet mash and grain and dry mash and grain, good results being obtained by both. Liberal quantities of green feed are given in each method. It is a difficult matter to say which is the better of the two, but to the general poultry keeper, more especially the man with little time and the novice, I recommend the use of dry mash. By this system a considerable saving in labour is made and the birds get a full supply of what should be a well balanced ration. It is impossible for the birds to swallow mash dry; therefore it should stimulate the secretion of saliva and aid digestion.

Wet mash feeding, however, has its advantages, in so far that large quantities of succulent green feed can be used and, where available, the mash can be mixed with milk; the feeder needs to be particularly careful to see that his birds have full and plenty, but should not leave food lying around to become fouled and sour.

Suitable mash mixture—Bran, 25 per cent.; pollard, 55 per cent.; lucerne meal or dust, 12 per cent.; meat meal, 5 to 10 per cent.; salt, 12 oz. to every 100 lb. of dry feed.

This mixture is that which was used in the egg-laying competition at Mount Gravatt, and it gave good results with a mixture of wheat and maize at night. The feed used throughout the whole test of twelve months had a nutritive ratio of 1 part protein to 4 parts carbohydrates. If dry mash is being fed this mixture can be mixed in bulk and fed in gravitating hoppers to guard against waste. If it is desired to feed wet mash, the lucerne dust or meal may be replaced with green feed and may be increased to 25 per cent. of the bulk, or in droughty time when feed is dear more green stuff may be used. When liberal supplies of milk are available the addition of meat meal is not necessary. Shell-forming material, such as shell grit and charcoal, should always be available, and the general health of the stock provided for by promoting exercise by feeding the grain in litter.

CHEESE BOARD.

The following nominations for election as producers' representatives on the Cheese Board have been received:—Henry Keefer, Pittsworth; Mads Peter Hansen, Maclagan; David Gabriel O'Shea, Southbrook; Henry Thomas Anderson, Biddeston; Thomas Dare, Narko, Cooyar Line; Albert George Tilley, Rosehill; and William Smith, Yangan. Five representatives only are required.

LIME.

By J. C. BRUNNICH, Chemist, Department of Agriculture and Stock.

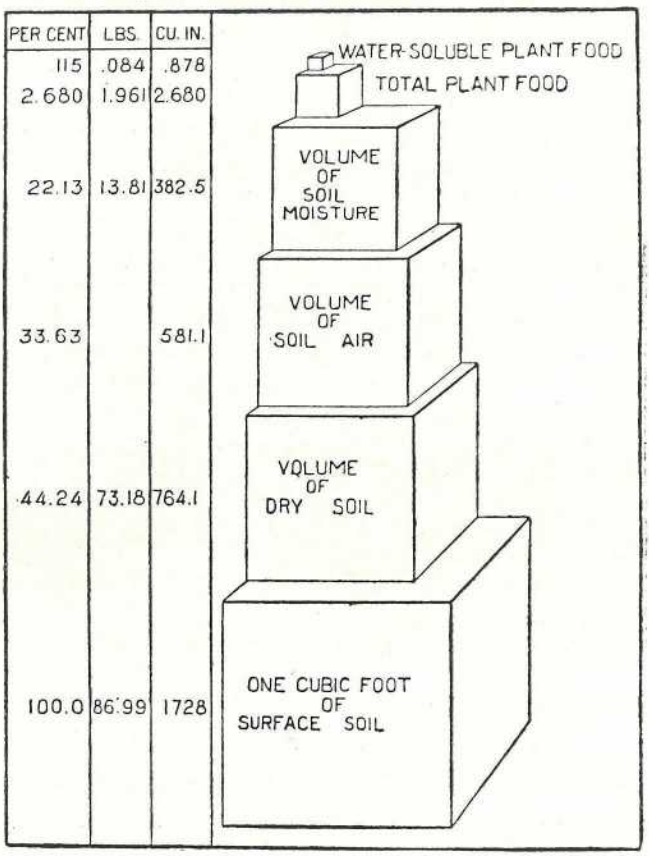
The late Director of the celebrated Rothamsted Experiment Station, Sir A. D. Hall, stated in his opening address of the meeting of the British Association for the Advancement of Science, held in Australia in 1914, as follows:—

"Of all soil factors making for fertility I should put lime the first. Upon its presence depend both the processes which produce available plant foods in quantities adequate for crop-production at a high level and those which naturally regenerate and maintain the resources of the soil. It is, moreover, the factor which is most easily under the control of the agriculturist."

Before, however, entering on the discussion of lime and its functions, a few remarks on soil management in general must be made, in order to understand the importance of these functions.

In order to establish, increase, and maintain the productivity of any soil, a careful management of the soil is required, and such management must be based, according to the late Professor F. H. King, on the following fundamental principles:—

1. The necessity for a *sufficient amount of room in the soil*, not only in the portion turned with the plough, but throughout the effective root zone.
2. The existence in the soil of *large amounts of plant food materials*, but not in available form, and which it must become the business of soil management to transform into available condition with sufficient rapidity to meet the need of a heavy crop.
3. The necessity of an *ample crumb-structure* of the soil throughout the effective root zone, which bad management breaks down and which good management builds up and renders more stable.



This Plate I. illustrates the different volumes of the component parts of a cubic foot of surface soil of average quality.

* This Plate and the following are taken from the late Prof. King's book, "Soil Management."

We are apt to look upon soil as a dead inert mass, but this view is entirely wrong, as each pinch of soil contains millions of living organisms, and is really a world of its own. The *internal surface of the soil* grains is the pasturage where all the micro-organisms grow and multiply, and where plant foods are made available and stored. Plenty of room within the soil is required for this world of life, where water is stored, air penetrates, the rootlets of plants develop, grow and feed, and finally decay.

In a fertile soil an abundant amount of all necessary plant foods must be present, and the absence of a single one would make the soil sterile; only a comparatively small amount need to exist in readily available form.

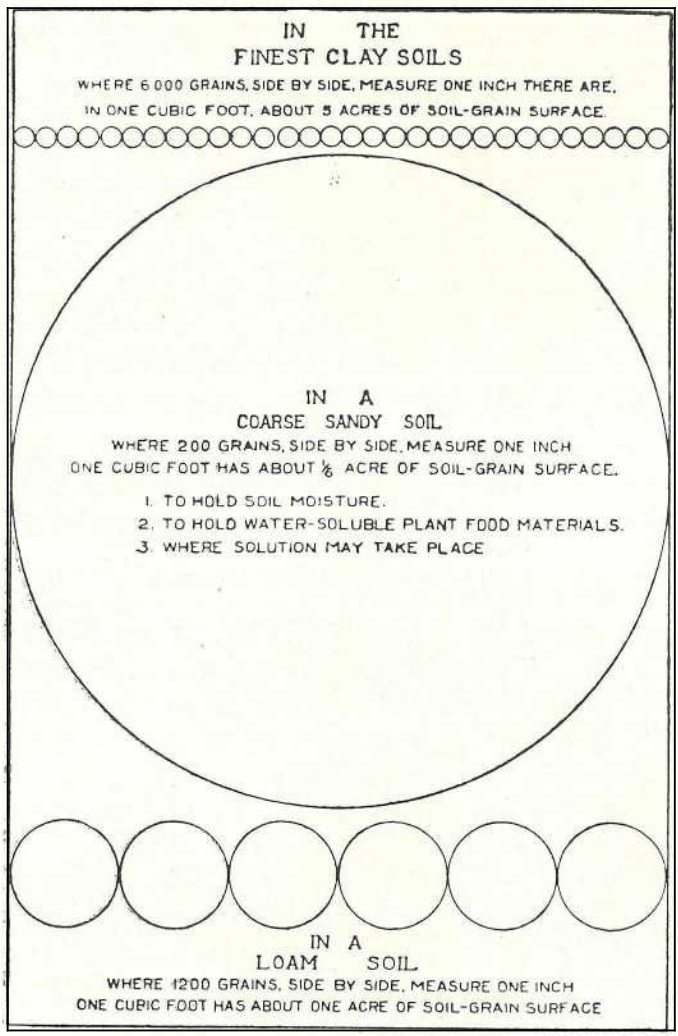


Plate II. shows the relative size of the various soil particles in loam and sandy soil.

An acre of soil, to a depth of 12 in., weighs on an average 3,500,000 lb., or 1,565 tons, and should contain about the following amounts of the essential plant foods:—

K_2O Potash.	CaO Lime.	MgO Magnesia,	N Nitrogen.	P_2O_5 Phosphoric acid.	SO_3 Sulphuric acid.
Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
20	9	7	4	$2\frac{1}{2}$	$\frac{1}{2}$

As the effective root zone in a well-drained soil reaches to a depth of 3 to 4 ft., a very much larger amount of plant foods than stated above are really available. The great bulk of these plant foods is in an insoluble form and therefore not readily leached out by rain, but small amounts are soluble in water, and further amounts are continually liberated by the activity of the living organisms, decay of vegetable organic matter, the interaction of various chemical constituents, the action of the fine rootlets, &c., and these liberated available plant foods are dissolved and stored in the thin film of water covering the soil particles.

The internal surface of a soil is therefore of the greatest importance, and becomes greater as the size of the particles becomes smaller.

A marble 1 in. in diameter, which just fits into a cubic inch of space, would have a surface of 3 1/7 square inch, the cube a surface of 6 square inches. Decreasing the size we get—

with 1/10	in. diam.	1,000	in a cub. inch, with	31.4 sq. in. surface
with 1/100	in. diam.	1,000,000	in a cub. inch, with	314 sq. in. surface
with 1/1000	in. diam.	1,000,000,000	in a cub. inch, with	3141 sq. in. surface

In a good soil there are from 40 to 80 per cent. of the particles smaller than one-thousandths of an inch, and therefore we get in an acre foot of soil, the surface of the soil granules amounting to: from 10 to 300 square miles.

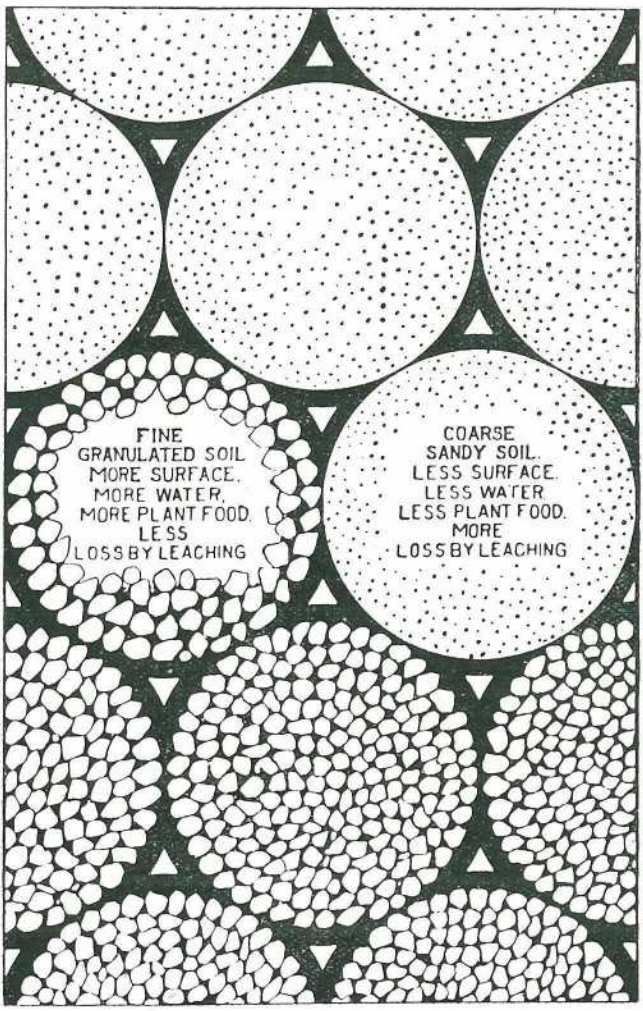


Plate III.

The most important physical condition of a soil *is its tilth*, which means a thorough deep and strong granulation, which produces the crumb-structure, without which there would be imperfect drainage, poor ventilation, and lack of room for the proper development of plant root and rootlets, and for the multitude of soil organisms, whose activity is absolutely indispensable for the maintainance of soil fertility.

The finest soil particles are so small, that if they were not bunched together they would be like heavy potter's clay, practically impervious to air and water. By proper soil management a proper tilth is obtained, which causes the fine particles to form such crumbs, and in this respect lime plays a most important part. Each such crumb of soil becomes like a sponge, and is full of water charged with available plant foods ready to be sucked up by the plant rootlets. Plate III. shows the soil granules of a loamy soil compared with a sandy soil. A good crumbly soil will retain in 1 ft. of depth as much water as given by 2½ to 4 in. of rain. This water is lodged in the spaces between the granules, and also in a thin film over all the finer particles, and in the latter case adheres to the particles very tenaciously, and can only be partially utilised by the roots. In a sandy loam containing a total of 18 per cent. of water a crop of corn can utilise the water down to about 4 per cent., whereas in a clay soil with a total of 25 per cent. water only down to 13 per cent. could be utilised; so that the drier sandy soil actually yields more water to the crop than the wetter clayey soil.

We have now some idea about the principles of soil management in affecting the physical condition of the soil, and lime, as stated already in the introduction, plays a very important part.

Let us now consider what *lime* is, how it is found, and in which forms it can be utilised by the agriculturists.

In nature, lime is found abundantly as *carbonate of lime*, in limestone, marble, and chalk, and also forms the principal constituent of coral, sea shells, egg shells, &c. By burning or roasting of carbonate of lime (limestone) in special kilns, carbonic acid is split off, leaving *calcium oxide*, or caustic lime, burnt lime, quick lime. This form of lime has a powerful caustic action, readily absorbs water, destroys organic

$$\mathrm{Ca\,\overset{O}{\underset{O}{C}}\,O} = \mathrm{Ca\,O} \text{ and } \mathrm{C\,O_2}$$

matter, and liberates ammonia from its salts. Left exposed to the air, quick lime slowly crumbles by absorbing water; this process is hastened by pouring water over the lime, and under evolution of considerable heat the lime changes into slaked lime

$$\mathrm{Ca\,O} + \mathrm{\overset{H}{\underset{H}{O}}} = \mathrm{Ca\,\overset{O\,H}{\underset{O\,H}{}}}$$

or *hydrate of lime* $\mathrm{Ca\,\overset{O\,H}{\underset{O\,H}{}}}$, which if left exposed to the air will absorb carbonic acid and revert slowly back to the carbonate. In air slaked lime we have therefore a mixture of carbonate and hydrate, which is called *mild lime*, and is in excellent condition for application to the soil if required for a fairly quick action.

Agricultural lime is lime carbonate in crushed form, and is made from limestone, shells, coral sand, and fine limestone earth found in some localities. The action of this lime is very much slower and depends largely on the fineness of the particles.

Lime is also found in nature in the form of limesulphate or *Gypsum*, and may be used for agricultural purposes (plastering of soil).

Lime carbonate is only slightly soluble in water, but more so if the water contains carbonic acid; for this reason lime is leached out from the soil by rain water and sinks deeper into the ground.

Lime is an *indispensable plant food*, intimately connected in the growth of plants with the building up of proteins and carbohydrates, and for the neutralisation of excess of organic acids. Lime is necessary in the building up of the cell walls

and for this reason we find larger amounts of lime in the leaves and young twigs than in other parts of the plants. Seeds generally contain only small amounts of lime, and the young seedling plants require lime at their early stages of growth for healthy normal development.

In the life process of plants frequently acids are formed, which in excess would kill the plants. These acids, chiefly oxalic acid, are neutralised by lime and deposited in the cells in form of fine crystals (raphides), found in large amounts in rhubarb, onions, cunjevoi, prickly-pear, &c.

Lime is also necessary for the bacterial life, and increases the activity of the azoto-bacteria, which are the agents of the fixation of the atmospheric nitrogen in the soil.

Lime has a powerful action on the physical properties of a soil, and applied as carbonate of lime, oxide or hydrate of lime, will increase the water-holding capacity of any soil. Burnt lime has the quickest and strongest action on the soil structure, as it coagulates the clay, gives it crumb structure, thereby increasing the porosity of the soil; it also has a favourable action on very sandy soils by giving them more body.

Further important functions of lime are the neutralisation of organic and mineral acids present in the soil, and the decomposition of injurious compounds. Lime aids in the fixation of soluble phosphoric acid and prevents the formation of the quite insoluble alumina and iron phosphates. An application of burnt lime actually makes some phosphoric acid available from such insoluble phosphates. Lime also appears to have some action on insoluble potash salts and renders them more readily available to plant life. This action is more particularly valuable on heavy clay soils, but would lead to loss of potash in light sandy soils, and for this reason lime should always be applied in form of lime carbonate (agricultural lime) to sandy soils.

Lime has also a pronounced action in aiding decomposition of organic matters, the *humus* in the soil, producing at the same time soluble nitrogenous compounds therefrom.

Addition of sufficient amounts of lime will produce neutrality or even slight alkalinity of a soil, which is necessary for the important process of nitrification, by which organic nitrogenous compounds are gradually changed into ammonia salts, and finally into nitrates, in which form alone the nitrogen can be utilised by plant life.

The lime requirement of certain crops is a very important matter, as some plants are much more affected by soil acidity than others, and in many cases of failure to get good results after application of artificial fertiliser the cause could be traced to want of lime in the soil. The lime requirement of a crop depends on the actual lime content in the plant, on the rate of growth, on the feeding power of the plant, which again is controlled by the root system and the physical condition of the soil.

Some of the crops greatly benefited by liming are: Cabbages, cauliflower, beets, lettuce, onions, parsnips, grasses, sorghum, cotton, and citrus fruits. Some plants are injured by excessive liming; for instance, cowpeas, peanuts, and water-melons.

In olden times, very heavy dressings of lime were practised; once every fifteen to twenty years 15 tons and more of lime were applied to the land, and in many localities caused rapid exhaustion of the soil. The modern practice of applying lime in smaller quantities every three to four years is to be preferred, as being much more economical and beneficial.

The usual rate at present is 1 ton of lime per acre; this quantity adds only 0.06 per cent. (six hundredth per cent.) of lime to the soil to a depth of 12 in., amounts to about ½ lb. per square yard, and forms a layer only one hundredth of an inch deep when broadcasted, the usual method of applying lime.

In order to increase the lime content of a soil by only one-tenth of a per cent., we would require an application of 31 cwt. of quick lime, or 56 cwt. of pure lime carbonate.

THE MAIZE GRUB PEST.

A SUGGESTION FOR COTTON FARMERS.

By E. BALLARD, B.A., F.E.S., Commonwealth Cotton Entomologist.

The damage done to cotton by the Maize Grub (*Heliothis obsoleta* F.) is only too well known to cotton farmers to need any detailed description. The havoc wrought by it early in 1924 is still fresh in the memory of many.

The season which is now closing saw a very marked diminution of the intensity of attack, and it was only in a few cases that conditions obtained akin to those of 1924.

The causes of this may have been the mild winter and early rains providing an ample supply of alternative food plants and the fact that parasites, especially egg parasites, were early at work. We do not yet know the full effect of different climatic conditions on the enemies of the maize grub, so that suggestions as to whether or no parasites are affected by lack of moisture or excessive cold or heat must be speculative. Whatever the causes, the maize grub population this year was comparatively low.

The superior attraction of maize for the maize grub has been known for years, and its use as a trap crop has often been advocated both in Queensland in the departmental bulletins and in other countries. Many farmers, however, do not yet know of it, and it is for them that this article is chiefly written.

I noticed this year when going about the country that quite a number of cotton farmers had maize planted amongst their cotton, but I also noticed that it was not cut out when ripe but allowed to stand there.

Some of the observations on the maize grub made this year will probably be of interest, and will show how necessary it is when using maize as a trap to do the thing properly.

The Most Critical Time.

The most critical time for the cotton crop is during December and January, when the squares are being set. The maize grub is particularly fond of squares, and if these are eaten as they are formed the plants put on wood and nothing else, and practically no crop is harvested as there is nothing to "hold the plant down," and to keep it from putting all its energies into growing. Once bolls have really matured, although loss from maize grub will occur, the real danger is past.

At the Agricultural College at Gatton there was a large field of maize planted early in October about 300 yards from one of the experimental cotton plots. This maize during November, December, and January was full of maize grub in all stages. Only one grub was seen in the cotton. At the same time the tomatoes in the College vegetable plots some distance away were infected.

Another plot of maize, about ¾ acre, was planted with different varieties of maize on 1st November. When inspected in February no maize grub was found in this, but a lot of peach moth grubs—but, early in January, maize was sown in another part of the farm. When examined in February, it being about a month old, it was found to be full of maize grub eggs. Out of 100 plants taken at random sixty-seven had eggs laid on them, usually four or five, but in one case as many as twenty-seven on one plant. The neighbouring cotton was quite free. It will be seen from the foregoing that there was a succession of growing maize from October onwards to March, and to this maize were attracted all the maize grub moths.

In a farm not far from Rockhampton there had been a very heavy attack by maize grub; no maize was planted at all until the 24th December. This farm was visited in February. There was very little maize grub then to be found in the cotton, but wild Cape gooseberry and the growing maize were full of grubs or covered with eggs.

An Experiment.

At the Cotton Research Farm at Biloela, on the Callide, an experiment was laid down to try and work out the amount of maize required to keep cotton free from maize grub. The presence of the ordinary rotation maize on the farm rather upset the experiment, but some interesting results were obtained.

The two one-acre plots used as a check on our experiment were placed as far from any maize as we could get them, but for all that the maize did exert some influence, so that even on these plots the loss was slighter than it would have been. In the trap crop plots of 1 acre each, a row of maize was sown between each

plot, and between two of them this was followed by another row six weeks later. The first row was sown at the time the cotton was planted and cut out before the silk dried.

Not far from these plots (about 150 yards) was 7 acres of maize planted in November. Rather further away was 20 acres planted about 7th December. In January the farm was alive with maize grub moths and it looked as though we were in for a really severe attack. The moths, however, avoided the cotton and eggs were laid freely on the maize. An inspection of the cotton in the check plots showed some eggs and grubs, especially on the side furthest from any maize influences, but nothing comparable to the rate at which eggs were being laid on the maize. In the trap crop plots and those near the maize of 17th December, eggs were only found with the greatest difficulty. The grub infestation in the maize was estimated at 50 per cent. in early February.

Nine rows of maize were planted alongside cotton sown for experimental purposes late in January. This maize attracted maize grubs as soon as it began to grow and the cotton was not touched.

Actual counts were made of all the bolls from a certain number of trees in the check plots and all the bolls from a similar number of trees in the trap crop plots. These showed attacks of just over 16 per cent. and 5 per cent. respectively from boll worms of all kinds. All the boll worm attack was not due to maize grub but most of it was. Counts made later in the season gave a more even rate of attack in each plot. From this we can see how necessary it is not to leave maize standing once it is well infested. The maize planted in November which was near the trap crop plots was left to stand and not cut. Grubs from this, after turning into moths, probably made themselves all the more felt by reason of the square shedding which had taken place in February. They were not able to do any very great damage, as in spite of very bad growing conditions plenty of bolls were set, and good yields were realised.

Trap Crop Methods.

At the State Farm at Monal, a series of three plantings saved the crop from attack, as here again maize grubs were in some numbers early in the season.

This trap crop method of protecting the cotton crop will, therefore, work if properly applied. It is very dangerous if not used as it should be used. It then simply becomes a means of attracting moths to the cotton.

The idea to work for is that of protecting cotton during the critical months of November, December, and January, and the early part of February. After this latter month maize grub attacks die away. Parasites and predators have apparently got the situation well in hand by March. This year, for example, no less than eight things were attacking the grub, including a bacterial disease and a small bug which sucked the eggs laid on the maize.

Suggestion for the Coming Season.

The suggestion put forward for the coming season is as follows:—Taking a basis of fifteen rows of cotton to the acre, the rate of two rows of maize per acre should be planted at the same time as the cotton. At the Cotton Research Farm the cotton plots will be divided into 4-acre blocks with 1 acre for maize in between each block, three rows of maize will be sown at the same time as the cotton, followed five weeks later by four more rows, and five weeks later by another four, and again five weeks later by two more. These lots of three and four rows will be cut while in silk and the ground scarified to destroy the chrysalides in the soil.

Any variation of this method best adapted for individual farms could be tried. The most essential point is that the maize plants must not be allowed to stand until the "silk" has dried up.

It is suggested that it is well worth the farmers while to give this method a thorough trial. It is not guaranteed as an absolute cure, but will, *if used properly*, reduce the chances of attack on the cotton. The alternative is dusting with calcium arsenate. This method it was not possible to test properly this season, as there was not a sufficiently heavy maize grub attack on the experimental farms. It is an expensive proceeding and laborious.

Calcium arsenate is about 1s. 6d. a pound, and probably four or five applications would be necessary. Dusting machines are expensive. The trap crop method is worth a trial, and will be used on the Cotton Research Farm this year as a matter of routine. But it is worth no one's while unless he is prepared to cut the maize while the silk is still fresh. If he does this, large numbers of grubs and eggs will be killed. If the maize is left to stand over these grubs will come to maturity and infect the cotton.

EGG-LAYING COMPETITION.

MOUNT GRAVATT.

During June laying has continued to be satisfactory, an average of 17·1 eggs per bird. This average is 1½ eggs better than for the same period last year. Two deaths occurred in Section 1—D bird of Mrs. Lindley and F bird of W. Melrose. Individual scores to date:—

SECTION 1.

White Leghorns.

Name.	A.	B.	C.	D.	E.	F.	Total.
W. E. Woodward	66	64	70	49	59	46	354
W. and G. W. Hindes	58	60	59	55	57	58	347
B. Driver	60	38	61	54	58	63	334
John J. McLachlan	58	62	59	47	60	45	331
E. J. Stilton	67	56	53	61	63	19	319
J. Harrington	46	46	54	59	56	56	317
Mrs. R. E. Hodge	55	49	50	66	42	54	316
Eclipse Poultry Farm	69	62	54	58	54	16	313
M. F. Marsden	58	44	43	37	57	62	301
Jas. Hutton	48	44	54	25	55	55	281
R. C. J. Turner	54	47	50	57	17	54	279
W. Wakefield	58	59	33	47	42	27	266
L. Bird	61	50	26	36	68	25	266
Jas. Earl	50	55	28	47	34	51	265
S L. Grenier	62	51	60	20	27	40	260
J. E. G. Purnell	51	25	51	57	39	31	254
E. Anderson	16	49	26	40	57	61	249
H. Fraser	17	50	57	47	42	30	243
G. W. Cox	39	24	44	46	59	37	229
A. S. Walters	43	46	23	38	23	55	228
N. F. Newberry	19	32	58	52	29	33	223
H. P. Clarke	22	51	21	31	47	50	222
Geo. Marks	26	49	35	24	54	27	215
Mrs. H. P. Clarke	13	49	44	32	51	23	212
T. W. Honeywill	31	1	57	38	47	28	202
Chris. A. Goos	52	4	33	46	14	45	194
T. H. Craig	20	46	29	32	22	39	188
Mrs. C. E. Lindley	24	11	30	51	30	32	178
W. D. Melrose	46	59	14	..	37	15	171

SECTION 2.

Black Orpingtons (except where stated).

Name.	A.	B.	C.	D.	E.	F.	Total.
Harry Cutcliffe	72	71	54	45	58	54	354
Eclipse Poultry Farm	58	56	67	57	57	54	349
Jas. Potter	71	44	50	54	61	66	346
Geo. E. Rodgers	36	57	62	46	58	51	310
E. W. Ward	47	50	55	54	54	49	309
W. and G. W. Hindes	73	26	36	27	47	68	277
E. Walters	26	41	37	47	61	55	267
Thos. Hindley	63	37	58	29	59	21	267
Mrs. A. E. Gallagher	40	46	51	19	41	56	253
J. Pryde (R. I. Reds)	24	48	32	58	41	50	253
Carinya Poultry Farm	53	52	8	40	58	38	249
C. Dennis	41	35	54	41	28	39	238
W. Melrose	10	45	49	60	51	13	228
R. Barnes	42	33	30	42	46	30	223
Jas. Hutton	38	27	58	48	6	28	205
E. C. Stead (Wyandottes)	..	4	5	14	25	2	50

YOUNG JUDGES COMPETITION AT AGRICULTURAL SHOWS.

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

It is evident that the Young Judges Competition are becoming more popular each year at our agricultural shows, both Royal National, Royal, city and country alike; indeed so popular have they become that at this year's Royal National Jubilee Show the sum of £50 has been allocated as prize money, this amount having been specially donated by Colonel Donald Cameron, M.H.R. In addition, several "Andrew Moles Memorial Medals" are being presented in the I.M.S. cattle section. Medals and trophies form the prize money also in the section in which young judges adjudicate on dogs.

The secretary of the Show, Mr. J. Bain, advises that in all there are 170 entries in these several sections for young judges, an entry which is considered extremely satisfactory. It is good to note that there is only one section—viz., the I.M.S. Cattle with twenty-one entries—in which the entries are greater than in the Pig Section with its total of twenty contestants.

Useful Hints for Young Judges.

The following suggestions have been prepared, not as the "sum total" of all young judges should note, but as indicating a number of special qualifications which fit a person to undertake the selection of animals or to act as a judge, no matter on what occasion or whatever the class of stock or product he has placed before him. The hints were in the first instance suggested for the young judges in the Pig Section in which two Berkshire boars are to be adjudicated upon, but being of general interest are published for the benefit of readers in general.

It has been noted that one of the special conditions attached to winning the Andrew Moles Memorial Medals in the I.M.S. section is that the competitor must place the six selected animals in their order of merit and state in writing the reasons for so placing, the judge in making the awards shall take into consideration the correctness of placing of the animals and the reasons given. This suggestion is worthy of emulation in other than the I.M.S. classes, for where the entry is heavy it is almost impossible for the judge to remember the remarks made by each individual contestant.

Note the Nature of the Useful Hints.

1. Be confident. Judges of any class of stock or product must know their business, they must understand the standard of excellence aimed at and the comparative value of each point on which the animal or product is judged.

Remember: The world makes way for the man who *knows*, the man who *knows* he *knows*.

2. Knowledge of your business inspires confidence. Young judges should not be afraid to ask questions on points on which they are not quite certain.

3. Be punctual in answering questions submitted to you by the judge, for judging is not guess work. If you give incorrect answers it is the duty of the judge to put you right. We live to learn.

4. Study the animal or the object you are to judge, and compare the respective points alongside those referred to in the standard of excellence.

5. Be prepared to undertake the judging of any other animal or class the judge may select to test your ability. You should practise judging and watch other judges at work as opportunity offers.

6. Study the list of disqualifications or objections to which reference is made in all standards of excellence. Judging is largely a matter of discovering faults or imperfections, and of comparing the seriousness of these faults with the increased value allowed for perfection. Some imperfections develop into disqualifications, some have hereditary tendencies, and tend to reduce the commercial value of the animal or product, some are of a less serious nature, and are not likely to influence the animal's value for show or stud purposes, but it is the animal whose scale of points approaches perfection who realises the highest value, and for whom there will be keenest competition if offered for sale.

