ANNUAL RATES OF SUBSCRIPTION.

Farmers, Graziers, Horticulturists, and members of Agricultural Societies, **Five Shillings,** including postage. Schools of Arts, **One Shilling.** General Public, **Ten shillings,** including postage.

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Event and Comment

Progressive Departmental Policy.

ADDRESSING a recent field-day gathering at Nambour, the Minister for Agriculture and Stock (Hon. Frank W. Bulcock) remarked that the large assemblage of fruitgrowers was impressive evidence of a very keen interest in orchard problems in Queensland. Referring to the series of field demonstrations that had been arranged for the occasion by officers of his Department, the Minister said that it was only by such means and the provision of experimental plots that the application of science to agriculture could be demonstrated in a practical way. What was being done at the present time was of advantage to both the individual and the State generally. The Department of Agriculture had pursued a progressive policy as well as an economic one. The Maroochy district had a fascination for him, the region containing possibilities that were not found in any other part of the State. His officers were zealous and keen and anxious to advance their work in the interests of agriculture in Queensland. The Department formed a triple alliance in which the Minister, the officers, and the producers each played their essential part.

Continuing, the Minister said that new possibilities were being opened up on the economic side of agriculture. The object was to make agriculture a much more agreeable occupation, and to make it as efficient as possible. In every primary industry the scientific aspect was given

greater consideration than ever. The remarkable efficiency of the Queensland sugar industry was an outstanding example of the value of science in primary production.

Supporting Mr. Bulcock's remarks, Mr. H. F. Walker, M.L.A., said that the Department of Agriculture, of which he was a former Minister, was conducted on a high plane of efficiency. He considered that the field days and the demonstrations given on experimental plots were of great benefit to the pineapple or any other industry, and the more the scientific side was encouraged the greater would be the development of all phases of their primary industries.

Mr. F. Nicklin, M.L.A., also spoke in commendatory terms of the work of officers of the Department. Great interest, he said, had been taken in the field demonstrations, from which growers were receiving untold advantages. Much had been achieved by the adoption of scientific methods in the cultivation of the pineapple, and this was all pointing to the importance of producing a better article for canning and the home market.

Dealing with marketing, Mr. Nicklin said the idea was to improve the quality of the pack wherever possible. The Department's efforts along these lines were bearing fruit already. In a marketing policy they needed the growers' wholehearted support, and anything that was done should be for the general advancement of the growers and the industry.

Loyalty to Co-operative Organisations.

IN the course of his address to the fruitgrowers at Nambour, Mr. Bulcock spoke of the necessity of primary producers remaining loyal to their organisations. The responsibility for their success or failure, he said, rested on individual members, and it was the duty of everyone to pull his weight. Any man selling outside his commodity board or outside the Committee of Direction might do quite well for a time, but eventually it tended to break up the scheme and the advantages of stabilised marketing.

Mr. Bulcock added that the pineapple-growers were now required to make important decisions, in the formulation of a scheme in connection with their industry through their sectional group committees and the Committee of Direction. In connection with any decision that the growers themselves might make it would be wise to see that they were wholehearted in any project undertaken, and before they embarked on any scheme in respect to the matter of canned pineapples they should be satisfied it was economically sound. He could assure them that as Minister every consideration would be given to a scheme with which the growers were unanimous. Whatever action was taken to protect economic interests he would be happy to assist as long as it was calculated to help the industry. He, however, urged strongly on the growers to discuss thoroughly and examine any proposition which was put forward, and when they had arrived at a decision to stand loyally by it. If they intended to venture into a new phase of the industry it would be necessary to investigate it from all angles. When they were satisfied that they had arrived at a stage of unanimity they could then approach the Government, which would give effect to it, if found practicable.

Fodder and Water Conservation.

SPEAKING at an annual agricultural show function at Wondai in the course of the month, Mr. Bulcock made an important announcement on the subject of fodder and water conservation. He said, *inter alia:*—

"There is a growing consciousness of the importance of the part agriculture plays in the general scheme of things, and the value of science as the handmaid of agriculture. . . . Industries must be prepared to make contributions towards their own advancement. . . . The problems of agriculture may be divided into three phases—cultivation or production, scientific, and the marketing or economic phase. At one time production was the only problem, markets being automatic. The next phase was the scientific, and until the post-war period the economic and marketing phase had not been considered.

"We talk of progress, but we are only on the fringe of agriculture in Australia. We should make greater effort to prevent loss; our scientific knowledge is not sufficiently applied to agriculture. The recent drought in the coastal and semi-coastal areas of the State resulted in a loss of £5,000,000 to the people of Queensland, and the pastoral areas had previously suffered tremendous losses through drought. I have no time for those who say that such losses are non-preventible.

"We should aim to each year reduce our economic loss. In dairying, among other problems, we have that of the low quality product. The sooner such problems are faced, the greater the results—but there must be the fullest co-operation among all concerned. How can we do it?

"I have on my table probably a hundred schemes for the conservation of water and fodder. I have appointed a committee to investigate and, after they obtain correct answers to a questionnaire, I will convene a conference of all the interests concerned. This is a national matter, and all from the National Government to individual primary producers will need to co-operate; if such is done, a scheme which is worthwhile will be brought about. I will not admit that no one has the capacity to evolve such schemes to release from the major difficulties which beset it, agriculture, which should not be the vassal of other industries.

"Why should it be represented that there is any disparity between the social standing of those engaged in other industries and those engaged in the most skilful occupation of agriculture? Cheap newspapers delight in depicting 'Dad and Dave,' and legislation to eliminate such misrepresentations might even be warranted.

"The time is not far distant when I will be giving very active consideration to the problems of conservation of water and fodder. These coastal and semi-coastal areas must be enabled to produce not only their own fodder requirements, but also those of the western areas. I believe a practical policy can be enunciated. Why should Queensland almost every year purchase large quantities of fodder from the southern States?

"We have the lands with capacity for enormous production of fodder; all we lack is regularity of water supply, and on such regularity depends the advancement of agriculture in Queensland. I desire to bring to fruition schemes for conservation of water and of fodder, and that is also the desire of the Premier. I hope to be able to introduce in next session of Parliament legislation on such lines and calculated to be a material factor in advancing the State's agricultural prosperity."

Seedling Pests of Cotton and Their Control.

W. J. S. SLOAN, B.Sc. Agr., Assistant Entomologist.

SPRING is a critical period for the cotton-grower, as failure to obtain a reasonable stand at this time of the year may greatly prejudice the success of the crop.

In young cotton, insect pests may impede the growth of the plant, produce a malformed bush, or totally destroy the seedlings. If seedling destruction is extensive, partial or complete replanting is then necessary, with a consequent loss of time and money. As some weeks may elapse before suitable rains permit replanting, the cotton may be unable to set an early crop of bolls. An early setting is desirable in order to minimise the adverse effects of possible subsequent unfavourable climatic conditions and further insect outbreaks.

The main pests associated with young cotton include cutworms, false wireworms, aphids, thrips, Jassids, grasshoppers, flea beetles, and corn ear worms. Larvæ of the cotton web-spinner may also cause considerable damage in some of the cotton-growing areas.

Cutworms are cosmopolitan pests which injure many different crops. The cutworm attacking cotton is the larva of a dark-brown moth,* and is a typical greyish-green or greyish-brown caterpillar, which grows up to an inch and a-half in length, and feeds at night both on the leaves and stem of the seedling. Trouble from this pest may be due to a migration from hosts outside the field or from weeds in the field itself.

The false wireworm is the larva of a beetle† which is a third to half an inch in length, is dark-grey in colour, and has longitudinally ribbed wings. The larva is thin, brown, shiny, and hard, and grows to an inch in length. Both adults and young may attack cotton seeds and seedlings. In the latter case, the larvæ attack the soft stem under the ground surface, while the adults injure the seedling by ringbarking it at or just above ground level.

The cotton aphid‡ is a small, soft-bodied insect usually living in colonies on the plant. The cream coloured immature forms are wingless but greenish-black winged adults occur in the colonies and are comparatively numerous during the autumn months. This insect appears on seedlings every season to a greater or lesser extent, and feeds mostly on the lower surface of the leaves. The foliage is distorted, and sometimes the central shoot may be killed, forcing the growth into two or more main branches—an undesirable feature in the cotton plant.

The cotton thrips§ is a small creamy-white insect which causes distortion of the leaves and main shoots. In heavily-infested seedlings the entire terminal bud may frequently be destroyed, and the plant makes no progress beyond the production of two thick seed leaves. Injured leaves usually show a silvered appearance on the under surface. This pest thrives on a variety of weeds—e.g., pigweeds and thistle, commonly found in cotton fields.

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* *Euxoa radians* Guen.
† *Dasus macleayi* Blk.
‡ *Aphis gossypii* Glov.
§ *Thrips tabaci* Lind.

The cotton-leaf hoppers or Jassids* are small, active, fly-like insects. There appear to be two or three species involved, a greenish winged form predominating. Infested plants show malformation of the leaves similar to that caused by the thrips and the cotton aphid. Heavy infestation may kill the foliage and sometimes the entire seedling if the weather is dry and soil moisture is low.

Grasshoppers damaging cotton seedlings belong to several species, and farmers are familiar with their main characteristics. The most troublesome are firstly a brown insect† which grows up to an inch and a-half in length, and secondly a large brown-winged species‡ which attains a length of approximately three inches, and has the immature stages prettily marked with yellow and brown patches. Both these grasshoppers are fond of weed hosts botanically related to cotton. The larger grasshopper is particularly common in softwood scrub areas.

The cotton flea beetles§ are small brown to black insects which derive their name from the nimble way in which they spring off a plant when disturbed. They feed on the web of the leaf, destroy buds, and sometimes chew into leaf petioles and the stem. Like the grasshoppers, they show a strong liking for native host plants which are allied to cotton.

The corn ear worm is the larva of a stout-bodied moth.‖ The moth has a wing expanse of about 1½ inches, the forewings being a reddish-pink, and the hind wings creamy-yellow with broad marginal areas of a smoky colour. When mature, the larva is about 1½ inches long. The colour of the larva varies considerably, shades of red, brown, yellow, and green being found in different individuals. The colours are arranged in stripes along the length of the body, adjacent bands being separated by irregular white lines just above the legs and along the back.

Damage from this pest may occur from migrations off host plants within and without the cotton field. The pest breeds on many plants, including maize, lucerne, pigweeds, bullhead, hogweed, thistles, wild gooseberry, and ragweed. Badly prepared land usually has patches of weeds on which the pest may breed. Cultivation of the cotton after the seedlings are up kills the weeds and leaves the pest no alternative but to attack the cotton.

Cotton paddocks, though themselves free of weeds, frequently suffer severe injury from invading swarms of corn ear worms. In this case the pest has bred up on nearby host plants, and when disturbed for some reason, they migrate rapidly in all directions. Should a cotton field be in the path of migration, the seedlings may be severely injured.

Corn ear worms injure the seedling by defoliating it, injuring the stem to cause a malformal bush, or entirely destroying it.

Unlike the above-mentioned pests which usually occur in some degree each season, the cotton web-spinner¶ is only occasionally destructive. The moth is small, inconspicuous, and brown to fawn in colour. The larva is a light to dark-green coloured caterpillar, which spins a web

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* *Empoasca* spp.
† *Phaulacridium gemini* Sjöst.
‡ *Valanga irregularis* Walk.
§ *Nisotra breweri* Baily, and *N. submetallica* Blk.
‖ *Heliothis obsoleta* Gn.
¶ *Loxostege affinitalis* Led.

profusely to form protecting tunnels. Fully matured, it is about three-quarters of an inch long. The female moth lays her eggs on many types of plants, including Noogoora and Bathurst burrs, certain weeds allied botanically to cotton, roly-poly, and the creeping saltbush. When the larvæ have consumed the readily available food supply, migration takes place. Occasionally cotton fields are close to the breeding centres and become infested by migrant larvæ. Leaves may be skeletonised, terminal buds eaten out, and the seedlings killed. Attacked plants are fouled with frass-cluttered webbing.

Control Measures.

Cotton crops grown in Central Queensland are very prone to corn-ear worm attacks between January and April, as the weather is then very favourable for the rapid multiplication of the pest. As maturing cotton suffers less than younger plants, late-planted crops are invariably more severely attacked. Early planting is therefore desirable, and land should be prepared in good time to enable the farmer to take advantage of any planting rains in September and October, for conditions will usually be suitable then for rapid seed germination and development. Failure to do so considerably increases the danger of crop losses by insect pests.

The over-wintering stages of most insects require an appropriately moist and warm environment before adult emergence is possible. These adults require fresh host plants on which to breed. Even spring rains, which are insufficient to allow planting on prepared land, stimulate the general emergence of the over-wintering insects. These insects will lack suitable hosts, and neither they nor their progeny will survive very long. Hence, though early sowing is generally desirable, it can be assumed that when inadequate rainfall delays planting beyond October, conditions are unsuitable for an early increase in the pest population. Under these special circumstances, late planted crops may escape serious infestation.

Most pests of seedling cotton breed on various weeds, many of which germinate and grow rapidly with the late winter and spring rains. It is therefore essential to keep both fields and headlands clear of weeds for at least a month before planting. Cutworm attacks are particularly common in seedling cotton grown on sandy soils in which this precaution has not been taken. It is a most undesirable practice to plough, harrow, and plant practically in one operation, especially if the land is carrying a growth of weeds. In some years such a procedure may be quite successful, but in ordinary seasons, any cutworms present on the weeds may survive and later attack the cotton seedlings soon after they germinate.

If possible, cotton should not be planted close to weedy fields or paddocks growing maize, lucerne, and tomatoes. Many weeds and the three crops mentioned often carry heavy populations of the corn-ear worm, and lucerne occasionally may have, in addition, larvæ of the cotton web-spinner. Should the pest larvæ migrate from any of these hosts, the nearby cotton may be severely damaged before suitable control measures can be applied.

Old cultivation paddocks should not be abandoned to weeds. The volunteer growth which is liable to breed cotton pests can be suppressed at very little cost by establishing a Rhodes grass pasture.

Higher seed rates than are necessary to produce a normal stand of cotton should be used, for it is easier to thin out excess plants than to replant depleted stands. Losses from false wireworm can usually be avoided in this way, for sufficient plants survive to give a reasonable crop.

For the control of invading swarms of caterpillars, both the molasses-lead arsenate swabbing mixture and the usual cutworm bait are useful.

The swabbing mixture is prepared according to the following formula:—lead arsenate, 1 lb.; molasses, 1 gallon; water, 6 gallons. The lead arsenate and molasses are first thoroughly mixed in separate containers with small quantities of water. They are then added to each other, and the whole made up to 6 gallons, the mixture being thoroughly stirred. The fluid so prepared is flipped on to plants in both the infested rows and a number in front of the swarm with a white-wash brush or a bundle of straw.

Freshly cut weed hosts, such as pigweeds and hogweed, dipped in the swabbing solution and spread as a barrier in front of the invading larval swarm, make an efficient and cheap bait.

The Paris green-bran cutworm bait formula is as follows:—Paris green, 1 lb.; molasses, 2 quarts; bran, 25 lb.; water, 2 to 2½ gallons. The Paris green and bran are thoroughly mixed dry, and the water in which the molasses has been dissolved is added to the mixture to make a friable crumbly mash. This bait is either scattered in front of the caterpillars and around the plants or distributed along the bottom of ploughed furrows separating the crop from the migrating pests.

Where the plants are very small, the use of baits is preferable to the swabbing method, for young plants treated with the swabbing fluid are often badly injured before the larvæ obtain a lethal dose of the poison. However, once the plants are established, swabbing with the sweetened poisoned solution is the most effective way of destroying the pests.

The cutworm bait scattered under and around the plants is a very successful method for combating cutworms and grasshoppers when they become established in a field. It is also effective in reducing the field population of adult beetles of the false wireworm.

Care must be exercised in the use of the swabbing mixture and the cutworm bait, for both contain a very poisonous chemical.

SCUMMY CREAM.

It frequently happens that when cream is being put through the strainer into the vat at a factory, a quantity of thick greasy substance is retained by the strainer. In most cases this is due to the inclusion of the thick scum from the interior of the separator bowl with the cream. This is a practice which cannot be condemned too severely and results frequently in the cream being graded down.

The Squirter Disease in Bananas with Special Reference to Its Control.

J. H. SIMMONDS, M.Sc., Senior Plant Pathologist, Department of Agriculture and Stock, and R. S. MITCHELL, M.Sc. Agr., Junior Research Officer, Council for Scientific and Industrial Research.

THE squirter disease of bananas, whilst well known to southern merchants and retailers, is merely a name to most banana-growers since it makes its appearance only as the fruit ripens and is rarely seen on the plantation. Nevertheless it is recognised as being one of the most serious, if not the most serious, transport disease affecting Australian bananas.

The symptoms consist of a dark watery rot which appears first along the centre of the pulp of the fruit—whence it extends outwards. In the early stages of infection it is usually impossible to recognise the disease on external examination. In more advanced stages the fruit is soft under pressure, this softness being towards the stalk end, but, until the flesh becomes semi-liquid so that it squirts out when pressed the disease can only be diagnosed by an examination of the interior. The affected fruit may be represented by a few scattered individuals in the case or may be as many as twenty-five to thirty per cent. and occasionally even more.

The difficulty in detecting the presence of squirter by a superficial examination of the case results in a very important indirect loss due to the prejudice formed against certain brands. Buyers tend to "hold off" consignments which, by experience, are known to have come from a grower who has previously forwarded affected fruit. There is also, naturally, a decreased demand by the consumer during periods when squirter affected fruit is in evidence.

Squirter is of importance only during the winter and early summer, mainly in the months from April to November, inclusive. Isolated cases have been recorded during December, January and March.

The Development of Ideas Regarding the Cause of Squirter.