7. Be careful in filling in your award cards, and be accurate with your figures. Officials of the society and representatives of the Press will inspect your cards.

8. Be prompt in attendance, and if unsuccessful in gaining the coveted awards, be a good loser and come up smiling again next time.

9. Carefully note the following:—In judging and selecting pigs, the following points should be specially noted:—

(*a*) Constitution as noted by general healthy appearance of animal, the quality of its skin and hair, the width between the eyes and ears, the width and depth of chest and body, the strength of the legs and feet, and by the animal's vigour.

(*b*) Pedigree.—For stud purposes, it is essential that the animal's pedigree should indicate careful breeding, that the parent stock were of reliable, vigorous and profitable strains, and that, in the case of a sire, he be unrelated to the dams to which he is to be mated.

(*c*) Type and Quality.—Type is important, as indicating the result of careful selection of the parent stock. Quality counts for much in the commercial world. Quality stock always realise top prices; they pay handsome dividends.

(*d*) Temperament.—Contentment and docility indicate the temperament of the animal. Note the appearance of the eye, a white streak in the eye is regarded as a sign of bad temper.

10. Value your animal.—A judge is quite within bounds in asking the approximate value of an animal or of its products. Practical experience and knowledge of the commerce of the animal is invaluable.

The Aim of these Competitions.

Young judges' competitions aim principally at one special objective—viz., that of training judges, not only for the purpose of judging at agricultural shows but more particularly in training them to become efficient in the selection of any class of stock they may be called upon to handle in the ordinary routine of farm work, and to know type, quality, and value when actually selecting stock for their own purposes on the farm, for there is no more important initial step in taking up stock raising than in being able to act on one's own initiative in inspecting and in purchasing breeding or store stock. It is important also when once stock have been produced that the breeder should be able to determine their commercial value and to know whether they are worth retaining in the stud or not. It is the desire of the promoters of these competitions that, as a result of the knowledge gained in taking part in them, that contestants will seriously consider following the matter up with a view to some day being appointed a judge in some one or other section of agricultural or other show activities, for certain it is that we need to train judges competent to undertake this important phase of agriculture. It is advisable for young judges to become associated with the agricultural society in the district in which they reside, as well as with the larger district and Royal shows. Junior farmers should also consider the advantages of becoming members of the Breed Societies controlling the interests of the breeds in which they are most interested, and to become subscribers to one or other of the Agricultural Journals specialising in or devoting space to these breeds.

Both the Department of Agriculture and Stock, as well as the Agricultural Societies, stand prepared to supply any further information required at any time.

For the benefit of readers who may not have immediate opportunity of taking part in the Pig Competitions at the Royal National Show, the following standard of excellence of the Berkshire breed is worthy of note. This standard should be used as a guide when practising judging and be preserved for use when actually selecting Berkshire pigs. The scale of points has been prepared also for the same purpose. It should be noted that while the standard of excellence for this breed is identical with the standard published in the Herd Books of the Australian Stud Pig Breeders' Society, the scale of points has not yet been adopted by that body for the reason that they have not yet considered same, but the matter will be discussed at the annual meeting of the Queensland branch of the society to be held at Affleck House, on the Show Ground, on Wednesday, 12th August, at 10 a.m.

Standard of Excellence and Scale of Points for Berkshire Boar and Sow.

Note.—This standard of excellence is identical with that adopted by the Council of the Australian Stud Pig Breeders' Society, in whose Herd Books Berkshires and

other breeds of pigs may be registered. The figures represent the comparative value of each point when perfect.

	Number of Points Allowed.	Points Awarded by Societies' Judge.	Points Awarded by Young Judge.	Variation in points Awarded by Societies' Judge and by Young Judge.
Colour—Black, with white on face, feet, and tip of tail (*Note.*—A perfectly black face, foot, or tail is objectionable, as also are white or sandy coloured spots, or white skin on body. White patches on inside or outside of ears are highly objectionable.)	15			
Skin—Fine and free from wrinkles (a "rose" on back is objectionable)	5			
Hair—Long, fine, and plentiful (a very coarse mane is objectionable)	4			
Head—Moderately short, face dished, snout broad, and wide between the ears and eyes	10			
Ears—Fairly large, carried erect or slightly inclined forward, and fringed with fine hair. (See note on colour)	5			
Neck—Medium length, evenly set on shoulders, jowl full and not heavy	5			
Shoulders—Fine and well-sloping backwards, free from coarseness	8			
Back—Long and straight, ribs well sprung, sides deep	10			
Hams—Wide and deep to hocks	15			
Tail—Set high and fairly large. (Note also colour)	3			
Flank—Deep and well let down, making straight underline	8			
Legs and Feet—Short, straight, and strong, set wide apart, and hoofs nearly erect. (*Note*—In-bent knees are objectionable)	12			

Note.—In boars, both testicles should be evenly developed and be free from any sign of rupture; there should be no enlargement at point of sheath. In sows, the udders should be well formed, twelve to fourteen teats being clear and distinct, well developed, and placed equidistant.

FORTHCOMING SHOWS.

Aug. 1—Pine Rivers.
1—Mount Gravatt.
5–6—Redcliffe.
10–15—Royal National.
22—Belmont.
26–27—Crow's Nest.
29—Coorparoo.

Sept. 2–3—Esk Bushmen's Carnival.
4–5—Wynnum.
12—Zillmere
16–17—Imbil.
19—Stephens
23–24—Gympie.
24–25—Beenleigh.
26—Maroochydore.
26—Rocklea

Oct. 1—Kenilworth.
2–3—Toombul.
9—Southport.
10—Enoggera.
16—Nerang.
17—Balmoral.

Nov. 25–26—Pomona.

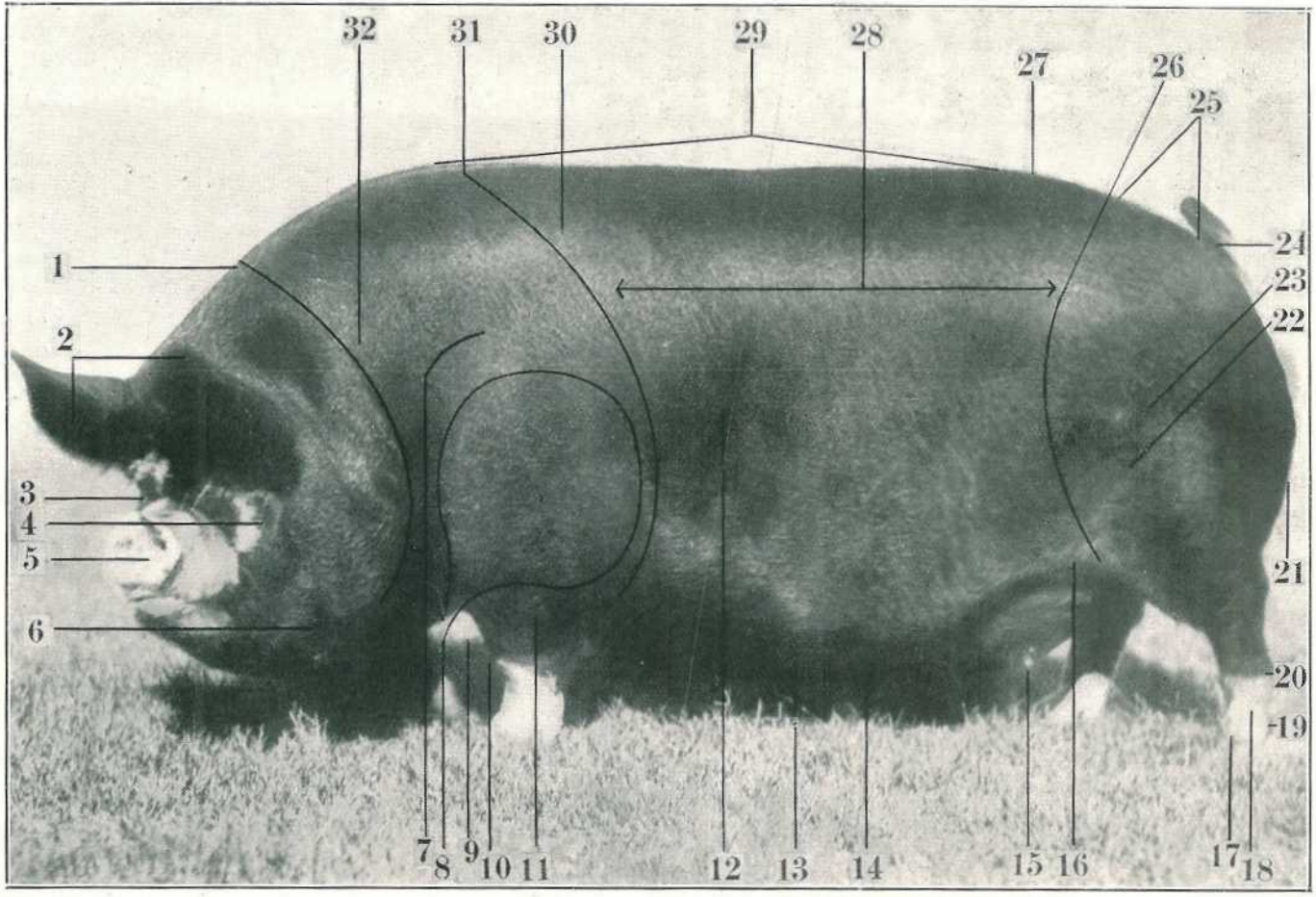


PLATE 34.—THE POINTS OF A PIG.

Description of Plate 34.

Principal Points of the Pig.

1. Head.
2. Ears.
3. Eye.
4. Face.
5. Nose or Snout.
6. Jowl or Cheek.
7. Shoulder.
8. Site of Shield in Males.
9. Chest.
10. Knee.
11. Forearm.
12. Side and Ribs.
13. Belly.
14. Site of Sheath in Males.
15. Teat.
16. Flank.
17. Foot and Hoof.
18. Pastern.
19. Dewclaws.
20. Hock.
21. Site of Testicles in Males.
22. Stifle.
23. Ham.
24. Tail.
25. Rump.
26. Hindquarter.
27. Loin.
28. Middle Piece.
29. Back.
30. Heart Girth.
31. Forequarter.
32. Neck.

Colour, Type, Conformation, Character, and General Appearance vary with the different breeds. Males should be distinctly masculine and females distinctly feminine in character irrespective of breed. The Pig is a quick-growing, early-maturing animal, hence size and condition for age counts for much. Other important characteristics are Constitution, Temperament, Pedigree, Quality, Prepotency, Prolificacy, and Adaptability.

CREAM TRANSPORT FROM FARM TO FACTORY.

By C. McGRATH, Dairy Instructor.*

Factory managers and those associated with them are well aware of the many problems and difficulties associated with the dairy industry, and which chiefly arise from the perishable nature of the product and its liability to deterioration from the time of production until it reaches the consumer.

I intend to deal with one of the difficulties that in my opinion is retarding the progress of the industry, transport of the cream from farm to factory. This matter has been considered on previous occasions, but I think that the time has arrived for discussing, with a view to improving, the general methods of handling and delivery of the cream on the factory floors.

Points for Consideration.

The chief points to be considered are—

1. Distance the cream has to be conveyed—(*a*) to rail, (*b*) to factory direct.
2. Condition of the roads.
3. Method of conveyance.
4. Suitability or otherwise of rail service.

Cream Transport.

Cream transport is of considerable interest to all associated with this important and rapidly growing industry, for it is one of the principal factors in the production of a high-class durable butter. It is the aim of all progressive butter manufacturers to produce a commodity of faultless flavour and durability. Durability looms largely as a characteristic of all our export dairy products, and is dependent upon the methods of production and handling on the farm, frequency and method of delivery from farm to factory, and methods of manufacture and storing.

The common lactic acid bacteria becomes weakened and stops developing when the formation rises to 0.6 and they give place to the rod-shaped lactic acid bacteria that will, if unchecked, produce in the cream three or four times as much lactic acid as the favourable lactic acid bacteria. This invasion by the unfavourable rod-shaped lactic acid forming organism results in imparting to the cream a strong over-acid flavour and lowers the general characteristics and durability of the product. This is one of the detrimental results of irregular and belated cream deliveries.

Delayed and irregular deliveries, whether the results of carelessness or thoughtlessness on the part of the producer or of inefficient rail or road transport, entails a loss to the producer amounting to many thousands of pounds annually.

The consequent decreased return to the producer for his labour and capital invested helps to check the expansion of the industry and retards agricultural development. Such a loss is therefore a national matter. Let the responsibility lie where it may, we know that a deficiency in transport service exists and we must not allow it to remain. It is in the interests of producers, factory managements, rail, road, and overseas transport people, and all others connected with the industry to secure proper treatment of this important article of food, from the pastures until it reaches the table of the consumers.

Organisation of and co-operation between primary producers, factory managers, and transport operators will serve to minimise to a great extent this loss to the industry. Any phase of the development and control of the industry that tends to improve the quality of its products demand attention. The dairying industry is still a comparatively young industry in this State. Most of those assembled built the factories they are at present controlling, or took over the plant they are operating. It seems but yesterday that the means of cream delivery to factories were by rail, where so served, and by horse-drawn vehicles, and when road conditions were unfavourable by packhorses. There was no competition or rivalry between these means of transport. Rail communication between dairy centres and factories was essential.

Settlement of vast areas of fertile land by dairy farmers and agriculturists followed rail communication. Where settlement preceded railways pioneering difficulties were many. With the linking up of industrial centres by rail, traffic was diverted from main roads to roads leading from the farms to the nearest point on the railway. Main road traffic became negligible and where left unattended reached rapidly a stage of disrepair.

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* In a paper read at the Butter and Cheese Factory Managers' Association, Brisbane, 23rd to 25th June, 1925.

The development in recent years of the internal combustion engine and the widespread use of motor traction have revolutionised rural transport and recreated a clamant demand for good roads. Modern motor transport services and good roads are now an essential in rural and industrial development. Motor traction has become a competitor with both rail and horse traction. The motor truck has proved more economical than the horse-hauled vehicle. Rapid transport of cream from farm to factory plays a leading part in this industry's welfare. Motor traction service is suitable for carrying on this work when road conditions permit. It widens the area of operation and reduces haulage costs. Each co-operative factory should draw suppliers from within a zone that offers facilities for efficient collecting and frequent and rapid transport to the manufacturing centre. A small quantity of cream is often despatched to factories outside the zone to which it rightly belongs. This practice frequently calls for extra handling on rail and tends to bring about deterioration in the quality of the cream in transit. Zone areas served by factories should be so divided that the products from each subdivision or block can be conveniently collected and delivered at the factory.

The factory management should have control of the cream transport service. When tenders are invited, or any other system of cream haulage is being dealt with by the management, the all-important matters of frequency of service and time taken in the collection and delivery of cream should not be overlooked.

In the few instances where there is no control by factory management, two separate services of cream haulage are operating in the same area. Such a method is wasteful and results in both services being discontinued when cream supplies begin to diminish. The suppliers are placed at a great disadvantage, for with falling supplies it is difficult to make fresh arrangements. The division of the trade during the normal period does not allow of either hauler obtaining a return that will enable him to carry on when supplies diminish. No encouragement is given to provide an up-to-date plant to meet the requirements of the industry. The collection of cream from within the same area, by two distinct co-operative companies, shows a want of a true co-operative spirit and is not in the best interests of the industry. This practice, however, is the exception.

Good Roads an Economic Factor.

Extension and success of a system of road motor traction depends on good roads. Bad roads increase costs, and decrease the effectiveness of both motor and horse services. The Main Roads Board should be requested to give consideration to the matter of improving main country roads connecting primary producers with their factories or rail centres.

The full benefits of a regular and satisfactory cream transport service can be secured by the co-operation of factory managements, producers, and transport directors. The duty of all suppliers is to assist as far as possible in facilitating despatch of the cream from farm to factory. Transport delays by individual suppliers tends to increase expenses and to bring about deterioration in the quality of the cream delayed in transit. Late deliveries of cream to the factory increases manufacturing costs. Each unit connected with the industry must function in unison in order that the full beneficial results of co-operative organisation may be secured. Cream contains and transmits its quality to the product and the dairyman must take every precaution to produce and preserve all the characteristics of a cream of an A1 quality.

Railways.

The dairying industry is firmly established in districts in this State which are served by main and branch railways. Where the volume of general railway traffic is not sufficient to warrant a frequent rail service dairy farmers are placed at a great disadvantage, as regular deliveries of cream to the factory are an essential in the production of a first grade butter. To adjust their arrangements with the train time-table it often becomes necessary for suppliers to deliver cream on rail overnight, and this practice naturally reduces its quality. Delivery of cream by rail at the factory after working hours increases handling costs. These are among the disabilities associated with cream transport and delivery.

It is realised, however, that the volume of trade offering on many branch railway lines may not warrant an extension of train services. With the opening up of more agricultural country by railway extension and the consequent expansion of the dairying industry the necessity for a well organised cream transport system becomes more evident each season, and this is one of the most pressing problems that confronts butter and cheese manufacturers to-day.

We cannot afford to mark time when such a problem awaits solution. In modern times no industry can stand still and survive. As with city traffic so with industrial life one hears frequently and insistently the order to move on. The heedless

will be removed or pushed aside as they obstruct the highways of progress. We should, therefore, consider this matter important enough to warrant the appointment of a committee, composed of representatives from the several dairying districts, to inquire into the matter of cream transport. The suitability of a rail motor service on branch lines should receive consideration. The railway authorities could be asked to co-operate with this committee and give advice and assistance through their engineering and traffic offices. The committee should begin its investigations as early as possible, and should use every effort to evolve a system that will prove of benefit to the dairying industry and a service to primary producers in general.

The industry with which we have been associated for the greater part of our lives holds a leading position among the varied industrial activities of this rich State, and is destined to increase in national importance from year to year. With expansion and general progress of the industry responsibilities increase and problems become more complex. It demands co-ordination in the work of all co-operative dairy units. The collective force and ability of the many managerial and controlling bodies, rightly directed and backed by thousands of primary producers, must be applied to the many problems, administrative and financial, associated with the industry. In their satisfactory solution are wrapped up the progress of the industry and the prosperity of all engaged therein.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF MAY, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALLS DURING MAY, 1925 AND 1924, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	May.	No. of Years' Records.	May, 1925.	May, 1924.
North Coast.	In.		In.	In.
Atherton	2·12	24	0·15	2 63
Cairns	4 66	43	0·10	5 22
Cardwell	3 74	53	..	1·52
Cooktown	3 08	49	0·09	2 79
Herberton	1·73	38	0·03	0 90
Ingham	3 61	33	0·25	9 79
Innisfail	12·81	44	2·77	14 20
Mossman	4 29	17	0 04	2·10
Townsville	1·37	54	...	0·15
Central Coast.				
Ayr	1·19	38	...	0·07
Bowen	1·35	54	...	0·54
Charters Towers ..	0 81	43	...	0·34
Mackay	3 93	54	0·44	6·06
Proserpine	5·01	22	0·89	3·65
St. Lawrence ...	1·84	54	0·81	0 38
South Coast.				
Biggenden	1·76	26	0·93	0·45
Bundaberg	2·64	42	0 59	0·22
Brisbane	2·87	74	5 94	1·31
Childers	2·22	30	0·91	0·65
Crohamhurst ...	5·14	30	7·61	4 29
Esk	2·03	38	3·12	0 61
Gayndah	1 54	54	0·89	0·08
Gympie	2·97	55	3 00	1·01
Caboolture	2·88	38	4·39	1·50
Kilkivan	1 88	46	2·97	0·05
Maryborough ...	3·09	53	1·18	1·65

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	May.	No of Years' Records.	May, 1925.	May, 1924.
South Coast—continued:	In.		In.	In.
Nambour	4·94	29	6 30	3·47
Nanango	1 58	43	1·71	0·41
Rockhampton ...	1 51	38	0·89	0 48
Woodford	2·96	38	3·79	1·82
Darling Downs.				
Dalby	1·31	55	2·54	0·03
Emu Vale	1·15	29	2 31	0·26
Jimbour	1 19	37	3 73	...
Miles	1·49	40	1·81	...
Stanthorpe ...	1·91	52	2·86	0·44
Toowoomba ...	2·24	53	1·89	9 40
Warwick	1·58	60	1·92	0·14
Maranoa.				
Roma	1·42	51	1·32	0·37
State Farms, &c.				
Bungeworgorai ...	0·55	11	1·04	...
Gatton College ...	1·71	26	1·55	0·30
Gindie	1·01	26	0·37	0·10
Hermitage ...	1·22	19	2·17	0·11
Kairi	2 13	10	..	2·65
Sugar Experiment Station, Mackay	3·54	28	0·86	4·40
Warren	1·02	11	0·22	...

NOTE.—The averages have been compiled from official data during the periods indicated; but the totals for May this year, and for the same period of 1924, having been compiled from telegraphic reports, are subject to revision.

GEORGE G. BOND, Divisional Meteorologist.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF JUNE, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALLS DURING JUNE, 1925 AND 1924, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	June.	No. of Years' Records.	June, 1925.	June, 1924.		June.	No. of Years' Records.	June, 1925	June, 1924.
North Coast.	In.		In.	In	*South Coast—continued:*	In.		In	In.
Atherton	1·52	24	3·22	0·89	Nambour	3·30	29	12·78	1·85
Cairns	2·81	43	6·77	2·37	Nanango	2·03	43	2·86	0·93
Cardwell	2·06	52	1·76	1·80	Rockhampton ...	2·14	38	5·07	3·08
Cooktown	2·03	49	1·21	3·37	Woodford ...	2·67	38	8·06	2·70
Herberton	1·00	38	2·02	0·43					
Ingham	2·39	33	1·48	1·20	*Darling Downs.*				
Innisfail	7·01	44	15·61	8·26					
Mossman	2·07	17	3·51	2·38	Dalby	1·70	55	0·60	1·52
Townsville	1·26	54	1·74	0·90	Emu Vale ...	1·45	29	1·56	1·25
					Jimbour	1·72	37	0·23	1·07
Central Coast.					Miles	1·91	40	1·28	0·24
					Stanthorpe ...	1·89	52	2·34	1·57
Ayr	1·36	38	1·41	1·63	Toowoomba ...	2·34	53	5·30	1·24
Bowen	1·61	54	2·03	1·84	Warwick	1·79	60	0·82	0·84
Charters Towers ...	1·29	43	1·39	0·21					
Mackay	2·70	54	3·28	1·77					
Proserpine	3·54	22	4·20	1·78					
St. Lawrence ...	2·45	54	3·74	1·53	*Maranoa.*				
					Roma	1·72	51	0·86	0·25
South Coast.									
					State Farms, &c.				
Biggenden	2·00	26	3·95	2·51					
Bundaberg	2·63	42	7·92	0·79	Bungeworgorai ...	1·76	11	0·59	0·23
Brisbane	2·73	74	7·32	4·80	Gatton College ...	1·79	26	2·99	2·88
Childers	2·24	30	5·42	1·30	Gindie	1·58	26	1·23	0·70
Crohamhurst ...	4·09	30	15·09	3·30	Hermitage ...	1·93	19	0·87	1·08
Esk	2·08	38	3·83	3·14	Kairi	1·32	10	3·55	0·95
Gayndah	1·88	54	1·28	1·14	Sugar Experiment Station, Mackay	2·39	28	3·17	1·55
Gympie	2·52	55	7·64	1·99					
Caboolture	2·47	38	6·41	3·62	Warren	2·08	11	4·54	3·52
Kilkivan	2·09	46	5·63	1·50					
Maryborough ...	2·84	53	8·73	1·35					

NOTE.—The averages have been compiled from official data during the periods indicated; but the totals for June this year, and for the same period of 1924, having been compiled from telegraphic reports, are subject to revision.

GEORGE G. BOND,
Divisional Meteorologist.

BACON PIG PRICES—CURRENT RATES.

Current rates for prime quality bacon pigs are as follow:—Both weights and prices are subject to variation month by month, for all factories do not pay on the same schedule. The figures are, however, a reliable guide.

Prime quality baconers, 86 to 94 lb. dressed weight, 6½d. per lb.; 95 to 125 lb. dressed weight, 7d. per lb.; 126 to 135 lb. dressed weight, 6½d. per lb.; 136 to 145 lb. dressed weight, 5½d. per lb.; 146 to 160 lb. dressed weight, 4½d. per lb. Pigs other than prime are paid for according to weight and quality.

Prime quality porkers up to 86 lb. dressed weight, 6d. per lb. Fat sows for smallgoods manufacture, 3d. per lb. Stags for smallgoods manufacture, 1d. per lb. Boars, large or small, not accepted, as they are unsuited to bacon or smallgoods manufacture.

Note.—In the case of co-operative factories, these rates represent the advance payment for the current month. Balance of payment, if any, is paid in the form of a bonus at end of each half-year. The proprietary factories pay cash "over the scales" at time of purchase, and pay on a dressed weight basis.

QUALITY OF RATOONED QUEENSLAND COTTON.

The following review of a paper on the quality of ratooned Queensland cotton, taken from the June issue of "Tropical Agriculture," the official journal of the Imperial College of Tropical Agriculture at Trinidad, is of particular interest to Queensland cotton growers. A paper on Rain Grown Cotton and Climate is also noted. The reviewer is Professor S. C. Harland, D.Sc., F.L.S., of the Imperial College of Tropical Agriculture.

The quality of ratooned Queensland cotton is the subject of a paper by Mr. Frederick Summers in the "Journal of the Textile Institute," December, 1924. It is a curious fact that throughout the controversy which has raged in Queensland over ratooned cotton nobody has made it their business to conduct an examination of first and second year cotton to see what the difference really is. Casual examination has been made by brokers and others, but the data given in Summers's paper constitute the first attempt to settle the vexed question of the quality of ratooned cotton. The facts obtained appear to establish that in two representative samples ratoon staple was 6 per cent. shorter and less uniform than that from annual plants. The hair width was about the same, while both wall thickness and breaking load were lower in ratoon. The hair weight per centimetre was also less in the ratooned sample. It is, however, not clear whether the differences found would affect spinning quality, and it is a pity that a spinning test was not carried out with the same material. It would have been of value also to have put forward the statistical constants of the mean values obtained for the measurable characters dealt with.

While Mr. Summers is on safe ground in stating that on the whole ratoon cotton is inferior in quality to annual, his argument that the cutting back of cotton after the first crop is equivalent to the hard pruning which young fruit trees receive after planting is less convincing. The analogy is not a good one for the following reasons:—

1. Cotton of the Upland type is like a good many other tropical mesophytes. It has very little storage capacity, and lives almost from hand to mouth.

2. The severe pruning given to young fruit trees is not given after a heavy crop has just been produced. If a good bearing fruit tree were cut practically level with the ground, it would be analogous to the ratooning of cotton.

3. Cotton has no normal rest period. When cut back the new shoots produce flower buds when only a few inches long and the plants attempt to be continuously reproductive. This is far from being the case in fruit trees.

A correct physiological appreciation of the ratooning question only becomes possible when it is realised that the operation entails the removal of about 75 per cent. of the dry weight of the plant just after it has produced a heavy crop.

Mr. Summers states that there are no grounds for regarding the first year's crop as a maximum, seeing that the root system, on which crop production ultimately depends, can only develop to a limited extent during the first year. Consequently, he continues, the first year's crop must necessarily be inferior to that which can be borne in later years when the development of the root has increased. The fallacy here is in ignoring the fact that an ordinary cotton field contains something like 30,000 plants per acre and that the total mass of the root system is as much as the soil will carry. The total root system being at a maximum the first year, it cannot be above it in any subsequent year, and owing to reduction of soil fertility by removal of seed, lint, and bush, is almost bound to be less. This is why the yield of ratooned Upland is almost always less than that of the first year, unless that of the latter is reduced by abnormal shedding.

In the same number of the "Journal of the Textile Institute" Mr. Ernest Canney writes on Rain Grown Cotton and Climate. He makes a general survey of the climate factor, and from it attempts to indicate the potential capacity of the world as a whole to produce cotton under rainfall conditions. It is the belief of the reviewer that surveys of this kind are of very doubtful value, and if attempted at all should be based on physiological and climatological observations made in the areas talked about. Too many people have already sat on office chairs in England and told us where and how to grow cotton in the Colonies. Mr. Canney, however, has read the literature with extreme care and has produced an interesting paper. He lays great emphasis on cloudiness as a climatological factor, probably correctly, although data are too scanty for adequate generalisation. He is probably right from a cotton-growing point of view in regarding much of Tropical Africa with suspicion, and in looking with favour on such areas as S. Sudan, N. Nigeria, S. Africa, and the Argentine, Uruguay, Paraguay, S. Brazil belt.

Photo.: H. W. Mobsby.

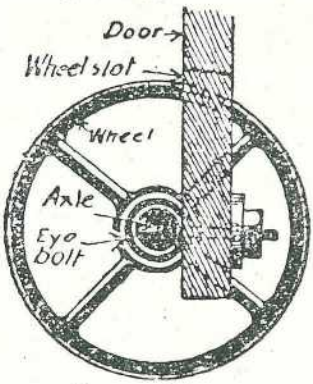
PLATE 35.—AUSTRALIAN WHEAT EXHIBIT AT WEMBLEY.

Photo.: N. A. R. Pollock.

PLATE 36.—GIANT FIG TREE ON THE BARRON RIVER, ATHERTON TABLELAND.
Note for comparison the size of the man on the horse at its base.

A SIMPLE REMEDY FOR SAGGING DOORS.

Wide, heavy swinging doors have a way of sagging on the ground and becoming hard to open and close. To get over this difficulty procure a light wheel, 12 or 15 in. in diameter, and having a fairly wide tyre. Cut a slot at the lower edge of the door and near its outer end large enough to accommodate the wheel and give it



SAGGING DOORS.

fairly free play. Block up the door to the desired height from the ground. Fit the wheel with an axle of proper length so that there will be some bracing strength beyond the eye bolts, one on each side of the wheel, with which it is attached to the door. Roll the wheel into position and assemble as shown in the accompanying sketch. This is the best means for handling wide doors satisfactorily.—"N.Z. Farmer."

RECENT VALUATIONS OF CERTAIN SAMPLES OF QUEENSLAND COTTON.

In order to obtain as accurate an idea as possible of the value of certain new cotton varieties that are being tried under varying conditions and in different localities in Queensland, a representative series of samples was collected by the Government Cotton Classer from last year's crop and forwarded to the secretary of the Empire Cotton Growing Corporation. He arranged for these samples to be examined and described by Messrs. Wolstenholme and Holland, one of the best known firms of cotton brokers in Liverpool, to whom we are indebted for the information given below. The samples were about 1 lb. each in weight and were taken from bales of ginned cotton last season, and they refer to the 1923-24 crop therefore. The samples were merely numbered, and the brokers, therefore, had no information as to the variety composing any particular sample or of the locality in which it was grown. The statement below gives their report.

Variety.	Mark.	Grower.	Locality.	Value.	Classification, &c.
Durango	3	Manager ..	Monal Creek Farm, Upper Burnett	16·75d. and 17d.	Good middling, slightly stained in places, staple $1\frac{3}{16}$ in., and strong
Durango	3A	Manager ..	Roma State Farm	17d. ..	Good middling to strict good middling, slight stain, staple $1\frac{3}{16}$ in., fairly strong
Durango	3B	Krapkatt ..	Mount Larcom	14·50d.	Strict middling, staple good, $1\frac{1}{8}$ in., strong
Durango	..	Krapkatt Frolich	Mount Larcom	14·25d.	Middling, staple $1\frac{1}{8}$ in. and $1\frac{3}{16}$ in., strong
Durango	3C	Ottaway and Skewes	Marlborough	16d. ..	Good middling, staple $1\frac{1}{8}$ in. and $1\frac{3}{16}$ in., strong
Durango	..	Ottaway, Skewes and Rake	Marlborough	15·50d.	Strict good middling, staple full $1\frac{1}{8}$ in.
Durango	3D	Gray ..	Wetheron ..	15·25d.	Strict good middling, staple good, $1\frac{1}{8}$ in., strong
Acala ..	4	Stephen ..	Beaudesert ..	17·50d.	Strict good middling, staple $1\frac{3}{16}$ in.
Lone Star	5	Uhlmann ..	Hemmant, near Brisbane	14·75d.	Strict good middling, staple $1\frac{1}{16}$ in., rather soft

Based on April American futures—13.00d.

The Acala was grown on a rich black alluvial flat. As it was roller ginned this may possibly have enhanced its valuation slightly, but, nevertheless, the result is sufficiently encouraging to indicate that this variety is one of great promise, and a good deal of careful experimental work and breeding has therefore been carried out on this variety during the current season. A limited amount of seed of this variety is available only, but arrangements are being made to propagate this seed on selected isolated plots scattered throughout the State during the coming season. At the same time this opportunity will be taken to study its behaviour under the varying soil and climatic conditions that occur throughout the belt.

The Lone Star was not grown under favourable climatic conditions and could not be planted early. It is a big boll type and some careful selection work has been started on this variety. These have been carried out during the present year with a view to improving the staple if possible. This work will be continued during the coming season, but it is obvious that it will be unwise to issue seed wholesale at the present time, until it has been further tested.

The Durango has shown high premiums with the exception of that grown in the Mount Larcom District. In this district the climatic conditions were unfavourable

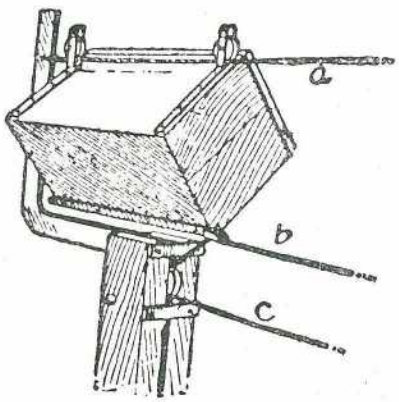
to cotton production, and it should be noted that the ordinary Upland cotton produced was also of inferior quality. With this exception, however, this variety is showing very promising results, especially in those districts a little way back from the coast. A sample of ordinary Upland cotton grown near Proston under approximately the same climatic conditions and of the same grade (good middling) as the Upper Burnett sample (3) was valued at 14.75, and sale prices generally would seem to indicate a higher value for Durango of approximately 200 points, or, put in another way, about £4 per bale of lint, due to the greater length and better regularity of the staple. This, on a 10,000 bale crop, would represent an increased value of £40,000, which would go a considerable way towards putting the industry on a more paying footing.

It is realised that these valuations are only indications of the values of these cottons, and that the final result will depend on the way the cotton behaves in the spinning sheds. Bales of Durango have accordingly been purchased by manufacturers and spinning tests are being carried out, but no reports have yet been obtained. On the present season's crop, large samples of both Durango and Acala are being sent on for exhaustive spinning tests and the results will be awaited with interest.

Sufficient has been said, however, to indicate that the Department is on the right lines when it advocates the substitution of the ordinary mixed seed by a pure variety of good quality Upland, such as Durango, more especially as this variety has been proved to yield very heavily over large areas in the cotton belt. After the plant breeders, who have already started systematic operation, have had time to produce results, no doubt it will be found that other varieties or new types of Durango will be evolved which will give as much better results as the Durango is now giving in comparison with the mixed seed, but for the present until other seed is curtailed, it would appear that obviously the wisest thing to do is to plant Durango, since this is a pure Upland type of proved merit, and the mixed seed is so rapidly deteriorating owing to the presence of degenerate hybrids that are increasing in number, that it is becoming most unsatisfactory from nearly every point of view.

MAIL BOX ON A TROLLEY.

This device isn't to encourage folks to be lazy, but there is no question but what it would be mighty convenient in some instances during the wet season. Where the house stands back some distance from the roadway a trolley can be erected, to save a lot of tramping through mud and slush to get the mail. It also means that it may save a lot of dirt being dragged into the house. A strong post with a



MAIL BOX ON A TROLLEY.

metal arm extended, as in the illustration, is set near the roadway. Suspended between it and the house is a trolley wire, A, on which the box runs. A pulley is fastened in or to the post and over it runs the cord, BC, which is attached to the box, being used to pull the box back and forth between the house and the road. The box is sent down to meet the carrier, who places the mail in it, and it is then pulled back to the house.—"American Agriculturist."

BEAN ANTHRACNOSE *(Colletotrichum Lindmuthianum).**

Mr. Henry Tryon, Government Entomologist and Vegetable Pathologist, has supplied the following reply to an inquiry by the Secretary of the Metropolitan District Council of the Local Producers' Association (Mr. J. T. M. Chataway), in respect to recent serious damage occasioned by Anthracnose to the bean crop of one of its members. Mr. Chataway asked:—"Is there (1) *any remedy, or* (2) *preventive measures, known by your Department?"*

TREATMENT.

1. Remedial Measures.

This bean disease is caused by a fungus parasite (*Colletotrichum Lindmuthianum*) operating within the tissues of the plant. It cannot be reached by any direct application of which it is made the recipient, nor is it known that soil-treatment influencing the growing plant indirectly through its root-system, has any influence on the action of the agent producing it—a remark that applies to all cultivated plants and their diseases of fungus-parasitic origin generally.

2. Preventive Measures.

We, however, know of certain preventive measures that can be pursued with success, and amongst these the following may be mentioned:—

(*a*) *Selection of site.*—This, preferably, should be of an open character, a hollow that dank foggy conditions prevail in, during the earlier hours of the day, being if possible avoided; and so, also, light loamy soil selected, rather than such as is of closer texture and heavy; and further, land that has yielded in the immediate previous year an anthracnose affected bean-crop should not be chosen, since otherwise the old plants, or remnants of them, still contained in the soil, will generally serve to convey the disease, to which they have been earlier subjected to the bean seedlings growing now therein. Should, however, the replanting of the same area be unavoidable, the ground to be used should have been ridden of its old diseased plants when whatever crop was present had been taken off, and these plants burned.

(*Note.*—Soil sterilisation by the use of chemicals is impracticable in farm practice; moreover, beans grown therein may, by reason of the fact that the soils already harbour the parasite, produce a worse affected crop than if grown in unsterilised soil.)

(*b*) *Selection of seed.*—Recognising as a fully established fact, that this bean disease, in the majority of instances of its occurrence, owes its origin to the use of seed-beans that already harbour the fungus parasite the cause of the malady, living dormant within their tissues, the following precautionary measures are called for:—

1. In selecting seed, choose that which has been yielded by a summer bean-crop, rather than yielded by one grown in the cold season—July-August—since the temperature conditions that limit the development of the parasite, prevailing during the summer, the probability of the bean Anthracnose occurrence in the field then is not at all a likely event.

2. If practicable only use bean seed from disease free sources.

3. Again, avoid sowing any bean seed that in appearance departs from what may be regarded as sound—*e.g.*, that which shows sunken, wrinkled or uneven patches, or that shows, if a red seed, any part, however small, that is of a blackish, brownish, or yellowish colour; or, if a white seed, of a brown colour, or in either case, is spotted: since the presence of the dormant parasite in the seed is indicated by these features, and better so in bean seed that is characteristically white or pale-coloured.

(*Note.*—Difference of opinion exists on the question of sterilising bean seed, in view of its being possibly disease affected, it being commonly held that "seed treatment for beans to control anthracnose is of no practicable value" where conditions of growth favour its manifestation. This has been stated both with regard to chemical-sterilisation and to heat-sterilisation. Steeping the seed for eight minutes in water of 122 deg. Fahr. temperature has been, however, confidently recommended —as the outcome of experiment—as adequate to effect sterilisation.)

(*c*) *The Growing Crop.*

1. Planting.—The beans should not be planted too closely, since otherwise the disease, once appearing, may be transmitted through an entire plot, principally by contact only; and, moreover, when this course is not followed the plants cannot be got at for subsequent attention.

*The word "Bean" here connotes the species of *Phaseolus* constituting the Canadian Wonder, the Butter Beans, and their numerous allies.

2. Cutting.—When the disease originates in the use of anthracnose-affected seed as comomnly happens, it will result that some seed will not germinate at all and there will be misses; the young seedlings will show its presence in their seed-leaves (two cotyledonous leaves); these seedlings will not grow—or its principal injuries will be remarked in the plants later on. It is therefore recommended to systematically traverse the bean-plot early in view of this possible happening, and remove, say in a bucket, all affected seedlings at once, on being thus so discovered, and forthwith burn them; for otherwise, if they are suffered to remain they may serve to propagate the trouble to clean bean plants in the same area.

3. Destruction.—Should under any circumstances (*e.g.*, the use exclusively of a special parcel of presumably disease-free seed) this bean trouble be found to be restricted to one of several plots of beans, the prompt destruction of it, and so the safeguarding thereby of the remainder, is recommended.

4. Spraying.—Bean anthracnose is usually regarded as principally a disease of the pods. However, it may early discover its presence in the foliage, leaf-stalks, and stems whilst these are still undamaged, and under these circumstances opportune spraying may constitute in some degree a useful measure of protection against further extension. Elongated brown markings with angulated borders along the leaf-veins are symptomatic of occurrences on the foliage; so also dark swollen areas involving the swollen bases of the leaf-stalks, &c.

Apart, again, from originating in disease-affected seed, this malady, after wet weather conditions, may be brought about by the spores of the parasite that have reached the ground or parts of the plant away from the spots on them of disease, being taken up by the wind and so conveyed to neighbouring clean areas; or similarly, further, this transference may have been effected accidentally by workers in the bean-plots in which anthracnose has already appeared, and these possible happenings may again justify spraying at any period in the growth of the bean plants.

The spray fluids recommended are Bordeaux Mixture in which the ingredients are in the proportion of 4-40-4 (*e.g.*, 4 lb. bluestone, 40 gallons water, and 4 lb. fresh unslaked lime) or lime-sulphur (32 deg. Baume 1-50)—the latter especially to be used if the pods have already attained two-thirds their full size—so as to prevent "staining." Insomuch, however, as the bean plant is readily injured otherwise, the Bordeaux Mixture should be quite neutral when used, as indicated by the ferro-cyanide of potassium and phenolphthalein tests. The application should be in the form of a mist-like spray and must be made thoroughly and with pressure to ensure the entire plant being reached. The use of a "spreader" in the spray fluid is also recommended.

(*Note.*—This procedure, it may be remarked, will assist in bean fly control, too.)

General systematic spraying that would need be done every ten or twelve days is not recommended, since the value realised for the crop would not at all justify the expenditure it would involve.

(*d*) *The Harvested Crop.*—When the beans are being grown with a view to marketing the green pods, it may happen that the "spotting" may become more pronounced after they have been gathered. This happening may be prevented by spraying them with lime-sulphur (1-50), turning them over on the floor to ensure thorough application, and allowing them to dry before they are packed.

General.

1. Certain of the abovementioned precautionary measures will suggest to the farmer the expediency of growing his own bean seeds, and securing them from weevil attack for future use. In this case, he will select from an apparently disease-free plot, and choose beans that come only from pods that are "clean," and discard those seeds that are in any way defective in the manner already described.

2. It may be pointed out that, other things being equal, certain weather conditions especially conduce to the presence of bean anthracnose—*e.g.*, humidity and coldness, and especially wet weather during our winter and early spring months that imply both.

3. Again, as have been well said:—"Control measures to be successful must be given consideration before the disease appears, or better before the crop is planted; and whatever measures are decided upon must be carried out completely. Frantic attempts to control the disease after it has appeared are usually a waste of time and money, and cannot be generally recommended." (M. F. Barras.)

4. Upwards of a hundred scientific workers, several of whom have prosecuted exhaustive investigations, the labour of years, have written concerning bean anthracnose from one point or another, and thus (to me also, I having too studied the subject) the need for further investigation is not very pressing.

Plate 37.—Australian Bakery at Wembley, where the Culinary Properties of Australian Flour were Demonstrated.

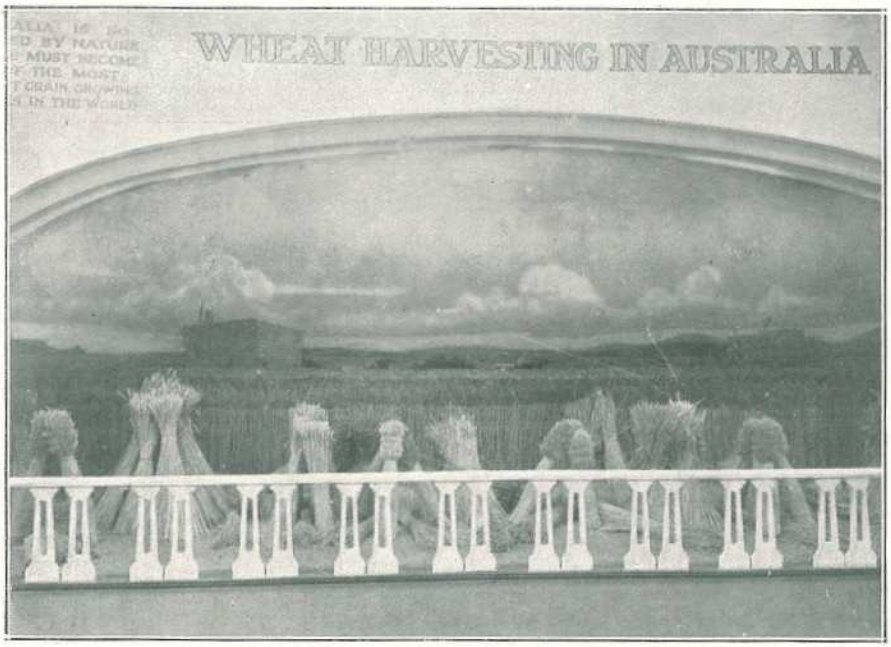


Photo: H. W. Mobsby.]

Plate 38.—Diorama at Wembley. Wheat Harvesting in Australia.

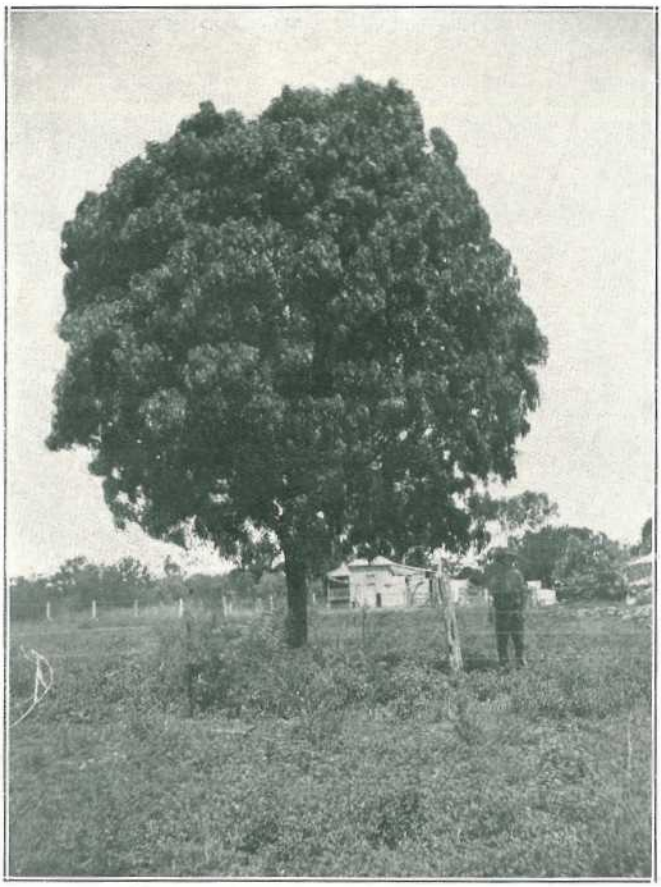


Photo.: N. A. R. Pollock.]

PLATE 39.—EMU APPLE TREE AT CHARTERS TOWERS.

This native tree is appreciated for its shade in sparsely timbered stock districts.

A THRIFTY, PROFITABLE LITTER.

This illustration of a large, thrifty, and profitable litter of Berkshire-Tamworth cross pigs, the property of Mr. George Stanfield, of "Stanberry," Wondai, indicates the wonderfully prolific nature of carefully selected strains of pigs. Mr. Stanfield states that the litter, fourteen in number, were eight weeks old at the time the photograph was taken. They were sired by a Berkshire boar purchased from Mr. W. Middleton, of Wyreema, and the dam is a Tamworth sow purchased from the stud at Queensland Agricultural High School and College, Gatton. Sows of this cross mated back to an unrelated Berkshire boar also give excellent results in the production of the fleshy early-maturing bacon pigs so much in demand in these days.—E. J. SHELTON, H.D.A., Instructor in Pig Raising.

PLATE 40.—A THRIFTY, PROFITABLE LITTER.

Litter of Berkshire–Tamworth Pigs, fourteen in number, 8 weeks old, the property of Mr. George Stanfield, "Stanberry," Wondai. The sire was a pedigreed Berkshire boar, purchased at Wyreema, and the dam a Gatton College Tamworth sow.

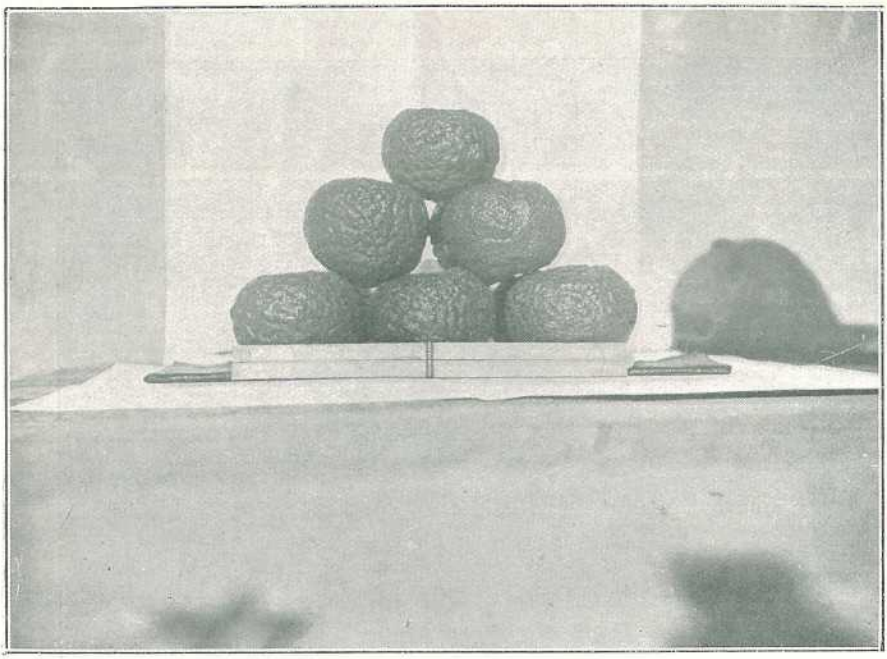


PLATE 41.—KING OF SIAM MANDARINS.

1st Prize Townsville Show. 1 doz. weighed 9 lb. 12 oz. Average weight each, 13 oz. Grown by Pilcher Bros., Pentland.

Photo.: N. A. R. Pollock.]

PLATE 42.—IN A NORTHERN JUNGLE. THE BLAZED TRAIL—A SHADOWED VISTA THROUGH GORGEOUS TROPICAL VEGETATION, PALMERSTON SCRUB, NORTH QUEENSLAND.

MARKETING PIGS IN QUEENSLAND.—III.

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

The marketing of his products is claiming much closer attention from the man on the land, and in this series Mr. Shelton describes how the farmer's pigs are handled at the selling end. In previous instalments in the June and July Journals several marketing systems with which Queenslanders are familiar were reviewed, and in the third article are many points of equal interest to the wide-awake pig-raiser.—Ed.

Brief reference has been made in preceding articles dealing with the subject of marketing to the prospects of the industry and to the possibility of an extension of operations, not only in districts now opening up but also in districts where the industry is already firmly established and where regular markets exist both for porkers, baconers, and store pigs.

From a perusal of Table I. herewith it will be noted that the total number of pigs in Queensland on 31st December, 1923 (the last date to which the figures available at time of writing referred),* was 132,243 head, a total which falls short of the totals of ten years ago by almost 8,000 head. The pig population of a few years later, viz., 1917, totalled over 40,000 head more than at the recent census, see also Table II., and compare with centesimal increase or decrease as shown in Table III. The return showing the number of pigs in the Southern, Central, and Northern divisions of the State, as at 31st December, 1923, is also of interest, as showing that, at present, despite the immense possibilities of the industry there are but very few pigs in the Central and Northern portions of the State in comparison with the immense area included in the Southern Division. (See Table IV.)

TABLE I.

Year 1922—Number of pigs in Queensland ..	160,617
Year 1923—Number of pigs in Queensland ..	132,243
Numerical decrease in 1923	28,374
Centesimal decrease in 1923	17.67

TABLE II.

Return for Ten Years Showing Number of Pigs in State.

Year 1913	140,045
Year 1914	166,638
Year 1915	117,787
Year 1916	129,733
Year 1917	172,699
Year 1918	140,966
Year 1919	99,593
Year 1920	104,370
Year 1921	145,083
Year 1922	160,617
Year 1923	132,243

* Owing to rearrangement of termination of financial year in the Statistician's Office it has not been possible to secure statistics for the year 1924, except in one or two instances. These figures will be available later.

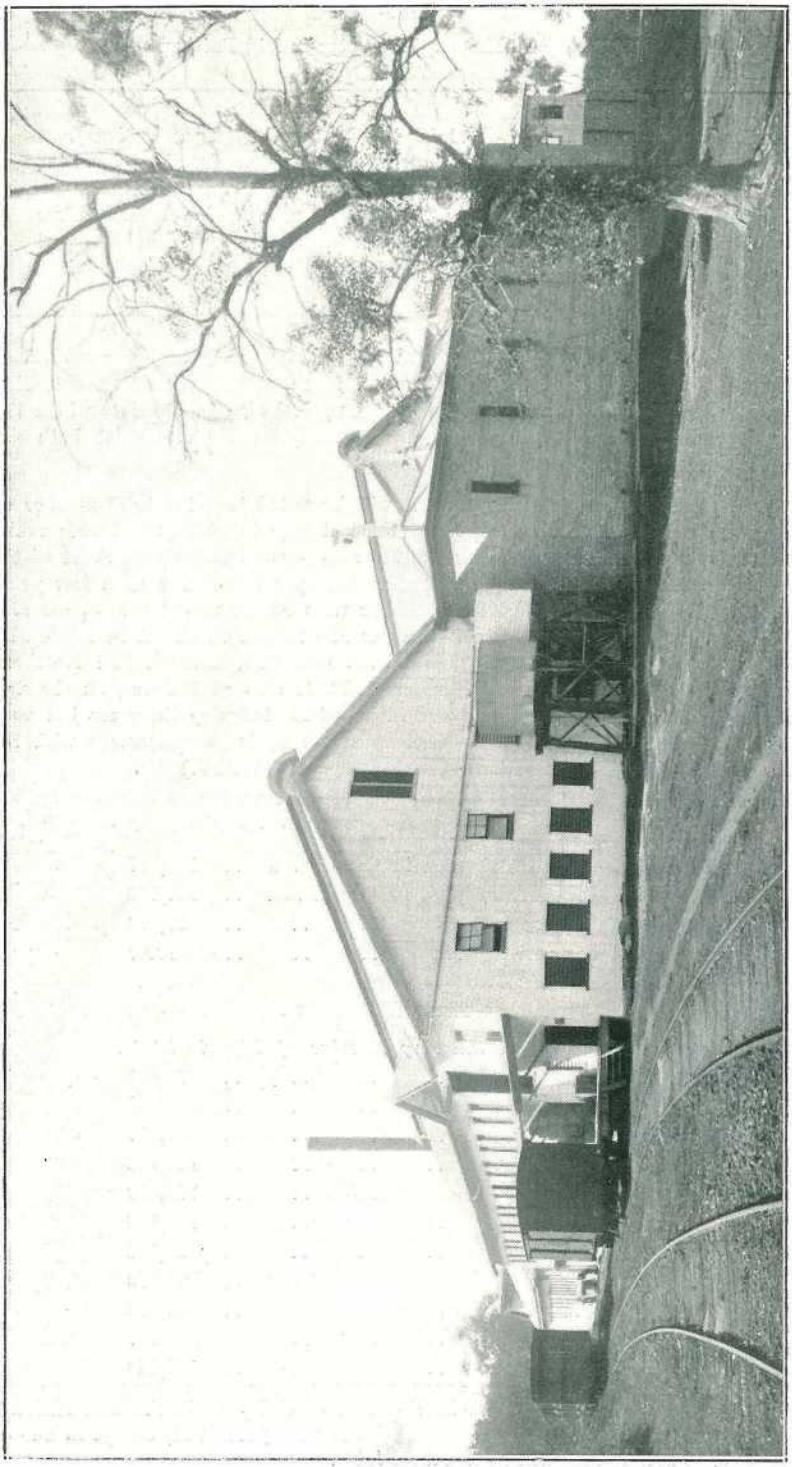


PLATE 43 (Fig. 1.)—QUEENSLAND CO-OPERATIVE BACON ASSOCIATION, LTD., BACON FACTORY, MURARRIE—VIEW FROM RAILWAY.

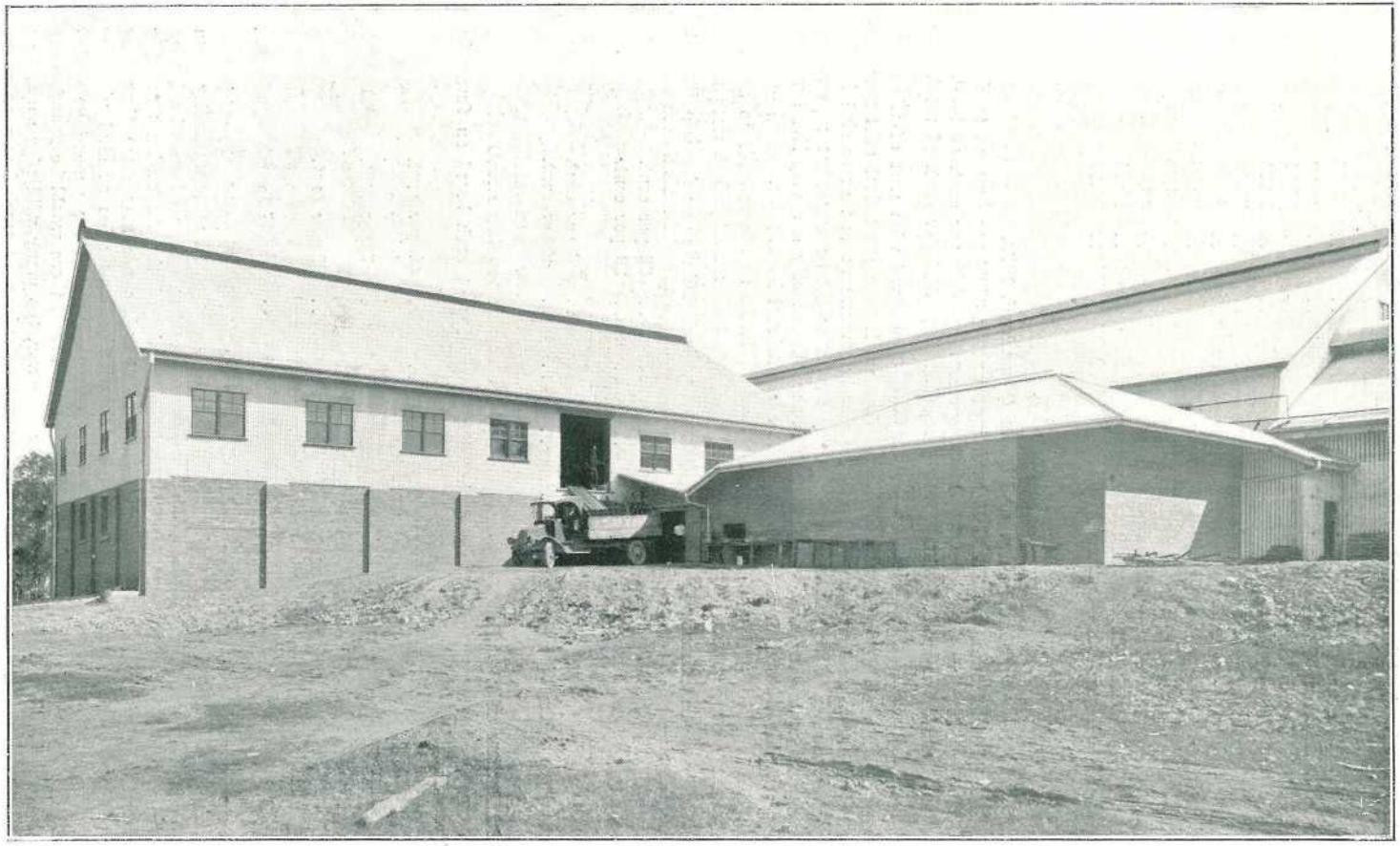


PLATE 44 (Fig. 2).—VIEW OF NEW CURING ROOM AND STORE ROOM RECENTLY OPENED AT BACON FACTORY, MURARRIE.

TABLE III.

Return Showing the Centesimal Increase or Decrease in Numbers of Pigs in Queensland for period named.

Year 1913—Centesimal decrease	2.54
Year 1914—Centesimal increase	18.99
Year 1915—Centesimal decrease	29.31
Year 1916—Centesimal increase	10.14
Year 1917—Centesimal increase	33.12
Year 1918—Centesimal decrease	18.37
Year 1919—Centesimal decrease	29.35
Year 1920—Centesimal increase	4.80
Year 1921—Centesimal increase	39.01
Year 1922—Centesimal increase	10.71
Year 1923—Centesimal decrease	17.67

TABLE IV.

Distribution of Pigs in Queensland, 1923.