The investigation of the cause and control of squirter has had a somewhat chequered history. A trouble referred to under this name was known as far back as 1920. An enquiry into the cause of the disease was first undertaken by Goddard [1] who came to the conclusion after several years' work that cool temperatures in the winter produced a physiological state of the fruit which responded to unsuitable temperature or other conditions during transport with an ensuing development of squirter. Young, Bagster, Hicks, and Huelin[10], in a report on the ripening and transport of the Cavindish banana, recorded some interesting experiments in which they showed that bananas held for several days at a temperature of 53 deg. Fahr. or lower developed a much higher percentage of squirter than those not subjected to chilling. These authors considered that exposure to low temperatures during storage or transport might accentuate the trouble which appeared to be, at least in part, due to some predisposing condition developed on the plantation. King[6], who carried out a soil survey in connection with the

For a more detailed account of squirter the reader is referred to McLennan and Hoette[8], Magee[7], and Simmonds[9].

incidence of squirter, came to the conclusion that soil type had no effect on the development of the disease. He noted the association of squirter losses with cold situations and suggested that a cold period might cause a cessation of certain physiological processes rendering the fruit more subject to breakdown.

The first suggestion that squirter might be of parastic origin came from Dr. D. A. Herbert[2] who in 1931 noted the presence of a fungus in affected fruit and later isolated this and determined it to be a species of *Nigrospora*. In 1933 McLennan and Hoette[3] in Melbourne and Simmonds[9] in Brisbane published the results of independent investigations which proved conclusively that the squirter rot was the result of infection by a parasitic fungus. The causal organism was referred to a new species of *Nigrospora, N. musae,* by the former authors and to *N. sphaerica* by the latter. Hoette[4] demonstrated later that the same organism was also responsible for a considerable proportion of the black end occurring during the winter and spring months.

As a result of this work it was shown that the internal nature of the rot is due to the manner of infection. The organism enters one or more vascular strands at the broken stalk end and travels down these without lateral extension until the ovular region is reached. The *Nigrospora* was found to be present in the plantation on dead banana tissue such as leaves, petioles, and bracts, and also on banana debris in and around the packing shed. The fungus has also been recorded on several of the common grasses found in the vicinity of the plantation as well as on sugar cane, rice, and maize. In the case of the last mentioned the organism exists in a pathogenic capacity, causing a dry rot of the ear.

Several aspects of the squirter problem were still in a doubtful position after the publication of the two papers mentioned. There was, firstly, the question of the correct nomenclature of the causal organism. Although this is a somewhat academic point it does have a practical bearing in that it is necessary to distinguish between parasitic and non-parasitic forms of *Nigrospora* when investigating all sources of spore contamination. Secondly, the contributing effect of chilling, although a recognised fact, could not be adequately explained. Lastly, and most important of all, the practical control of the disease was not in a much better position after than before the cause was known. The obvious suggestions regarding sanitation, although no doubt helpful, did not result in a definite control of the disease.

During the latter part of 1934 and the years 1935 and 1936 the junior author was seconded by the Council for Scientific and Industrial Research to the Department of Agriculture and Stock, Queensland, to assist in the investigation of banana transport diseases. This was made possible by the Commonwealth grant towards the development of scientific research in the banana industry. Although most attention was paid to black end and anthracnose, some work having an important bearing on the control of squirter was also carried out and it is chiefly with this that the present paper seeks to deal.

Following on the work reported in the paper already cited, Hoette[5] carried out some further investigations in Queensland and New South Wales. These were, by arrangement, mainly of a mycological and physiological nature and have been summarised in an unpublished report

to the Council for Scientific and Industrial Research to which the authors have kindly been give access. Reference is made to this report in connection with matters of relevant interest.

Early Investigations Bearing on Control.

As long as squirter was considered to be of physiological origin it was difficult to arrive at a fully effective means for controlling the disease. Certain practical suggestions were based on the knowledge that cold temperatures were a contributing factor. These received support from the work of Young, Bagster, Hicks, and Huelin[10], who showed that chilling on the plantation or during transport was detrimental to the proper ripening of the banana and was definitely conducive to squirter development. The chance of fruit being subjected to excessively cold temperatures while in transport although not great is now minimised during the winter months by sheeting the railway trucks and insulating the fruit in the case by packing with a complete lining of paper. Hicks and Holmes[3] showed that the risk of chilling in the plantation is more serious and it is a recommendation that, during cold weather, the fruit should be picked during the warmer part of the day and should be covered and protected from the cold as much as possible until placed in the van.

Young[10] and his co-workers quote an experiment in which it was shown that considerably less squirter developed in fruit packed in hands and part hands than in singles, facts which are easily explained now that the parasitic origin of the disease is known. These results were later confirmed by Hoette[5] and the authors. It was shown by the former who used artificially inoculated fruit that the greatest reduction is obtained when the fruit are packed in full hands with an appreciable amount of cushion left attached. The amount of squirter developing in a part hand pack is usually definitely less than in the case of singles, but is of a somewhat variable order. Packing in hands and part hands avoids a certain amount of injury through bending and splitting of the stalk, which may not be entirely eliminated even when the utmost care is exercised when breaking into singles. This method therefore also has the advantage that there is less loss from the development of black end. The full hand pack has a number of disadvantages from the commercial point of view. The part hand pack is preferable as it has these drawbacks to a considerably less extent. However, the adoption of the part hand pack, while bringing about an appreciable reduction in losses, is not a sufficiently reliable or efficient method of control to be regarded as a satisfactory solution of the squirter problem.

With the knowledge that squirter was caused by infection by the spores of a parasitic fungus, it was natural to suggest sanitation measures. It has been shown by Simmonds[9] and later confirmed by Hoette[5] that the source of infection lies in the *Nigrospora* associated with banana trash, old fruit stalks and other debris in and around the packing shed and even more particularly with dead leaf stalks, dead areas of leaf tissue, and the bunch bracts and spathe in the plantation. The exposure of plates of culture media in the packing shed and plantation has shown that the spores are commonly wind borne.

Although fresh infection is possible in the packing shed, examination of fruit before harvesting and immediately on arrival at the shed shows that they are, in many cases, already plentifully scattered with

Nigrospora spores, and it is accordingly considered that the plantation is the most important source of contamination. During the operation of breaking into singles and packing the organism is enabled to reach the freshly exposed surface of the fruit stalk and bring about infection. Cleanliness in the packing shed, coupled with periodic spraying thereof with 5 per cent. formalin solution, will tend to reduce the amount of infection taking place at the shed, but will not account for those spores which are present on the fruit when it arrives there. The authors conducted an experiment to see whether the careful removal of all dead leaf material and bracts from a block of plants, in conjunction with spraying the packing shed with formalin, would reduce squirter losses. No essential difference was noted in the distribution of squirter in fruit from this and the control block. Possibly had the treatment been carried out over the entire plantation for a longer period at frequent intervals instead of only the once, better results might have been forthcoming.

Control by a Fungicidal Treatment of the Fruit.

It is obvious that all the measures so far described, although contributing to a reduction in the amount of squirter developing, can not be relied upon to eliminate it entirely and even a small percentage of affected fruit is sufficient to prejudice southern buyers. To attain the desired end, it appeared necessary to develop a method of sterilizing the surface of the fruit immediately prior to packing. As pointed out by Simmonds[9] a treatment at this time is not impracticable provided a suitable fungicide is available. Both Hoette[5] and the authors showed that dilute solutions of formalin as well as certain other fungicides would prevent the germination of *Nigrospora* spores and carried out preliminary field tests which were, however, inconclusive. Attention later became focussed on developing a fungicide for the control of black end and anthracnose and as these diseases were easier to work with than squirter the control of the latter was left in abeyance for the time, it being considered that a treatment effective for *Gloeosporium musarum* would be equally so for *Nigrospora*.

For the control of black end and anthracnose vapour and liquid treatments were tried. Formaldehyde gas, sulphur dioxide and several other vapours were used, but these either failed to give control or when used at an effective concentration resulted in severe injury to the fruit. Wet treatments included formalin at various strengths, Shirlan, malachite green, sodium benzoate, copper sulphate, and borax. In most cases laboratory experiments with inoculated fruit and field tests were carried out. A solution of formalin at ·25 per cent. and 1 per cent. strength used as a dip reduced the amount of black end somewhat and caused only slight injury to the fruit. Shirlan A.G. and XP18 at ·75 per cent. concentration and over gave somewhat better control, and caused no injury. No appreciable deposit was left at concentrations of less than 3 per cent. Borax used at 4 per cent and 8 per cent. in water at 50 deg. and 54 deg C. gave good control of anthracnose and a control of black end similar to that of formalin, but the necessity for maintaining a constant temperature and other disadvantages make the use of this material uneconomic. It was very noticeable that the control exerted by Shirlan when a large proportion of the black end was due to *Nigrospora* infection was much greater than when *G. musarum* was the chief causal agent. This is illustrated in Table I.

TABLE I.

THE DIFFERENCE IN THE EFFECT OF SHIRLAN ON BLACK END WHEN DUE TO INFECTION BY (1) *Nigrospora* AND (2) *Gloeosporium musarum*.

Treatment.	Organism mainly responsible.	Percentage of severe Black End.	Number of fruit.
Dipped 1·0 per cent. Shirlan A.G. ..	*Nigrospora*	0·3	398
Untreated	..	48·6	372
Dipped 1·5 per cent. Shirlan A.G. ..	*Gloeosporium* ..	3·3	155
Untreated	..	9·8	165
Dipped 3·0 per cent. Shirlan A.G. ..	*Nigrospora* ..	8·2	447
Untreated	..	61·9	540
Dipped 3·0 per cent. Shirlan A.G. ..	*Gloeosporium* ..	4·1	171
Untreated	..	14·3	134

Since none of the fungicides used could be claimed as an unqualified success so far as black end and anthracnose were concerned it became necessary to take up the matter with special reference to squirter. Some difficulty was experienced in obtaining satisfactory and uniform infection with the disease. In the latter part of 1936, however, a plantation from which it was possible to obtain heavy natural infection with squirter came under notice and results of a conclusive nature were obtained from field experiments carried out there. As Shirlan had given best results in the control of black end this fungicide was used at first and the success was so marked that all future work was concentrated on how the Shirlan could be put to best advantage. Formalin was known to inhibit germination of the spores and Hoette[5] had obtained an indication that it might be useful as a fruit treatment, but the disadvantages in that there is danger of serious skin injury with solutions stronger than 1 per cent. and that reinfection is possible once the solution has evaporated are such that this disinfectant was not further investigated.

Fruit for the field experiments was obtained at the plantation in the bunch, brought to the packing shed and there cut and treated immediately. Comparable lots of fruit were obtained by dividing each hand into two or three approximately equal parts, depending on the number of lots required. The fruit were broken into part hands or singles as the case might be, immersed in the suspension of Shirlan for just sufficiently long to ensure thorough wetting, and then drained and packed. They were ripened as slowly as possible in the rooms of the Committee of Direction of Fruit Marketing by subjecting them to the lowest temperature available at the time.

In the original experiments, when Shirlan XP18 was used, only the fruit which felt soft at or near the end was examined internally. In subsequent trials all the fruits were cut longitudinally to ensure that no affected ones were overlooked. Throughout these experiments all doubtful and some definite infections were tested by making tissue plantings from the flesh to potato dextrose agar. Particular attention in this respect was given to treated fruit. The small number of doubtful cases which gave growth to *Nigrospora* were classified accordingly.

In Table II. are given the results obtained by the use of three forms of Shirlan at different strengths. All the experiments listed were field trials, and in each case the fruit was broken into singles for packing. Shirlan A.G. is the commercial article on the market in Queensland. It consists of a 25 per cent. suspension of salicylanilide in

water together with a wetting and spreading agent. Shirlan W.S. is the water soluble sodium salt of salicylanilide while Shirlan XP18 has copper in combination. Neither of these two appeared to possess any advantage over Shirlan A.G.

TABLE II.

THE RESULTS OF TREATING BANANA FRUIT WITH SHIRLAN FOR SQUIRTER CONTROL.

Fungicide.	Method of Dipping.	Per Cent. Squirter.		No. of Fruit.	
		Treated.	Untreated.	Treated.	Untreated.
Shirlan XP18 3 per cent.	Singles	0	1·0	88	199
Ditto	Hands	0		95	
Ditto	Singles	0	1·1	186	190
Ditto	Singles	0	5·6	136	142
Shirlan XP18 1 per cent.	Singles	0	12·2	79	80
Shirlan W.S. = 1 per cent. A.G.	Singles	0		82	
Shirlan A.G. 6 per cent.	Singles	0	11·1	221	216
Shirlan A.G. 3 per cent.	Singles (ends only) ..	0		134	
Ditto	Singles	0		127	
Ditto	One-third hands ..	1·6	30·2	337	356
Ditto	Singles	0		339	
Shirlan A.G. 1 per cent.	Hands with bunch stalk attached	17·5	17·1	145	192
Ditto	Singles	0		187	
Ditto	One-third hands dipped and dried	0·6	21·7	153	180
Ditto	Singles	0		211	

All fruit represented in this table were packed in singles.

The results show complete control of squirter with all strengths of Shirlan used, when the fruit were dipped in singles. Dipping in one-third hands and then breaking into singles gave a reduction from 21·7 per cent. and 30·2 per cent. in untreated fruit, to 0·6 and 1·6 per cent. for a 1 per cent. and 3 per cent. suspension respectively. This is good commercial control, and it is furthermore considered that, if the fruit were to be dipped in part hands and then packed as such, without further exposure of broken surfaces, the control would approximate to that obtained by dipping in singles. Treatment with the bunch stalk still attached is unsatisfactory. The comparative results obtained for dipping before dehanding, dipping part hands, and dipping the fruit in singles suggest that a protective covering over the cut and broken end is essential for complete control by Shirlan.

A certain amount of blackening and drying of the fruit stalk occurred but, even with 3 per cent. Shirlan, this is not sufficient to be of commercial importance. With concentrations of 3 per cent. and

higher a grey powdery residue is left on the fruit. With 1 per cent. this deposit occurs in occasional isolated areas and can be detected only after careful examination.

As a result of these experiments it is firmly considered that a practical and economic method of controlling squirter is now available. Immersion of the fruit as singles (or part hands when packed as such) in a 1 per cent. suspension of Shirlan A.G. is recommended as a routine practice during the winter and early summer months on all plantations where experience suggests losses from squirter are likely to occur. It is worthy of note that this treatment also reduces black end, particularly black end due to *Nigrospora*. Hands should be broken into singles and dipped in the Shirlan mixture as soon as possible after they are removed from the bunch. When a convenient number of fruit have been immersed they can be removed and drained for a few minutes when they are ready for packing.

According to the manufacturers the diluted Shirlan will keep for a considerable period without deterioration. Hence it should be possible to use the same mixture on more than one packing day provided a method of preventing evaporation is available.

Previous recommendations such as the prevention of chilling, sanitation in the plantation and packing shed, and others, still hold good and should be used in conjunction with the dipping. In many cases, where squirter infection is rare, these precautions will be all that is required and the treatment with a fungicide will be unnecessary.

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Contagious Pneumonia in Pigs.

PNEUMONIA is one of the commonest diseases of pigs in this State and is responsible for considerable losses each year. It appears in several forms, having a variety of causes, and may be deal twith as follows:—

1. Pneumonia caused chiefly by a specific germ (*Bacillus suisepticus*).
2. Peumonia caused by pyogenic bacteria (chiefly *Bacillus pyogenes suis*).
3. Parasitic pneumonia caused by infestation of the large round worm of pigs, *Ascaris lumbricoides.*

All forms are most commonly encountered in young pigs in that stage of life between weaning and bacon or porker age.

The varied symptoms, post-mortem appearances, and mortality rate make it possible to differentiate the types with little difficulty.

Swine Plague.

This, caused by *B. suisepticus,* is probably responsible for the majority of outbreaks of pneumonia in young pigs.

Undoubtedly this form of contagious pneumonia has been present in this State for a considerable time, and it would appear to have a wide spread distribution.

The disease may suddenly appear in a herd of pigs without any history of introduction of new pigs or contact with suspected cases.

Infection.

The causal organism may be present in the respiratory tract and alimentary canal of normal pigs, also in the soil, food, and drinking water, so it is obvious that factors other than the mere presence of the organism are necessary for the production of the disease. Thus it is believed that organisms present in the normal animal and ordinarily causing no harm, are spurred to an added virulence by certain conditions of diet and/or general surroundings which also tend to lower the natural resistance of a susceptible animal, with the result that the organism, with its greater disease producing capacity, overcomes the weakened resistance of the animal and the symptoms of swine plague appear.

Keeping in mind the manner in which the disease is produced, it is easy to appreciate the fact that swine plague is more likely to be encountered in piggeries where general management and feeding are far from ideal.

However, swine plague often occurs in piggeries where conditions are excellent, and in such cases it is not infrequently found that the factor responsible for the increased virulence of the organism is dietetic in nature—some sudden change in the routine of feeding or quality of the food.

It must not be overlooked that affected pigs are a danger to others, and when a pig has apparently recovered from the disease it not uncommonly still acts as a "carrier" on account of the continued existence of a small patch of pneumonia in the lung. The contact of young and grown pigs should therefore be avoided.

Symptoms.

These may be per-acute, acute, and chronic in type.

In the per-acute form the pig will suddenly be noticed to be sick, with a high temperature, lying down and having no inclination to move, any such attempt being marked by a staggering involuntary gait. The affected pig may sit on its haunches with head stretched out, breathing being rapid an distressed. Usually death quickly supervenes, occurring 12 to 24 hours after the onset of symptoms, or may sometimes occur without warning symptoms, the animals simply being found dead.

The symptoms of the acute form are those of an active pneumonia, i.e., there is high temperature, little inclination to feed, coughing is marked, and the breathing rapid, panting, and distressed, giving rise to a common name for the disease—"pants"; a sticky discharge from the nostrils, and sometimes from the eyes is common.

Constipation, present in the early stages, is often followed by a blood-flecked diarrhœa, particularly towards the end of the sickness, which lasts 1 to 2 weeks and usually terminates in death.