Southern Division ..	115,128 head representing	87.06 per cent. of total.
Central Division ..	6,388 head representing	4.83 per cent. of total.
Northern Division ..	10,727 head representing	8.11 per cent. of total.

For comparison of total number of pigs in Queensland with that of the other States, see Table V., which also indicates that we have a good deal of leeway to make up before we can boast of as large a pig population as that carried in the Southern States. Nevertheless, though these figures might be somewhat depressing, the figures quoted in Table VI. indicate that the pig industry is a very live business in this State and that it is of very considerable national importance.

Percentage on Farms.

It has been estimated that our pig population is distributed on farms somewhat as follows:—

On Dairy Farms	60 per cent.
On Mixed Farms	30 per cent.
On Suburban and Metropolitan Piggeries, Butchers' Piggeries, &c.	8 per cent.
On Stud Piggeries	2 per cent.

Distribution of Breeds.

It has been further estimated that the proportion of each breed on farms in Queensland is approximately as follows:—

Pigs of the Berkshire breed	40 per cent.
Pigs of the Yorkshire breed	12 per cent.
Pigs of the Tamworth breed	7 per cent.
Pigs of the Duroc-Jersey, Poland-China, and Gloucester Old Spot breeds ..	1 per cent.
Crossbred pigs, Large Black grades, and pigs of no recognised pure breed ..	40 per cent.

It should, of course, be noted—and this is important in dealing with the subject of marketing—that the pigs in Queensland generally are of good average quality from the standpoint of the bacon curer, and though the percentage of pure-bred pigs actually eligible for registration in the Herd Books of the Australian Stud Pig Breeders' Society is lower than it should be, breeders are now more than ever realising the advantages of improved breeds of pigs, and sales of stud pigs for breeding purposes are increasing largely annually. Even in the percentage stated as being crossbred or pigs of no recognised pure breed, there would be found many pigs of good type and quality. There are, however, too many wild pigs as well as many mongrels in the State, but as these are nowadays of much lower or of no

commercial value in comparison with pigs carrying improved breeding and quality, they are not being used in the production of bacon and hams as they were formerly. No figures are available to show the number of such "Wild" or "Bush" pigs.

TABLE V.

Number of Pigs in each of the Six States of the Commonwealth and also Northern Territory and Federal Capital Territory.

Year 1922—Number of pigs in Queensland ..	160,617
Queensland (December, 1923)	132,243
New South Wales (June, 1924)	323,196
Victoria (June, 1924)	259,795
South Australia (June, 1924)	73,414
Western Australia (December, 1923)	61,478
Tasmania (March, 1924)	47,101
Northern Territory (December, 1923)	647
Federal Capital Territory (June, 1924) ..	434
Commonwealth Statistician's Totals for Commonwealth, 1924	897,874

TABLE VI.

Total value of Bacon, Hams, and Lard manufactured in Bacon Factories of Queensland.

1920.		
Bacon and Hams ..	11,031,691 lb. ..	£902,807
Lard	474,426 lb. ..	33,601
Other Products ..	.. ..	321,148
(includes Pork) ..	200,970 lb. ..	11,194
Total		£1,257,556
1921.		
Bacon and Hams ..	11,973,725 lb. ..	£772,194
Lard	800,280 lb. ..	31,867
Other Products ..	.. ..	289,231
(includes Pork) ..	987,309 lb. ..	45,696
Total		£1,093,292
1922.		
Bacon and Hams ..	15,130,545 lb. ..	£729,688
Pork	901,894 lb. ..	41,912
Lard	781,650 lb. ..	26,943
Other Products ..	.. ..	252,239
Total		*£1,050,782
Pigs slaughtered, 181,108.		
1923.		
Bacon and Hams ..	16,219,969 lb. ..	£911,840
Pork	541,923 lb. ..	24,847
Lard	833,159 lb. ..	35,904
Other Products ..	.. ..	197,061
Total		*£1,169,652
Pigs slaughtered, 200,234.		

*Includes for 1922 and 1923 farmers' pigs, bacon, hams, and pork, also pigs killed and pork obtained at meatworks.

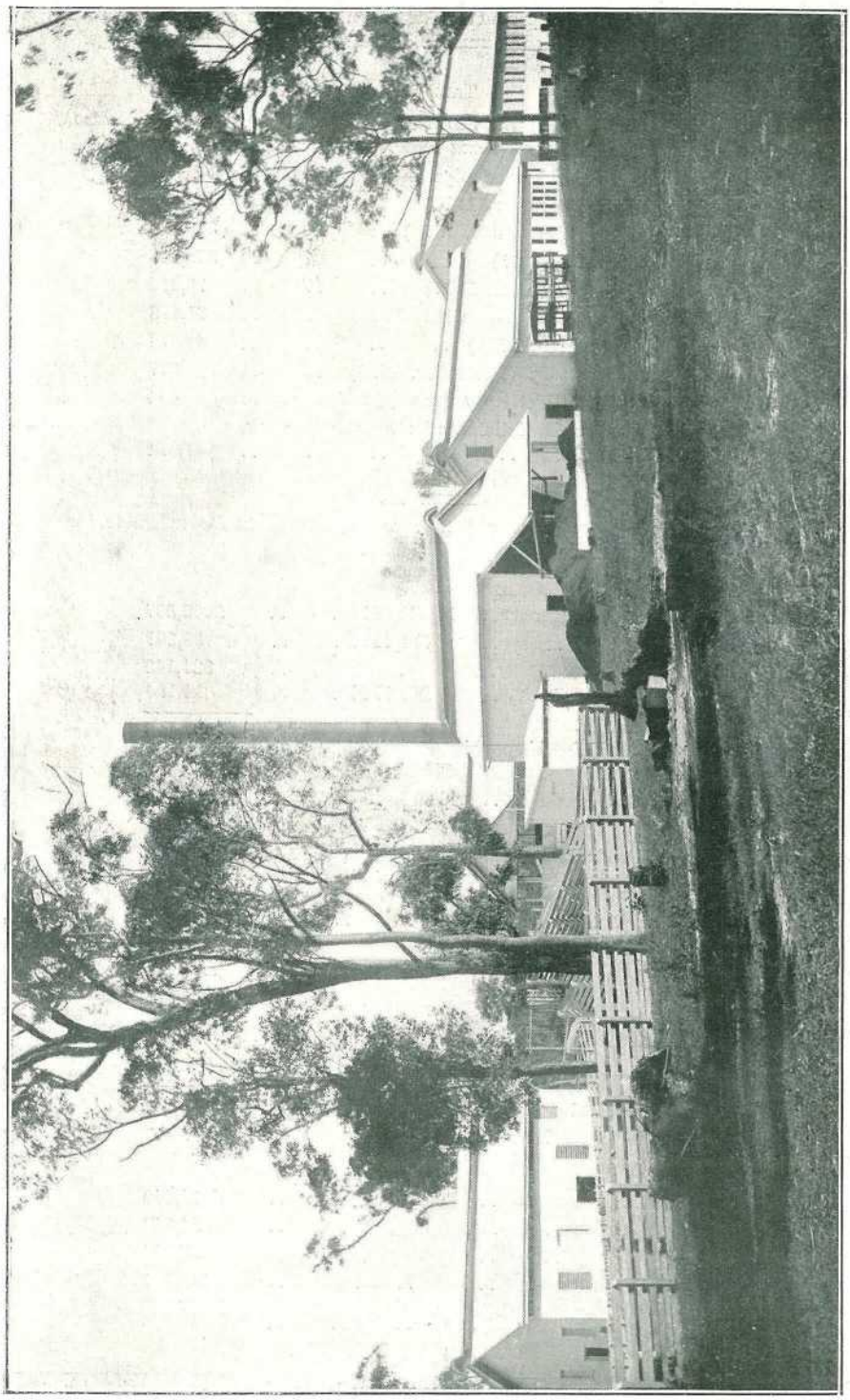


PLATE 45 (Fig. 3).—QUEENSLAND CO-OPERATIVE BACON ASSOCIATION'S FACTORY AT MURARRIE—ANOTHER VIEW.

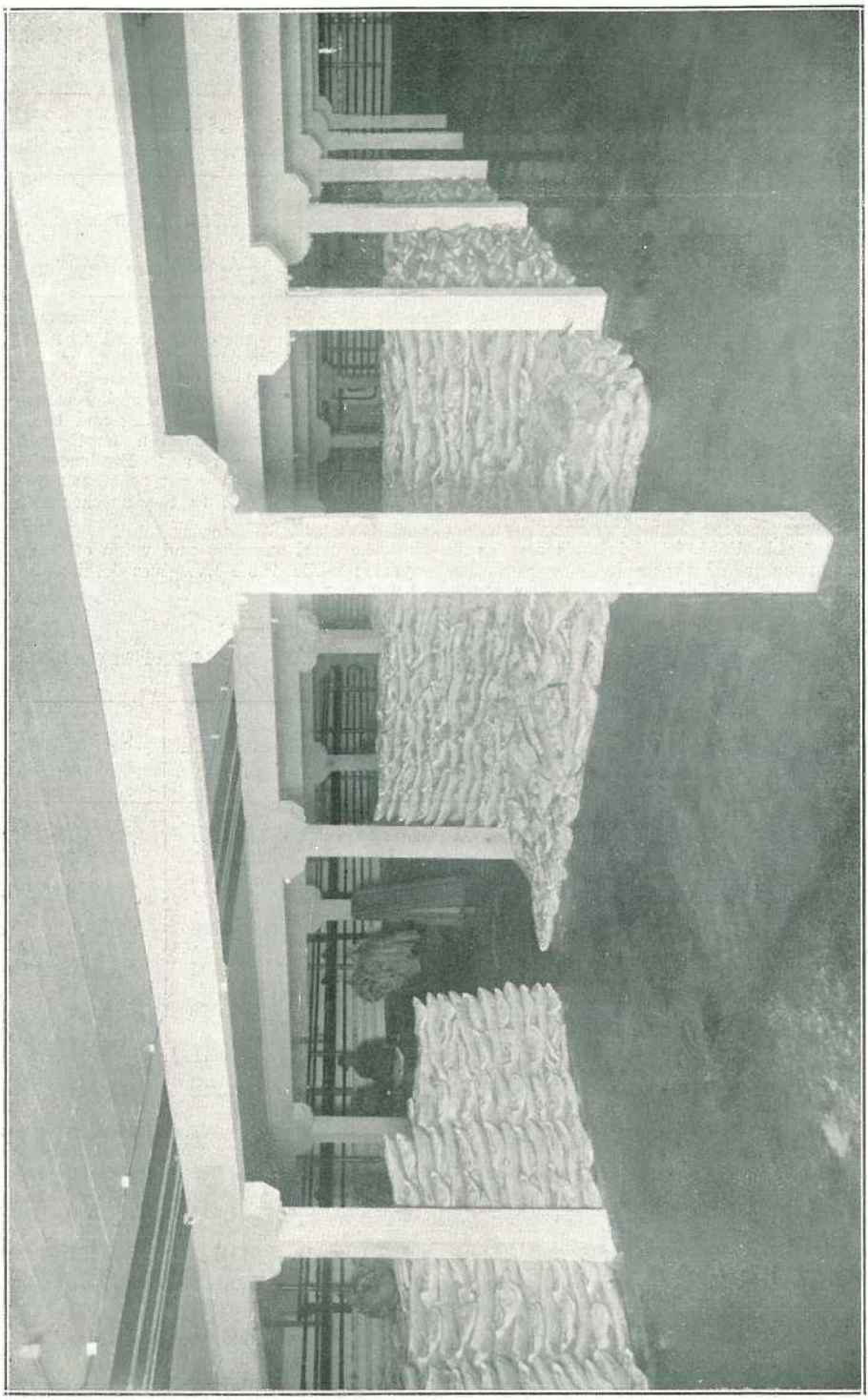


Plate 46 (Fig. 4).—View of Portion of New Curing Room, Murarrie Bacon Factory.

Table VII. shows the number of Bacon Factories in this State, with output, &c.

TABLE VII.

Return showing the number of Bacon Curing Factories in Queensland, with Output, &c.

Year.	Kind of Establishment.	Number.	Number of Hands Employed.	Value of Machinery and Plant.	Value of Land and Premises.	Value of Output.
				£	£	£
1922	Bacon factories ..	6	404	63,039	109,955	987,480
1923	,, ,, ..	6	421	60,782	111,507	1,129,070

In addition to the six old-established bacon factories in Queensland—viz., Zillmere, Oxley, Willowburn, Toowoomba, Maryborough, and Murarrie—there has recently been established the North Queensland Co-operative Bacon Company, Limited, with factory at Floreat Siding, Mareeba, which centre is adjacent to the Atherton Tableland. There is also a bacon factory at Warwick conducted by the Warwick Bacon Company, Limited; while in the Central Queensland district bacon curing and the manufacture of smallgoods, &c., is carried on by Messrs. Conaghan Brothers, Limited, East street, Rockhampton (formerly the Farmers and Producers' Co-operative Company). This latter factory, however, is not at present continuously engaged in bacon curing, &c., this addition being an adjunct to the butchering business carried on by this firm.

Table VIII. is of interest also as showing the total quantity and value of the manufacture of pig products over a series of years; while Table IX. gives details of the export, which it will be noted is at present not large.

TABLE VIII.

Return for ten years of Pigs slaughtered for Bacon, Hams, and Pork in the State of Queensland.

Year.	Number of Pigs Slaughtered.	Production of—		Quantity of Lard Produced.
		Bacon and Hams.	Pork. (*a*)	
		Lb.	Lb.	Lb.
1913	172,084	13,709,716	670,345	836,353
1914	174,653	13,339,131	522,477	929,610
1915	174,980	12,363,939	884,736	698,905
1916	137,919	10,427,649	737,606	622,369
1917	170,490	14,791,540	808,518	761,060
1918	208,498	16,476,480	890,252	854,161
1919	166,575	12,155,489	721,072	656,547
1920	132,049	11,337,050	668,445	474,426
1921	160,205	12,386,417	1,506,982	800,280
1922	181,108*	15,130,545	(*a*) 901,894	781,650
1923	200,234†	16,219,969	(*a*) 541,923	833,159

(*a*) Pork (salt and fresh).

*9,728 pigs killed by farmers and 1,035,927 lb. of pork and bacon made therefrom during 1922 are included in this Table.

†7,933 pigs killed by farmers and 816,854 lb. of pork and bacon made therefrom during 1923 are included in this Table.

TABLE IX.

Quantity and Export Value of Hams and Bacon, Queensland.

—	Imports.		Exports.	
	Lb.	£	Lb.	£
1919-1920	2,230	176	1,264,542	111,757
1920-1921	352	39	1,514,250	157,944
1921-1922	416	43	1,515,588	122,843
1922-1923	Figures not available			91,745
1923-1924	,,	,, ,,		77,107

The Queensland Co-operative Bacon Association, Limited, Murarrie.

The illustrations (Figs. 1, 2, 3, and 4) are of the Queensland Co-operative Bacon Factory, Murarrie, one of the largest and most up-to-date bacon factories in Queensland. Situate as it is but seven miles on the south side of the river, at Brisbane, on the Cleveland line, it occupies a prominent position in a rapidly developing suburb, and is destined to become a factory of considerable importance in the commercial life of the Greater Brisbane area. Though our factories are not, of course, to be compared in size with the huge packing houses of the American cities, it can be fairly claimed that they are equally as efficient in their methods of manufacture and handling of the product.

The company commenced operations in August, 1913, and the figures as under show the number of pigs treated and the amount of sales for each year since:—

	No. of Pigs Treated.	Sales. £	s.	d.
1914 (ten months) ..	27,024 ..	63,048	5	7
1915	23,762 ..	83,100	11	9
1916	21,274 ..	73,636	2	4
1917	28,079 ..	92,895	1	1
1918	21,656 ..	114,712	7	6
1919	21,362 ..	102,486	12	1
1920	21,700 ..	123,904	8	6
1921	25,889 ..	156,543	17	10
1922	33,444 ..	157,312	10	2
1923	43,720 ..	179,576	9	10
1924	35,862 ..	199,156	5	9
	303,772	£1,346,372	12	5

This is a purely co-operative company, and during the past four years bonuses amounting to approximately £20,000 have been returned in cash to suppliers of pigs.

This factory, built to treat 1,000 pigs per week, has on many occasions been hard pressed for necessary space and storage, hence quite recently the curing and store room accommodation has been increased, so that now the factory is capable of handling up to 2,000 pigs per week.

The Sale of Stud Pigs for Breeding Purposes.

It is satisfactory to note that as a result of the continuous efforts on the part of the Department of Agriculture and Stock, the combined efforts of the several bacon factories, and the support of the Queensland Branch of the Australian Stud Pig Breeders' Society, quite a noticeable improvement has taken place in the quality of the pork and bacon pigs being marketed during the past two or three years. Coincident with this there has developed quite a keen demand for better quality boars and sows with which to stock up new piggeries or with which to replace animals that have been culled for one reason or other. The number of breeders handling stud pigs has increased, and as a result a great deal more interest has been taken in the exhibition of pigs at shows and in the Stud Pig Sales which are held each year during the currency of the Royal National Show at Bowen Park, Brisbane. This year's exhibit of Stud Pigs at Brisbane Show, for instance, breaks all previous records both for number, quality, and variety of entry, some 250 head or more having been entered. The entry at Toowoomba Royal Show and at the Rockhampton Show this year also created new records, whilst at shows in the South Burnett and in the South Coast districts, Beaudesert, &c., there was quite a substantial entry.

These shows are, of course, not only intended to create the opportunity for breeders to exhibit their animals; the shows, particularly the Royal National, are noted for the annual Stud Stock Sales to which breeders from all parts of this and sister States look for supplies, hence Stud Pig Sales provide a very valuable

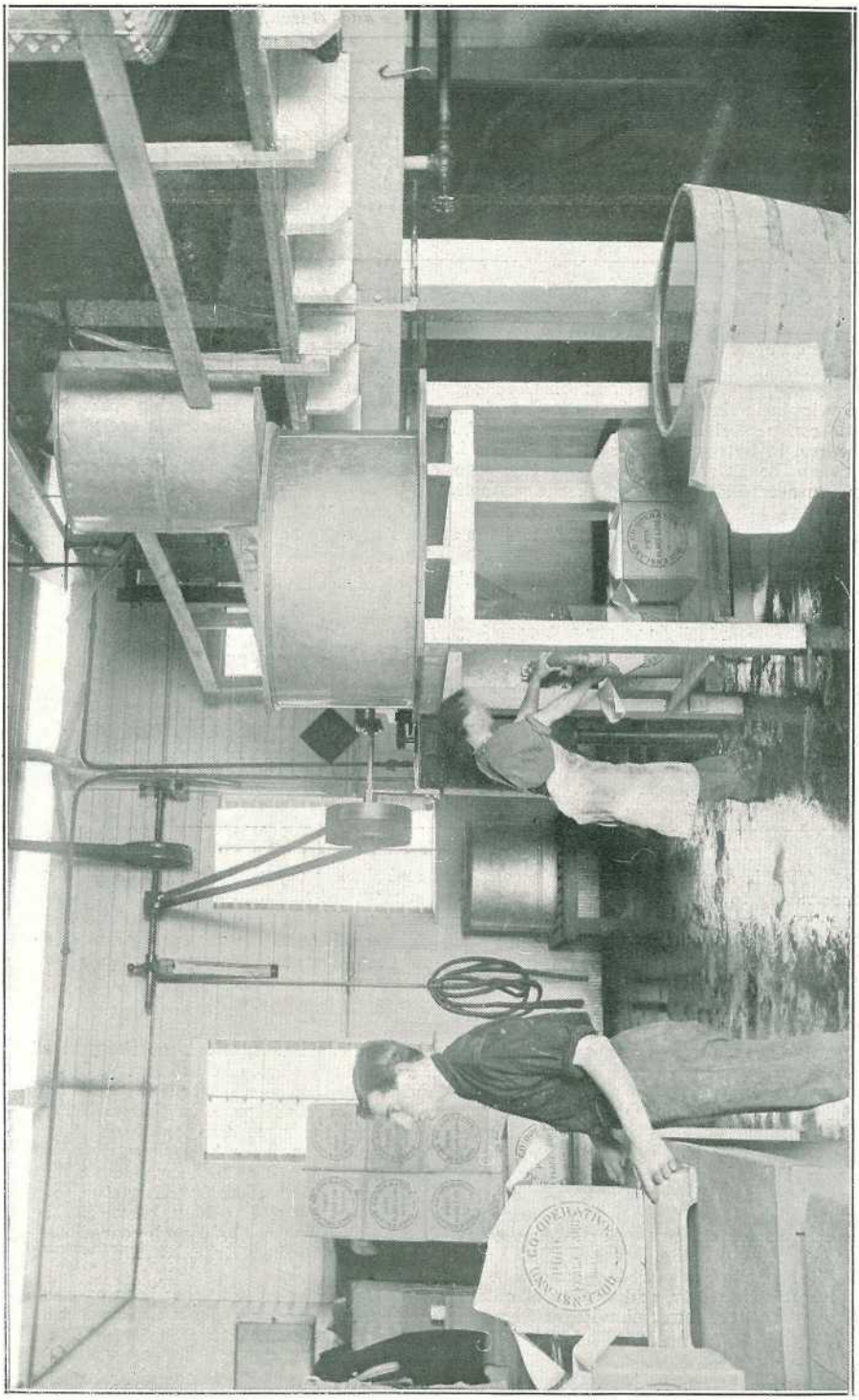


Plate 47 (Fig. 5).—The Lard Room at the Murarrie Bacon Factory.

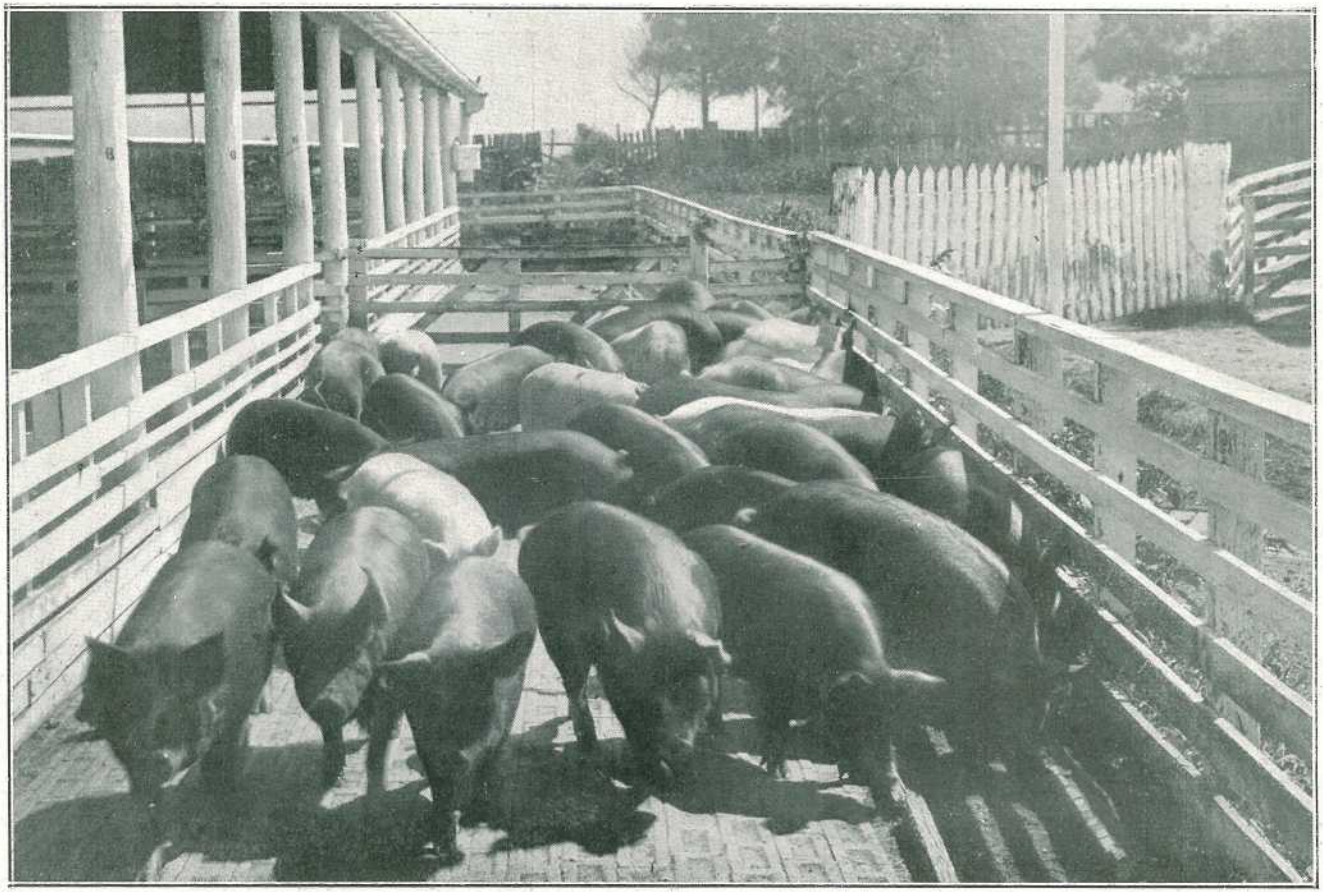


PLATE 48 (Fig. 6).—A LINE OF PRIME BACON PIGS AWAITING SLAUGHTER.

Note their length, quality, and the medium weight and fleshy condition. There is no demand now-a-days for heavy weight overfat Pigs.

"market" for the product of the stud pig farm; they also are of very considerable advertising value, and many private sales follow as a result of the shows. Indeed, to many breeders these annual Stud Stock Sales are an inspiration; they become one of the principal aims of the stud farm. That they have proved successful is demonstrated by the fact that every year sees larger entries coming forward and better prices being obtained for selected animals.

A great deal has been done by what might correctly be called the live stock mail order sale system. The writer, for instance, has selected, crated, and despatched some thousands of stud pigs to farmers in distant parts of the Southern States, and more recently has been doing something on these lines in Queensland in an endeavour to assist breeders unable to attend the sales, yet who desire to secure selected males and females for their studs.

This year's Brisbane Show Sales should also constitute a record, for some of the finest pigs that have ever been exhibited at a Brisbane Show, or at any other show in this State, will be on offer, and breeders should not lose the opportunity of inspecting or of making due inquiry as to the stock available. The writer will be pleased to assist breeders in any part of the State in these matters.

Values of Stud Pigs.

It is difficult to quote values in so far as stud stock is concerned, but in general the higher quality prize-winning animals and their progeny can safely be valued at one guinea per month of age up to twelve months old—that is to say, a selected boar or sow six months old is honestly worth six guineas. After twelve months of age the value depends entirely upon the animal's special qualities, its pedigree, and prize record, &c. Some Queensland farmers think the values referred to above are excessive. The writer does not, for it is claimed that it does not pay to produce stud animals unless they will realise more than bacon or pork values and show a working margin that will allow for crates, cartage, correspondence, feeding, and extra attention.

Sows in pig and boars at a serviceable age are always in good demand, whilst at recent sales young pigs have sold remarkably well. This subject will be referred to in more detail in the September Journal, when a report of the Stud Sales and illustrations of some of the prize-winning animals will be given, as well as further notes on the marketing question generally.

(To be continued.)

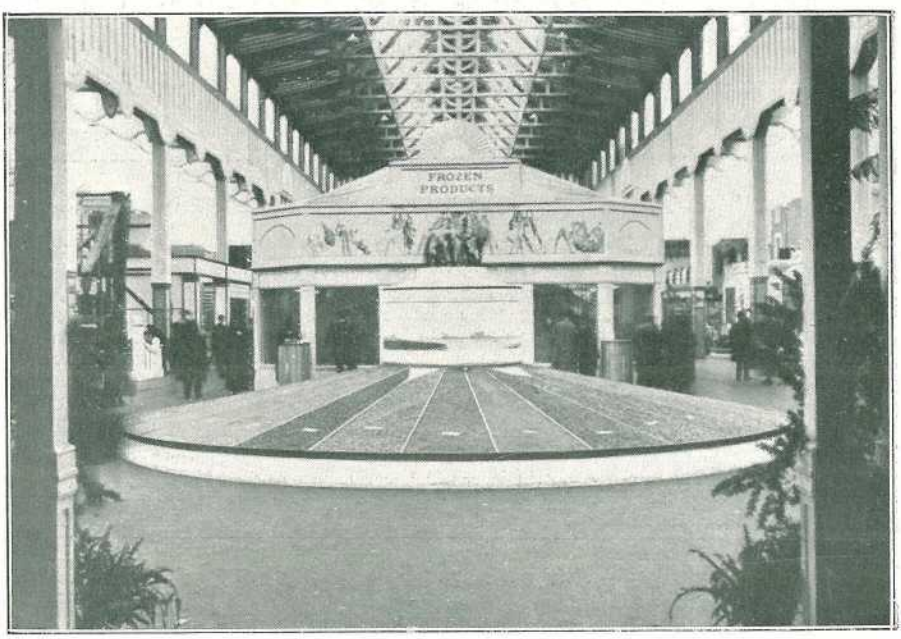


PLATE 49.—DISPLAY OF GRAINS AT AUSTRALIAN PAVILION, WEMBLEY, 1924.