The chronic form may follow a partial recovery from either of the above forms, or may appear in the herd as the typical form. The general appearance of the animals is altered, pigs becoming sluggish in movement, and the appetite is partially lost, maybe perverted, affected pigs eating all types of foreign material. Coughing is persistent, breathing somewhat laboured, and badly affected animals will assume a position with backs arched and front legs spread wide apart. Sticky discharges are usually present from nostrils and eyes, and a constipated state commonly followed by diarrhœa. Skin eruptions may also be present in the form of red spots, scabs and scales later forming over them. Inflammatory swellings may occur in the joints, leading to stiffness and lameness. The disease runs a course of two to three weeks. Some animals gradually recover, the lameness disappearing, scales peeling off and leaving a healthy skin and the discharges clearing up, but a short, sharp cough usually persists.

It must be realised that the above description of symptoms of per-acute, acute, and chronic forms of Swine Plague refers to typical forms; actually an outbreak of Swine Plague may present all three types, or some combination of these types.

Post Mortem Appearances.

Naturally these vary according to the form the disease has taken.

In the per-acute form the post-mortem changes are not particularly obvious, but on examination the lymphatic glands are found to be swollen and usually darkish-red in colour, and a gelatinous fluid may be pressed from the tissues in the region of the neck and from the swollen (œdematous) lungs.

The commoner acute form shows more typical changes, particularly in the chest cavity, where the lungs are found to be affected with a definite pneumonia, the colour of the lungs varying from dark-reddish to light-grey, and the substance of the affected lung is firmer than a normal lung. An extensively affected lung will not float in water. An excessive amount of fluid may be found in the chest cavity and in the sac surrounding the heart, and affected areas of the lungs will be seen to adhere to the chest wall by fibrous strands and patches.

Lymphatic glands of the chest may be swollen and slightly hæmorrhagic, while the mucous membrane of the stomach and intestines often shows inflammatory changes varying from slight congestion to more intense congestion with occasional hæmorrhagic areas.

The changes observed on post-mortem examination of animals, dead from the chronic form, are mainly confined to the lungs, which, without showing intense changes seen in the acute form, possess areas of somewhat solid consistency, light-greyish-red in colour and smoother in appearance than normal lung. Lung adhesions are marked, the walls of the chest cavity presenting a discoloured roughened and stringy appearance. Reddish-yellow fluid may be noticed in the chest cavity and in the sac surrounding the heart. General lesions of emaciation are present in cases of considerable duration.

Treatment and Control.

Medical treatment is not recommended, greater importance being attached to prevention and control. Preventive vaccination may be carried out, but should never be considered without complete discussion and investigation by the Veterinary Officer.

The practices of inbreeding and intensive feeding are often responsible for the conditions of lowered resistance and greater virulence previously referred to, and such proceedings should therefore be carefully controlled.

Particular care should be paid to the hygienic conditions of the piggery as regards housing and general accommodation. Factors such as exposure to cold, overcrowding in small runs, and unsuitable sheds, and the entire question of feeding, must be investigated. Where a piggery suffers an outbreak of Swine Plague and the owner is quite sure that the best possible conditions of general accommodation prevail, it would be wise to thoroughly check over the question of feeding.

Immediate isolation of all infected pigs is of paramount importance.

In those cases where no improvement is noticed after a couple of days, the wisest procedure is to slaughter affected animals. Even should an infected animal subsequently recover there is the possibility of relapse with reinfection of the piggery.

Steps should be taken to exclude poultry from the piggery, because in the presence of poultry complete isolation of infected pigs is impossible. Certainly where poultry have access to contaminated troughs and yards they are going to spread infection to every yard which they may happen to stain with their droppings.

Thorough disinfection of infected premises with lime is necessary, and where the infection is widespread throughout the piggery it is advisable to consider the establishment of a fresh site.

Pyogenic Pneumonia.

While Swine Plague is probably the commonest type of pneumonia encountered, other forms exist. The chief one of bacterial origin is that caused by *B. pyogenes suis,* the symptoms of which are as follows:—

The first sign of anything wrong may be the onset of nervous symptoms, the commonest being the holding of the head on one side, movement being in circles. The nervous symptoms wholly or partially subside and an acute pneumonia develops, the affected pig being loth to move about, the appetite diminished or absent, and the breathing distressed and very rapid.

The symptoms become progressively worse, the affected pig remains prostrate and death usually supervenes about seven to ten days after the onset of symptoms.

Abscess formation may occasionally be noticed in the region of the hock and knee joints.

Post-mortem appearances are rather typical and small areas of yellowish pus being found in various parts of the body. Muscles, subcutaneous tissues, and lungs contain these purulent foci, which may also be present in lymphatic glands, joints, kidneys, spleen, liver, and bones.

Medicinal treatment is of no use, and if the disease is to be controlled the measures recommended for the control of Swine Plague should be adopted.

Parasitic Pneumonia.

This form of pneumonia is caused by migration through the lungs of immature forms of the large round worm of pigs. It is fairly common in young pigs, but usually does not run the severe course described for the bacterial forms.

Persistent coughing and sluggish development are the commonest manifestations of the condition.

It is found that in the two bacterial forms of pneumonia the number of pigs affected on a property is not excessive, but the majority of affected pigs die. Parasitic pneumonia on the other hand affects a large number of young pigs on a property but deaths are few.

In the event of any piggery becoming affected with sickness resembling the diseases described above, the owner would be well advised to isolate affected animals immediately and communicate with the district Veterinary Officer to establish diagnosis and arrange subsequent methods of control.

PARSNIP GROWING.

Although the parsnip is a native of England and must therefore be classed as a temperate climate vegetable, it may be grown with reasonable success in the tropics during the winter season.

Soil for growing this vegetable should be deep, rich, and free. A good sandy loam gives excellent results. The soil should be prepared some months previously by trenching or cultivating deeply, and incorporating a heavy dressing of stable manure. Organic manures should never be applied in considerable quantities immediately before planting this crop, as they frequently induce forking of the roots. At the end of the wet season the ground should be thoroughly worked up and reduced to a very fine tilth. The seed is then sown thinly and very lightly raked over, after which the soil should be rolled or well packed down with the back of a spade along the drills. The packing is necessary to ensure close contact between the seeds and the soil. A light covering of old horse manure well crumbled, or old sawdust, will assist germination by preventing the caking of the soil.

As soon as the seedlings are well up, thin them out where they are overcrowded and, when about 4 to 6 inches high, thin out finally to about 1 foot apart.

Parsnip seed is usually of rather poor germinating capacity, and is practically useless unless quite fresh.

—*S. E. Stephens.*

Hints for Pig Exhibitors.

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

THE desire of every stud stock breeder is to develop animals that will win awards in the best of company. The following points are suggested for the consideration of show exhibitors:—

Selection.

The possibility of securing premier honours, while depending very largely on bodily conformation, colour markings and freedom from faults, depends also on the time the exhibitor is willing to give to the preparation of his stock and the businesslike attitude he adopts towards the job. He will learn by experience that there are times when a few extra minutes spent, and additional care, may mean the difference between a champion, a first, a second, or even a third prize. Successful exhibitors spare no effort to do everything possible to have their stock ready at the time of judging.

Some animals are more readily handled than others, some are good feeders, some are intelligent, while others are good but stubborn. Some feed well in familiar surroundings, but when placed in the show pens in a strange environment become restless and disgruntled, refuse to eat, and rapidly lose bloom, thus spoiling the exhibitor's chance in competition.

In selection, nothing but the best should be penned. It is useless filling up show pens with second-grade animals. The size and importance of the show, and the competition, must of course be taken into consideration. To win a championship at a small country show is quite different from winning premier awards at a show like the Royal National, Brisbane, or the Royals at Sydney and Melbourne.

The exhibitor should study carefully the prize schedule long before the show at which he proposes to exhibit, and should aim at having his animals entered in classes for which they are most suited. A class for boar over nine months and under twelve months is more readily won, other things being equal, with a boar twelve months' old than with one at nine months old. The prize for sows with litter not more than ten weeks of age is more frequently won with a really good sow with a litter ten weeks of age, than with a really good sow and a litter ten days old.

Size for age is also important. In a class for sow twelve months of age the sow should be fairly forward in her gestation period; a sow not in pig does not or should not stand the same chance of winning.

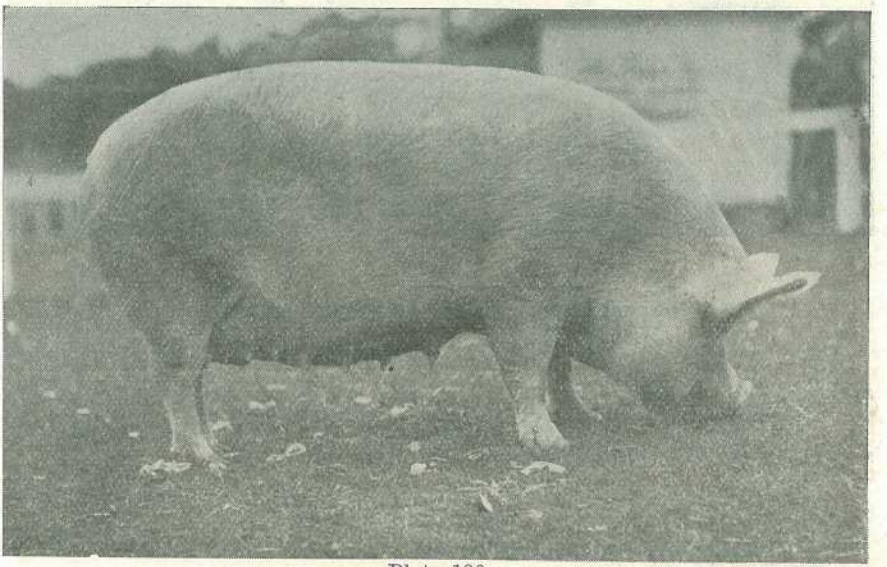


Plate 180.

Typical Large White Sow showing long sides and back, deep roomy body, well-developed udders and teats, and other desirable feminine characteristics.

Animals with manifest faults should never be exhibited. A boar with only one testicle showing, or a sow with several blind or dummy teats, should be rigorously excluded. A pig with a long, unmanageable tongue, which protrudes several inches from the mouth, should not be shown, nor should pigs that are mismarked or otherwise faulty.

Condition.

Breeding stock should be shown in good breeding condition only: any tendency to excessive fatness should be avoided. If breeding stock over twelve months of age are any good as breeders, and are shown in profitable condition, they will not be overfat. Similarly, animals in low condition are undesirable: even a sow with a large litter should be in good condition, otherwise she will not show to advantage.

Commercial stock should be shown in medium condition only, for there is no demand for very fat meat, and the judge is at fault who recognises and places overfat animals.

All pigs shown should be absolutely free from parasites—body lice, fleas, or worms. Animals with a vicious temperament should be excluded, and should not be kept on the farm.

Preparation.

It is unwise to smear the skin and hair with a heavy coat of sticky oil. It is equally unwise to permit the exhibition of pigs without first thoroughly washing and cleansing the skin and hair. Regular washing with warm water and soft soap should be the rule for several weeks before the date of showing. The exhibitor who pens pigs bespattered with mud and in a dirty condition, only exposes himself to criticism. Careful washing and grooming, and a light brushing over with a brush or cloth, using colourless oil, is advised, and especially immediately before parading. Regular oiling will assist in keeping the animals free of parasites, and in mellowing the skin and hair, with obvious advantages.

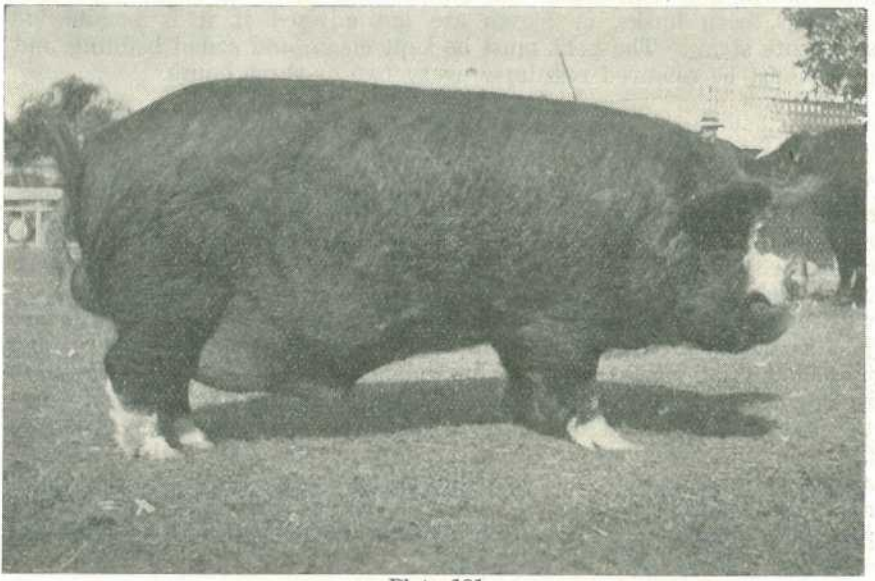


Plate 181.

Typical Berkshire Boar, a prominent prize winner at Queensland shows. Note great depth of body, strong masculine characteristics, and correct colour markings.

In the exhibition of stud pigs, clipping of the hair is always objected to as it is not actually necessary, and any attempt to clip with a view to removing natural markings is an offence.

Animals should be carefully trained to parade properly, and to stand at ease before the judge. The anxious, excitable animal—who also is in charge of an excitable exhibitor—usually fares badly, whereas the well-trained animal in the hands of a patient, observant exhibitor, is more likely to succeed.

Judging Rings.

It is, of course, essential to parade all mature animals before the judge, for it is quite impossible to judge mature stock satisfactorily while they are penned in small enclosures. Judging rings are best where they can be arranged for, provided that the animals are well-trained, and that exhibitors are prepared to devote time to the job.

Feeding.

Regular exercise is essential to the successful exhibition of pigs, and plenty of green food, and clean drinking water should be provided. Purgative methods should not be employed, nor should foods of a very laxative nature be used.

The animal should not be overfed, nor should stale, sour, or high-smelling food be used. The food troughs should be scrupulously clean. Feed should be given strictly at regular intervals, and, most important of all, the same class of feeding stuff should be used for several days before taking the pig to the show, so that it may become accustomed to any change of food. If an animal refuses to eat, and appears to be losing bloom, a slice or two of apple or carrot, a piece of pumpkin, or some such tasty morsel—especially if sprinkled with salt—will often bring the animal back to its food. In fact a very light sprinkling of salt over the food followed by clean drinking water will be found useful for show pigs. Clean, dry straw, and plenty of it, is advisable for bedding down, and will make the animal feel more at ease. Sawdust, shavings, corn husks, or leaves are not advised if it is possible to substitute straw. The pens must be kept clean, and soiled bedding and dung must be removed regularly every two or three hours.

General.

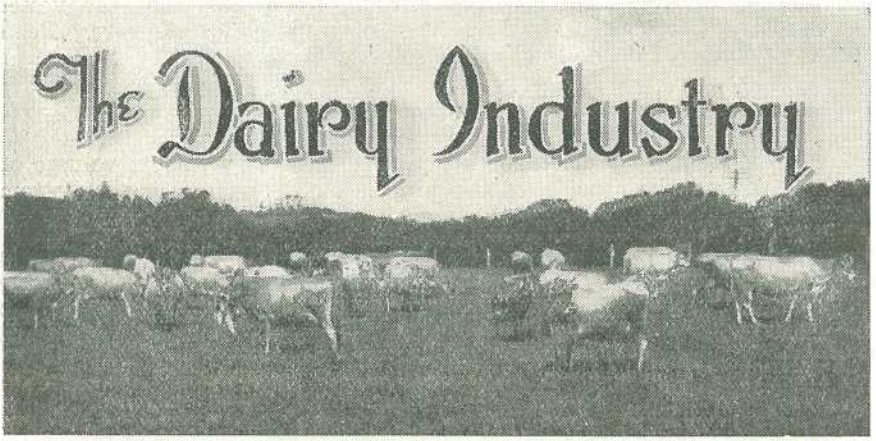
It is unnecessary for the exhibitor to appear before the judge in "pig pen togs"; he should be just as spic and span as the animal. A combination of both, added to a pleasant, courteous manner, and a smile even under difficult circumstances, does much to create confidence. The exhibitor should watch the animal during judging; but should not watch the judge, except to receive instructions. When the judge has finished with an animal, its owner should not worry other exhibitors, who are just as keenly interested in their own exhibits, as he is in his. The judge has a difficult task, and he appreciates the co-operation of exhibitors in placing the animals before him. Exhibitors should not try to influence the judge; but should be ready at any time to answer any questions the steward might ask. When judging is completed, the exhibitor should await a favourable opportunity for having a chat to the judge about the exhibits. Shows are educational, and are for the purpose of providing comparisons. Exhibitors are, of course, entitled to their own opinions just as much as the judge.

Agricultural societies are always glad to have suggestions from exhibitors. Every exhibitor is, or should be, a show official, and as such should have some influence on the success or otherwise of the show. Exhibitors have the privilege of sending in nomination of judges for consideration by the show society.

It is well to remember that it is only fair to other exhibitors of pure bred stock that the stud pigs of others should be registered in the appropriate herd book, or be eligible for registration. The Australian Stud Pig Breeders' Society provides for registration. It is wise also to have printed pedigree forms for stud pigs, and it is important to have the pedigrees prepared in readiness, so that when an animal is sold, the pedigree may be handed over with the receipt. Delay in the issuing and forwarding of pedigrees, and the incorrect preparation of pedigrees which are lacking in detail, cause trouble, confusion, and unnecessary inconvenience to the buyer.

Judicious advertising should not be neglected. The Stud Pig Breeders' Society will advise any breeder interested as to the prices he or she should ask for pedigree male or female animals.

Full particulars about the size of crates, material to be used, method of construction, and other relevant information, may be obtained free of cost from the Department of Agriculture and Stock. Crates should be returned promptly if required and in as good a condition as when received.



Estimation of Acidity in Milk, Cream and Whey.

L. A. BURGESS, A.A.C.I., Dairy Research Laboratory.

THE regulations under the Dairy Produce Acts specify that no milk containing more than 0·25 per cent., nor cream containing more than 0·67 per cent. of acidity shall be classified as first-grade quality. The development of acidity in milk and whey is all important in cheesemaking and accurate control of cream acidity plays a very large part in the manufacture of a good quality butter.

For these reasons it is essential that accurate acidity tests be performed at all times. Attention to details and a knowledge of the principles involved in the estimation are as necessary to the factory operative as they are to the analyst.

Reagents.

1. *Decinormal sodium hydroxide,* also known as tenth normal or N/10 alkali.

2. *Phenolphthalein* indicator solution.

Apparatus.

1. *Burette,* graduated in 0.1 ml. divisions.

2. *Burette stand* and *clamp,*

3. *Pipette,* may be of any desired capacity. Usually a 9 ml., 10 ml., 17·6 ml., or 20 ml. pipette is used.

4. *Titration vessel.*

5. *Glass stirring rod.*

Determination.

(a) *Milk and Whey.*—By means of the pipette measure out a known volume of milk or whey, wiping the outside of the pipette *before* adjusting the bottom of the meniscus to the graduation mark.

Transfer to the titration vessel. Add 5 to 10 drops of phenolphthalein solution. From the burette run in the decinormal sodium

hydroxide solution drop by drop stirring the contents of the vessel constantly. Stop when the first tinge of pink colour appears. Read off the volume of decinormal alkali solution used.

$$\text{Percentage of acidity} = \frac{\text{ml. of N/10 alkali used} \times 0{\cdot}009 \times 100}{\text{quantity of sample taken.}}$$

(b) *Cream.*—By means of the pipette measure a known volume of cream, wiping the outside of the pipette *before* adjusting the bottom of the meniscus to the graduation mark.

Transfer to the titration vessel. Rinse out the pipette with warm distilled or rain water by filling to approximately the position of the graduation mark and add the rinsings to the contents of the titration vessel. Add five to ten drops of phenolphthalein solution and proceed as directed for milk and whey.

Acidity.

When milk is freshly drawn from the udder it has an acidity ranging from 0·1 to 0·2 per cent., in some cases even higher, the average being about 0·17 per cent.

This initial acidity is due to acid salts, casein, and dissolved carbon dioxide. On exposure to the air some of the carbon dioxide escapes and the acidity drops a little. It soon begins to rise again owing to the action of bacteria which act upon the lactose, forming lactic acid. There are thus two forms of acidity in milk, the initial acidity due to normal milk constituents and that due to lactic acid.

As it is difficult to differentiate between the lactic acid and other acidity, the whole acidity is for convenience calculated and reported as percentage of lactic acid.

Principle of the Test.

When an acid is mixed with an alkali a chemical reaction occurs with the formation of a neutral substance, termed a salt, and water. This reaction is known as neutralization. Thus when lactic acid and sodium hydroxide react, neutralization occurs with the formation of sodium lactate and water.

$$\underset{\text{Lactic acid}}{C_3H_6O_3} + \underset{\substack{\text{Sodium}\\\text{hydroxide}}}{NaOH} \longrightarrow \underset{\text{Sodium lactate}}{C_3H_5O_3Na} + \underset{\text{Water}}{H_2O}.$$

As this is a reaction between definite chemical compounds, it is a comparatively simple matter to estimate the percentage of lactic acid when a known amount of milk or cream is initially taken and neutralized with a sodium hydroxide solution of known strength. The neutralization must not be overdone, however, and a substance known as an indicator is used to show when the neutralization is complete. Indicators are substances which display a marked colour change in acid and alkaline solutions. Phenolphthalein, for example, is colourless when acid and red when alkaline, and has been found to be the most suitable indicator for the particular purpose under discussion.

Calculation of Percentage.

From the equation shown above it has been calculated that ninety parts by weight of lactic acid will be neutralized by forty parts by weight of sodium hydroxide. The decinormal sodium hydroxide is made to a

definite strength and contains 4 grams per litre. Thus 1 ml. (one thousandth of a litre) contains 0·004 gram of sodium hydroxide. It is just a matter of simple proportion to determine that 1 ml. of decinormal sodium hydroxide solution will neutralize 0·009 gram of lactic acid.

When a known quantity of milk or cream is taken and the acidity is neutralized by a determined volume of decinormal sodium hydroxide, the percentage of acidity may thus be determined:—

$$\text{Acidity percentage} = \frac{\text{ml. of N/10 alkali used x 0·009 x 100}}{\text{quantity of milk or cream used}}$$

This equation may be used when any known quantity of milk or cream is taken. Applying it to the widely used 9 ml. pipette the equation becomes

$$\text{*Acidity percentage} = \frac{\text{ml. of N/10 alkali used x 0·009 x 100}}{9}$$

$$= \frac{\text{ml. of N/10 alkali used}}{10}$$

*Strictly speaking this only gives the percentage by volume, i.e., 100 volumes of milk or cream contain so many parts by weight of lactic acid. The figure so obtained is, however, close enough for most practical purposes.

When any other volume of milk or cream is taken the full equation must be used.

Precautions to be Observed.

1. *The sample taken for examination must be representative of the bulk.*—This is so obvious that a detailed discussion is unnecessary. Care must therefore be taken to thoroughly mix the contents of the vat or other container, then take a number of small samples from different places, and thoroughly mix these small samples together.

2. *Location of Equipment.*—The tests should be performed in a well lighted position but not in direct sunlight. It should, of course, be close to the neutralizing vats in a butter factory and to the cheese vats in a cheese factory. It has sometimes been noticed that the equipment is located in a small cupboard or dark corner of a factory where accurate tests are impossible. It is such an essential part of factory routine that provision should be made for this equipment when the factory is being designed.

3. *Accuracy of the graduated glassware.*—There are now included in the Dairy Produce Acts specifications for 9 ml. pipettes used for acidity tests. Such pipettes must be submitted to the Department of Agriculture and Stock for approval. Burettes have been noticed in factories which have been found to be inaccurate. Although no definite specifications for burettes have been made, as designs and sizes vary considerably, butter and cheese factories should, for their own protection, demand that their supply houses submit burettes to the Department for approval.

4. *The Titration Vessel.*—The ideal titration vessel is a shallow white cup or basin with translucent walls. This is hardly necessary for ordinary work for which a shallow wide-mouthed cup will be found satisfactory. A metal vessel, such as is used in butter factories for collecting cream samples, is very unsatisfactory and should never be used.

5. *The water added when testing cream.*—The water used to rinse out the pipette when cream is being tested should be neutral in reaction—i.e., it should be perfectly colourless when phenolphthalein is added to it, yet should turn pink when one drop of N/10 alkali is added to 9 ml. of water. There are a number of factories using bore or well waters which contain considerable quantities of sodium carbonate in solution. Such waters are alkaline and will neutralize at least a portion of the acidity. One case has been noticed where 9 ml. of water was responsible for neutralizing 0·09 per cent. of acidity when 9 ml. of cream was used. The acidity tests in that particular factory would therefore be about 0·09 per cent. lower than the true percentage. In another case the water was distinctly acid, due to a clarification process, and tests using this water were higher than the true percentage. Water for the acidity test should not be taken from the hot water vessel used for the Babcock Test as this may be distinctly acid. A vessel recently washed with an alkaline cleanser may be responsible for considerable alkali being added with the water. If possible, distilled water (condensed steam), or rain water should be used.

6. *Accuracy of the decinormal sodium hydroxide.*—Most factories purchase their supply of decinormal sodium hydroxide solution from supply houses.

If kept in stock for too long a period a flaky sediment is formed by the action of the alkali on the glass. This may be very largely prevented by manufacturers coating the inside of the bottles with hard paraffin wax which is unaffected by alkali.

As usually prepared, the required weight of sodium hydroxide is weighed out, dissolved in the required volume of water, and the solution is then tested and corrected. This is somewhat unsatisfactory as even the purest sodium hydroxide may contain up to 2 per cent. of sodium carbonate. This has the effect of causing the pink colour to appear and then fade rapidly although the total alkalinity may be correctly decinormal. A more satisfactory method of preparation is described later.

If the alkali solution is exposed to the air for any length of time, either by removing the stopper or allowing to stand in the burette, carbon dioxide is absorbed from the air forming sodium carbonate. Care should therefore be taken to keep the stock bottle well corked, and discard the alkali remaining in the burette after the final titration for the day.

7. *Depth of pink colour.*—The depth of colour developed during the titration has been noticed to vary considerably, depending apparently on the person performing the test. This may be due to inability on the part of the operator to detect the first tinge of pink, an insufficiency of phenolphthalein solution, carelessness, or ignorance of what is required. Some firms supply glass stirring rods in which are enclosed pink paper and the titration is supposed to proceed until the pink colour in the milk or cream matches that of the paper. This is not always successful as some milks and creams normally have a rich yellow colour and the first change of colour noticeable is more orange than pink. Probably the most satisfactory method is to have a second cup in which is placed 9 ml. of the particular milk being tested, or 9 ml. of the particular cream and 9 ml. of water, alongside the operator. By comparison the first change of colour is easily noticed.

As the pink colour only develops slowly it is necessary to have sufficient phenolphthalein present to give a distinct pink with one or two drops of excess alkali. At least 5 drops of a 1 per cent. phenolpthalein solution should be added and the same quantity should be used for each test.

8. *Effect of carbon dioxide.*—Carbon dioxide, which is also known as carbonic acid gas, seriously affects the acidity test.

When carbon dioxide is present it combines with the sodium hydroxide and forms sodium bicarbonate and sodium carbonate. As the former compound decolourises phenolphthalein, erroneous results are obtained. When fermented or gassy creams are being tested the error may be as high as 0·07 per cent., or even higher.

After cream is neutralized it is passed over the pasteuriser and the heating to which it is subjected liberates most of the carbon dioxide. If pasteurisation is followed by, or is simultaneous with, a vacuum treatment, it is probable that all carbon dioxide is liberated. It is because pasteurised cream thus contains less carbon dioxide than raw creams that the acidity following pasteurisation is generally lower than that desired. If very accurate acidity tests are desired for cream, the 9 ml. of cream and rinsings should be gently boiled for about 30 seconds. Having thus liberated the carbon dioxide the cream should be cooled and titrated as usual.

Preparation of Decinormal Sodium Hydroxide.

For those factories which have the services of a chemist available, the following method of preparation is strongly recommended. Dissolve one pound of the purest sodium hydroxide obtainable, preferably of "AnalaR" or "Guaranteed Reagent" quality, in one pound (450 ml.) of distilled water. This solution is to be allowed to stand for some days in a resistance glass vessel, or in a bottle internally coated with hard paraffin wax, securely stoppered with a rubber cork or waxed bark cork. After a few days the sodium carbonate, which is practically insoluble in such a strong solution of sodium hydroxide, will have settled to the bottom leaving the supernatant liquid clear. This clear liquor, which contains about 50 per cent. by weight of caustic soda, has a specific gravity of about 1·53, and can be siphoned off into another similar container for storage purposes. This solution is of such strength that only from 5·5 to 6 ml. is required for each litre or decinormal solution required.

When diluting this strong solution preparatory to standardising, the distilled water should be boiled and cooled just prior to use. This is to free it from carbon dioxide which it absorbs from the air. Rain water may be used, but other waters are unsuitable. The diluted solution should be made slightly stronger than decinormal, as it is far easier to dilute the solution than to add a small amount of strong alkali during the subsequent adjustment.

A known volume of a standard acid solution (N/10 or N/5) is pipetted into a titration flask, one or two drops of phenolphthalein solution added, and then titrated with the approximately N/10 alkali until the pink colour remains for some twenty or thirty seconds. (It will eventually disappear by the solution absorbing carbon dioxide from the air.) The required volume of water to be added may then be calculated as follows:—

Twenty ml. of standard N/10 acid (or 10 ml. of standard N/5 acid) required 19·1 ml. of the approximately N/10 alkali solution. If the alkali were accurately N/10 it would have required 20 ml. exactly. Say that there is 9,900 ml. of alkali solution left after the intial test. The amount of water to be added is then—

$$\frac{(20{\cdot}0 - 19{\cdot}1) \times 9{,}900}{19{\cdot}1} = \frac{0{\cdot}9 \times 9{,}900}{19{\cdot}1} = 466 \text{ ml.}$$

As a precautionary measure only 450 ml. of water should be added and the solution tested as before. When the solution is accurately adjusted at least two titrations should be made to confirm the standardization.

The solution should then be stored in tightly-corked resistance glass bottles or waxed bottles, labelled, with the date and the name of the person who performed the standardization.

Preparation of Phenolphthalein Solution.

The indicator solution is prepared by dissolving 1 gram of phenolphthalein power in 100 ml. of 90 per cent. alcohol. The alcohol need not be that known as rectified spirit, methylated alcohol, or denatured alcohol being quite satisfactory. Methylated spirits, however, should not be used for the purpose.

THE AGE OF A COW AND ITS EFFECT ON MILK.

How does the age of a cow influence the composition of its milk? This is a question often asked. From the dairyman's point of view the fat is the most important constituent, and much experimental work has been carried out to determine how the fat test varies with the age of the cow. It has been shown that, with advancing years, cows produce milk containing a diminishing percentage of fat. The variation observed is not of any serious consequence, but it is nevertheless noticeable when average figures are taken. A cow of a high testing breed, which shows an average test of 5 per cent. of fat as a young animal, will decline to about 4.5 per cent. if she continues to produce to fourteen years of age.

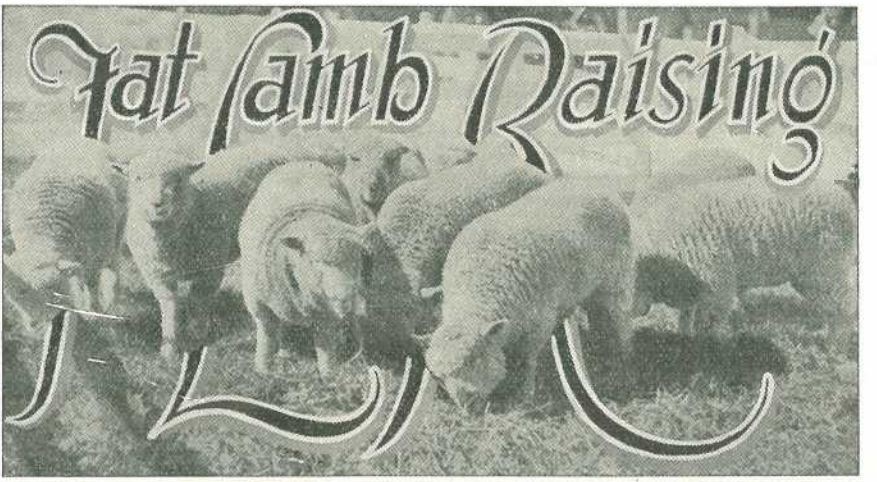
It is sometimes thought that a heifer showing a low test as a two-year-old may improve as she matures. There are no grounds for such a belief, and any farmer building up hopes of this nature is likely to be very disappointed. The richness of milk is a matter of inheritance, and so far as is known nothing can be done to change it in an individual animal.

An interesting feature with this work is that mathematicians have taken an interest in it, and one man has actually worked out a formula for calculating the fat test for any specified age, provided that the average test for the first milking period is known.

The effect of age on the other constituents of milk has also been studied and there is a decrease, with age, in all constituents except albumen, which increases slightly from year to year.

The effect of age on the fat test (richness) of milk should not be confused with the effect of age on milk production. There is a gradual increase in the quantity of milk produced from year to year until a maximum period is reached, after which the production figures show a slow decline. The age of maximum milk production for most breeds has been shown to be eight or nine years.

—O. St. J. Kent.



Fat Lambs in Queensland.

J. L. HODGE, Instructor in Sheep and Wool.*

QUEENSLAND can produce fat lambs as good in quality as any of her sister States or New Zealand. It is safe to say that there is no quicker money to be made out of sheep than in the production of the right type of sucker lamb. Prices during the past three years have been exceptionally good, and at the present time compare more than favourably with values elsewhere. The Department of Agriculture and Stock has more or less concentrated on fat lamb raising during the past few years, and the results have been highly gratifying. At the same time the opportunity exists for the profitable production of a great increase in numbers to the direct benefit of the farmer and the State generally.

The scarcity of the right type of crossbred ewe is one of the difficulties with which the industry is at present faced. So much is this the case that for the present the crossbred ewe may be disregarded and the presumption that a start has to be made with the merino ewe taken for granted. The best ewe for the production of fat lambs is got by the introduction of the long wools, such as Border Leicester, Romney Marsh, or Lincoln rams with the most robust strong woolled merino ewes. The ewe portion of the resultant drop should be retained as the breeding flock.

If one is fortunate enough to be able to purchase Corriedale ewes so much the better, but these, too, are difficult to come by. Here it may be stated that the few breeders of Corriedales in Queensland are allowing their flocks to become a great deal too fine in the wool. It is a common thing these days to see so-called Corriedales carrying a fleece of merino counts and not strong even at that. This is defeating the object for which the Corriedale was evolved. Properly bred, the Corriedale is an excellent all round farmer's sheep.

Although it is correct to say that in the production of fat lambs the clip from the ewes is of secondary importance, more attention may be given to the fleece with profitable results, provided always that the lambs be regarded as of major importance.

*In a broadcast talk from Radio Station 4QG (Australian Broadcasting Commission).

A properly bred Corriedale ewe is ideal for the purpose, and in addition the ewe gives a fleece of relatively high value. The Border Leicester-Merino cross also produces a nice fleece of high-yielding wool.

The Romney Marsh with the merino also nicks splendidly. All three crosses mentioned may be highly recommended as the mothers of fat lambs. On any of these crosses (the Corriedale is included for the purpose) a Downs-bred sheep should be used. Opinions naturally differ as to the best of these breeds. There is little doubt that the Southdown is the fashionable lamb at present. He is so shapely and, provided he is adequately fed all the time, he is early maturing. However, it is of importance to remember that the Southdown receives no check. Should this happen he does not compare with some of the other crosses at a more advanced age. Then again the wool from the Southdown may be almost disregarded.