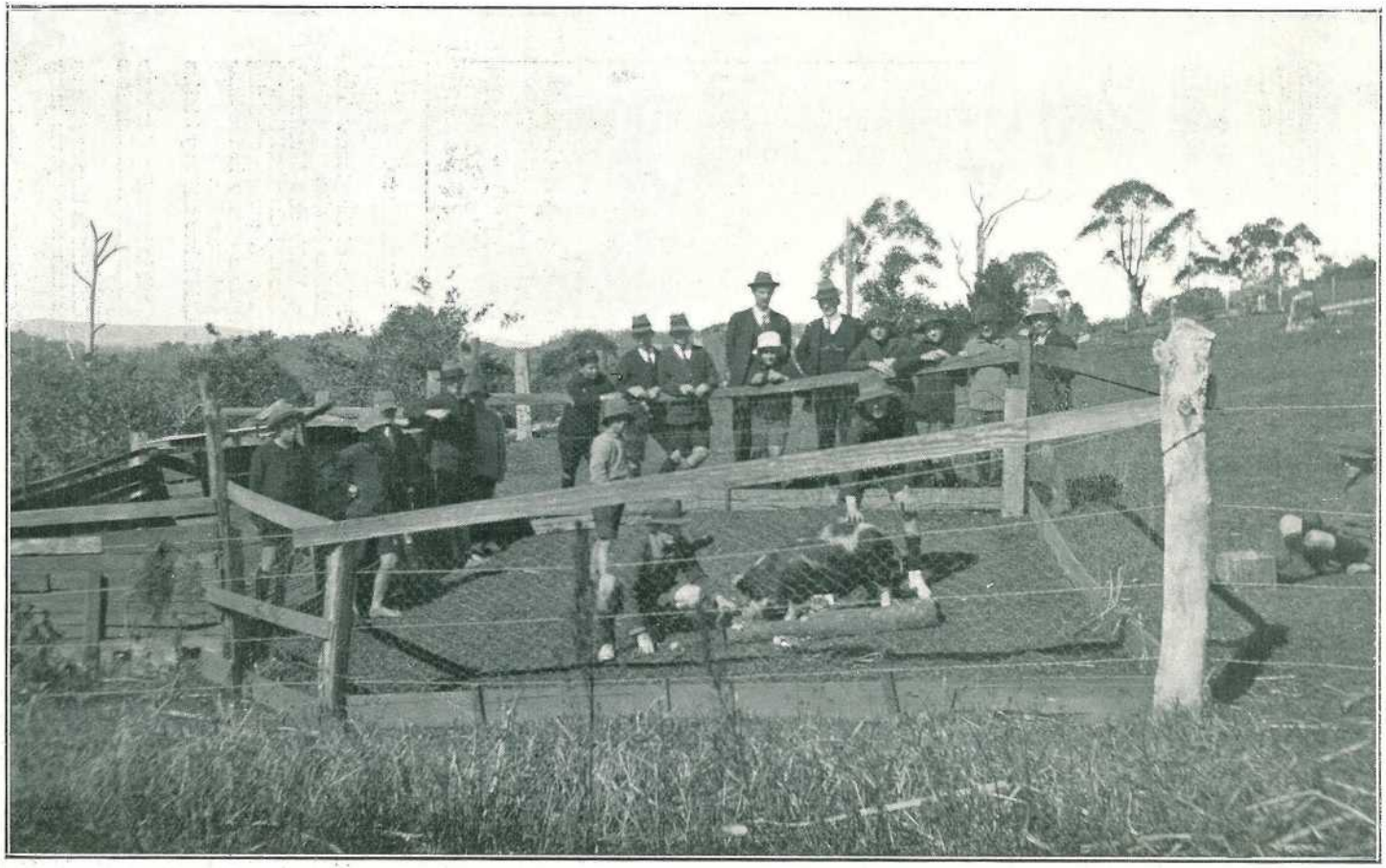


PLATE 50.—NORTH COAST PIG CLUB SCENE—BACON PIGS IN PROCESS OF FATTENING.

Visit of inspection to a Club Member's Pig Pen at Mapleton. The group includes the Head Teacher Mapleton State School (Mr. Watt), the Instructor in Pig Raising (Mr. Shelton), and Club Members.

A VALUABLE DEPOSIT OF LIME.

N. A. R. POLLOCK, Northern Instructor in Agriculture.

What must be considered as a unique and valuable deposit of calcium carbonate, or lime earth as it is popularly called, occurs near the north bank of the Reid River, somewhat over a mile down the river from the Reid River Railway Station, on the Great Northern Railway, thirty-five miles from Townsville.

Though limestone in a bed of 50 feet in thickness may be found tilted at various angles in the hills nearby, it is improbable that this lime earth was derived from its disintegration, but would rather appear as if it had never been subjected to sufficient pressure to cause it to solidify.

The area of the deposit must be very considerable, as except on approximately 2 acres, which are exposed, the balance is covered by soil and detritus. The depth has not been proved, but probably is considerable.

The material is remarkably pure, analysing on an average nearly 90 per cent. $CaCo_3$, the balance being mainly insoluble, while there are no stones or large particles

PLATE 51.—LIME DEPOSIT, REID RIVER, NORTH QUEENSLAND.

such as might be expected were it formed from the disintegration of limestones. The remarkably fine state of division also is evidence of its deposition *in situ*.

The illustration depicts a portion worked by Messrs. Webb and Wordworth, where it will be noted the material is broken down with picks and shovelled through a screen, after which it is bagged and carted to the railway. A portion adjoining is worked by Mr. T. Ryan, who also supplies burnt lime from a quarry in the limestone bed previously mentioned at Calcium Siding, nearer to Townsville.

The price of the lime earth delivered on trucks at the Reid River Railway Station is 20s. per ton plus the cost of bags.

For agricultural purposes this lime is very suitable, since it is in such a fine state of division, being in this direction much superior to the average pulverised limestone available, while the price must be regarded as very reasonable.

Very many of the soil areas on the northern coast are deficient in lime or give an acid reaction, much benefit having been experienced with this lime by the many farmers using it.

Though not so quick in its action as burnt lime, it is equally as effective in the long run, and is to be recommended applied as a top dressing of 20 cwt. per acre, or when more is required an additional application after six months or a year.

General Notes.

Not a Bad Word for Australia.

A prominent Californian ranch owner writing to Mr. W. G. Brown, sheep and wool expert of this Department, for information on the resources of this State, has something interesting to say, from the American viewpoint, of Australian development. He writes, *inter alia*, "'I have never heard a man say a bad word of Queensland or Australia yet' is a common expression in this Western country."

The Main Features of a Good Dairy Farm.

Dairy farming may be likened to a chain, in that it is only as strong as the weakest link. Many dairy farms have serious weaknesses, which nullify much good work.

The main features or "links" in the "dairy chain" are:—

1. Good pastures of suitable grasses for milk production.

2. A permanent water supply, and adequate fodder reserves.

3. A tested herd, with available records of each cow's milk and butter fat production.

4. A "quality" pure-bred herd sire.

5. A system of pasture dressing, and drainage of low areas.

6. Well laid out dairy buildings and yards, where dirt can be reduced to a minimum, and where the herd can be handled with ease and satisfaction.

7. Satisfactory arrangements for cleansing dairy utensils, and the care and storage of cream.—"Victorian Journal of Agriculture."

How Much Butter Fat?—Quantity and Test.

Supplying a dairy factory often tends to emphasise in the minds of dairy farmers the percentage of butter-fat in the milk (commonly called the "test") rather than the quantity of butter-fat. Although the education which herd-testing has helped to develop has done much toward dispelling this tendency to think in terms of "test" (writes W. M. Singleton, in the "New Zealand Journal of Agriculture"), one still finds many dairymen who are apt to stress the importance of the butter-fat percentage. Unless the herd is used for supplying milk for human consumption, when a certain legal minimum of fat has to be adhered to, the "test" itself can be taken too seriously.

And, after all, even dairy factories do not pay out on test, but on test multiplied by weight of milk supplied—a very different matter. There is also a tendency, though less frequent, to stress milk-quantity, though this is not so common as in those countries where records are taken for yield of milk alone.

A good example of the inaccuracy of judging milk production by test alone, or by quantity of milk alone, is found in a study of the records of pure-bred cows under C.O.R. test in New Zealand. Taking all Friesians (413) in the two-year-old class which have gained certificates since the commencement of the C.O.R. system in 1912 to the end of 1923, it is found that the six highest testing individuals averaged 4.74 per cent., and the six lowest only 2.79 per cent.

Judging from the test alone, the first-mentioned were 69 per cent. better cows than the lower testers. On the other hand, on milk alone the higher testers yielded on the average 9,601.4 lb., and the lower testers 16,012 lb.; so that, judged on milk alone, the latter group was approximately 67 per cent. better than the first.

When one comes to butter-fat, however, it is found that the average production for the groups was 455.19 lb. for the six higher testers, and 447.26 lb. for the lower—an actual difference in production of only 7.93 lb.

All things considered, therefore, it is not right to judge a cow by milk alone nor by test alone. The only fair and accurate guide to the ability of the dairy cow is her butter-fat yield for the season.

Whitewash Formulae.

Lime or whiting (which is carbonate of lime) is the basis of the more common mixtures for whitewashing walls and ceilings of farm buildings, dairies, &c. The following are among the formulæ which have been found in practice to be most satisfactory for the purpose.

One of the best whitewashes, and one which can be relied on to make a brilliant and enduring coating, both for indoor and outdoor work, is the formula used by the United States Government in all their important work, such as lighthouses and public buildings—it is the one used for the painting of the White House in Washington. It is as follows:—Unslaked lime 2 pecks, common salt 1 peck, rice flour 3 lb., Spanish whiting ½ lb., glue (clean and white) 1 lb., water in sufficient quantity. Slake the lime in a vessel of about 10 gallons capacity, cover it, strain, and add the salt previously dissolved in warm water. Boil the rice flour in water, soak the glue in water and dissolve on water bath, and add both to the mixture, together with the whiting and 5 gallons of hot water, stirring all well together. Cover to protect from dirt, and let it stand for a few days, when it will be ready for use. It is applied hot.

The following formula provides a cooling covering for either rough timber, brickwork, or corrugated iron, and is said to be as effective in reducing temperature as the best of the refrigerating paints:—Quicklime 10 lb., glue 1 lb., powdered alum 1 lb. Slake the lime with hot water, keeping it covered during the process. Dissolve the glue and the alum in hot water, and mix well together with the slaked lime. Do not make too thin. Strain the mixture and cover for two or three days, when it is ready for use. Apply two coats, the second after the first has been well set.

Early Tomatoes.

Planting of tomatoes in the open cannot take place until the district is clear of frosts unless means be taken to shelter the young plants every evening. For early crops the young plants must be got ready in a cold frame, in order that they may be planted out as soon as the weather has become favourable.

The seed or plant bed may be made any desired size, according to the extent of cropping, and a frame of the required size may be built on the plot. The seed may be sown in shallow boxes under cover or in the frame, and covered with a sprinkling of fine loamy soil. One or two ounces of seed will produce more than sufficient plants for 1 acre. As soon as the plants are large enough to handle (2 or 3 in. high) they should be transplanted into the frame, the soil in which by this time should have been worked up to the finest condition and tilth.

The plants should be set out in rows 5 or 6 in. apart, with the same distance between plants, setting each plant opposite the space in the previous row. Here they remain and grow until time for transplanting into the field; and by removing the frame cover, giving them air, light, and sunshine on fine days, and covering up in the evenings or during spells of frost, they should presently become stout and stocky plants. After they are once set out, do not give them much watering, or they may be inclined to draw up and become lanky and tender.

The main points in a frame or seed-bed are to keep it dry and warm and to protect it from winds, which cause considerable damage. In transplanting into the frame, care must be taken that the plants are not much lower than in the seed-bed, as the deeper they are set the more liable they are to damp off. If any plants have got rather down in the seed-bed, and become long-shanked, they should be laid slanting, just below the surface, and they will take root along the stem, and become stout and stocky plants. The drier the bed is kept (with discretion) the better, for tomatoes have their full share of fungus trouble.

When the plants becomes 5 or 6 in. high, some will want to outrun their neighbours; these should be pinched in a little so as to allow the weaker plants to come up uniform in strength before putting out. Any suckers that may appear should also be removed if it is intended to grow for early fruit.

As a precaution against seed-bed troubles with tomatoes, only soil that is free from contamination by tomato and potato rubbish should be used in the seed boxes. Soil for seed-beds may be sterilised by soaking it with formalin, and although such sterilisation is costly, it pays where much trouble is encountered with seed-bed diseases. One part of the commercial solution should be used to fifty of water, and about half a gallon employed to each square foot of the seed-bed. These preparations should be made at least a week before sowing, and in the interval the soil should be turned over thoroughly to enable the vapour to escape when it has done its work.

Lamb Marking Mortality.

There can be little doubt that a large number of lambs are lost annually as a consequence of neglect during and following the process of marking.

Every season a number of deaths are reported closely following the period in which the operation is usually performed. The fact that deaths always cease within a short time of the healing of the wound and start a short time after its infliction supports the assertion that they are generally traceable to one of the various diseases (notably tetanus, malignant œdema, septicæmia, and anthrax) capable of transmission by inoculation, the unhealed wounds providing the channel by which the infection reaches the lamb.

When marking small flocks, it is best to use temporary yards made of wire netting, situated in a fresh paddock. Where the size of the flock makes this impracticable, the surface soil of the yards should be removed to a depth of about 6 in., placed in a heap and thoroughly mixed with quicklime. The fresh surface should then be saturated with a strong solution of a non-poisonous sheep dip.

In addition to the above precautionary measure, it is essential to adopt some means of preventing the germs of disease from gaining entrance into the flesh-cuts made in the scrotum and tail. As the yards, although the main, are not the only source of infection, it is recommended that wounds of the scrotum and tail be either smeared with Stockholm tar broken down with kerosene or dressed with carbolised oil (1 part of carbolic acid to 12 parts of oil) before the lamb is released after the operation. This is most important.

Knives used for docking and tailing should be boiled, and not allowed to come in contact with the ground during use.

Lambs dead of any of the diseases mentioned, if not destroyed, form fresh centres of infection by absorption of the micro-organism by the earth. All carcases should therefore be destroyed by burning. Finally, if measures are not taken to prevent these diseases, the losses, in addition to occuring annually, will show a tendency to increase in extent by reason of the increased soil contamination.

Care of Cream—Some Necessary Precautions.

Do not blame the factory manager or the grader if your cream is put out of "choicest" class—look for the cause and remedy it. Here are a few ways in which quality may be safeguarded:—

Separate milk at blood heat as soon as you can after milking. Fix a cooler to the cream spout of the separator and so cool all cream—it will keep ever so much better.

Do not mix new cream with that from the previous separating until it has been cooled. Mix by pouring from one vessel to another. This allows the air to purify it and makes it keep better. For the same reason, stir the cream can frequently, using an enamelled stirrer—do not use wood.

Keep the cream can in a cool, draughty, vell-ventilated place, and exclude flies. Keep the can covered with a piece of wire gauze fitted into a small, handy wooden frame. Do not allow the direct rays of sun to reach the cream.

When sending to the factory, fill cans to the neck rim; this prevents churning in the can, which would mean a loss in weight and an incorrect test.

Separate in the summer to get a 40 to 42 per cent. test, and in the winter to get a 33 to 36 per cent. test. When the cream is excessively thick there is a loss of fat in the skim milk. When it is too thin in the summer season it may become too sour, and curdled milk is formed. Do not use too much washings to get the last of the milk through the bowl. When separating, be very careful of three things—(1) Have the temperature of the milk over 90 deg. Fah.; (2) keep the speed even and bowl up to the specified revolutions; and (3) keep the inflow of milk to the bowl regular and full.

Keep cans of cream in the shade, especially when being carted or when waiting at the roadside for the cream van. A small shelter-box should be provided, high enough from the ground to be safe from dogs. Deliver cream to the factory daily if possible. The cream wagon or cart should have a cover to keep the sun's rays from the cans; even a 6-in. space between the top of the cans and the cover will be sufficient.

If you cannot improve the quality of your cream by the abovementioned means, ask the advice of the departmental dairy instructor in your district or of your factory manager.

Better Dairying—Clean Milk Conditions.

Clean milk competitions are a somewhat recent development of dairy life in England. The competitions appear to last for some time, for the custom is for the competing farmers to take routine samples of their milk at intervals and to dispatch them at regular intervals to the laboratory; but the county inspector, who usually acts as judge, makes surprise visits and takes samples for himself. These samples are tested for keeping quality, number of bacteria present, and degree of contamination by fæcal matter, while the butter-fat and visible dirt are also frequently ascertained. The animals, sheds, dairy, and methods of each competitor are examined and score-carded, and the inspector is frequently able to give a bit of instruction or to offer a hint as to some portion of the dairy, as well as to point continually to the value of thorough cleanliness.

Originally the custom was to publish a short report at the end of the competition, but it was found that competitors had a very keen interest in knowing how they were getting on, and the practice has been adopted of sending out interim reports at stages at which all competitors have submitted an equal number of samples for analysis. The reports give notes on the analyses and on the surprise inspections. No names are mentioned, but the code numbers (known only to the organisers and each competitor) are given, so that each farmer can pick out his own results. These reports are very carefully studied, all are enabled to profit by suggestions (and at the same stage in the competition), and much important information is disseminated.

The effect of the competitions has been a marked decline in the number of bacteria present in the samples from competitors, and a distinct increase in the period over which the samples of milk will keep sweet.

The Value of Maize.

Australia usually produces 1,000,000 bushels short of her annual requirements of maize, although possessing very much more than sufficient suitable soil to make up this shortage. Maize is one of the easiest crops to grow on good land, and both the grain and the fodder produced are among the most valuable feeding stuffs for practically all kinds of stock.

The value of the grain is well known for the topping of pigs for market, for poultry feed, for maintaining the stamina and warmth (particularly in cold weather) of horses doing arduous work, and for keeping sheep alive during periods of drought in the west, but its utility has not yet been realised sufficiently for topping lambs and steers for market as is done in America, nor do the excellent qualities of the grain as a concentrate for increasing the milk flow of dairy cattle seem to be appreciated thoroughly except by a few farmers in certain districts. For green fodder there is no crop better for stimulating the milk production when summer pastures are short, and maize unquestionably makes the best silage of any crop known. In certain districts (particularly those with cold dry winters) the utilisation of the crop for the dual purpose of providing both grain and fodder (stover) is becoming more general.

In general, it might be said that the true value of the maize crop will not be properly realised until it is utilised to a greater extent on the farm where it is grown. By combining maize-growing with live stock raising, but little of the actual crop need leave the farm. In the United States of America it is estimated that 90 per cent. of the maize that is produced is utilised in this way, that is, about 27 bushels per head of population. In Australia only about 2 bushels per head of population is used altogether, and probably less than half a bushel per head is utilised by feeding to live stock on the farm where it is grown.

Maize-growing can be made more profitable on the farm, firstly, by making more use of it as food for stock, instead of depending so much on the direct sale of the grain, and, secondly, by obtaining increased yields per acre. These are the only individual counters to a low market price, such as occurs at times when there is over-production in the country.

The yield of maize depends on the fertility of the soil, on the climate and season, on the inherent vigour and soundness of the seed, and on the cultivation methods adopted. Most important of the latter are deep early ploughing and winter fallow. Experiments at Grafton Experiment Farm averaged over four years showed winter-ploughed land to yield at the rate of 53 bushels 10 lb. per acre, as compared with only 41 bushels 40 lb. per acre from spring-ploughed land.

Pasteurisation of Milk—Processes Involved.

So much has been said about the pasteurisation of milk that the subject would seem to be well nigh exhausted, yet every now and then (writes G. L. A. Ruehle, in the Michigan Experiment Station "Quarterly Bulletin"), a remark is made which suggested that, although everyone is familiar with the name for the process, the process itself is not well understood.

What is pasteurisation? In the first place it should be understood that pasteurisation to-day and pasteurisation in the early days, when it first acquired its dark reputation, are not the same thing. In those days pasteurising meant heating the milk to a fairly high temperature, anywhere, say, from 165 deg. Fahr., to 190 deg. Fahr., for anywhere from ten to sixty minutes.

To-day, the term pasteurisation when applied to market milk means heating milk to 142-145 deg. Fahr. for twenty-thirty minutes. A further extension of the definition should include prompt cooling to 50 deg. Fahr., and proper safeguards to prevent reinoculation of the milk with undesirable bacteria.

The effect of pasteurisation upon the physical and chemical properties of milk has been the subject of much controversy. This was due to the differences in definition of the term pasteurisation. There is no doubt but that heating milk to a high temperature imparts a decidedly cooked taste, which is due to several factors—driving off of the natural gases of the milk, partial decomposition of the proteins, with the production of new compounds and caramelisation of the milk sugar. Highly cooked milk also is thought by many to be less digestible than raw milk, although there is still a difference of opinion among good dietitians on this point. High heat also causes a breaking up of the clusters of fat globules into independent fat globules which rise less readily to the surface than the larger clusters. This results in destroying the cream line. But milk pasteurised by modern methods does not have any of these objections to a noticeable degree. There is no evidence that pasteurised milk has any less food value than raw milk, with the exception that vitamine C is partially destroyed. This, however, is easily replaced in the diet by the use of fresh fruits (the juices of oranges, tomatoes, &c., for babies) and greens, so that there is no excuse for giving up the safety of pasteurised milk on account of its deficiency in vitamine C. For properly pasteurised milk is safe milk, while all raw milk is potentially dangerous.

The purposes of pasteurisation may be said to be two: first, the hygienic reason, for which the milk is made safe for human use, and second, the economic reason for which the keeping quality of the milk in enhanced.

Southern Sheep-Feeding Trials.

Requests that investigations be undertaken with regard to the provisions of additional food for ewes and lambs when the latter are intended to be marketed as fat lambs, led to the inauguration by the New South Wales Department of Agriculture recently of experiments which would afford some specific information. As practically no work of this nature had previously been undertaken in this country, and as conditions here, both as regards the raising of live stock and the growing of feed, differ markedly from those in countries in which experimental work has been carried out, it was necessary to commence with very simple experiments, in order to collect data on which to continue investigations. The first experiment was carried out at Bathurst Experiment Farm.

The trial was carried out with 150 ewes and their lambs, the plan being to run these on fodder crops and fallows during the day, and at night to draft them into three lots (each lot having been previously branded distinctively) for separate yarding; Lot 1 to be supplied with roughage and maize at the rate of 6 oz. per ewe, Lot 2 with roughage and oats at the rate of 6 oz. per ewe, and Lot 3 not to be hand fed. The feed was given in shallow bag troughs in the yard where the ewes were kept for the night, and the usual departmental lick was also supplied to each lot in the yards at night.

The trial was commenced on 22nd August, the lambs being then an average of seven weeks old. The ewes and their lambs were divided as follows:—Lot 1, 57 lambs and their mothers; Lot 2, 56; Lot 3, 51. For three weeks very little of the feed which was given in the troughs was eaten, and most of the roughage (straw chaff) was scattered about by the sheep. On account of this waste it was decided to dispense with the roughage and feed the grain alone. By the end of

September all the feed was being cleaned up readily. Very little difference in appearance could be noticed between one lot and another during the course of the trial, except that towards the end the lambs in the oat-fed trial had more bloom on them. The season was very favourable to the growth of the fodder crops, and green feed was plentiful up to the end of the trial. Throughout the trial all the sheep, both ewes and lambs, were in excellent health.

The average weights of the lambs at the start and three months later (3rd December), when it was decided to dispose of half of them, were as follows:—

Lot 1.—First weighing, 37.1 lb.; second weighing, 68.0 lb.; increase, 30.9 lb.

Lot 2.—First weighing, 42.7 lb.; second weighing, 74.0 lb.; increase, 31.3 lb.

Lot 3.—First weighing, 36.7 lb.; second weighing, 66.5 lb; increase, 29.8 lb.

The remainder, which comprised the younger lambs of the drop, were continued on the same ration, and were marketed on 22nd January. The average price realised at each sale and the combined averages were as follows:—

Lot 1.—First draft (27), 37s.; second draft, (30), 28s. 7d.; combined average price (57), 33s. 1d.

Lot 2.—First draft (33), 38s. 7¾d.; second draft (21), 28s.; combined average price (54), 34s. 10½d.

Lot 3.—First draft (28), 30s. 9¼d.; second draft (21), 29s.; combined average price (51), 29s. 1¾d.

The difference in price realised at the two sales was attributed to the facts that, on account of the pastures going off somewhat, the second draft were rather dry in appearance when sold, and that the lamb market on 22nd January was lower than usual.

As the full amount of the grain was not eaten, particularly at the beginning, the quantity was reduced, then increased gradually, so that the sheep just cleaned up the amount of grain given, the amount never exceeding 6 oz. per ewe. A record was kept of the total amount of grain given to the two lots which were fed. Lot 1 was fed 1,314 lb. maize at 5s. per bushel, total value £5 17s. 4d. for the 57 lambs. Lot 2 was fed 762 lb. oats at 4s. 7d. per bushel, total value £4 7s. 4d. for the 54 lambs. There resulted, therefore, the following figures:—

Lot.	Cost of Grain per Lamb	Average Value per Lamb.
	s. *d.*	*s.* *d.*
1	2 0¾	33 1
2	1 7½	34 10½
3	..	29 1¾

"The figures show," according to the report on the experiment, "an average added value for the lambs fed on oats of 5s. 8¾d., and for those fed on maize of 3s. 11¼d. over the lot which had no extra feed. As a matter of fact, in the case of the first draft fed on oats, the cost of grain per lamb works out at a little under 1s. 5d., while that for the second is about 1s. 11d. This will increase the advantage of the lambs fed on oats in the first draft to 6s. 5½d. above the lambs receiving no extra feed. In the case of the second draft the advantage is only 1d., which is a rather remarkable contrast. The first draft of those fed on maize cost just under 1s. 9d. to feed, and consequently show an advantage of 5s. 3d. over those not fed on grain. The second draft cost 2s. 4½d. in feed, and consequently there was a loss of 7½d. on this draft. The reasons for the marked difference in comparative values does not appear capable of satisfactory explanation, and the point will be carefully watched.

"The work entailed in drafting and putting out the feed each evening has not been considered in these results. Under ordinary conditions very little work would be necessary, as after about a week the sheep would come readily to the feed trough placed in the paddock.

"These results tend to show that extra feed in the shape of concentrates is of value in forcing the growing lamb. Feed given in this manner should be specially valuable if the season becomes dry, resulting in the green feed not being as succulent as it should be."

Benefit of Cultivation.

The benefit of cultivation for the conservation of soil moisture is emphasised by experiments carried out at the Dominion Experimental Station, Swift Current, Canada. It was found that stubble land, in the spring of 1924, contained only 1·18 inches of available water, while land summer-fallowed in 1923 contained 6·75 inches. Both soils were seeded to wheat and received 7·73 inches of rain during the growing season. In all, therefore, the crops received 8·91 and 14·48 inches respectively, yet the fallow land, with a 60 per cent. increase in moisture, produced three and a-half times as great a crop as that from the stubble land.

A Good Bull a Good Investment.

A great many farmers consider a good pure-bred dairy bull to be an expensive luxury —an animal that is very nice to have on the farm, but only an investment for wealthy men. This is quite wrong, points out E. W. Sampson, in the Journal of the South African Department of Agriculture. A good bull can earn more money than cows bought for the same sum. The better bred the cow is, the higher the profit she can yield if properly handled. If the farmer were to put a good bull to his cows and gradually replace the old stock by heifers that gave better yields than their dams, his extra profits would soon more than cover the cost of the bull.

But the money earned by the bull may be calculated in a more direct way than this. Suppose a farmer has thirty low-grade cows, and decides to improve his herd with a pedigree bull having good milk records on both his dam's and his sire's sides. Let us suppose that the low-grade cows are worth £10 a head and that the price of the bull is £40. It is reasonable to suppose that about twelve heifers will be reared per year. The value of these heifers at calving should be at least £3 per head higher than that of their dams, and this would mean that the bull had earned £36 on his first lot of calves.

Hoof Wounds—Treatment.

Wounds occur in horses' hoofs principally as the result of the animal treading on such sharp bodies as nails, wire, and pieces of iron or glass, which penetrate the soft structures of the foot. The horny sole is itself impervious, and such foreign bodies almost invariably enter through the frog, injuring the sensitve under-structures of that organ, and in exceptional cases the pedal or navicular bones.

The objects aimed at in treatment are to prevent infection, and to limit the spread of inflammation. The foreign body must be located and removed, and precautions taken against any particles being left behind, after which the wound must be well washed out with some antiseptic solution. If a nail has caused the injury, the track should be cut out until the injured soft structures are exposed, and the wound thoroughly washed with an antiseptic, such as lysol and water, and syringed out with tincture of iodine; it may then be packed with a dressing consisting of iodoform 1 part and boracic acid 6 parts, or with a saturated solution of iodoform and eucalyptus oil, and finally bandaged.

The wound must be dressed and bandaged daily until healing occurs. When the animal is fit for work, the sole should be smeared with tar, packed with tow, and a leather sole put on with the first shoeing to prevent any further injury to the old wound, which will then be only covered with a thin layer of horn.

Shaping Young Fruit Trees.

When pruning young fruit trees the main thing to keep in mind is the establishment of a good framework, and for the first few years of a tree's life it is advisable to cut the leaders well back.

The advantages of a good framework are many. The limbs can carry the weight of fruit, picking, spraying, and cultural work is facilitated, free circulation of air is allowed, and the sun's rays are permitted to penetrate, which is an important consideration for bud formation in the centre of the tree. When pruning young trees it is always advisable to encourage them to spread; spreading trees (but not so spreading as to impede cultural operations) are more easily handled than more upright trees. After a good framework has been developed, and if the tree is still making heavy growth, it would be advisable to allow it to go unpruned for a season. This will have the effect of inducing it to crop.

In pruning older trees, the characteristics of the various kinds and varieties must be taken into consideration. The pruner should remember that peaches crop only on the previous year's growth, and the older wood will not retain a permanent, self-replacing fruit spur like the apple and pear. In old apple or pear trees it is sometimes necessary to thin out fruit-bearing spurs or they become too crowded.

There is no hard and fast rule that applies to pruning—there are so many factors which influence the tree, such as soil, location, stock, and the treatment that the trees receive as regards spraying, cultivation, manuring, &c. Each tree of each variety must be treated individually, and given the particular treatment that will result in the greatest annual productivity of good fruit, and to do this work intelligently the habits and conditions of each tree must be closely studied.

Green Manuring Crops.

Among the most effective means of adding humus to the soil is the ploughing under of a green crop. The district and the conditions will largely determine the choice of crops for green manuring purposes, but farmers generally are not inclined to sow a crop which occupies the land too long unless it can be grown as a cover or companion crop, or unless it can be utilised partly for fodder purposes. An indication of the crops which may be chosen can be obtained from the following classification:—

Very Warm Moist Climates.—Spring or summer sowing: Velvet beans, sunn hemp, cowpeas, pigeon peas, dolichos beans, Florida beggarweed. Autumn or winter sowing: Field peas, vetches, clovers.

Warm or Temperate Moist Climates.—Spring or summer sowing: Cowpeas, dolichos beans, soy beans. Autumn sowing: Field peas, vetches, clovers.

Moderately Dry Climates.—Autumn sowing: Field peas, vetches, clovers.

Cool Climates.—Late spring sowing: Soy beans. Autumn, spring, or summer sowing: Field peas, vetches, clovers.

Only leguminous crops are included in the above in view of the superiority of the legumes for green manuring generally, but in some districts fodder crops which are non-legumes are sometimes grown for feed, and a little aftergrowth is sometimes allowed for ploughing in. This practice has some benefit in improving the tilth of the soil, but is not as good as the growing of legumes for increasing the organic matter and nitrogen in the soil. These crops are winter growing—rye, barley, oats, wheat, rape, mustard, &c.

Manuring of Orchards.

Interesting reference to the subject of orchard manuring is made by officers of the Fruit Branch of the New South Wales Department of Agriculture in the current "Agricultural Gazette."

That it pays to manure citrus trees, say the writers, is universally recognised in this State. On rich deep soil it may not be necessary for the first few years after planting, but later, when the trees have borne a few heavy crops, fertilisers are necessary to obtain maximum returns.

With deciduous trees generally, and with apples and pears especially, there is not nearly the same certainty of manuring paying on all classes of soil. On our very poor, light, sandstone soils the manuring of even young apple trees is necessary to obtain sufficient growth to build up a tree of reasonable size, and later to maintain sufficient vigour in the tree when it is cropping. Undoubtedly in these cases stable manure gives the most satisfactory results. An instance is also known where old apple trees on rich deep soil were restored to vigour and profitable cropping by heavy applications of stable manure. It seems feasible that in such cases the results obtained are to some extent indirect, in that the stable manure has improved the condition for soil bacteria, and has also improved the capacity of the soil for retaining moisture. At the departmental orchards at Bathurst and Glen Innes, the first on a granite country and the latter on a heavy basalt soil, experiments in manuring of apples have completely failed to show any result. At the latter place the experiment is being continued.