The use of the Dorset horn ram is to be highly recommended. One advantage he possesses over all other breeds is the fact that he will, like the merino, work at any season of the year. All other English-type sheep mate best in the autumn and spring. The Dorset horn produces a particularly nice lamb, hardy and early maturing, and provided they are truly fat they scale well at a very early age. The wool is not high class. The use of the Border Leicester ram is to be recommended, especially when joined with merino ewes. Some buyers prefer the progeny from the merino ewe when the Border Leicester is in question, to the lamb produced from the crossbred ewe. The contention is that the merino ewe throws a lamb of greater refinement than the crossbred ewe to this particular ram. Then again the skin value is greater. For all-round purposes the Border Leicester is hard to beat, and no farmer should regret using him.

It should be the object of the farmer to produce a lamb straight off the ewe and truly fat, weighing 32 to 34 lb. at not more than four months of age. From the teat to the block should be the fat lamb raiser's slogan. To do this with any degree of certainty cultivation is essential. It is a waste of time and money to try and grow fat sucker lambs on natural grasses. Sheep in conjunction with wheat is a splendid proposition, and it is not now a question as to whether the wheat farmer can afford sheep, but rather whether he can afford to be without them. All cereals are to be recommended for the grazing of ewes and lambs. Nothing is better than lucerne, and it is surprising on what lands this highly valuable plant will grow if properly sown and looked after in the early stages of its growth. Provision should be made for winter feeding, and in this connection something definite should be done with regard to permanent improved pastures. Country in the south, which I remember as worth 30s. to £2 per acre, is to-day worth up to £12 and £15 per acre purely as the result of pasture improvement. It is unfortunate that the fencing of a property and its paddocks should be such a comparatively expensive matter where sheep of British breeds and their crosses are depastured.

Nothing less than netting of some sort will hold them, and to mention the worst breed in this connection is only guess work, unless it happens to be the breed the farmer is running. Cultivation paddocks must be securely fenced in order that they may be grazed as required, and the boundary fences must be postively sheep-proof or trouble with neighbours will occur.

A short description of the British breeds used in the production of fat lambs may be of interest.

The Southdown.

The Southdown is a mousy faced, chunky sheep of comparatively great depth and thickness, broad chest, with splendid loins and thighs. As previously explained his progeny require the best of attention with regard to feeding.

The Dorset Horn.

The Dorset horn is a bold fellow with horns placed well forward on the head, differing in this respect from the merino, with well-sprung ribs, broad chest, good loin and thigh. He is of especial value on account of the fact that he will mate at any time of the year. His lambs are hardy and early maturing.

The Border Leicester.

The Border Leicester is a fine upstanding sheep with a noble carriage, plain head and points, showing a nice square effect of body. He is particularly suited to the high lands, produces a neat, early maturing lamb, and crosses particularly well with the merino. The ewe cross Border Leicester-merino is a highly valuable type for the production of fat lambs.

The Romney Marsh.

The Romney Marsh is a sheep of large frame, black nose and preferably feet, carrying a fleece of wool finer and with more refinement than the Lincoln. He, like the Border Leicester, crosses particularly well with the merino, and the ewes got from this cross are regarded as of great value. They are fine milkers. Perhaps the greatest value in the Romney Marsh and his crosses lies in the fact that he is pre-eminently the sheep for over-wet conditions and on lands where other breeds would prove a failure. In the use of the Romney Marsh for the production of fat lambs, I prefer the blood in the ewe. A Downs ram on top of the Romney cross ewe gives a splendid lamb which is thoroughly nourished by the mother.

The Shropshire.

The Shropshire is a sheep with black face and feet, symmetrical in shape, and the producer of a very nice lamb. Where Shropshires are used it is better to market the whole of the drop, as the black is inclined to predominate, and the wool produced by this breed is not regarded with favour. The ewes used in fat lamb raising, whether Corriedale, crossbred as described, or merino, should not be allowed to get too fat before and at mating time. Good strong store condition is all that is necessary. Over-fat ewes are likely to be shy breeders, and this chance cannot be afforded where high-lambing percentages are looked for. In the condition described it is a good plan to flush the ewes on rich and succulent feed a fortnight before joining the rams. Yarding the ewes and rams three or four times a week is to be recommended. The rams, if working, should be left in for a period of six weeks. It is a good plan, if sufficient rams are at the disposal of the farmer, to hold some in reserve and join these in addition to those originally joined about three weeks after the first mating.

As previously intimated, the Dorset horns may be joined with every prospect of a successful mating at any time when the feed is good. All the other British breeds mate best in autumn and spring. Too much importance cannot be attached to the fact that all sires should be pure bred. It is commonly thought that any sires of British type are good enough for fat lamb getters. No greater mistake could be made. One has only to see a crop of lambs got by pure bred sires alongside those from

inferior animals to realise the importance of this question of pure sires. The cost of the rams should not enter into the question at all. It is safe to say the pure bred more than pays the additional cost of his purchase in the first crop of lambs. Lambs should be marketed as soon as fit. It is essential in order to achieve top prices that they should appear before buyers with the bloom on them. Too often losses are sustained by growers waiting for the more backward lambs to mature so that a large portion of the drop may be marketed at the one time. In these days of good roads and motor transport, it is an easy matter to land lambs at the yards a few hours after leaving the ewes. That is all to the good.

If conditions are such that lambs have to be driven to the rails, farmers are advised to take a proportion of the ewes with them. It must be remembered that true suckers have never been away from their mothers, and there is a grave risk of knocking the lambs about if the attempt is made to drive them on the roads without some of the older sheep to steady them. Never truck lambs in a heated condition. Never overload the truck. Never poke lambs with sticks. Remember the tenderness of a sucker lamb and handle it as such.

THE REMOVAL OF SOOTY MOULD FROM CITRUS FRUITS.

Owing to the very adverse weather conditions which prevailed in the spring and early summer, citrus growers in the coastal areas were not able to adhere to the normal spray programme. As a result scale insect infestation, particularly of the wax scales (pink wax and white wax) is now at a very high level, and, as usual, is accompanied by a copious growth of sooty mould. Even if the usual sprays were applied in the autumn, it is probable that many growers will be considerably inconvenienced by the presence of this growth on the fruit. The fungus, as most growers are aware, subsists on the sweet secretions of certain scale insects, notably pink and white wax. Except in very severe cases, it causes little direct injury to the tree, but the disfiguration of the fruit is a serious matter.

Various methods are used for the removal of sooty mould. In all of them, injury to the rind should be avoided at all costs, because it opens the way to infection with blue or green mould in the fruit. With moderate blemishes, a light brushing of the fruit will suffice. If the fruit is badly affected, brushing, sufficient to remove the mould, may seriously injure the rind. Cleaning the fruit in a rotating barrel partially filled with sawdust is a method very commonly used, but has little to recommend it. Damaged rind and bruised flesh too often result from this procedure.

If washing has to be resorted to, the fruit should be immersed for about one minute in a solution containing ¼ lb. of boracic acid and ¼ lb. chloride of lime to each gallon of water. This solution has been used extensively by growers and has been found very satisfactory. After immersion in the cleansing solution, the fruit should be well washed in clean water to avoid a whitish deposit on drying, and then should be dried thoroughly before packing.

Removal of the sooty mould by a spray before the fruit is picked is rarely practicable, and should be considered only as an emergency measure.

—*N. Caldwell.*

Poultry Feeding.

P. RUMBALL and J. J. McLACHLAN, Poultry Staff,
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THERE is probably no matter of greater importance to the successful poultry raiser than that of feeding. For this reason and to assist in the economical utilisation of the various foods available, poultry raisers should have a thorough knowledge of the principles underlying feeding. Although it is possible for many to buy mixed foods suitable for either egg production or the growth of young stock, it is not always advisable for the commercial poultry raiser to rely solely on these foods, for the distance from the manufacturer adds considerably to their cost; besides it may also be possible for the poultry keeper to make use of foods obtainable in different localities at lower values.

Poultry, as with all livestock, require food first for the maintenance of the bodily functions—that is, the supplying of heat and energy and repair of waste tissue, the surplus only being used for body development, or, in the case of moulting stock, the growth of feather, and in laying stock the production of eggs. It is possible, and it frequently happens, to retard the development of growing stock by incorrect feeding, and in adult stock to just maintain the birds in perfect health without procuring the desired production of eggs. It is, therefore essential for the poultry raiser to realise at the outset that under-feeding is not conducive to satisfactory results, also that the production of eggs or the bodily growth of young stock can only be obtained by feeding quantities in excess of the bodily requirements of the bird.

To attain success in poultry feeding, a practical knowledge of food values, the classification of ingredients, uses of these ingredients, and the composition of various poultry foods is necessary.

CLASSIFICATION OF FOOD INGREDIENTS.

The food ingredients are generally classified in the following groups:—Proteins, carbohydrates, fats and oils, fibre, ash, and moisture.

In addition to this classification, most careful consideration has to be given to substances known as vitamins, for it has been proved by experiment that it is impossible to obtain correct development in growing stock, or satisfactory egg production from laying hens, with a properly balanced ration of protein and carbohydrates if certain vitamins are absent. Further, the absence of essential vitamins is responsible for diseases of a malnutritional nature and the reduction of natural resistance against diseases.

Protein.

Protein is a compound built of nitrogen, hydrogen, oxygen, and a few minor constituents. During the process of digestion the insoluble proteins are converted into soluble amino-acids which are absorbed by the walls of the intestines, passing into the circulating blood, by which means they are transported to the various parts of the body to fulfil their functions. There are about twenty known amino-acids, many of which are essential to the well-being of the fowl. All forms of these acids are not found in any one class of food, consequently it is necessary to have variety in the ration in order to avoid the absence of any essential amino-acid.

As there is approximately 20 per cent. of protein in the body of the fowl (live weight), the importance of feeding an ample supply of protein can be understood, but it is not wise, in fact harmful, to feed protein-rich feeds to excess. In the first place, protein-rich foods are generally the most expensive of the food material available, and for this reason an excess is uneconomic. Secondly, protein cannot be stored in the body for future requirements. The surplus after being converted into amino-acids is divested of its nitrogen by the liver and converted into fat, and is stored as such, and the separated nitrogen voided as uric acid through the kidneys. Therefore, as well as an excess being uneconomic, it places an undue strain upon two vital organs—namely, the liver and kidneys.

Carbohydrates.

Carbohydrates are compounds of carbon, hydrogen, and oxygen. Substances such as sugars and starches are carbohydrates. During digestion these substances are broken down into simple sugars and absorbed. After absorption these sugars combine with the oxygen of the blood and are converted into carbon dioxide and water. The process of oxidation yields the heat and energy. Excess of carbohydrates are stored as fats.

Fats.

Fats are compounds of carbon, hydrogen, and oxygen. The oxygen content is about 11 per cent., whereas that of carbohydrates varies from 49 to 53 per cent. Fats and oils are chiefly used by the bird to supply heat and energy, the surplus being stored as fat. Owing to the greater quantity of oxygen necessary to oxidise fats and oils, due to its lower oxygen content, a given quantity of such substance will represent more energy than a similar quantity of carbohydrates.

Fats are not so easily digested as carbohydrates, and should not be fed to excess. As heat and energy produces, fats are worth from 1·9 to 2·5 times as much as carbohydrates.

Mineral Matter.

Mineral matter is that portion of plant or animal life that is left after burning. It is used in building up the frame, and ensures the proper functioning of body fluids. It has been established by practice that all minerals required by poultry are not present in the usual food supplied on commercial farms, also that the mineral requirement of the fowl varies with age. Only a sufficient quantity of mineral matter is absorbed by the fowl for immediate requirements, consequently a continuous supply must be fed.

Fibre.

Fibre includes the least digestable of foods, such as the outer cells of grains and fibrous matter in plants. Excessive quantity of fibre are to be avoided, as they are not only indigestible by poultry but, when excessively fed, especially in young stock, irritate the intestines.

Vitamins.

Vitamins are now known to be chemical substances, and may be classed as accessory food factors. No matter how well a ration may be balanced, without these substances satisfactory results cannot be obtained. There are five vitamins, commonly known as A, the B Group, C, D, and E.

Vitamin A may be referred to as a growth-promoting factor. It is built up by plants, and is found in green feeds, lucerne chaff and meal (commonly used as a green-feed substitute), bran, yellow maize, and whole wheat. Cod liver oil is also rich in *Vitamin A*. The absence of this vitamin in a ration fed to adult stock will cause nutritional roup and render the birds more susceptible to coccidiosis, fowl pox, severe colds, tapeworm infection, &c. Its presence in sufficient quantity will increase production, hatchability, and better development in growing stock.

It has been estimated by one authority that it is necessary to feed with bran and pollard 5 per cent. dry lucerne and 30 per cent. yellow maize meal with grain feeding in the evening of equal parts yellow maize and wheat to supply all the vitamin A necessary to good production.

The most economic form of supply of this vitamin is green feed and yellow maize, while the most convenient, in the absence of either of these foods, is 1 per cent. of a good grade of cod liver oil.

Vitamin B.—This vitamin is common to most of the foods fed to poultry, and no trouble has been recorded due to its shortage.

Vitamin C.—It was at one time thought that poultry were not susceptible to scurvy, but a recent report of an American authority indicated that growing chickens were subject to the disorder, but only after feeding a ration that would not be used commercially. This vitamin does not appear to be of importance in poultry feeding.

Vitamin D.—This vitamin, with vitamin A, is most important in the feeding of poultry. It is essential for the assimilation of the calcium and phosphorous, and naturally most important to the growing birds. This vitamin is present in abundance in cod liver oil and animal fats. Sunlight enables it to be developed in the body of the bird. With modern conditions of rearing it happens that chickens, and at times adult birds, do not get all the sunlight they should. In such cases cod liver oil can be used as a substitute. Prolonged over-feeding of vitamin D produces loss of appetite, followed by loss of weight, general ill-health, and ultimately death.

Vitamin E.—This vitamin is associated with reproduction. Investigations have shown that the feeding of rats with a ration in which this vitamin was absent brought on sterility. Sterility was cured by the feeding of small quantities of wheat germ oil. In practice breeders would guard against the possible cause of infertility by feeding good sound wheat of wheat germ oil and green food, particularly lettuce, in the ration of their breeding stock.

Digestibility of Foods.

The chemical composition of a food does not indicate its digestibility, and as regards poultry little is known on the subject. It is a question that can only be definitely ascertained by feeding experiments conducted with poultry.

Palatability of Food.

Results are not obtained by making up a ration with definite proportions of the constituents referred to later unless the fowls will eat it. If they become hungry enough they will consume a sufficient quantity of almost any food, but it will be at the cost of a very much reduced

egg yield. Upon analysis, barley is found to be a food carrying almost the right quantities of protein and carbohydrate essential for egg production, but when put into practice we find that fowls do not relish the grain, and have to be gradually accustomed to consume it. It may be as well here to mention that in making any change in the ration to laying stock, do so gradually, as sudden changes in the diet cause a reduced egg yield and frequently a false moult.

METHODS OF FEEDING.

Several methods of feeding are commonly practised, and in many instances with equal degree of success. Each method has its own advantage and appeals to the individual feeder.

The methods are known as—(1) wet mash and grain, (2) dry mash and grain, (3) and all-mash.

Wet Mash and Grain.

The mash is a mixture of different ingredients, moistened to the extent that when a handful is squeezed it will remain in mass form, and when dropped a few inches will break up into small particles. It would be more in keeping with this class of mash if it were termed "moist" instead of "wet."

With this type of feeding the mash has to be prepared daily and distributed to the birds, care being taken to feed sufficient for their requirements and not allowing any to remain unconsumed—say, after an interval of half-an-hour after feeding. The mash should be placed in shallow narrow tins or troughs, and as the food should be consumed within about half-an-hour there should be no lack of feeding space or the more timid class of bird will not procure all that she requires for maximum production.

It is usual to feed wet mash first thing in the morning and grain late in the afternoon. Many breeders reverse this order with successful results, and find that it fits in better with the daily routine.

Dry Mash and Grain.

A mash similar to that used for a wet mash is prepared dry and placed in hoppers. Birds are at liberty to consume the food at will, and although certain feeding space has been found necessary for best results the more timid fowl has a better chance of securing its requirements from a limited space than is the case in wet mash feeding. One foot of hopper space should, however, be allowed for each ten birds. The advantage of the system of feeding is that instead of mixing and feeding mash daily a quantity can be prepared and distributed once per week, and so reduce the labour of feeding. The most serious disadvantage, however, that the writer sees in this method is that the constant supply of feed encourages rats to harbour in the poultry pens.

With this system of feeding grain is usually fed during the afternoon, allowing birds ample time to scratch and find grain distributed.

All Mash.

As the name suggests, nothing but mash is fed. A suitable mixture is made and placed in hoppers. The birds have access to this food at all times throughout the day. This system of feeding possesses advantages over both the other systems previously mentioned, although it has

the disadvantage of encouraging rats. With the all-mash system, quantities of food can be placed out once per week, thereby saving the daily attention of feeding. The birds are also compelled to consume a ration suitably balanced, and from practical experience this system suggests the possibility of preventing breeds of the heavy variety putting on excessive internal fat. Production with this system of feeding is equal to any other. Fowls do not take kindly to radical changes in grain feeding, but with the all-mash system the meal of various grains may be substituted without any appreciable easing in production. Naturally, the converting of grain into meals increases the cost of feeding slightly, but the saving in labour and the assurance that the birds are being fed a ration suited to their requirements appear to justify the slight increase in cost.

THE FEEDING OF CHICKENS.

In the feeding of chickens it is most important to bear in mind that nature has provided for the first day or so of the chicken's life, as just prior to hatching the balance of the egg yolk is drawn into the abdomen of the chick. Most breeders allow at least forty-eight hours to elapse before feeding. Chickens fed earlier are subject to bowel trouble. A system of prolonged starving, however, should not be practised, as it has a weakening effect, from which many chickens do not recover.

Requirements of Growth.

Chickens make very rapid growth the early part of their life. This development is most rapid during the first six to eight weeks, consequently rations having a relatively high protein content are necessary to give the best development. From experimentation it has been definitely established that rations having a crude protein content of 18 to 20 per cent. should be used during the first six to eight weeks, and after that period reduced to 15 per cent. The protein requirement of a chicken does not alter as sharply as this, but these periods and protein content are suggested as meeting the practical requirements of the poultry raiser. Part of the protein in a ration should be of animal origin.

It is a common practice among many poultrymen to cut down the protein content after the chickens are about sixteen weeks of age, in order to delay sexual development. This, we think, is desirable if the birds are maturing too rapidly, but development can be controlled to only a very limited degree. Excessive protein feeding must be guarded against, as constant and overfeeding of protein-rich foods causes deposits of urates in the ureter, kidneys, and other organs, as well as placing an undue strain upon the liver.

It is generally conceded that milk is the most desirable protein feed for chickens and growing stock, but owing to its cost its exclusive use is not possible. Wherever possible milk should form a portion of the ration. It may be given in the form of curds, semi-solid milk, butter milk, or butter milk powder. As a drink milk is excellent, but it is objectionable owing to the difficulty of keeping chickens clean. The writers favour butter milk powder, owing to the ease with which the powder may be incorporated in the mash, thereby controlling the kind of food that each chicken consumes. It has, however, no definite advantage from a feeding value point of view apart from its concentration. Proteins build up the flesh, but at the same time a bony framework is necessary. Analysis of the chicken at different ages, according to

Halnan, indicates that it was particularly important to allow for the mineral requirement from the eleventh to the twenty-fourth week. In all experiments conducted by the Department, the increased mineral intake has been allowed for by the addition of bonemeal to the mash at eight weeks of age, and by allowing the birds free access to grit (shell and hard).

Food Consumption of Chickens.

One is often asked how much food should be given to chickens. Probably no better reply can be given than the publishing of a table from actual experiments conducted in this State.

FOOD CONSUMPTION AND WEIGHT OF CHICKENS.

Age.	LEGHORNS.		AUSTRALORP.	
	Weight of Chickens.	Food Consumed Weekly.	Weight of Chickens.	Food Consumed Weekly.
	ozs.	ozs.	ozs.	ozs.
Day old	1·3	..	1·36	..
1 week	1·97	1·64	2·14	1·53
2 weeks	3·31	3·36	3·61	3·32
3 weeks	5·31	4·80	5·84	5·05
4 weeks	7·61	6·46	8·68	7·20
5 weeks	9·94	7·58	12·08	6·89
6 weeks	12·92	8·96	15·86	10·62
7 weeks	16·65	8·65	20·17	13·95
8 weeks	20·41	13·29	25·31	15·05

The variation in weight from week to week and the ever-increasing amount of food required suggests the undesirability of indicating what should be supplied.

The food requirements increase week by week, and a system of feeding where the growing birds may consume all they require is the most desirable.

The all-mash method of feeding chickens by reason of the fact that the kind of food consumed is easily controlled, and that it is always in front of the birds, is suggested as being the most desirable. All-mash should be placed in shallow trays about 1 inch in depth during the first few days. The trays are then increased to a depth of 2 inches, and by the end of the first week troughs about 4 inches wide may be used. At this age chickens will commence to scratch with more vigour, scattering the feed from the trough. This can be prevented by placing a piece of netting on top of the mash loose enough to sink as consumption takes place. During the first week 8 lineal feet of feeding space should be allowed for every 100 chickens, and later increased to 12 feet. Prior to the mash being covered with netting it is important that only a little food at frequent intervals should be placed in the trays in order to avoid wastage.

In fact, the frequent feeding of all-mash appears to induce a greater food consumption, with the result of better development.

Breeders who do not desire to feed an all-mash may make use of commercial chick grains and growing mashes. These could be fed as directed by the manufacturers. It has been the custom for many poultry raisers to use scratch grain only for a short period of a

chicken's life, but in view of the more satisfactory results obtained by feeding a ration of a relatively higher protein content than chick mixtures usually have, early mash feeding appears essential.

Chickens may be reared satisfactorily upon moistened mashes and grain from about two weeks of age, but the mashes must be fed at frequent intervals. This system offers the advantage of utilising milk as a medium of moistening the mash when such is available. The feeding of dry mash, however, is suggested as a safer method of feeding, as the possibility of food becoming sour, and the probable consequent bowel trouble among chickens, is avoided.

SUITABLE ALL-MASH MIXTURE.

The following mashes have been used successfully in experiments conducted by the Department, and are suggested as a basis upon which to work. At times it may not be commercially sound to adhere rigidly and fast to the ingredients suggested, but from the table of analyses supplied it will be possible for the breeder to compound other suitable mixtures.

Ration.	1–8 Weeks.	8 Weeks to Maturity.
Maize meal	40	63
Bran	20	13½
Pollard	20	13½
Meat and Bone meal	7½	5
Dried buttermilk	10½	3½
Salt	1	1
Cod Liver Oil	1	1
Lucerne meal	..	2½
Crude protein content	17·15	14·40

REQUIREMENTS FOR EGG PRODUCTION.

The laying fowl has first to provide from her food supply for—

(1) Maintenance of vital functions;
(2) Growth requirements; and
(3) The production of eggs.

The first call upon the food supply is for that of vital functions, then growth, and any surplus nutrients are used in the manufacture of eggs. It will therefore be seen that the greater the production the greater will the consumption be, and that egg production is only possible by feeding quantities of food in excess of body requirements. It is generally estimated that a hen in full lay will consume approximately 2 ounces each of grain and mash per day. This quantity, however, will be in excess at times, and again be deficient during the period of peak production.

The majority of cereal foods available are generally deficient in protein, and in preparing a ration it is necessary to use protein-rich foods in the form of milk, milk powders, and meat meal. Protein-rich vegetable foods are available, but it has been found from experience that animal proteins give better results than vegetable. This probably is due to their greater palatability and to the fact that the range of amino-acids is wider. From practice it has been found that rations

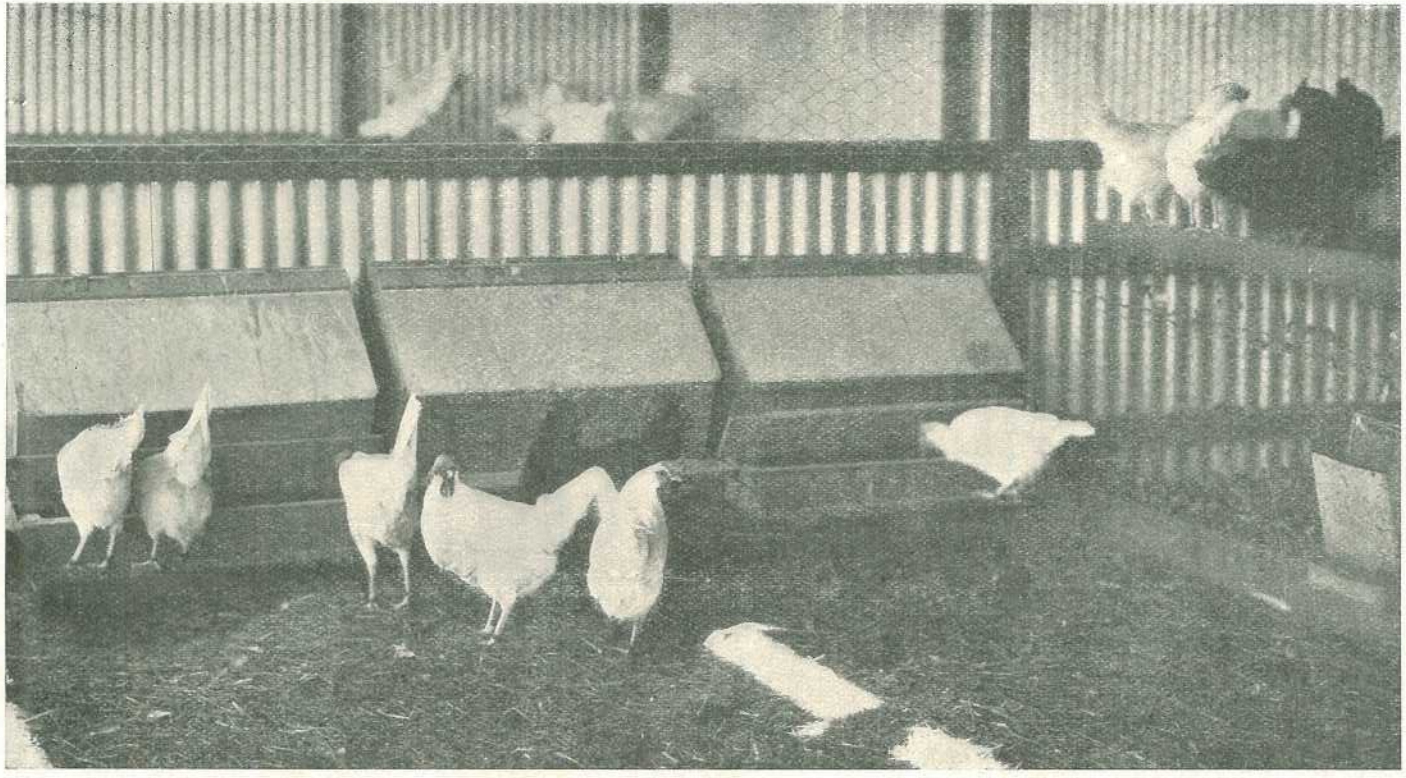

Plate 182.
Automatic feeding hoppers in use on a poultry farm near Brisbane.

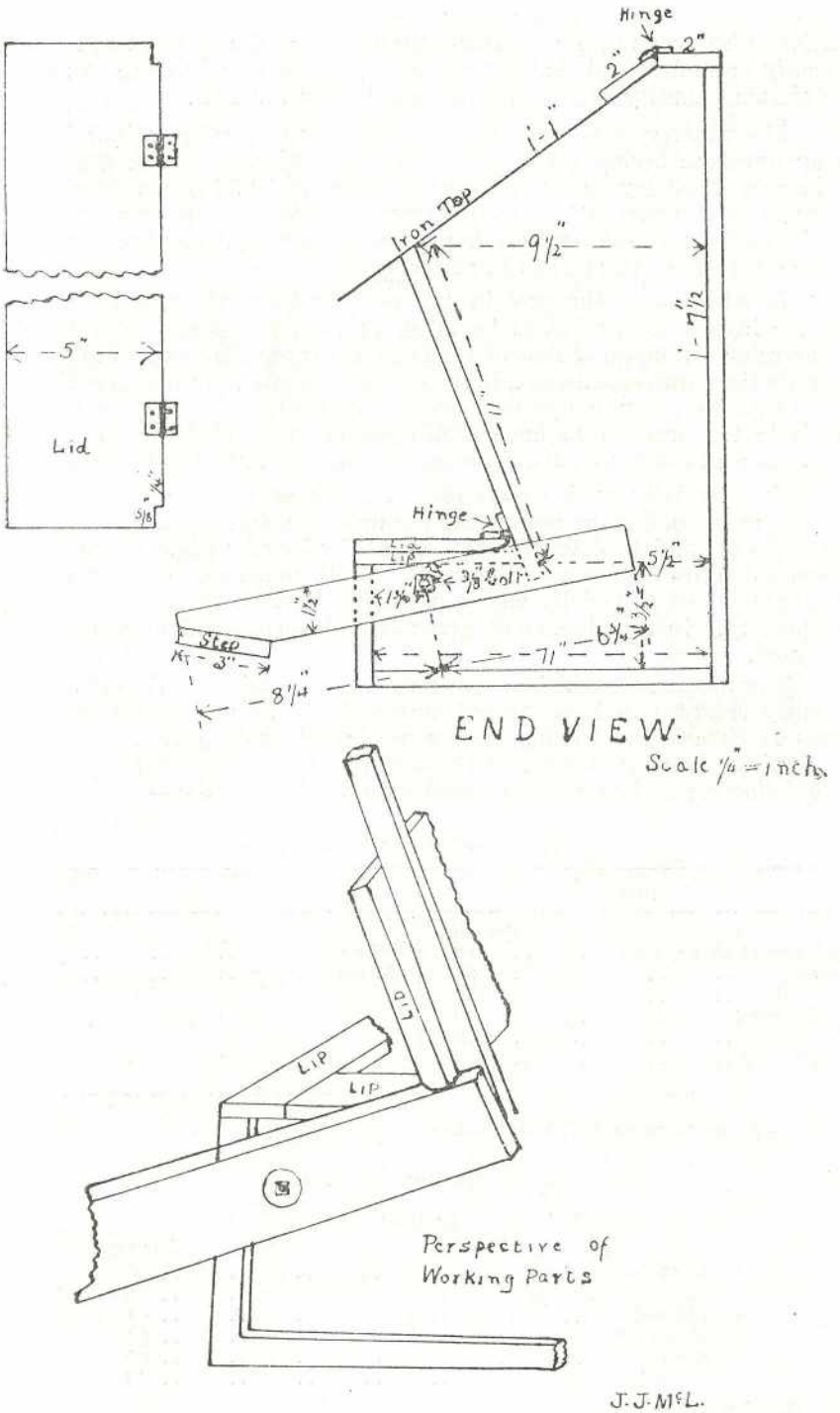

Plate 183.
Plan of automatic feeding hoppers as illustrated.

having a total protein content of slightly less than 15 per cent. give satisfactory results. As protein-rich foods are the most costly, it will readily be understood that the object of the feeder should be to use the minimum quantity necessary for maximum production.

The poultry raiser who does not desire to prepare rations himself may purchase laying mashes to be fed in conjunction with grain, also all mash. Most laying mashes contain from 17 to 20 per cent. of crude protein, and when fed in conjunction with grain, say equal parts of maize and wheat, the total crude protein content of the ration is reduced to the vicinity of from 14 to 15 per cent.

In addition to the protein and carbohydrate, the mineral content of the layers' ration has to be taken into consideration. The average amount of carbonate of lime of the egg shell is one-fifth of an ounce. To supply the requirements, say, in the mash, 4 per cent. of calcium carbonate would be necessary, but as hens not laying would only void the material it is better practice to have shell-forming material in the nature of limestone and shell grit always before the bird in separate receptacles.

Commercially, yolk colour does not appear to have as yet caused us any concern, but the consuming public do not like an excessively pale-yolked egg, and to overcome this green feed and yellow maize should form a definite part of a laying ration. Both foods are rich in vitamins, and green feed materially assists in supplying the mineral requirements of poultry. In the absence of green feed, lucerne chaff or meal should be used.

The manner in which layers may be fed varies. All systems previously referred to have proved successful. The most popular at the present time is the feeding of dry mash and grain, although all-mash is coming more into vogue. For those who desire to prepare mixtures, the following rations are suggested as a working basis:—

RATION—GRAIN AND MASH.

Mash.	Per cent.	Grain.	Per cent.
Lucerne chaff or meal	10	Wheat	50
Bran	28	Maize	50
Pollard	30		
Maize meal	20		
Linseed	2		
Meat meal	10		

Supplements to each 100 of mash—

½ lb. Salt.
2 lb. Sterilized Bone Meal.

All Mash.

	Per cent.
Meat Meal	5
Lucerne Chaff	6
Linseed	1
Maize Meal	30
Bran	20
Pollard	40

Supplements—

Bone meal	2 lb.	To every 100 lb. of Mash.
Salt	½ lb.	

CARE OF MOULTING HEN.

It is a common practice among breeders to give little attention to moulting birds. In many instances they receive nothing but a grain ration. Feathers contain a considerable amount of protein, and the most economical manner of getting birds back into production is to feed protein-rich foods as provided in a laying ration. Moulting may be induced by the feeding of nothing but grain at or about the time birds usually moult. When once the moult has commenced laying rations should be supplied, as it will take about a fortnight for the manufacture of the first egg after the moult is completed.

FATTENING.

Two classes of birds have to be considered—old hens and cockerels. The ability of the feeder to do much with old hens in good condition is questionable, but those slightly out of condition may be improved with ten to fourteen days' crate feeding. From experiments it has been found economical to rear cockerels to the various marketing stages on the growing rations used for pullets. Ten to fourteen days of crate feeding for these birds would undoubtedly add to their market value. As the old hens or young cockerels are to be handled they should be freed of external and internal parasites before being submitted to a fattening process. The crates could be small coops 2 feet wide, 3 feet deep, and 3 feet high. These crates hold about six birds, and if the floor is wire netting and off the ground the droppings would fall through and the birds will be kept clean. The front should be of wire or slats wide enough apart for the birds to get their heads through to feed from a trough in the front. An all-mash mixture of a relatively high protein content fed as a gruel three times a day will undoubtedly improve condition. With this system of feeding water is not necessary. Any food left over, say, after half-an-hour, should be removed in order to keep the appetite keen. A mash of equal parts maize meal and pollard, plus 10 per cent. butter milk powder and 5 per cent. meat meal, is suggested.

PREPARATION OF MASHES.

On the majority of farms the various ingredients that go to make mash are either mixed with a shovel upon the floor of the feed room or in some trough.

If the mash is to be fed wet it is a good idea to soak the lucerne chaff or meal in water over night. Just sufficient water should be used to make the mash of the correct consistency. The salt used in the mixture should be dissolved in the water first. This ensures equal distribution.

In making a dry mixture the salt should be added to the protein-rich foods in order to increase the bulk through which the salt is distributed. This action ensures an even distribution of salt throughout the mash.

Much labour will be saved and better mixing of the various ingredients ensured by using a mash mixer. An appliance that serves the purpose is easily constructed by the poultry raiser. The mixer consists of a drum constructed of 22-gauge galvanised sheet iron with tongued and grooved pine ends, as illustrated. A pipe of 1¼-inch diameter is passed through the centre of the drum, fitting into hardwood bearings at each end. This pipe can be keyed to the drum by boring a hole through the pipe close to the drum and using a piece of No. 8 wire as a key. The No. 8 wire must be bolted to the drum.