It is interesting to note that similar results have been observed in the United States. Bulletin No. 516, published by the New York Agricultural Experiment Station, under the title of "Twenty-five Years of Fertilisers in a New York Apple Orchard," in giving results over the period mentioned under a system of clean cultivation, and non-leguminous cover cropping, states that "the application of fertilisers has resulted in no consistent differences either in total yield of fruit, size, colour, date of maturity, flavour, texture, or keeping quality." Besides dealing with the results from the twenty-five years' experiments, a summary of reports from other States regarding fertiliser applications in apple orchards is given in the Bulletin, which concludes the matter as affecting apples thus:—

"In general it can be said from these results reported from different sections of the country, contradictory as some of them may seem, that fertilisers are, in the main, held to be of value on thin or worn-out land, or in orchards which are making weak growth. At the same time well-cared-for orchards on good land, under proper conditions of clean cultivation and cover cropping, show little favourable response to fertiliser applications.

"If sod orchards were to be considered in this connection, it would be apparent at once that there is hardly a single exception to the general rule that sod orchards respond markedly to nitrogenous fertilisers."

Mouse Infested Buildings—Fumigation.

Replying to a recent inquiry as to whether fumigation was advocated as a means of ridding of mice a concrete store containing maize and chaff, the Entomologist of the Department of Agriculture of New South Wales stated that the method could be recommended as effective. Care must be taken, however, to make the store reasonably gas-tight by plugging up or pasting slips of paper over all windows and cracks and finally sealing the door in a similar manner. Either of the following methods could be advised:—

Fumigation with Carbon Bisulphide.—This should be used at the rate of 10 lb. per 1,000 cubic ft. of space. The carbon bisulphide is simply placed in saucers or other shallow receptacles, preferably near the ceiling, and the door closed and sealed as described. The building should be allowed to remain closed for twenty-four hours.

The chief disadvantage of carbon bisulhpide is that it is highly inflammable, and no light of any sort (neither pipes or cigarettes) should on any account be allowed in the vicinity during the process of fumigation.

Fumigation with Hydrocyanic Acid.—This is a very satisfactory fumigant for work of this kind, but the gas itself and the potassium cyanide solid from which it is generated are extremely fatal to all life, including that of man, and great care must be exercised in handling it. On no account must the building treated be entered during the process of fumigation or until it has been properly aired after fumigation is completed. Arrangements should be made for opening the building from the outside after fumigating, and nobody should be allowed to go near it until all the gas has been dispersed. The gas is generated by the inter-action of potassium or sodium cyanide and sulphuric acid, 1 oz. of potassium cyanide and 1 fluid oz. of sulphuric acid being used to each 100 cubic ft. of space. The process is as follows:—

Divide the cyanide into two or more parts (according to the quantity of it to be used) and place in brown paper bags tied with string. Divide the acid in the same way, and then mix each separate lot of acid with three times the quantity of water; thus, 1 oz. of sulphuric acid would be mixed with 3 fluid oz. of water. In mixing, pour the acid gradually and slowly into the water, not the water into the acid. The acid and water can be placed in kerosene tins, pitched or paraffined inside, or other receptacles, such as earthenware pots if available. The bags containing cyanide are then placed in the acid, commencing with the tin farthest away from the door. Immediately this is done, leave the building, and carefully seal the door to prevent any fumes from getting out.

Notices should be placed in conspicuous places on the outside of the building as to the dangerous nature of the fumigant inside. The period of fumigation should be from twelve to twenty-four hours, the charge being placed in the building late in the afternoon and the latter opened up the following morning. In opening up the building, the operator is especially warned not to enter it or to breathe any of the gas; doors, windows, or ventilators should have been left in such a manner that they can be easily opened from the outside, and the fresh air allowed to enter for several hours before any person has access.

Meat Meal for Poultry—Southern Feeding Experiments.

At the conference of poultry farmers held at Hawkesbury Agricultural College in July last year it was announced that the next set of feeding experiments to be carried out there would be on ratios, and that these would be commenced in the spring of that year. In accordance with this announcement 160 pullets were penned, divided into four lots of forty each, which were again subdivided into twenty each, two twenties being regarded as one unit for the purpose of the experiment. Since the ratio fed would depend upon the quantity of meat meal or concentrates used in connection with the other constituent articles of the morning mash, it was decided that it would simplify the experiment if it was arranged in terms of the quantities of meat meal used daily for the different lots.

The following was the morning mash fed to each section, in conjunction with a grain ration of two-thirds wheat and one-third maize for the evening meal:—

Pens 1 and 2.—Pollard, 66⅔ per cent.; bran, 33⅓ per cent.; meat meal, nil.

Pens 3 and 4.—Pollard, 65 per cent.; bran, 32½ per cent.; meat meal, 2½ per cent.

Pens 5 and 6.—Pollard, 63⅓ per cent.; bran, 31⅔ per cent.; meat meal, 5 per cent.

Pens 7 and 8.—Pollard, 61⅔ per cent.; bran, nearly 31 per cent.; meat meal, 7½ per cent.

The experiment was conducted over the flush period of laying—September to March inclusive—so that it has a direct bearing and value in connection with the question that was being debated at the time—the necessity of feeding meat meal or concentrates during the summer months.

The total yields per lot of forty pullets for the period and the average number of eggs per hen were as follows:—

Meat meal.	Eggs.	Eggs.
None	3,643 ..	91
2½ per cent.	3,686 ..	92
5 per cent.	4,265 ..	106.6
7½ per cent.	4,145 ..	103.6

The table shows that as between the group fed on 2½ per cent. meat meal and none at all there is a difference of 43 eggs in favour of the former, but as between the group fed without meat meal and that receiving 5 per cent. there is a difference of 622 eggs, or almost 52 dozen eggs in favour of feeding meat meal on that basis. The lots fed 7½ per cent. meat meal actually gave 120 eggs less than the 5 per cent. group.

A close observation was kept as to the condition of the birds during the experiment, but it was not until February that there was any noticeable disparity between the various groups. In that month the no-meal and the 2½ per cent. meat meal groups were seen to be falling off in condition, compared with the two groups receiving 5 and 7½ per cent. meat meal respectively. During the whole of March there was a marked difference in the health and condition of the two latter groups as compared with the two former, in so much that they were standing the strain of the moult much better. In the no-meal section, in particular, there were distinct signs of fag.

A calculation shows that the forty birds in the 5 per cent. meat meal section consumed meat meal to the value of 9s., but they produced two short of 52 dozen more eggs than the no-meat group, the value of which was £3 16s. 3d. The profit on meat feeding on the 5 per cent. basis was thus £3 7s. 3d. This, in conjunction with the better condition of the birds at the conclusion of the test, shows the value of meat feeding over no-meat feeding to be of considerable importance. M.I.B. meat meal was used in the test.

This seven months' experiment having been carired out over the warm part of the year, and the results being so remarkable, it was decided to carry out another test over the full twelve months. From this experiment, which commenced on 1st May, it is expected that valuable data will be obtained on points such as egg production, behaviour of the birds in respect of moulting, &c.

What the Farmer Owes to the Scientist.

One often hears from a farmer that such and such an investigation is not practical, that it will not lead to useful results, that it is a waste of time and money. Sir Robert Greig points out in the "Scottish Journal of Agriculture" that this is a natural but a short-sighted view. It is natural because a farmer, who makes his living by applying science to his industry, wants to see how he can make an immediate increase of profit or avoid a loss. It is short-sighted because all applied science is the outcome of pure research.

If all scientific men were to devote themselves to the application of the results of research, and to ignore pure research—*i.e.*, research without a practical object—the increase of knowledge would immediately be curtailed, and applied science would suffer accordingly. It is easy to cite examples of the practical benefits resulting from pure science. Researches upon the comparatively unimportant metal, selenium, have shown the probability that through its reaction to light rays the blind will in future be able to read by sound a book in ordinary type, instead of being compelled as now to read clumsy and expensive embossed type by touch. Yet it is probable that nothing was further from the mind of the researcher than that this extraordinary benefit to the afflicted would come out of his research. In Canada competent authorities estimate that hundreds of millions of dollars have been added to the wealth of the world by the introduction of Marquis wheat. It may be said that Marquis wheat was the product of an agricultural experiment station, and so it was; but it was the fundamental knowledge of pure science, the science of botany, which enabled the investigator to produce Marquis.

It is true that the gains from research for its own sake are more numerous and spectacular in public health and in naval and military science than in agriculture. It is also true that some of the discoveries which have benefited agriculture have been due to empirical experiments, such as the use of basic slag on suitable land or the inclusion of wild white clover in grass-seed mixtures. But this is no argument for the neglect of pure science; rather it is an encouragement to attack the fundamental principles which lie at the roots of our farming methods, and without regard to immediate results, to believe that at any moment a great discovery may be made.

Let not the farmer regard too lightly or contemptuously the man of research. It may be that some obscure investigator, after years of apparent failure, will supply the piece that enables the scientist in Vienna or California to complete the pattern which as a whole will shake the world with a new idea. It is true at all events that in different parts of the world there are men working at questions of heredity and sex determination on snails or frogs or monkeys with no thought of the stockowner's problems, nor any interest in them, but building up such a body of knowledge that one day the breeder may breed colts or fillies, bulls or heifers, just as he may determine.

A little consideration will show that our present research institutions are based upon, and could not exist without, the foundation of pure science. An investigation of the mineral requirements in the food of animals could not be undertaken if the pure chemist had not long ago, and without any regard for results, discovered the inorganic composition of the earth and the actions and reactions of its elements. But his knowledge would have been useless at this stage if the physiologist had not demonstrated the circulation of the blood and the processes of digestion and respiration. It is only in the light of such knowledge that it is worth while to ask such a question as what foods and combinations of food will produce the most rapid and healthy growth in an animal.

Without the physicist the experiments which are being carried out to-day on the effects of light upon growth would be impossible, and the hope now held out that the rearrangement of buildings and the judicious use of artificial light will add to the health and productivity of domestic animals would be unfounded.

The classification of soils into their superficial chemical and physical types is the result, within the last century only, of the work of the geologist, the chemist, and the physicist. A soil survey for the information of the farmer cannot be undertaken without a knowledge of, and a reference to, the discoveries of men who had no practical end in view, but only the craving to know.

Many of the new varieties of our farm plants are due not to agricultural experts but to Mendel, a priest who occupied his leisure by growing peas; De Vries, a professor of botany, who experimented with marigolds and primroses; and Nilsson, a botanist who knew nothing of farming. These men blazed the trail, and our plant-breeding stations, from which, especially in Canada and Australia, such marvellous economic results have been reaped, are the outcome of pure research.

Levy on Sugar-cane Growers—Farleigh, Cattle Creek, and Pleystowe Mills.

Additional Primary Producers' Levy Regulations for 1925 have been issued, empowering, on conditions mentioned below, the Mackay District Council to make a levy on sugar-cane growers in localities and at rates as follows:—

(*a*) Lands situated on the north side of the Pioneer River and assigned to the Farleigh Sugar Mill—2d. per ton of sugar-cane delivered to Farleigh Mill.

(*b*) Lands assigned to the Cattle Creek Sugar Mill—2d. per ton of sugar-cane delivered to Cattle Creek Mill.

(*c*) Lands assigned to Pleystowe Sugar Mill—1½d. per ton of sugar-cane delivered to Pleystowe Mill.

Such levies to apply to the period 1st June, 1925, to 28th February, 1926.

The above levies will be made, however, only on the following conditions:—

If at least 100 sugar-cane growers in any of the localities abovementioned, on or before the 24th August, 1925, make in writing to the Minister a request for a poll on the question of the levy proposed to be made, a poll of all growers concerned shall be held, and if the majority of votes is against the making of the levy the levy shall not be made.

The amount of every such levy shall be deducted by the manager of the mill concerned from the cane payments due by each mill to sugar-cane growers concerned, and shall be paid by him to the Mackay District Council for utilisation for the purposes of the Check Weighmen's Association of such mill.

A penalty of £5 is provided for any breach of these Regulations.

Feeding the Dairy-Bred Calf.

While good breeding is essential to success in stock-raising, the best of breeding may become of little value if the young animals are not properly raised. This is particularly true of the dairy-bred calf. The young of practically all other classes of stock are reared by their dams in the natural way, and so long as the dam is well fed and proper housing is given, the young are assured of a good start in life. Not so with the dairy calf. In the majority of cases, and certainly in all cases where economy is any consideration, the calf is taken from its dam when a few hours, or days, old and reared by hand. The efficiency of the method of hand-feeding followed has much to do with the ultimate size, strength, and usefulness of the animal.

At the Central Experimental Farm, Ottawa, a fairly successful system of calf feeding has been developed, as a walk through the calf barn at any season, but particularly at this season of the year, will demonstrate. Moreover, the system followed is not one that is so intricate and so costly that the average farmer cannot follow it.

For the sake of brevity, it is outlined in the following table:—

DAILY RATIONS IN CALF FEEDING.

Age of Calf in Weeks.	Whole Milk.	Skim Milk.	Fat Substitute in Skim Milk.	Dry Meal.
	lb.	lb.	lb.	lb.
0– 2	8—12	..	..	..
2– 4	10—12	..	..	..
4– 6	7	7	0—$\frac{1}{16}$	0—$\frac{1}{4}$
6– 8	..	14	$\frac{1}{16}$—$\frac{1}{4}$	$\frac{1}{4}$—$\frac{1}{2}$
8–12	..	14	$\frac{1}{4}$—$\frac{1}{2}$	$\frac{1}{2}$—1
12–16	..	14	$\frac{1}{2}$—1	1—1$\frac{1}{2}$
16–20	..	14—12	1	1$\frac{1}{2}$—2
20–24	..	12—0	1—0	3

The above table outlines the system followed. A little amplification, however, will not be amiss. In the first place, if the calf is not left with the cow a day or more, so that it may get a proper feed of the first milk or colostrum, nature's bowel regulator, then care is taken to see that it gets a feed or two of this milk by hand. It is then continued on its dam's milk as long as possible. If for any reason its dam's milk is not available, then milk from another comparatively fresh cow is used. Care is taken to avoid overfeeding; small quantities being given three times a day at start rather than overloading the calf's stomach at greater intervals.

All changes are made gradually, reducing rather than increasing the amount given, while a change is being effected.

The temperature and freshness of the milk fed and cleanliness of the pails used are extremely important factors in successful calf feeding. Milk should be as near blood heat as possible and all pails should be scrubbed out after each feeding and not be left as a feeding place for flies.

As regards a fat substitute to be fed with the skim milk, there are several commercial calf meals on the market which have been tried out with fair success in most cases. If used, the manufacturers' directions for feeding should be followed. It will usually be found, however, that the commercial calf meals are unnecessarily expensive when an equally satisfactory calf meal can be mixed up at home at much less cost.

The home-mixed fat substitute used at the Central Experimental Farm is finely ground oats 2 parts, corn meal 2 parts, and ground flax seed 1 part, plus one-half per cent. salt and 1 per cent. bone meal. Where corn is difficult or impossible to obtain, results practically equal may be obtained if the amount of corn in the ration is reduced and more oats, preferably with hulls sifted out, is used in the mixture in its place, as corn is a fattening rather than a growing food. This is particularly true where there is any tendency to beefiness in the calves being fed. There is no

substitute for the ground flaxseed, but where it cannot possibly be obtained, 2 parts ground oil cake may be used to take its place.

This mixture is fed by putting the necessary amount, for a day's feeding for a lot of calves, in a pail and pouring scalding water over it, then mixing it up thoroughly. This is done in the morning and the mixture is fed that night and next morning in the milk.

The calves are started on the dry meal ration as soon as they will start to eat it. This consists of bran 3 parts, oats 2 parts, and oil cake meal 1 part. The only other feed they have is good alfalfa or clover hay, of which they get all they can eat.

At five months of age, the skim milk and fat substitute is removed from the ration, though it might well be continued if skim milk were plentiful. At this time the dry grain ration is increased and ensilage is given in small quantities. The dry grain ration is kept up until the animal is a year old, by which time it is so well developed that it will go on and do well thereafter on good pasture or silage, clover hay, and straw. The above outline of Central Experimental Farm methods is for fall and winter calves. In the case of summer calves, they are kept indoors until they are three or four months of age and then turned out at night time only in hot weather, and in day time only later in the season.

Where skim milk is lacking entirely, whole milk should be fed for a longer period—*i.e.*, at least eight weeks—gradually decreasing the amount fed and replacing with water, at the same time increasing the amount of calf meal, giving even more than the maximum outlined in the foregoing table. In such cases, the percentage of bone meal in the calf meal might well be increased to 3 per cent. to make up for the loss of mineral matter through not receiving skim milk.—Geo. W. Muir, Chief Assistant, Animal Husbandry Div., Canada, in "Seasonable Hints."

Principles of Hay-Making.

The aim of the farmer in this matter is to obtain for the feeding of his stock the largest weight per acre of palatable nutritious dry matter; to this end the crop must be cut when its principal components (grasses or clovers) have arrived at such a stage that the maximum yield or weight of hay per acre will be attained without material impairment in composition or digestibility having taken place. If the crop is cut too early the maximum weight of hay will not be obtained; if on the other hand it is left uncut until the final stages of ripening have set in, the nutritive value of the resultant hay will be distinctly lowered. This latter is by far the more serious fault, for as the plant ripens it loses rapidly in the most of its valuable nutrients, viz., protein, and, in digestibility, due to the woody character of the crop becoming more pronounced. For example, taking the case of timothy we have the following data:—

Timothy Hay (15 per cent. water).

Stage of Growth.	Protein.	Fibre.	Per cent. of Dry Matter Digestible.
	Per cent.	Per cent.	
Seeds formed	14·27	24·16	59
Seeds, fully ripe	6·98	25·95	52

These figures clearly show the great loss in protein, the increase in woody fibre, and the lowering of the digestibility of the hay which result from allowing the crop to become ripe before cutting. We therefore strongly counsel beginning the haying operations at or shortly after the flowering period, so that cutting may be completed before the seed is fully ripe.

In curing the grass to hay, rough handling and frequent manipulation should, as far as possible, be avoided, since such lead to loss of the finer and more nutritious portions—leaves and small stems.

The best cured hay results from a fairly rapid drying; though sunshine is the chief contributor, wind is a factor of no mean importance. If the day is sunny and breezy curing in the windrow or swath may be sufficiently thorough to reduce the moisture content to a safe limit and at the same time yield a fragrant hay with much of its original green colour.

Of course, hay which is perceptibly moist or damp to the touch—owing to insufficient drying or rainy weather—should not be stacked or put in the mow, since such will readily heat. Damp hay is liable to spontaneous combustion, and no doubt has been the cause of the destruction by fire of many barns with their contents.—Frank T. Shutt, Dominion Chemist, in "Seasonable Hints" (Canada).

Pedigree Breeding and Progeny Testing of Poultry.

Practically all pedigree work in poultry-keeping hinges on the trapnest. It is possible to get good results by keeping the hens in single pens, as is done in Australia and New Zealand, but the cost of housing makes the trapnest more practical in this country.

By marking each egg as it is taken from the trapnest with the number of the hen which laid it, these can be hatched separately. This can be done either under hens, by setting only the eggs from one dam under each hen, or in incubators. In the latter the eggs are handled in the ordinary way until the eighteenth day, when they are separated and each hen's eggs are put in wire containers. These can be bought or made at home—corn poppers are frequently used—or baskets can be made with mosquito netting or more open wire, about 4 in. high and of a size to suit the number of eggs being hatched. In all cases the baskets should not be filled too full, as the chicks when hatched and the empty shells take more room than the eggs. Pedigree hatching takes more incubator capacity than when the eggs are hatched in the ordinary way.

When the chicks are taken from the incubator each one is marked with a numbered band and a record kept of its parentage. These bands are usually wrapped on the leg and left there until the chick is about three weeks old, when they are transferred to the wing, but some breeders use a very small band and insert them in the wing at a day old. With this information the breeder gets the pedigree of these birds, and each year of this work gives him a more extended pedigree for his cockerels and pullets.

Pedigree hatching is being done on such an extensive scale to-day that no poultry-keeper who is anxious to improve his stock should use a male in his pens that is not pedigreed. If he is not trapnesting himself he can avail himself of the other men's work by buying a pedigreed cockerel. Selection by external characteristics is a very valuable help in selecting females, but considering how much is involved and how much the production of a flock might be reduced by using a son of a poor producer, a pedigreed cockerel is a sound investment.

Pedigree work can be carried a step further by the breeder who is trapnesting, and it is a long step too, but one which is neglected by many—this is progeny testing, particularly as regards the males. How many times has a breeder realised what wonderful pullets a mating has given him only after the male at the head of the pen has been killed or disposed of. "Swat the rooster" is a good slogan, where no intelligent breeding work is being done, but is responsible for the loss of some very valuable birds. By keeping over every male which has given good hatching results, until such time as his daughters have been tested out for vitality, production, size of egg, &c., it may be possible the next spring to mate up pens headed by males which have proved their ability to throw satisfactory producers. Some money may be wasted in keeping over birds for nearly a year only to be slaughtered in the end, but if only one good bird is discovered in this way it will more than offset that loss.

Tabulate all pullets from one hen, then all those from the next hen in the same pen, and so on until the progeny of that pen is all entered. Mark in the egg production of these pullets month by month, the size and quality of the egg, freedom from disqualifications, weight of bird, and any other particulars that will help you in the ideal you are striving for. By comparing and averaging up all the progeny from each sire and dam in this way you can see at once just what these parent birds have done for you, whether to put them in your breeding pens and just what you can expect from them if you do. As the winter months are most important, a good idea of the value of any particular bird can be obtained through its progeny before the next breeding season. The probable value (as breeders) of cockerels can also be arrived at by the performance of their sisters.—H. M. GREENWOOD, Exp. Fm., Agassiz, B.C.

Inexpensive Herd Testing—A Simple Method.

For many years the question of bringing about a universal system of testing dairy herds has agitated the minds of dairymen and the Departments of Agriculture and been keenly discussed at gatherings. No apparent progress of a general character has been made. Herd testing societies now going well are excellent in their way as far as they reach, but how limited they are—only touching a very small percentage of the dairy herds of the States, due to the expense of organising and operation. Everyone agrees that a fairly close knowledge of the milking capacity of each cow in a dairy herd is necessary in order to cull out the worst and bring about general improvement. There are unprofitable cows in every herd which has not been subjected to some system of culling, and these should be discovered so that they may be

fattened for slaughter. So far the main hindrance to the testing of ordinary herds has been the expense of testing the milk samples. That has been the bar to the individual farmers testing their own cows. Although simple to perform, the working of the Babcock test is often regarded as a "fiddling job," which does not appeal to many people, and farmers will not do it in the bunch; but an alternative method which should suit all but those who are actually indolent is here presented. The writer has had some experience in testing and is strongly in favour of complete testing in all its features as practised by the herd testing societies, but as this is at present impracticable for all the herds of the State, a method is submitted that could be put to a great deal of practical use in the meanwhile in culling "wasters" from the herds.

We shall suppose that the average production of our regular dairy herds is about 150 lb. butter fat per year, which would represent 400 gallons of milk at 3.8 per cent. test. The average test of ordinary dairy cows is certainly less than 4 per cent. of butter fat. Experience in testing ordinary herds of cattle show that farmers could not at present afford to cull out cows giving over 200 lb. butter fat in the season, and at 3.8 per cent. test these would be 500-gallon cows. This, therefore, may be safely set as a minimum milk yield for profitable production in the ordinary dairy herd. If they are breeding regularly it is only the extra good cows which will give milk in any quantity over nine consecutive months. The cow which will come in giving 25 lb. milk per day, and holding to that quantity for four months of her flush, does not drop off faster than 10 gallons per month afterwards, will pass the 500-gallon mark in even eight months lactation period. No dairy farmer will say that 2½ gallons milk is too heavy a yield to expect from a fair average cow on ordinary spring pasture; but when this standard is reached it will be found that there are large numbers of cows which fall very far short of this quantity.

It has been found that by weighing the milk from each cow in a herd at both milkings on a regular day in each month an estimate of the whole month's yield can be made, which is accurate enough for farm testing, so the work of checking the yields of the cows throughout the year resolves itself into a very simple matter. With the weight of each bucket marked on it the weighing and recording of each cow's milk is quickly put through, and yet the result will enable the owner to see which of the herd are giving a fair return for the grass they consume in comparison with the rest. If a closer record should be desired let the weighing be done weekly instead of monthly, although the latter period serves the purpose practically.

The outcome of starting on such a system as this is easy to foresee. Once the owner realises the great difference in the production of cows he is very likely to investigate further as to the quality of their milk, and will either get a tester for his own use or move to form an association which will assist to get the work done for him. In most cases where such a start has been made there follows further progress, but, as stated, it has been the expense of the taking of samples and testing them for quality which has held up the whole scheme.

This rudimentary system, if put in force by the farmer, would be making a start at the important and payable object of knowing and getting rid of the duffers in his herd, but his ultimate aim should be to get joined up with a recognised testing association so that his paying cows would have the privilege of receiving a certificate or "diploma" of efficiency.

There are many milk recording societies in England and Scotland working on the gallon yield only, and there is ample evidence in both the Government and district herd testing work done in South Australia to show that very great progress has been made, and following the above system would further assist in the general betterment of our dairy herds.

Agricultural societies might well assist in pushing this proposition. The few district testing associations that have been established in the State to date and the comparatively small number of dairy farmers who are members of those societies is proof that something more simple is required in laying the foundation of dairy cattle improvement. The extreme simplicity of this method of trying out the cows should appeal to everyone who desires to see the State's average dairy production take a definite upward tendency. On the basis stated no 500-gallon cow will be found unprofitable, while a cow will require to be something better than ordinary in test to make a profit if she gives a lower gallon yield. The work of milk recording when once started will quicken interest of the farmer in his herd. It will more especially concentrate interest or attention on the short-term milkers which in instances give a big flush flow, and then dry off quickly; these are often in the majority. Unquestionably a very great amount of good can immediately result from the inauguration of milk recording by the farmers of the State.—J.D. in "The Garden and Field" for June.

Importation of Second-Hand Sacks.

The Minister for Agriculture (Hon. W. Forgan Smith) has announced that he has received advice from the Director-General of Health, Melbourne, to the effect that it has now been decided to permit the importation into Australia of second-hand jute bags from Great Britain. The prohibition against the bringing into the Commonwealth of second-hand jute bags from the United States of America or any other country in which Foot and Mouth Disease is known to exist still remains in force.

Spraying Weeds on a Banana Plantation.

"My son has a dairy farm on the Richmond River and has put in about 8 acres of bananas in the very rocky high land at the back of the block. They are greatly troubled with weeds, which it is very difficult to deal with by chipping, as they grow in the cracks of the rocks. They have been advised to spray with arsenite of soda or one of the advertised weed-killers, but I am doubtful as to the effect on the bananas. Would you be good enough to give me your opinion?"

The writer of the foregoing was informed that the practice of destroying weeds in canefields by spraying with a solution of sodium arsenite had been successfully used in Hawaii. In one case land was sprayed for five years for weed destruction at the rate of three applications per year, using 5 lb. arsenious acid per acre for each application. The results obtained indicate that no fear need be entertained regarding any detrimental influence on organisms upon which the plants rely for nitrogen, provided proper soil texture is maintained. It was also found that the arsenic practically lost its toxic influence towards plants.

The reply added that if it was intended to attempt weed eradication on a banana plantation the arsenical spray should be applied to the weeds only, care being taken not to spray the banana plants as well. It appeared doubtful, however, whether small amounts of fine spray falling on the stems of adult banana plants would seriously injure them.—A. A. RAMSAY, Chemist, N.S.W. Dept. Agr.

A Cure for the Self-Sucker.

One of the most perplexing problems confronting dairy farmers is the occasional bad habit developed by cows of sucking themselves. Where a large number of dairy calves are raised on skim milk they quite frequently acquire the habit of sucking their stable mates, and often this habit is continued until maturity.

There seems to be no good explanation as to why cows should suck themselves, and it is equally true that in the past there has been no satisfactory method of curing or preventing this bad habit. Various types of muzzles have been suggested, certain types of yokes have been tried, sticks have been attached to halters and passed down between the front legs of the cow and attached to a belt, with the idea of preventing the cow from getting her head back to the udder. Most of these devices have, however, proved ineffective or inhumane, and sooner or later the cow with this habit finds her way to the butcher's shop as the only positive and permanent cure.

Veterinary surgeons in the United States of America have tried an operation which consists of removing a part of the side and end of the tongue, but this has not been very satisfactory.

A simple device in use on the farm of the Georgia State College of Agriculture appears to be 100 per cent. efficient in curing the habit, and it is very inexpensive and simple to use. Take a piece of ordinary ½-in. pipe about 6 in. in length; put a ring in each end like an ordinary bridle bit. Ten or twelve 1-in. holes are then bored through the pipe in every direction. This hollow bit is put into a halter, or device similar to a bridle. It has been found best to use a nose band on the bridle so as to hold the bit securely in place.

In order for the cow to draw milk she puts her tongue around three sides of the teat and presses it against the roof of her mouth. When she sucks she tends to produce a vacuum. With the hollow bit across the tongue, air is admitted from the ends, and it is impossible for her to draw milk, since she cannot form the necessary vacuum. After a few trials the cow soon learns that she cannot suck and soon stops trying. Nor can she suck other cattle.

The cow eats and ruminates normally with the hollow bit in her mouth. However, it is impossible for her to drink unless the water is deep enough for her to submerge the ends of the pipe.—"Live Stock Journal," England, 14th November, 1924.

Dairy Produce Regulations.

Regulation 144 of the Dairy Produce Act has been amended. This Regulation deals with milk supplied to cheese factories. Such milk must be tested by the Babcock or other method approved by the Minister. Payment for all milk received at a cheese factory must be made upon the basis of the grade and the butter fat content thereof. In estimating the weight of milk, the commercial gallon of milk shall be deemed to contain 10 lb. avoirdupois. The following forms have been added to the list of forms provided in connection with the Regulations:—Application for the Renewal of Registration; Certificate of Renewal of Registration; Particulars of Inspection; Monthly Milk Statement.

Cotton Seed.

The Minister for Agriculture and Stock (Hon. W. Forgan Smith) announces that the issue of cotton seed for planting in the coming season is proceeding satisfactorily. The agents for the distribution are the British Australian Cotton Association, Limited, and the seed is being distributed from the three ginneries—Whinstanes, Gladstone, and Rockhampton. Before issue the seed is fumigated in a Simon's heater to ensure protection against Pink Boll Worm. Mr. Forgan Smith adds that it is satisfactory to note that up to date seed for more than 15,000 acres has already been applied for, and with the exception of that required for less than 200 acres it is all Durango, which is a sign that farmers appreciate the value of a high-quality cotton.

Pamphlets for Pig Raisers.

Pamphlets on Pig Raising, listed as under, may be secured gratis on application to the Department of Agriculture and Stock, William street, Brisbane. Application may be made personally or by letter at any time:—

The Dentition of the Pig; Weaning the Pig; Feeding Pigs—Feeding Problems; The Berkshire Breed, Litter Records; Concrete Feeding Floors; Mineral Mixtures for Pigs; Pure Bred v. Mongrel—a Striking Contrast; Diarrhœa or White Scour in Pigs; Paralysis of the Hindquarters in Pigs; Pig Breeding, Root Crops for Pigs; A Peculiar Disease Affecting the Ear of Pigs; Early History of the Pig; Gestation Chart for Pigs; Selecting the Boar—Points Worthy of Note; Farm Bacon Curing; Marketing Pigs in Queensland; *Various Breeds of Pigs; Queensland Hams and Bacon; The Australian Stud Pig Breeders' Society; Maize for Pigs; Pig Clubs for Scholars—School Pig Clubs; *Plan and Detail of Movable Hurdle for Pigs; and several other pamphlets.

*In course of preparation.

Dairying Losses from Underfeeding.

The appended remarks on the subject, extracted from a recent address by the Dairy Expert of the New South Wales Department of Agriculture, are worthy of study by every dairy farmer. Following a review of the past season, and a comparison of the quantity of butter produced with that produced in seasons when feed was less plenteous, the speaker said:—

"The low average production yields of the dairy herds of Australia are not brought about so much by the poor quality of the cattle as by the inadequate food that is given them. . . . Taking the average production capacity of a cow for 365 days in a bad season to be 120 lb. butter, and in a good season to be 230 lb., the difference would be 110 lb. each cow. This at 1s. per lb. would represent £5 10s., or at 1s. 3d. per lb. £6 17s. 6d. Calculating that there are some 700,000 cows in registered dairies, it will be seen that at 1s. per lb. the loss made by the whole of the herds throughout the State owing to the difference of feed between a good and a bad season would amount to £3,850,000. At 1s. 3d. per lb. for butter, this loss would amount to slightly over £4,800,000. This demonstrates what good feeding does to the present class of New South Wales dairy stock, and the average yield put up during the past year shows that our dairy herds compare favourably with those of most other countries *if they are fed.* Taking the difference between the average production in a medium season and in a bad season, giving each cow a full 365-days production period, it would work out at £1 10s. per head with butter at 1s. per lb., or £1 17s. 6d. per head with butter at 1s. 3d. per lb. For the whole of the herds throughout the State, this would mean a loss of £1,000,000 owing to bad feeding conditions when butter is 1s. per lb., or £1,300,000 when butter is 1s. 3d. per lb."

Staff Changes and Appointments.

Mr. F. W. Haynes has been appointed as Inspector, Agricultural Bank, at Atherton.

The Police Magistrate, Charleville, has been appointed Government Representative on the Charleville Dingo Board.

Mr. J. G. Low, Winton, has been appointed a part-time Inspector of Slaughterhouses.

Mr. C. R. W. H. Lloyd, junr., of Rockhampton, and Messrs. G. Brown, H. W. Anning, A. J. Thompson, and R. S. Black, of the Royal Queensland Golf Club, have been appointed Officers under and for the purposes of the Animals and Birds Acts.

Mr. G. M. Watt, of Charters Towers, has been appointed an Honorary Inspector, Diseases in Plants Acts.

Constable J. J. Gallagher, of Turn-off Lagoons, has been appointed an Inspector of Slaughterhouses.

Mr. D. K. Paine, a member of the Brisbane Golf Club, has been appointed an Officer under and for the purposes of the Animals and Birds Acts.

Mr. H. R. Horton, of Eumundi, has been appointed an Honorary Inspector under the Diseases in Plants Acts.

The appointment of Mr. C. R. Toop as part-time Veterinary Officer, Northern District, has been cancelled, and Mr. J. G. Brandsen has been appointed in his stead, with headquarters at Atherton.

The Egg Pool has been extended until the 31st August, 1925, and the present Members of the Board to deal with such Pool will hold office until that date.

The resignation of Mr. I. G. Hamilton as Temporary Plant Breeder, Cotton Section, Department of Agriculture and Stock, has been accepted as from the 10th August, 1925.

Mr. W. H. Austin, State Trade Commissioner, has been appointed Representative of Queensland on the Australian Meat Council.

Messrs. C. G. Young and J. Beck, of Deeford and Stanwell respectively, have been appointed members of the Cotton Advisory Board, *vice* Messrs. C. W. McLean and A. H. Carrington.

Stabilisation of Agricultural Prices.

The British Ministry of Agriculture has issued as the second of its series of reports on economic questions relating to agriculture a report by a committee appointed by the late Minister of Agriculture to consider the problem of the stabilisation of agricultural prices. The subject is one of the highest importance to British agriculturists, and the report which deals with it opens up new fields for thought and inquiry into the complex economic conditions which surround British agriculture. It is to be hoped that persons who are interested in the modern organisation of agriculture will not fail to give these problems their due attention.

First of all, the report analyses the many causes which bring about fluctuations in the prices of agricultural commodities, and the harm which those fluctuations cause, showing in a striking manner that not only in recent years but in earlier periods of agricultural history a sharp or prolonged rise in the purchasing power of money has had serious and sometimes disastrous consequences to agriculture. Generally, it favours a policy of monetary stabilisation on the lines of the financial resolutions of the Genoa Conference held in 1922, and recommends that steps should be taken to put this policy into practice.

The remainder of the report deals with fluctuations in prices due to conditions of supply and demand. It shows how agriculture suffers in a peculiar degree from the fact that demand is relatively steady, while supply, depending as it does on conditions beyond the control of the grower, is liable to vary very widely. A striking example of this and its effects on prices is shown in the case of hops. Potatoes, eggs, fruit, and vegetables, and indeed most other agricultural products, are liable to suffer similar fluctuations in a greater or less degree. The possible remedies are next considered, and attention called to the almost universal movement towards the centralisation of marketing in agriculture, and particularly to the great advances made in this direction in the United States and the Dominions.

The report puts forward the suggestion that what the Americans call "orderly marketing" might, if applied to commodities mainly produced in Britain, be successful in creating a more even flow of agricultural produce to market. As regards marketing foodstuffs which are mainly imported from abroad, the possibilities of establishing a more stable system in regard to them are briefly reviewed and discussed.

The Fruit Industry.

A deputation representative of the Fruit Standing Committee of the Council of Agriculture in the personnel of Messrs. T. M. Ruskin (Chairman), J. A. Grassick, T. W. McEwan, C. Batman, and C. W. Fielding waited on the Minister for Agriculture (Hon. W. Forgan Smith) recently, and urged that the Fruit Branch of the Department of Agriculture be reorganised, and that experts be appointed for the citrus, deciduous, pineapple, and banana sections of the fruit industry. The deputation pointed out that the value of those sections of the fruit industry warranted the appointment of experts who would be able to devote the whole of their time in dealing with the particular problems of the respective sections. This would materially benefit the fruitgrower, and enable him to have the advice of experts in the production of his commodity.

The Minister, in reply to the deputation, expressed himself as being sympathetic to any proposal that had for its object the advancement of agricultural production in the State. He pointed out, however, that in any scheme of reorganisation, it was essential to have co-ordination between the proposed sectional divisions, and he thought that if that co-ordination could be secured, the scheme might be advantageously adopted. He promised to go very fully into the whole matter, and would see whether anything could be done to achieve the objective underlying the deputation's request.

Durango Cotton—Coming Season's Planting.

Questioned on the suggestion that only Durango cotton seed should be issued for planting during the coming season, the Minister for Agriculture (Hon. W. Forgan Smith) has announced that it is the policy of the Government to encourage the planting of better quality cotton, and for this reason he is anxious to see as large an area of Durango planted in the coming season as possible. This variety has given most promising results over large sections of the State, and in those few instances where it is reported to have yielded poorly the cause was apparently due to unfavourable weather conditions rather than to any inherent fault in the seed. Durango is the only pure variety of which the Department has any large quantity of seed yet available, and growers are advised to plant this variety until the departmental officers have had time to breed and propagate sufficient seed of new types and varieties now being tested. Some farmers who have not tried this variety have been somewhat disturbed by one or two current Press reports. They do not realise that Durango is also an Upland cotton and has the merit of being pure, and it produces a longer stapled and much more valuable fibre than the ordinary mixed seed. In view of the fact that prices for the ensuing season are to be based on length of staple as well as on grade, growers will, therefore, find it advisable to consider carefully whether it will not pay them to grow the pure variety instead of the old mixed seed, which bears every sign of rapid deterioration, and which has in fact degenerated greatly, particularly in the last two years.

There will be no compulsion, and growers may choose between Durango and the ordinary mixed seed, and may send in their applications for seed accompanied with a remittance of ½d. per lb. to the Assistant General Manager of the British-Australian Cotton Association, Whinstanes.

In order to safeguard the purity of the Durango seed, the Department is arranging for pure seed areas grown by communities of farmers who have expressed their desire to co-operate.

The Cotton Industry.

The Minister for Agriculture (Hon. W. Forgan Smith) has made available the following particulars concerning the cotton industry. Some time ago the Minister was requested by growers to sanction the decontrol of the industry with a view to arrangements being made with the Commonwealth Government to provide a bounty upon all cotton grown. He agreed to the proposal, but the Commonwealth Government has not made an announcement of its decision in the matter of the payment of a bounty.

As the season is approaching when the preparation of the soil for the forthcoming crop has to be taken in hand by the farmers, it is only reasonable that prospective cotton-growers should be advised as to the position. Accordingly the Minister stated that he desired it to be known that in the event of the Commonwealth Government not being prepared to accept the proposal to provide a bonus for cotton, the State Government was prepared to guarantee a price for the cotton grown in the forthcoming season. The guarantee would be based on the staple length as well as on the grade of the cotton. Full details of the guarantee will be made public as soon as opportunity allows of a consultation with the Commonwealth Government in the matter.

Orange-Sucking Bug—Advice to Citrus Growers.

Citrus growers in all districts where damage has been caused during recent years by orange-sucking bugs are strongly advised not to neglect the winter treatment of these insects, as at the present time they are in a dormant condition and can be easily destroyed, whereas if they become active in spring they are very much more troublesome and difficult to deal with.

There are two kinds of bugs, first the well-known Bronzy Orange Bug, which passes the winter in the form of small, very thin, flat, greenish bugs, which are found on the under side of the leaves and are easily overlooked unless the trees are carefully examined. The remedy is to spray trees on which the bugs are harbouring with a contact spray with an oil emulsion, resin wash, or similar insecticide. This will destroy all the young insects that it touches, and if systematically carried out will effectively rid the tree of the pests.

Probably some of the insects will fall on the ground, and these may be prevented from climbing back again on to the trees by placing a sticky bandage around the trunk so that the insect cannot cross it.

The other sucking bug is known as the Spiny Orange Bug. These insects pass the winter in the adult form and may be seen clustered in masses, varying from a few individuals to hundreds, attached to the smaller twigs usually in the top of the trees. If the trees are carefully examined these insects may be easily detected and caught and destroyed in large numbers. If left they start breeding as soon as warmer weather comes, and the trees are soon covered with a fresh crop of bugs.

If these simple precautions are carried out the damage caused by these pests will be materially decreased.

Warning to Cotton Growers—Fire Risks in Seed Cotton Consignments.

The Department of Agriculture and Stock wish to point out, as a warning to growers of cotton when preparing their seed cotton for despatch to the ginneries, the great danger of fire likely to be caused by leaving foreign substances amongst the seed cotton, such as matches, nails, clothing, stones, &c. The fire that occurred at the Gladstone ginnery on the 17th May last is an instance of what may happen through this extraordinary sort of carelessness. At this fire seven bales of lint cotton were damaged and the whole ginnery was in jeopardy. The following extract from the Police Magistrate's report on his inquiry into the origin of the fire is therefore worthy of careful attention:—

"It is clear that the fire commenced within one of the bales of cotton lint; an inspection of the bale after the fire revealed the fact that the fire had commenced from about the centre of the bale and had burnt its way from the centre to the outside of the bale, and coming into contact then with the air burst into flame, causing the damage previously mentioned.

"No person can be held responsible for the fire, which was not caused by the wilfulness or negligence of any person employed in or about the ginnery or otherwise. In my opinion it was caused by some foreign substance coming into contact with the gin saw, thereby causing a spark which had been pressed into a bale of cotton lint, and has smouldered for a considerable time within that bale, and burned out to the outside of the bale, setting fire to the hessian covering of that bale, the flames then reaching the other bales and setting fire to the building.

"This inquiry has emphasised the necessity of strict precautions being taken to prevent fires in cotton lint, which is highly inflammable, and also of a strict compliance with section 30 of "*The Cotton Industry Act of* 1923." From the evidence of the manager of the ginnery it is a common experience to find matches amongst seed cotton received at the ginnery. Matches may easily escape notice in the cleaner box and be brought into contact with the gin saw, through the feed pipe, and cause a very serious fire. Apart from matches it is evident that other foreign material, such as nails and pieces of iron, clothing, rocks, &c., are sometimes put into bales of seed cotton, and it may not generally be known that these articles when brought into contact with the gin saw are sufficient to cause a spark, which would become pressed into a bale of cotton lint and be the means of starting a serious fire and inconvenience to cotton-growers themselves. Special precautions should be taken to ensure the fact that no foreign substances are placed in bales of seed cotton when being forwarded to a ginnery."

DAMAGE DONE TO COTTON SEED BY PLANT BUGS.

E. BALLARD, B.A.F.E.S., Commonwealth Cotton Entomologist.

The plant bugs dealt with in this article are (1) the Harlequin bug, and (2) and (3) the large and small cotton stainers.

All three of these feed on the seeds in open bolls; the myriads of small cotton stainers and the bright red nymphs of the large stainers must be familiar to every cotton farmer.

The actual amount of stain produced by these insects in open bolls is so small as to be negligible. A previous article dealt with the damage done to green bolls where stain due to fungus diseases follows on the boll being pierced, but in the open boll any staining of the lint from these insects is very small indeed. They may very occasionally get squashed in the process of ginning and then stain the lint, but this in actual fact seldom happens, as by the time the cotton is ginned either all the "stainers" as a rule have left it or are dead and dried up, and, moreover, those which are still alive in the cotton pass through the gin unharmed. A few may be squashed during picking.

The accompanying photographs are taken from a sample of Durango from 1923-24 crop. At the top is a normal seed, and the rows below show quite well the appearance of seeds damaged by sucking insects.

If a normal seed is cut open the two halves appear quite solid and filled with the embryo which will be the future cotton plant. The seed leaves are seen to be spotted (Plate 53, No. 2), and the part which will form the first root (radicle) shows white and is easily distinguished from the rest of the embryo (Plate 53, No. 1).

When a seed has been pierced by either of the three bugs mentioned at the beginning of this article, its appearance differs in one or all of the followings ways:—

The radicle is shrunken and either stained a yellow-brown all over or has a yellow-brown ring round it. Yellow-brown areas may sometimes be seen in other parts of the embryo, more often at the butt of the seed, frequently at the side or in two or three places on the same seed. Sometimes all the seed is discoloured, and again, it may have shrunk to half its normal size.

Rarely the track of the stylets which have pierced it can be made out. This staining and discoloration is due, firstly, to the fact that the seed has been punctured and, secondly, to the action of a fungus and three or four bacteria. The fungus alone is capable of causing damage—the bacteria can only do damage when associated with the fungus. This fungus cannot enter the seed unaided, but only through a wound.

An examination of the photographs will give a better idea than any description of what happens to a seed when infected by this fungus through insect agency.

In Plate 53, No. 1, a normal seed is shown at the top; (1) the radicle (2) the folded cotyledons. The seed at the left-hand top row shows infection of the butt end of the seed (5). The seed marked (3) shows a damaged radicle, as does No. 4, while (6) and (7) are very advanced cases.

In the first photograph (Plate 52) the normal seed—the one at the top—has not come out so well, but the infected ones show cases of slight infection quite plainly. Note the shrinking which has taken place in the seed on the bottom right-hand corner (8). The butt end of the seed is more likely to get infected than the rest of it, as this is the part which is uppermost and upon which an insect would first alight. Seeds infected while in the unopened boll more usually show signs of disease at this spot than at the other end.

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(1) *Tectacoris lineola* F.

(2) *Dysdercus sidæ*, Montr.

(3) *Oxycarænus luctuossis*, Montr.

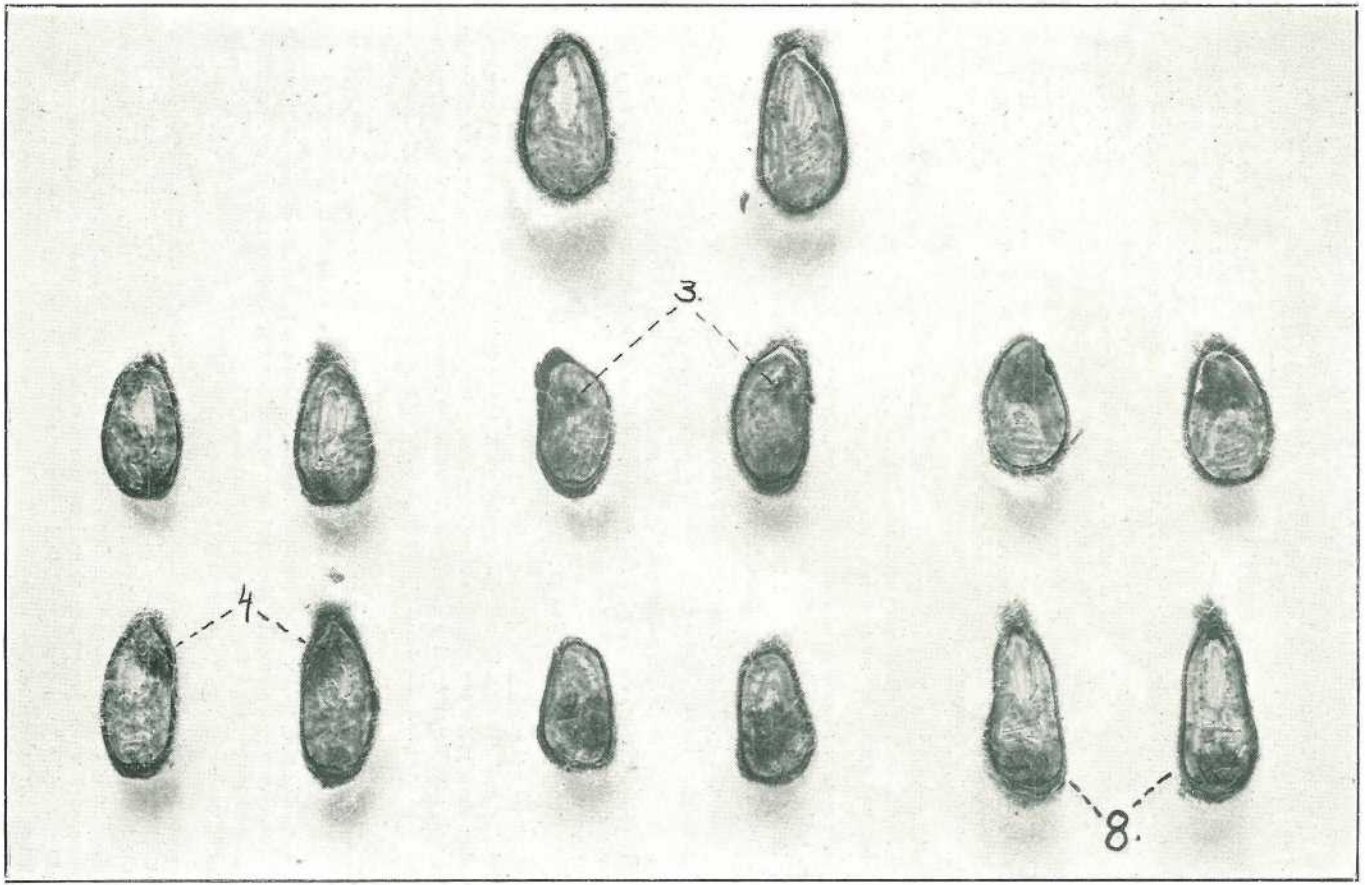

PLATE 52.—DURANGO COTTON SEED AFFECTED WITH FUNGUS DISEASE.
Top—Normal seed. Remainder—Early stages of infection.

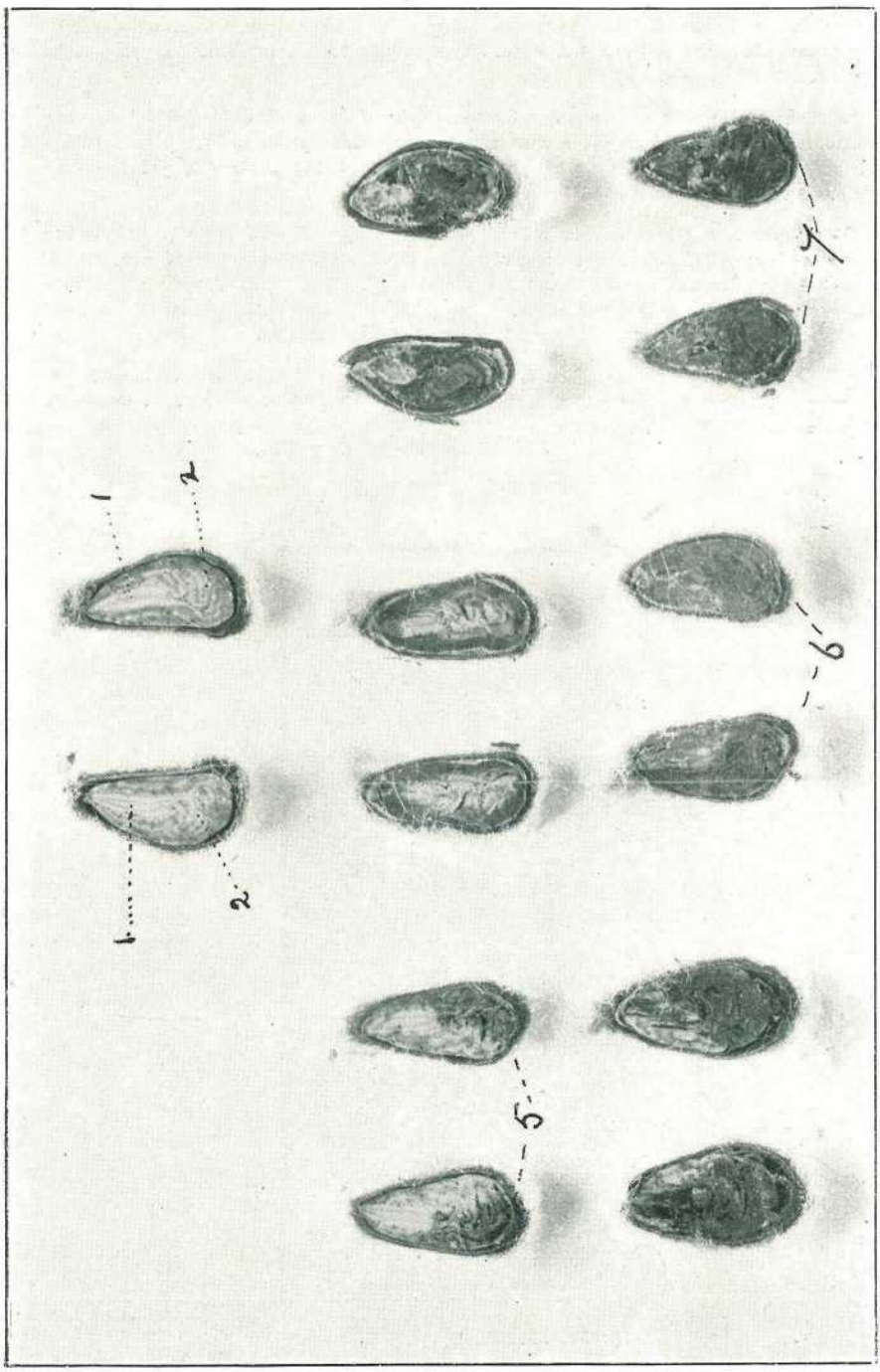

Plate 53.—Durango Cotton Seed affected with Bacterial (?) Disease.
Top—Normal seed, Remainder—Later stages of infection.

When such infected seed is sown, germination will probably take place if only the seed leaves have been infected and the fungus has not spread very far. If the root has been touched, then germination may begin but it will not be completed. Seed which has failed to germinate from this cause if cut open will show a brown slimy mass where the embryo had been. This is due to the combined action of the fungus and the bacteria.

Seed from 1923-24 crop showed 30 per cent. of the seed damaged by sucking insects. It may seem incredible that the young cotton stainers can pierce cotton seed with their delicate stylets or piercing organs of the proboscis, yet the fact remains that they can do so.

The obvious way in which to reduce the percentage of damage is to reduce the number of bugs—but up to the present no very satisfactory method of doing this, adapted to Queensland conditions, has been evolved. Experiments with traps have been conducted this season and gave rather promising results, but much more work must be done in this direction before any success can be claimed.

The Harlequin or Chinese bug can be kept under control by hand picking, but this does not apply to either the large or small cotton strainer—which it would be impossible to collect in this way.

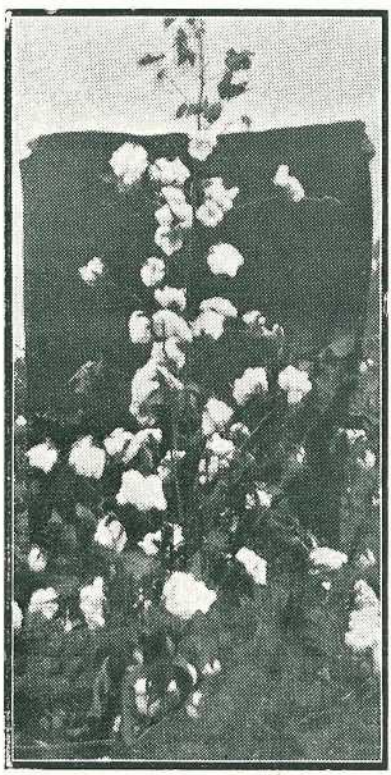

Photo.: N. A. R. Pollock.]

PLATE 54.

COTTON IN NORTH QUEENSLAND—A FAIR AVERAGE SAMPLE OF DURANGO.

Answers to Correspondents.

Mouth Affection in Pig.

W.C. (Kerraba, New South Wales)—

Your pig is apparently suffering from an overgrown tooth or from some abnormal condition of the mouth or throat, as there is no specific disease that would cause the symptoms to which you refer, nor would it appear that this trouble should render the animal unfit for human consumption, provided the pig is otherwise healthy and in suitable condition. It would appear also that as the animal has been such a growthy good doer that there was no serious disease checking his progress, so Mr. Shelton's advice is to use him in whatever way you think best. Nevertheless, after killing the pig, we would be interested to know if you found any abnormal condition, or if any of the internal organs appeared to be affected with disease. You could address your reply to Mr. Shelton direct.

Pig Feeds.

R.A.B. (Tamaree).—The Instructor in Pig Raising, Mr. Shelton, advises:—

The arrowroot plant is similar in type and growth to the ordinary garden variety of canna—in fact, arrowroot (*Canna edulus*) is a member of the same plant family. There is, as far as we are aware, no other dahlia-like plant of commercial value for pig-feeding purposes, and the bulbs of the ordinary garden dahlia should not be used as food for pigs, as they have no special food value and are largely fibrous. Cassava is grown extensively in Java and other countries, but not exclusively for stock food. The farmers in the Baffle Creek district, on the North Coast Line, grow Cassava a good deal, and it is used there as a pig food. They claim that its special local value—viz., that it can be used as a "stand over" crop during any portion of the year, and need not necessarily be dug at any particular time—gives it an added value over sweet potatoes, which in some districts do not carry well in the ground after they ripen. The latter crop is the one we specially recommend for all classes of pigs, but Cassava is well worth trial. Peanuts may, of course, be used as a food for pigs, but care is necessary in feeding "nuts" as they contain a large percentage of oil, and if used too freely will produce a soft oily pork of little or no value for curing or shop purposes. They are, however, a valuable stand-by, and are also worth trial. Seed may be obtained through any of the produce merchants in Gympie. Turnips, particularly swedes, are also of value for pig feeding, but they do not compare favourably with sweet potatoes, and are not as reliable.

Frost Prevention.

Mr. H. A. Tardent, of Wynnum, courteously supplies the following information to an inquirer:—

1. *Tar Drums.*—The best plan is to have a few on light hand sledges which can be moved from place to place, according to whence the morning breeze is blowing. Any ordinary tar will do. Sawdust may be mixed with it and a pine stick stuck in the midst of the drum. The price of tar may be ascertained from firms stocking it.

2. *Chemicals used by military and naval authorities for producing artificial smoke screens.*—It is presumed that information may be obtained direct from the military or naval authorities, as well as the conditions under which it may be supplied for frost prevention.

Great possibilities are anticipated in that direction, if the price of chemicals is not too high.

Smoke Screens.—Any attentive observer will notice that on a frosty morning the smoke has a tendency to descend from hillsides to form a kind of canopy over the low-lying places. It is, therefore, a good plan to burn the smoke-producing materials near the top of the hillside and to try to have as much as possible the smoke screen between the rays of the rising sun and the field to be protected. It is at about sunrise that the vegetable cells are burst and the damage is done, therefore the smoke screen must be ready before daybreak. Experiment for a few cold mornings with some cheap fuel is advised. Dry cane trash recovered with green weeds make excellent—and cheap—smoke-producing material.

Pig Breeding.

C.H. (Murgon)—

As far as our observations and experience go we feel sure that the Duroc Jersey crossed with the Berkshire would give results equally as good as the Tamworth-Berkshire cross. Quite recently the Instructor in Pig Raising, Mr. Shelton, inspected some bacon pigs sired by a Duroc Jersey boar and from a Berkshire sow. These, he says, were very suitable quality pigs of a desirable type, and we propose to illustrate these crosses and to give the weights attained by these pigs in an early issue of this Journal, a publication you should subscribe to, if not already a subscriber. The cost is but 1s. per annum to cover postage, and the Journal is regarded by all readers as a very useful publication, carrying regular articles on pigs as well as much other information of value to farmers.

Mr. Thos. Bellotti, of Ashfield Farm, Merlwood, *viâ* Murgon, has some Duroc Jerseys, as also has Mr. Leo. Delroy, of Merlwood, and Mr. C. M. Shelton, of the same centre. These farmers all speak well of the breed, and our opinion is that they are worth careful study, but further experiments are being arranged, and when the details and photographs of the animals concerned are available, they will also be given publicity in the Journal.

For the time being Mr. Shelton recommends your starting, for preference, with pure-bred or first-cross Tamworth sows and a pure-bred Berkshire boar. We could put you in touch with breeders having stock for sale, and shall be glad to assist you.