The mash is mixed by a tumbling process, and to assist in raising the mash on the side of the drum while it is revolving four battens should be attached lengthwise inside the drum 2 inches from the iron. The battens should be of 2½ by 1-inch timber.

The diameter of the drum is 3 feet 6 inches, and the length equal to the width of the iron. The sheet iron to pass around the drum must be riveted end to end, and the sides attached to the pine ends every 2 inches with screws. A convenient sized opening, the full length of the drum, must be left for filling. A sliding close-fitting door must be provided.

When using cod liver oil, an equal distribution is ensured by corporating it in the bran in the first instance.

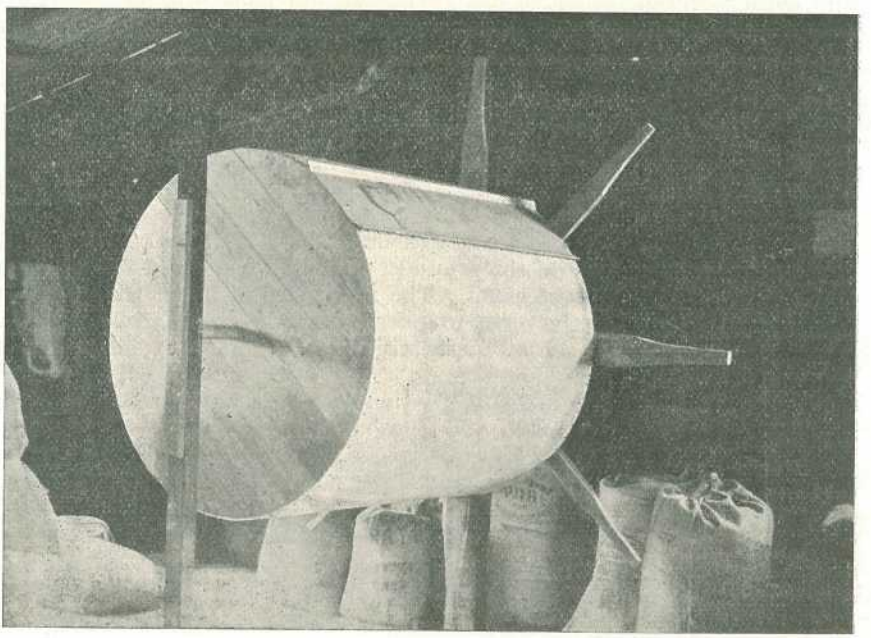

Plate 184.
A handy mash mixer.

Dry-mash Hoppers.

It is most difficult to design a dry-mash hopper that is efficient in all respects; however, the accompanying illustration will prove quite satisfactory. This hopper, being wider at the bottom than the top, tends to obviate the trouble of mash sticking which is so common in other designs. In addition, the lip on the feeding trough will prevent much wastage of mash. Such a hopper could be built in lengths to suit the number of birds, allowing 1 lineal foot of feeding space to every ten birds. The feeding space, however, could be increased where all-mash is fed by allowing 1 lineal foot to every eight birds.

Wet mash should be fed in troughs or on a sheet of iron; after the birds have consumed the mash these receptacles should be stood up to avoid contamination.

TURKEY FEEDING.

No food should be given for at least forty-eight hours after hatching. Hard grit, charcoal, and water should be the first material provided. The hard grit assists in mastication, and charcoal has no equal as a bowel corrector. Turkey chickens will gorge themselves if allowed, and this gorging is responsible for a considerable amount of trouble. Turkeys in their wild state gather their food very slowly, and it is found best to imitate them as far as possible by feeding the young chickens only a little at a time, and fairly frequently. This prevents them from overloading their digestive organs, and helps to retain that keenness of appetite which is essential to success.

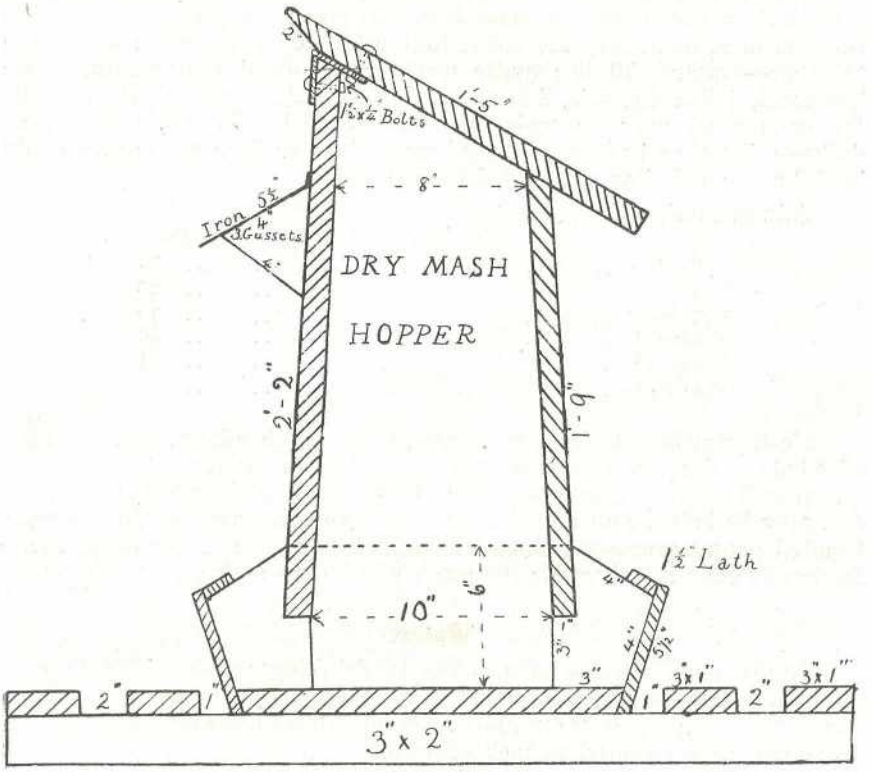

Plate 185.

Stale bread soaked in milk and then squeezed fairly dry is the most handy food on the farm, and gives excellent results. This can be fed five times a day for a few days, and variety can be added by the replacement of some of the meals with chick grains, mashes of bran and pollard mixed with milk, to which is added a small amount of minced meat, and tender green feed. This mash should be made crumbly and not sticky.

When on range the quantities of food will vary according to what they can gather for themselves, but surplus milk can be fed at all times either thick or fresh, but it is as well always to feed it in the same condition. Green feed should be fed in abundance to both growing and adult stock, but where range is allowed on good green pasture it is not so important.

Grains should always be fed at night, to induce the flocks to return to their camps. Oats, maize, and wheat are suitable for this purpose.

In the management of turkeys, especially in the rearing of young stock, cleanliness is essential. Food should not be allowed to lie about, and a strict outlook must be kept for vermin of all sorts.

DUCK FEEDING.

Ducklings require no feed for forty-eight hours after hatching.

During this period they should have water, coarse sand, and charcoal constantly before them. A mash that will give good results if fed from the first meal until they are about four weeks old is prepared by mixing together—pollard, 10 lb.; maize meal, 8 lb.; dried butter-milk, 2 lb.; bonemeal, ½ lb.; fine salt, 2 ounces. If this mash is mixed, the amount for each meal may be moistened as required. Feed several meals daily—a little, and often, is a good motto. After four weeks they could be fed a mash similar to that fed to the adults.

Adults mash—

	Per cent.
Pollard	55
Bran	25
Maizemeal	10
Meatmeal	10
Bonemeal	1
Fine Salt	½

Feed growing stock three meals daily. With adults, a small meal of whole maize could be fed in the evening in addition to the mash. In fattening ducks, cheap foodstuffs in the form of potatoes, pumpkins, &c., may be boiled and added to the mash to the extent of 40 per cent. Chaffed young greenstuff should be added, but when using other cheap foodstuffs omit it, otherwise the mash will be too bulky.

Water.

Ducks must always have access to drinking water. This is *most important* with ducklings, and the water vessels should be deep enough for them to submerge their heads. Many ducks die annually, and the cause can be attributed to lack of water.

COMMERCIAL FOODS AND THEIR FEEDING VALUE.

Barley.

Not a popular food among poultry-keepers nor do fowls consume it readily. It has a fair feeding value, but in order to increase its palatability it should be soaked or sprouted. When corn and wheat are high in price, barley may be used to the extent of 50 per cent. of the grain mixture, but the change over should be gradual.

Beans and Peas.

When whole, stock do not take kindly to either of these grains; crushed they add to the protein content of the mash, and may be used to the extent of 10 per cent.

The Grain Sorghum.

In the drier areas this crop may be grown successfully when maize or wheat are failures. They are slightly higher in protein content than maize, but do not contain the fats. Feterita and Milo are preferred, and are extensively used by some breeders with a good deal of success and economy in feeding. Some varieties of the grain, notably Kaffir corn, are credited with a binding effect, but as an offset against this plentiful supplies of green feed can be used.

Maize.

This is one of Queensland's staple grain crops of which poultry are very fond. Large grain should be cracked, but the smaller varieties can be fed whole. When purchasing maize for grain feeding, it is as well to try and secure the small grain. The quality is then easily judged, and there is no waste. Cracked grain should always be sieved before being used, and the fine powder used in the mash. Yellow corn should be used in preference to the white on account of its *vitamin A* content.

Oats.

In some places oats is one of the principal poultry foods. Most of Queensland's supply is, however, imported, and it therefore cannot be used economically in large quantities. It is, however, desirable to add variety to the ration of breeding stock by using a proportion of this grain.

Rice.

In the northern portion of Queensland, where this grain is grown, it may be possible to use quantities economically. It is a very starchy food of a fattening nature, but can be used to the extent of one-third of the grain ration. Crushed or ground rice should be used with care. It has a tendency to go rancid.

Wheat.

This grain provides the bulk of our poultry food. It is readily consumed by poultry, and can be fed as a part or whole of any grain ration, the market price of various grain foods available being the guide as to the quantities used. Plump wheats of a hard nature are of better feeding value than pinched grain or full soft grains.

Bran.

Bran is rich in protein and mineral matter, but contains a considerable quantity of fibre. This fibre is useful in adding bulk to the ration. It also assists in making a mash when fed wet of a desirable consistency. Use at the rate of up to 30 per cent. of the mash.

Pollard.

Pollard has a greater proportion of carbohydrates than bran, but not so much ash and fibre. It forms the principal constituent of mashes, and may be used to the extent of 60 per cent. of the total mash.

Maize Meal.

This meal is of especial value in fattening poultry. Some should be used in all mashes.

Ground Oats, Rolled Oats, and Hulled Oats.

Ground oats—that is, oats without the hulls—is an excellent food for both laying and growing stock. The use of these foods is largely governed by the price.

Linseed Meal.

Rich in oils and proteins, also fibre, it may be used to the extent of 2 per cent. in the laying mash, and increased slightly during the moulting period.

Cotton Seed Meal.

Cotton seed meal, on analysis, would appear to be a splendid food for poultry, but in practice the extensive use has not given good results. A good grade may be used to the extent of 5 per cent., but never exceed this quantity.

Peanut Meal.

Peanut meal is protein-rich and easily digested meal. The keeping quality of the food is poor, being inclined to go rancid, but it may be used to assist in building up the protein content of mashes.

Meat Meals.

Meat meals vary considerably in their analysis. They are essential for high egg-production. The quantities to be used vary according to conditions under which poultry are kept. In closed runs where no other class of animal food is available, they may be used to the extent of 10 per cent., but with stock on free range during periods when animal food in the form of insect life is plentiful, the quantity should be considerably reduced.

Dry Crushed Bone and Bone Meal.

These materials are essential for the development of the bony structure of young growing stock and beneficial to laying birds. Quantities up to 5 per cent. may be used. Poultry keepers who are a distance from markets may burn any bones about the place, which renders them easily crushed, and so have a supply of mineral matter suitable for feeding to young growing stock.

Milk.

If all poultry keepers had a good supply of skim milk or butter-milk there would not be such a large number of poorly developed stock. There is no better animal food for stock than milk or milk products. In a sour state it is recommended by some authorities as preventative of diarrhoea and coccidiosis. In feeding, vessels should be kept clean, and although the milk is being fed in a sour state, putrification must be avoided.

Dried Buttermilk.

This is an excellent food for those who have not the fresh product, and in a State such as Queensland, where the dairying industry is so extensive, poultry breeders should be assured of continuity of supplies. Milk and milk products appear to be a tonic as well as a food, and highly suited for laying, growing, and breeding stock. When used for the latter purposes, it has been our experience that the hatchability of the eggs has been increased. It may be used as the sole source of animal food, or in conjunction with other forms of animal food. The price will govern its use.

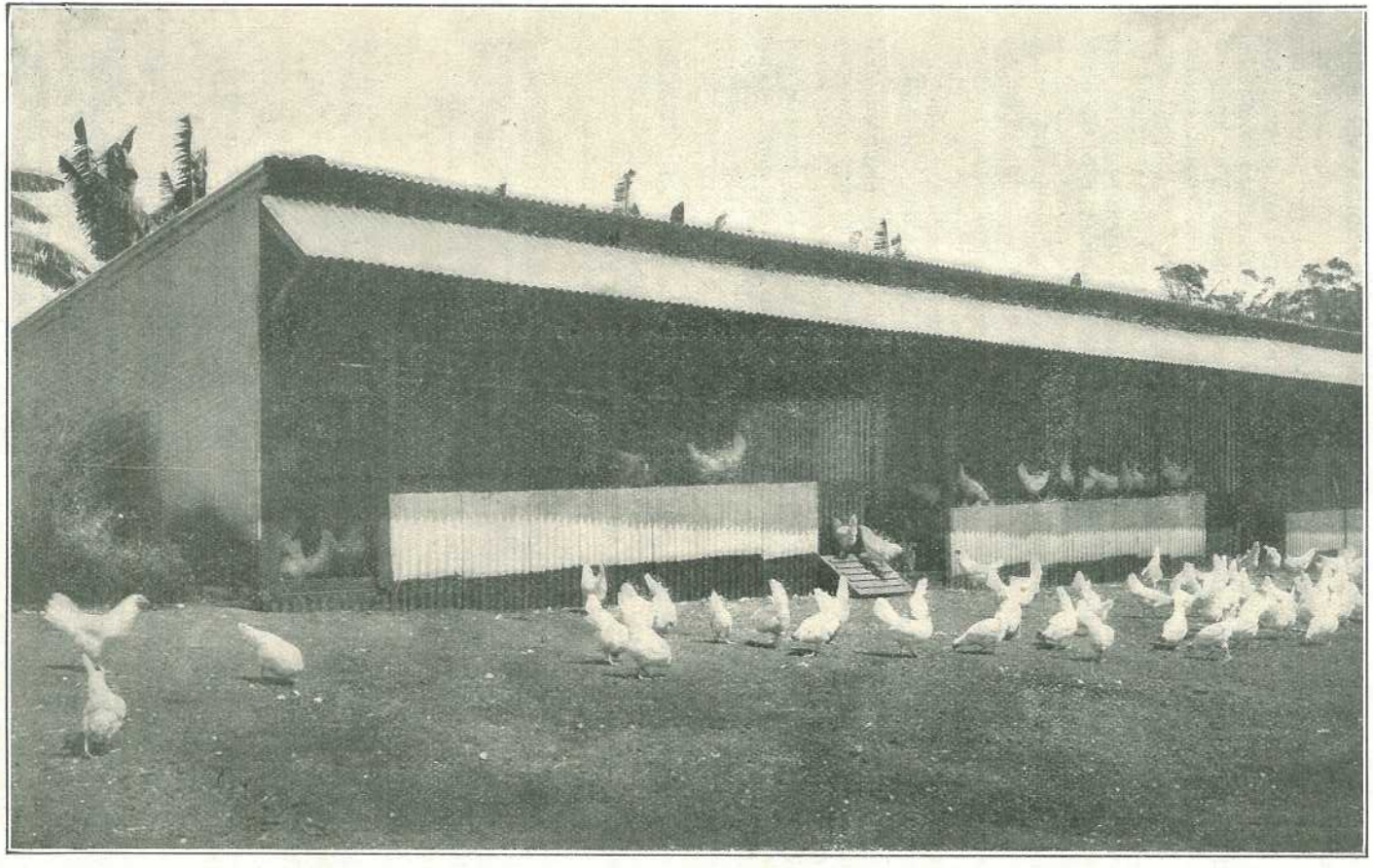

Plate 186.
An intensive laying house on a poultry farm near Brisbane, built according to the plan shown on page 169 of the February issue of the Journal.

Green Feed.

Some sort of succulent green food is essential to maintain the health and vigour of stock.

It has long been recognised as an important food for poultry, but it is only during recent years that scientists have found that green foods have been supplying an element essential to life. Green feed stimulates the liver and increases the secretion of digestive juices. The kinds of green feed most valuable and relished by fowls are the young, tender-growing portions of lucerne, lettuce, kale, rape, silver beet, barley, oats, maize, sorghums, &c. In fact, all green foods are good, but it should be young or tender. The quantity used is dependent upon supplies and general conditions. When feeding by itself, say, at midday, give the birds as much as they will eat. If used in a wet mash, the quantity could be as high as 25 per cent. of the bulk, and during droughty periods, when poultry foods are costly, green feed can be used to the extent of 60 per cent. of the mash; but when fed in these quantities, two mashes, one at 7 a.m. and one about 1 p.m., should be fed daily, followed by a grain feed, say, at 5 p.m. Poultry have not a great holding capacity, hence the necessity of feeding two mashes to enable them to deal with the bulk.

When fresh green feed cannot be obtained, lucerne chaff or meal makes an excellent substitute. This class of food, being dry, however, cannot be used to the same extent as if green. By weight, 12 per cent. should be the limit. If feeding on the wet mash, the dry lucerne can be soaked over-night with just enough water to mix the mash. This softens the lucerne and makes it more easily digested.