The Brisbane Show Stud Pigs Sales will offer opportunity to purchase a number of pure-bred Tamworth sows, while doubtless Mr. George Keating of your own town would be able to offer you suitable cross-bred sows at about bacon values.

Pig Feeding.

G.W.M. (Casino, N.S.W.)—

From the table of rations, &c., given on the closing pages of the pamphlet on "Pig Raising in Queensland," which has been posted to you, you will note various rations in which a variety of food is used; the crop guide is also useful in that it refers to a great variety of crops used as foods for pigs. However, so long as you can grow lucerne, cowpeas, rape, and barley, and crops of a like nature, in addition to having good succulent herbage on which your animals may graze, there should be little or no need to spend very much on the purchase of protein concentrates, such as meat or linseed meal.

Milk is not a necessity on the pig farm, though it is undoubtedly the most valuable and economical food you can use, but for your purpose in feeding breeding sows, and indirectly and mainly through them feeding the young pigs you propose to breed for sale, your proposition is one in which the food given to the brood sow is the principal item to consider.

If the sow is properly fed the young pigs will need but little else than the sow's milk up to the age of six weeks or so, after which barley meal and vegetable matter, plus perhaps 5 per cent., or even up to 10 per cent., of meat meal would be the most suitable foods, and in this case cowpea meal, plus lucerne, could replace the meat meal if that concentrate were not available.

For autumn and winter brood sow feeding there is nothing better than root crops such as sweet potatoes, artichokes, mangel-wurzels, &c., &c. These are bulky, succulent foods much appreciated by sows, and if carefully handled they can be relied upon during the greater part of the winter and spring months. The best winter green food is Dwarf Essex rape and Skinless barley, sown in combination in the early autumn. If the worst comes to the worst you could fall back on chaffed lucerne hay, lucerne meal, or lucerne dust for protein during the driest of winters. These if soaked and fed with the other foods would be of much value. As to which is better, meat meal or linseed meal, our advice is to experiment for yourself with a couple of pens of pigs. Both meals are very useful, but in one sense they are both rather expensive, especially when they can be replaced with cheaper farm-grown protein foods.

Sows certainly benefit by having a large grazing area and good, clean, warm shelter sheds.

The pamphlet dealing with mineral mixtures for pigs gives details as to quantities to use in making up a suitable mixture.

The description of your styes is very interesting. We would be glad to have a good clean, sharp photograph of them.

Paralysis in Hindquarters of Pig.

B.T. (Copeland, New South Wales)—

Your sow appears to be affected with paralysis in the hindquarters. The swollen and tender joints are due in part to the other conditions, and they have no doubt been exaggerated by the variable weather experienced in the South recently. They are indicative of rheumatism and of a weakened constitution. Replace her with a more useful animal, a sow of good quality of the Berkshire or some other breed suited to the special purpose you have in view in the breeding of pigs. It is useless retaining stock for breeding purposes unless they prove entirely satisfactory and grow and develop to the best advantage.

Concrete Wallow for Pigs.

G.E. (Mount Larcom)—

Mr. Shelton, Instructor in Pig Raising, advises that a concrete wallow for pigs need not necessarily be an expensive convenience, nor need it be very large, that is unless a large number of pigs are being handled. If it is built to the following measurements it should suit admirably for about a dozen or more sows:—18 feet long by 6 feet wide and 20 inches deep, allow for 5 feet batten or drop towards the centre at each end and for 8 feet level bottom (20 inches deep) in the wallow. It would be preferable, of course, to use concrete as material, although the writer recently inspected a very satisfactory wallow in the Cinnibar district, which was constructed principally of rejected railway sleepers fitted together as closely as possible, the crevices being filled with a mixture of tar and sand. In this case the overflow from the windmill and tanks was allowed to flow into the wallow, thus ensuring a continuous supply of clean water. Much smaller wallows would, of course, be satisfactory where only two or three sows are being kept; one, say, 6 feet long 3 feet wide and 12 inches deep would at least provide a cool bath for the animals during hot weather.

Ailing Sow.

C.A.McR. (Gladstone)—

Where a pig develops sickness, particularly lung trouble to the extent to which you refer in your letter, it is almost impossible to suggest a reliable form of treatment which would prove beneficial, for once disease passes a certain stage in animals, it is frequently more risky to attempt treatment than to allow the animal to take its chance. Mr. Shelton, Instructor in Pig Raising, does not, in any case, recommend dosing the animal, unless it be by medium of food or water, for drenching an animal suffering from an advanced form of pneumonia is likely to prove disastrous. He cannot, therefore, recommend any other than careful handling, the provision of suitable accommodation, good clean dry bedding, and soft succulent nutritious food, such as a gruel composed of milk and some form of meal (pollard, maize meal, barley meal, wheat meal, &c.). The animals should have good clean drinking water; it is an advantage to add a teaspoonful or two of Sweet Spirits of Nitre to the water for each pig. It is an advantage, too, to allow the pigs a good area of succulent herbage over which to graze, and, if they are inclined to mope about, compel them to take liberal exercise, though not forced and continuous exercise, for this might prove fatal also.

You did not state the breeder's name from whom you purchased your pigs, but it is worth noting that pigs that are crated and despatched per train or steamer during the cooler months of the year frequently develop coughs and colds as a result of their crates being placed in cold draughty situations, the animals are also frequently unprotected during heavy showers of rain.

It is apparent that your pigs are not suffering from neglect on the farm, and your treatment of them to date appears to be satisfactory. Give them plenty of green food and abundant exercise, for this will prove an advantage in more ways than one.

In the event of the sow dying, it is quite possible the vendor would replace her if you informed him of the circumstances surrounding her death.

It is, of course, possible to insure stud animals both on the farm and in transit, and this is a matter well worth consideration, though, of course, the insurance companies will only issue a cover on animals which appear perfectly healthy.

We shall be glad to supply any further information.

Citrus Queries.

"ORCHARDIST" (Woombye)—

Your communication and specimens, addressed to the Fruit Expert, were referred to Mr. Henry Tryon, Government Entomologist and Vegetable Pathologist, who replies:—

As the correspondent must have perceived, the peel of every species of citrus—including lemon and mandarin, as well as "round oranges" generally—has oil-containing cells occurring densely everywhere just beneath the surface.

The oil of these cells readily issues from them on any—even slight—injury that the fruit may experience, whether of the nature of a bruise, skin-abrasion, puncture, or physical (*e.g.*, sunscald), chemical (*e.g.*, caustic spray-fluid) irritant. Moreover, when thus it has become exposed to the air it undergoes chemical change and forms a resin that is very difficult to dissolve; whereas, as an oil, it readily blends—with water even.

On the fruit this oil may spread-out so as to form patches or even occupy the entire surface; or little globules of it—one or more from each oil-cell—may run together to produce similar features.

In these cases the change above remarked—from oil to resin—soon takes place, and so we get a pale greyish-brown surface-film of varying extent, whose attachment to the surface of the peel is so intimate as not to admit of its even being readily scratched away.

Further, should this resinous film have been formed before the fruit is of its full size, it becomes finely cracked and fissured, as this presses it from beneath in the course of ordinary growth. Moreover, it may develop a dark colour, wholly or in part, due to little fungi of a mould-character growing upon it.

The fruit forwarded exhibits this resinous incrustation as occurring under three different circumstances.

(1) The round orange—on which this substance forms three large stains as it were. One can conjecture only how these have originated, but their shape would appear to indicate the former presence of some chemical irritant, such as may have accumulated where these marks occur—lime-sulphur of improper strength-solution, for example—or they may be due to sunscald where similarly water has become condensed. The mere swaying of the fruit against some weak obstacle may again produce skin blemishes, somewhat of the kind shown, but in its case greater irregularity of outline is produced.

(2) In this case indefinite cloud-like patches of greyness of varying density, occur on two opposite faces of the fruit. Here we find the cloud-like patches composed of numerous little rings with fine waved lines radiating from them in a very irregular manner so as to form an intricate picture. Each of these has evidently been formed by the individual oil-cell, under pressure of some kind, giving up its fluid-content, the oil first forming a ring around the lowly raised cell and then flowing outwards from it in a radiating manner. This may have been due to the fruit's exposure to sudden changes of temperature, and to its surface being unable to quickly respond to this influence whilst laden with juice, and so the oil becoming, as it were, squeezed outwards as an exudation from each oil gland.

(3) A round orange conspicuously marked with large, dark cloud-like markings, merging into one another outwardly, and showing in marked contrast to the remaining yellow surface-colour. This peculiar manifestation of oil-resin occurrence is what is known by citriculturists as "Maori," by reason of its characteristic colour. It is occasioned when the fruit is still green and is as yet not full grown. Then it appears as an indistinct greyish hue, that takes the place of the ordinary brightness and pure green of the healthy rind. Moreover, trees exhibiting these early symptoms in their oranges also exhibit a want of brightness in the foliage that one can soon learn to recognise. This is caused by innumerable little forms of life of an elongated form and of a pale sulphur hue of colour. The insect is named *Phytopus oleivorus*, two words signifying "leaf cutter" and "oil feeder." These on their hosts, whilst biting the surface of fruit or leaf, cause a minute quantity of oil to exude on the surface, and hence the delicate fine encrustation that darkens with age. At first the *Phytopus* mites may readily be discerned by aid of a good hand-lens, on viewing with it the surface of the green fruit of a tree that has earlier borne "Maori" fruit; but later in the season, when this fruit is maturing or is even ripe, only small minute white elongated fragments (cast skins) persist to indicate the former presence of the agent—the cause of the "Maori." This trouble that seriously impairs the appearance and sale of the orange crop, may be prevented by the timely use of any substance that contains sulphur—dry or fluid—but preferably the latter in the form of a mist-like spray such as sulphide of potash or sulphide of soda dissolved in a soap-solution.

Farm and Garden Notes for September.

With the advent of spring, cultivating implements play an important part in farming operations.

The increased warmth of soil and atmosphere is conducive to the growth of weeds of all kinds, particularly on those soils that have only received an indifferent preparation.

Potatoes planted during last month will have made their appearance above the soil, and where doubt exists as to their freedom from blight, they should be sprayed with either Burgundy or Bordeaux mixture as soon as the young leaves are clear of the soil surface.

Land which has received careful initial cultivation and has a sufficiency of sub-surface moisture to permit of a satisfactory germination of seeds may be sown with maize, millets, panicum, sorghums, melons, pumpkins, cowpeas, broom millets, and crops of a like nature, provided, of course, that the areas sown are not usually subjected to late frosts.

Rhodes grass may be sown now over well-prepared surfaces of recently cleared forest lands or where early scrub burns have been obtained, and the seed is sown subsequent to showers. More rapid growths, however, are usually obtainable on areas dealt with, say, a month later.

In connection with the sowing of Rhodes grass, farmers are reminded that they have the Pure Seeds Act for their protection, and in Rhodes grass, perhaps more than any other grass, it is necessary that seed of good germination only should be sown. A sample forwarded to the Department of Agriculture will elicit the information free of cost as to whether it is worth sowing or not.

Where the conditions of rainfall are suited to its growth, paspalum may be sown this month.

The spring maize crop, always a risky one, requires to be sown on land which has received good initial cultivation and has reserves of soil moisture. Check-row seeding in this crop is to be recommended, permitting as it does right-angled and diagonal cultivation by horse implements, minimising the amount of weed growth, and at the same time obtaining a soil mulch that will, with the aid of light showers, assist to tide the plant over its critical period of "tasselling."

Although cotton may be sown this month, it usually stands a better chance if deferred until October. The harvesting of cotton during the normal rainy season is, if possible, to be avoided.

The sowing of intermediate crops prior to the preparation of land for lucerne sowing should be carried out in order that early and thorough cultivation can take place pior to the autumn sowing.

The following subsidiary crops may be sown during the month:—Tobacco and peanuts, plant sweet potatoes, arrowroot, sugar-cane, and cow cane (preferably the 90-stalked variety), and in those districts suited to their production yams and ginger. Plant out coffee.

Kitchen Garden.—Now is the time when the kitchen garden will richly repay all the labour bestowed upon it, for it is the month for sowing many kinds of vegetables. If the soil is not naturally rich, make it so by a liberal application of stable manure and compost. Manure for the garden during summer should be in the liquid form for preference. Failing a sufficient supply of these, artificials may be used with good results. Dig or plough the ground deeply, and afterwards keep the surface in good tilth about the crops. Water early in the morning or late in the evening, and in the latter case, stir the soil early next day to prevent caking. Mulching with straw, leaves, or litter will be of great benefit as the season becomes hotter. It is a good thing to apply a little salt to newly dug beds. What the action of salt is, is not exactly known, but when it is applied as a top dressing it tends to check rank growth. A little is excellent for cabbages, and especially for asparagus, but too much renders the soil sterile, and causes hardpan to form. French or kidney beans may now be sown in all parts of the State. The Lima bean delights in the hottest weather. Sow the dwarf kinds in drills 3 ft. apart and 18 in. between the plants, and the climbing sorts 6 ft. each way. Sow Guada bean, providing a trellis for it to climb on later. Sow cucumbers, melons, marrows, and squash at once. If they are troubled by the red beetle, spray with Paris green or London purple. In cool

districts, peas and even some beetroot may be sown. Set out egg plants in rows 4 ft. apart. Plant out tomatoes 3½ ft. each way, and train them to a single stem, either on stakes, trellis, or wire netting. Plant out rosellas. Sow mustard and cress, spinnach, lettuce, vegetable marrows, custard marrows, parsnips, carrots, chicory, eschalots, cabbage, radishes, kohl-rabi, &c. These will all prove satisfactory, provided the ground is well worked, kept clean, and that water, manure, and, where required, shade are provided.

Orchard Notes for September.

THE COASTAL DISTRICTS.

September is a busy month for the fruitgrowers in the coastal districts of this State, as the returns to be obtained from the orchards, vineyards, and plantations depend very largely on the trees, vines, and other fruits getting a good start now.

In the case of citrus orchards—especially in the Southern half of the State—it is certainly the most important month in the year, as the crop of fruit to be harvested during the following autumn and winter depends not only on the trees blosoming well but, what is of much more importance, that the blossoms mature properly and set a good crop of fruit.

This can only be brought about by keeping the trees healthy and in vigorous growth, as, if the trees are not in this condition, they do not possess the necessary strength to set their fruit, even though they may blosom profusely. The maintenance of the trees in a state of vigorous growth demands—first, that there is an adequate supply of moisture in the soil for the requirements of the tree; and, secondly, that there is an adequate supply of the essential plant-foods available in the soil.

With respect to the supply of moisture in the soil, this can only be secured by deep and systematic cultivation, excepting in seasons of good rainfall or where there is a supply of water for irrigation. As a rule, September is a more or less dry month, and when it is dry there is little chance of securing a good crop of fruit from a neglected orchard.

If the advice that was given in the Notes for August regarding the conservation of moisture in the soil has been carried out, all that is necessary is to keep the soil stirred frequently, so as to prevent the loss of moisture by surface evaporation. If the advice has been ignored, then no time should be lost, but the soil should be brought into a state of good tilth as quickly as possible.

Where there is a supply of water available for irrigation, the trees should receive a thorough soaking if they require it. Don't wait till the trees show signs of distress, but see that they are supplied with an adequate supply of moisture during the flowering and setting periods.

It is probable that one of the chief causes why navel oranges are frequently shy bearers in the coastal districts is that the trees, though they produce a heavy crop of blossoms, are unable to set their fruit, owing to a lack of sufficient moisture in the soil at that time, as during seasons when there is a good rainfall and the trees are in vigorous growth or where they are grown by irrigation, as a rule they bear much better crops. The importance of maintaining a good supply of moisture in the soil is thus recognised in the case of this particular variety of citrus fruit.

When the trees show the want of sufficient plant-food—a condition that is easily known by the colour of the foliage and their weakly growth, the orchard should be manured with a quick-acting, complete manure; such as a mixture of superphosphate, sulphate of ammonia, and sulphate of potash, the plant-foods which are soluble in the water contained in the soil and are thus readily taken up by the feeding roots.

Although the above has been written mainly in respect to citrus orchards, it applies equally well to those in which other fruit trees are grown. Where the land has been prepared for bananas, planting should take place during the month. If the plantation is to be made on old land, then the soil should have been deeply ploughed and subsoiled and brought into a state of perfect tilth prior to planting. It should also receive a good dressing of a complete manure, so as to provide an ample supply of available plant-food. In the case of new land, which has, as a rule, been scrub that has been recently fallen and burnt off, the first operation is to dig the holes for the suckers at about 12 ft. apart each way. Good holes should be dug, and they should be deep enough to permit the top of the bulb or corm of the sucker to be 6 in. below the surface of the ground.

Take great care in the selection of the suckers, and see that they are free from beetle borers or other diseases.

As a precaution it is advisable to cut off all old roots and to dip the corms for two hours in a solution of corrosive sublimate, made by dissolving 1 oz. of this substance in 6 gallons of water.

In old banana plantations keep the ground well worked and free from weeds and remove all superfluous suckers.

Where necessary, manure—using a complete fertiliser rich in potash, nitrogen, and phosphoric acid, such as a mixture of meatworks manure and sulphate of potash, 4 of the former to 1 of the latter.

Pine apples can also be planted now. The ground should be thoroughly prepared —viz., brought into a state of perfect tilth to a depth of at least 1 ft., more if possible—not scratched, as frequently happens; and when the soil requires feeding, it should be manured with a complete manure, which should, however, contain no superphosphate.

Old plantations should be kept in a good state of tilth and be manured with a complete fertiliser in which the phosphoric acid is in the form of bones, basic phosphate, or finely ground phosphatic rock, but on no account as superphosphate.

The pruning of custard apples should be carried out during the month, leaving the work, however, as late in the season as possible, as it is not advisable to encourage an early growth, which often means a production of infertile flowers. If the weather conditions are favourable passion vines can also be pruned now, as if cut back hard they will make new growth that will bear an autumn crop of fruit instead of one ripening during the summer.

Grape vines will require careful attention from the time the buds start, and they should be regularly and systematically sprayed from then till the time the fruit is ready to colour with Bordeaux mixture, in order to prevent loss by downy mildew or anthracnose.

Where leaf-eating beetles, caterpillars, or other insects are present, the trees or plants on which they are feeding should be sprayed with arsenate of lead. All fruit-fly infested fruit must be gathered and destroyed and on no account be allowed to lie about on the ground, as, if the fly is allowed to breed unchecked at this time of the year, there is very little chance of keeping it in check later in the season.

GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

Where not already completed, the winter spraying with lime-sulphur should be finished as early in the month as possible. Black aphis should be fought wherever it makes its appearance by spraying with a tobacco wash, such as black-leaf forty, as if these very destructive insects are kept well in hand the young growth of flowers, leaves, wood, and fruit will have a chance to develop. Woolly aphis should also be systematically fought wherever present, as once the trees are in leaf it is much more difficult to treat.

The working over of undesirable varieties of fruit trees can be continued. The pruning of grape vines should be done during the month, delaying the work as long as it is safe to do so, as the later the vines are pruned the less chance of their young growth being killed by late frosts. Keep the orchards well worked and free from weeds of all kinds, as the latter not only deplete the soil of moisture but also act as a harbour for many serious pests, such as the Rutherglen bug.

Grape vines should be swabbed with the sulphuric acid solution, mentioned in the Notes for August, when the buds begin to swell and just before they burst, as a protection against black spot and downy mildew.

New vineyards can be set out, and, in order to destroy any fungus spores that may be attached to the cuttings, it is a good plan to dip them in Bordeaux mixture before planting. The land for vines should be well and deeply worked, and the cutting should be planted with one eye only out of the ground and one eye at or near the surface of the ground.

In the warmer parts which are suitable for the growth of citrus fruits, the land must be kept well cultivated, and if the trees need irrigating they should be given a good soaking, to be followed by cultivation as soon as the land will carry a horse without packing.

In these parts fruit-fly should be systematically fought, as it will probably make its appearance in late citrus fruits and loquats; and if this crop of flies is destroyed, there will be every chance of the early crops of plums, peaches, and apricots escaping without much loss.

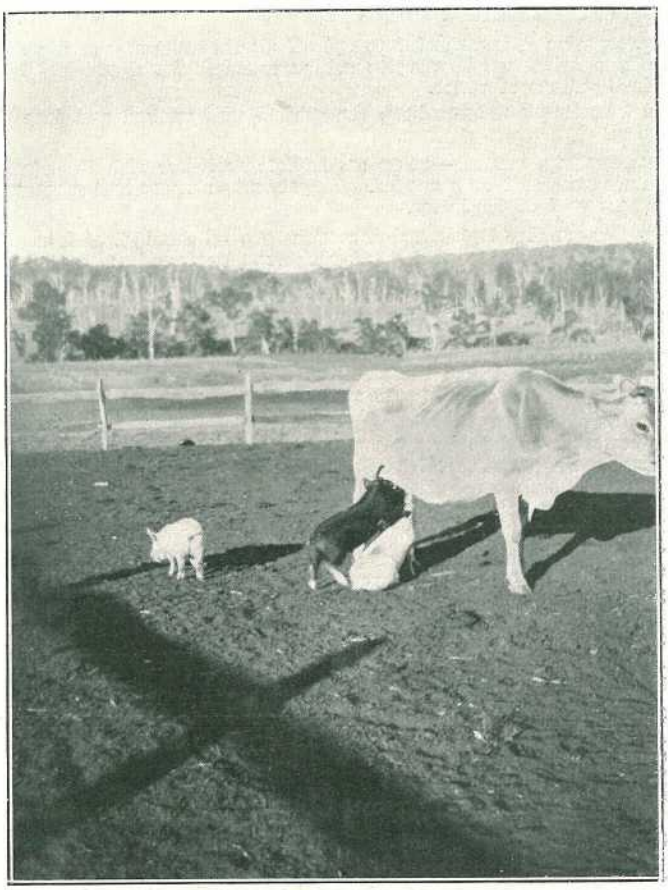

Photo.: Daily Mail.]

PLATE 55.—THE WISE PIGLET NEVER MISSES AN OPPORTUNITY.

A USEFUL FENCE FOR PIG PADDOCKS.

This type of fence, though somewhat expensive in the first instance, is undoubtedly of such solid construction that it will prove satisfactory for at least twenty years. Pig fencing requires to be of a permanent and efficient nature, otherwise a great deal of expense will be incurred in repairing and keeping the fence in order, for pigs are severe on fencing, and if it is not of solid construction they will soon root or force their way through, under, or over. Post, rail, and picket fencing of the type illustrated is recommended particularly for pig yards and small pig runs, as well as for pig paddock purposes generally. The photograph is sufficiently clear to provide all the details necessary as regards construction, though it might be noted that the pickets should be inserted into the ground to the depth of at least 3 inches below the ground level. The height of the fence will depend entirely on local conditions; it should be sufficiently high not only to keep the pigs in but to keep horses and cattle out. The fence needs to be higher if it forms part of the boundary fence of the farm than if it forms part of a subdivision fence inside the ring fence.—E. J. SHELTON, H.D.A., Instructor in Pig Raising.

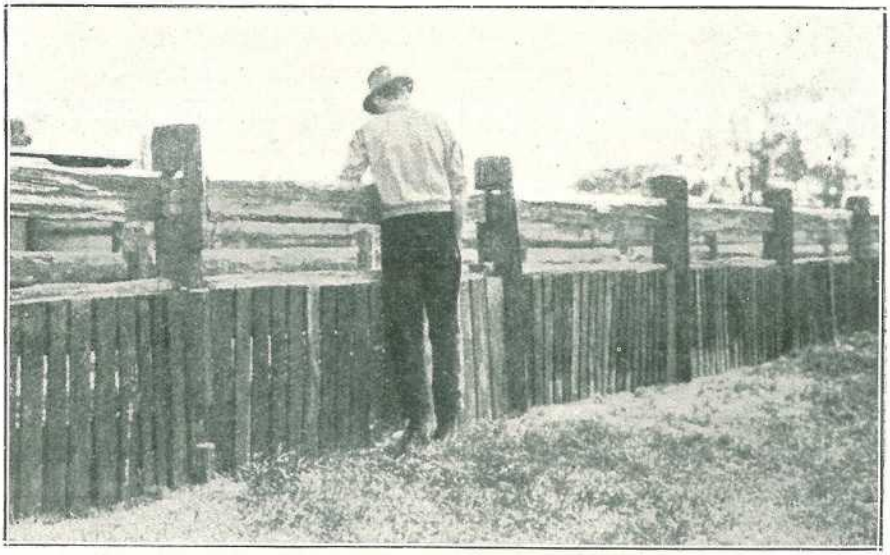

PLATE 56.—A USEFUL TYPE OF FENCE FOR PIG PADDOCK.

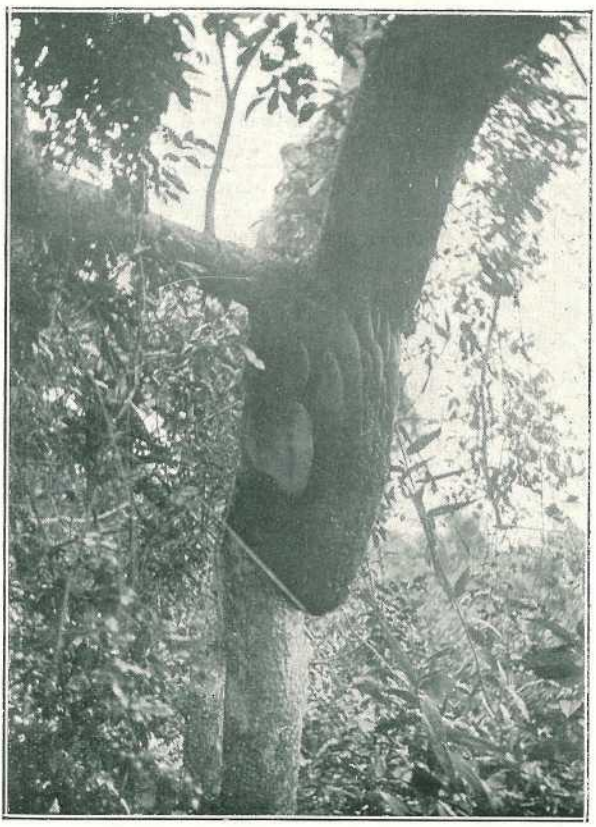

Photo.: N. A. R. Pollock.]

PLATE 57.—A "SUGAR BAG" NEAR COOKTOWN.

In country where hollow trees are scarce, bees sometimes build their honey-comb on a sheltered part of a tree trunk.

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON, F.R.A.S., AND A. K. CHAPMAN.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

1925.	JULY.		AUGUST.		JULY.	AUG.
					MOONRISE.	
Date.	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	p.m.
1	6 43	5·7	6·34	5·22	1·2	1·57
2	6 43	5·7	6·34	5·22	1·42	2 56
3	6 43	5·8	6 33	5 23	2 28	3·59
4	6 43	5·8	6 32	5·23	3·19	5·5
5	6 43	5·9	6·31	5·24	4 15	6 14
6	6·43	5·9	6·31	5·25	5 18	7 22
7	6 43	5·9	6·30	5 25	6 25	8 26
8	6 43	5·10	6·29	5·26	7·32	9 27
9	6·43	5·10	6·29	5·26	8 38	10·26
10	6·44	5·10	6·28	5 27	9·42	11·23
11	6·44	5·11	6·27	5·27	10·42	nil
						a.m.
12	6 43	5·11	6·26	5·28	11·41	12 19
13	6·42	5·12	6·25	5·28	nil	1·14
					a.m.	
14	6 42	5 12	6·24	5·29	12·35	2 6
15	6 42	5·13	6 23	5·29	1·32	2 59
16	6 41	5·14	6·22	5·30	2 26	3 48
17	6 41	5·14	6·21	5·30	3·20	4·35
18	6 41	5·15	6·20	5·31	4·12	5·19
19	6 40	5·15	6·19	5·31	5 3	6·1
20	6·40	5 16	6·18	5 32	5 52	6 39
21	6·40	5·16	6·18	5·32	6 38	7·16
22	6 39	5·17	6·17	5·32	7·21	7·50
23	6·39	5 17	6·16	5 33	8·2	8·26
24	6·39	5·18	6·15	5 33	8·43	9 1
25	6 38	5·18	6·14	5·33	9·15	9 37
26	6 38	5·19	6·13	5·34	9·48	10·16
27	6·37	5·19	6·12	5 34	10 23	10·59
28	6 37	5·20	6·11	5·35	11·0	11 47
						p.m.
29	6·36	5·20	6·10	5·35	11·37	12 38
					p m.	
30	6 36	5·21	6·9	5·36	12·19	1·40
31	6·35	5·21	6·8	5·36	1·5	2·43

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S., add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhere about six hours before the sun sets, and 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 July	○	Full Moon	2 54 p.m.
13 „	☽	Last Quarter	7 34 a.m.
21 „	●	New Moon	7 40 a.m.
29 „	☾	First Quarter	6 23 a.m.

Perigee, 6th July at 12 16 p.m.
Apogee, 20th „ at 12 30 p.m.

On 3rd July at midday the earth will be in the part of its orbit which is at the greatest distance from the sun, 94,360,000 miles. On 4th July at 10.25 p.m. Jupiter will be in conjunction with the moon, that is apparently so close to it as to appear less than four diameters of the moon south of it. Both will be high up in the sky nearly due north. On 10th July at 8 p.m. Jupiter will be directly opposite to the sun, rising soon after the sun sets. On 11th July about half an hour or a little more after sunset, if the western sky is clear, the three planets, Mercury, Venus, and Mars, will be seen apparently very close to one another rather low down in the west, while not far above them the the bright star Regulus of Leo will add to the beauty of the scene. An annular eclipse of the sun will take place on 21st July, but visible only as a partial eclipse throughout the greater part of Queensland. Venus will be occluded by the moon on the 23rd about midday in Northern Queensland, but appearing to be a little above the moon though very near to it in the more southern parts of Queensland. An interesting daylight spectacle will be somewhat marred on this occasion by its nearness to the sun. Mercury will be in conjunction with the moon at 4.50 p.m. on the 2 rd and should be noticeable in the western sky at sunset. On the 28th Mercury will be at its greatest height above the horizon at sunset.

4 Aug.	○	Full Moon	8 59 p.m.
11 „	☽	Last Quarter	7 11 p.m.
19 „	●	New Moon	11 15 p.m.
27 „	☾	First Quarter	2 46 p.m.

Perigee, 4th August at 8 0 a.m.
Apogee, 17th „ at 4 0 a.m.

A partial Eclipse of the Moon will take place on the 4th between the hours of 8.27 p.m. and 11.17 p.m., when the Moon will apparently change from full to a crescent shape at 9.55 p.m., and again become full.

THE PLANETS.

Jupiter will be in conjuction with the Moon on the 3rd. at 3.55 a.m. Venus will be in conjunction with the Moon on the 22nd at 3.46 p.m., when the planet will be about seven times the diameter of the Moon above it. Saturn will be in conjunction with the Moon at 5.46 p.m. on 25th, and will be well seen in the west soon after sunset.