Grits.

Shell grit, limestone, or crushed bone should be provided. Plentiful supplies of oyster shell or ground lime should always be available, while bone may be supplied either in the form of meal or grit.

Hard Flinty Grit.

Hard pieces of rock, sand, &c., are necessary for poultry to grind their food, and should be in free supply, particularly with stock confined to pens. Without grit it is impossible for stock to digest their food thoroughly, and any system of feeding where this is not supplied is wasteful.

Charcoal.

This may be fed either in the mash or be made available to stock at all times. When it is desired to feed powdered charcoal in the mash it should be used at the rate of 2½ per cent. Charcoal is valued for its mineral content and its action as an aid to digestion.

In feeding all grit continuity of supply is essential, otherwise stock are liable to gorge themselves, with resultant troubles in the nature of distended crops, &c.

Salt.

With a good system of feeding—that is, variety and plenty of green feed—there is generally a sufficient supply of salt to meet the body requirements, but small quantities, 8 oz. to every 100 lb. of mash should be used to make the food more palatable, with the result of greater consumption and production. Salt, however, needs to be well mixed with the mash; when wet mash is fed it may be dissolved in the water, but when fed dry too much care cannot be exercised in thoroughly distributing it throughout the mash. Excessive quantities are poisonous.

COMPOSITION OF SOME POULTRY FOODS.

CRUDE NUTRIENTS.

Food.	Protein.	Fat.	Carbo-hydrates.	Fibre.	Ash.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Barley	8·6	1·5	71·0	2·7	2·2
Beans	25·4	1·5	48·5	7·1	3·2
Kaffir corn	9·9	1·4	74·9	1·5	3·0
Maize	9·5	4·0	69·3	2·8	1·4
Oats	10·3	4·8	58·2	10·3	3·1
Rice	7·6	1·9	66·7	9·3	4·9
Wheat	12·8	2·0	67·7	2·4	1·7
Bran	15·8	2·6	56·3	9·8	4·9
Cotton-seed meal (decort.)	41·0	7·0	29·0	8·0	6·0
Linseed meal (new process)	27·2	0·8	40·7	13·9	6·2
Maizemeal	8·6	3·7	71·4	2·0	1·3
Peanut meal	47·6	8·0	23·7	5·1	4·9
Pollard	15·7	3·6	61·4	5·8	3·1
Meatmeal	54·4	8·0	6·1	..	23·5
Skim milk	3·8	0·1	4·9	..	0·8
Dried buttermilk	34·5	1·1	49·1	..	8·3
Lucerne chaff	20·7	1·4	40·9	20·0	9·0

TABLE OF WEIGHTS AND MEASURES.

In order to prepare mashes which will give maximum results it is necessary for the various ingredients to be weighed. As scales are not available on all farms the average weight of the various kinds of foodstuffs most commonly used is given for two convenient measures, the kerosene tin and the quart measure. These weights refer to the measures being filled but not pressed.

Kerosene Tin.

Bran	12 lb.	Maize (whole)	28 lb.
Pollard	18 lb.	Maize (cracked)	25 lb.
Lucerne meals	12 lb.	Wheat	30 lb.

Quart Measure.

	lb.	oz.		lb.	oz.
Barley meal	1	8	Linseed meal	1	0
Bone meal	1	12	Pollard	1	0
Bran		8	Salt (fine)	2	0
Maize (whole)	1	12	Wheat	1	12
Maize meal	1	8	Wheatmeal	1	8
Meatmeal	1	8			

MILK AND CREAM TESTING EXAMINATION.

An examination will be held for certificates of proficiency in milk and cream testing and milk and cream grading on Saturday, 24th July, 1937; and in butter making and cheese making on Saturday, 31st July, 1937. The examination will be held in convenient centres. Candidates should notify the Under Secretary, Department of Agriculture and Stock, Brisbane, not later than the 5th July.

Entrance fee 5s. for each subject should accompany the notification, with an additional 10s. 6d. if a special country centre is desired as the place of examination.

Candidates must not be less than 18 years of age on the day of examination.

Soil Problems in Brigalow and Belah Country.

E. HIRSCHFELD, M.D., and R. S. HIRSCHFELD.

Subjoined is a report submitted to the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, who has approved of its publication as a contribution to a discussion on a subject of importance to Queensland farmers and graziers.

The report is especially interesting on account of its explanation of the melon-hole phenomenon. The large depressions characteristic of the brigalow melon-hole country are reminiscent of the shell holes of the war zone, and set the mind wondering what has caused them. The authors of the report seem to have hit upon a feasible explanation, which is sure to interest readers of the Journal who are familiar with the peculiarities of our brigalow country.—Editor.

BRIGALOW and belah country stands in a class of its own. Having lived on it, grazed on it, and improved it for the past eight years, we must outline first its features as we see them—features which set it apart from other types of land in the West.

1. The first thing to impress one is the density of the scrub. So dense is it that it is not easy for man or beast to make their way through it. We counted between 800 and 1,000 trees per acre. We look for a dense growth of trees in the rain forests near the coast, but do not expect to come upon it in our western lands with their limited rainfall.

2. Brigalow and belah country is practically useless for grazing purposes until it is rung. The trees are in possession of the soil, its mineral wealth, its water, and do not give grass and herbage a chance to grow. The dense scrub, however, affords shelter from westerly winds and warmth for stock during winter.

3. The peculiar formation of melon holes breaks up the level surface of the earth to such an extent that at first sight the country looks almost hopeless for agricultural purposes. The origin of these melon holes has never been explained satisfactorily. The name fits them. Many look as if they had been punched out; they average 10 or 20 feet across, are from 2 to 4 or 5 feet deep. Some melon holes are not round, but lengthwise and form small gullies 70 or more feet in length. After rain they hold water for quite a while, and are popular with the stock. Cattle seem to prefer the stagnating water in melon-holes, probably because it contains mineral matter. We found it a good plan to throw a few runners of water couch into the melon holes; they take root readily and reduce evaporation to some extent. When the hole dries up the water couch affords to stock a pleasant change from the ordinary pastures and remains green longer than the grass on the ordinary surface.

4. No other land in the west costs so much to improve; no other land will provide more employment than the brigalow and belah country. The ringbarking averages from 4s. 6d. up to 10s. an acre, according to the density of the scrub. And the man who does the ringbarking earns all the money he gets. The erection of an effective dog and rabbit-proof fence in brigalow and belah country may run to between £140 and £150 per mile. The provision for water requires the sinking of bores or making of dams.

5. The liability of the brigalow to sucker makes it risky to clear up the country for at least three to five years after it is rung. The timber fights back: the brigalow with its suckers and the belah with its seedlings.

Worst of all is the ti-tree, which runs in narrow belts and takes advantage of the country as soon as its big neighbour has died. Indeed, it is a stubborn country.

6. Once the brigalow and belah country is improved, it begins to repay the time, thought, labour, and money expended on it.

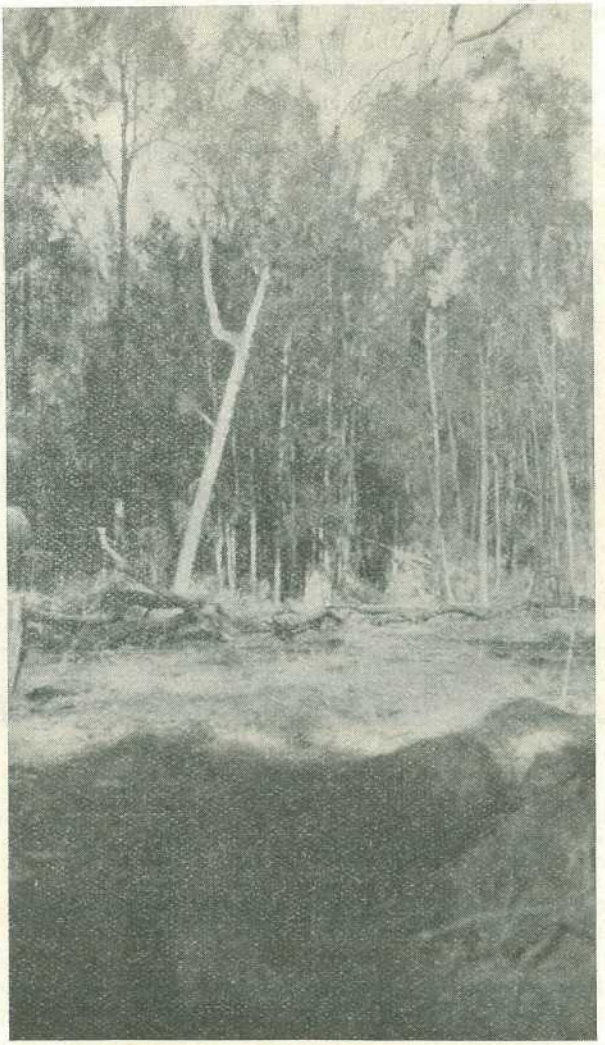

Plate 187.
TYPICAL BRIGALOW AND BELAH COUNTRY.

The outstanding feature, however, which has impressed us most is this: On the improved brigalow and belah country, as one dry spell succeeds another, stock manage to keep condition, not merely exist, in spite of the deficient rainfall. We are not over-stocked, nor are we

under-stocked. What are the qualities of this soil that enable brigalow and belah country to weather drought, and often produce a green bite, while the rest of our country is getting brown?

To try and find the answer to that question was the starting point of our soil experiments. We shall now describe how we put the question to Nature.

ARRANGEMENT OF EXPERIMENT.

Holes were sunk in the soil to different depths down to three feet, although the present experiments were confined to

(*a*) The soil on the surface;
(*b*) The soil at 6 inches below the surface;
(*c*) The soil at 12 inches below the surface.

Plate 188.
A CLEARING PROBLEM.

The bringing of Brigalow country into production is not such a formidable task as it appears at first sight. Ringbarking, poisoning with arsenic pentoxide, and the fire stick are the usual means employed.

The soil on the surface was smooth; it began to get crumbly or rather lumpy the deeper we went. After many months of westerly wind and no rain it looked bone dry. At 9 to 12 inches the small lumps showed here and there a white surface as of chalk. This was probably due to the presence of lime. The importance of this will become apparent later on.

Samples of soil were taken from each level—surface, 6 inches and 12 inches—wrapped in brown paper and taken to the homestead. We did not have the resources of a well-equipped laboratory there, but worked with the means at hand, such as they were. The soil was crushed and evened up with a rolling-pin. To make the mesh of the soil equal in each experiment, a sieve was required. A gravy colander was found to answer the purpose, and was requisitioned from the kitchen.

We had purchased a number of rain gauges, which with their graduated facing, permit of reading any change in the level of their contents; 72 cc. of each sample of soil were placed into each gauge, filling them up to the line marking 15 points. An equal quantity of rain water was subsequently added, and the results noted and tabulated in the record.

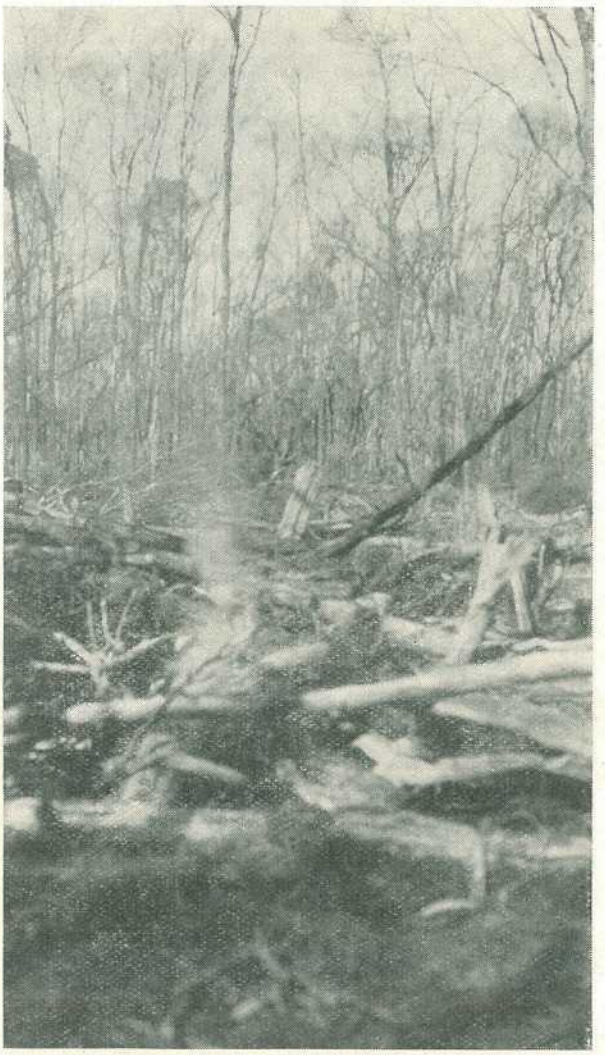

Plate 189.

A BRIGALOW FALLING "IN THE ROUGH."

A tangle of logs covering "melon-holey" ground, which, before long, will be clothed with nutritious indigenous and introduced pasture grasses.

What happens in a rain gange one and a half-inch in diameter and filled with soil artificially powdered probably differs vastly from what happens in the earth under natural conditions. This difference has always been kept in mind when interpreting the results of the experiment.

The Soil Breathes.

When a lump of sugar is dropped into a cup of hot tea, bubbles rise to the surface, as the air imprisoned within the sugar is set free. Precisely the same thing happens, when water is added to the soil in our gauges. The water as it soaks into the soil expels the air from within the soil and forces it up in bubbles. The surface soil holds more air—nearly half its volume—the deeper layers less.

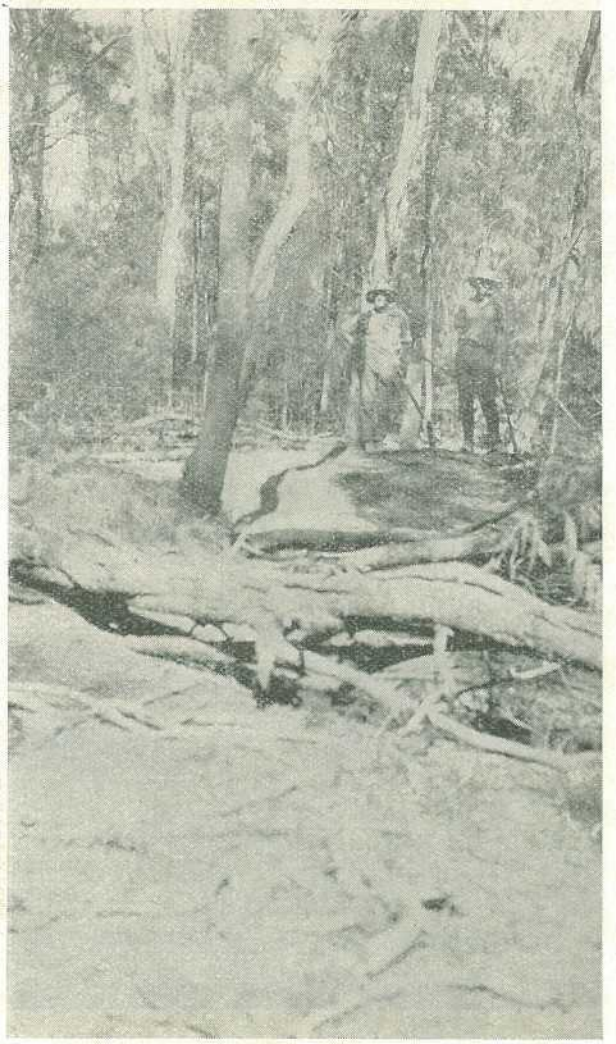

Plate 190.

A LARGE MELON-HOLE ALMOST HIDDEN BY SCRUB DEBRIS.

As in the gauges, so in Nature. As the rain falls, the infiltrating water drives out air and gases from the soil, in which they had lodged. Everyone knows the smell of moist earth after a shower. The gases displaced from the soil by the rain may give rise to this smell.

How does the air get into the soil? We know, of course, that without air in the soil plant-life would not be possible. When the wind raises clouds of dust it leaves behind air in the surface layers in exchange for the particles of soil it has blown away. Yet it is hard to imagine how this air reaches the deeper layers. Gases, without a doubt, form in the soil itself. The earth is full of life: animal, plant and bacterial. Life gives place to decay, decay gives place to life. Carbonic acid and other gases are thus formed and held captive within the earth. But the bulk of the air, especially oxygen, must come from the atmosphere.

Plate 191.
A FENCE-LINE CLEARING.
Note melon-holes in the foreground.

It was not our gauges, but the observations in the paddocks, which supplied the answer as to the origin of air in our soil.

The soil shrinks in dry weather and develops cracks. These cracks are mostly found in the heavy black soil of the Darling Downs, the western plains and the brigalow and belah country, wherever there is a heavy clayey subsoil.

The man on the land hates these cracks; they are unsightly, a hindrance to agricultural operations; they are credited with preventing the growth of trees by tearing their roots, and are always associated in his mind with droughts.

Plate 192.
A SUBDIVISIONAL BOUNDARY CLEARED FOR FENCING.

Yet, we cannot escape the conclusion that these cracks are absolutely necessary for the well-being of the soil. Through them the atmosphere gains access deep down to portions of the soil, which otherwise could never be ventilated; the air breaks up the soil into lumps, crumbles and weathers it. Apart from the many huge cracks, there are found all over the country minute cracks which serve the same purpose in a smaller way.

When the rain comes the water pours down these cracks following the channels which the dry season had formed for it. Thus the rain saturates the soil from above and below. The water drives out the excess of air, although much air may be imprisoned by the rapid swelling of the soil.

Plate 193.

A DOG-PROOF NETTING FENCE IS A NECESSITY IN BRIGALOW COUNTRY.

In dry weather the soil breathes in air; in wet weather the soil breathes out air.

Droughts and dry spells in the West are not unmitigated evils; they really are factors that cannot be done without. And Nature takes care that they are not done without. The liberal aëration of the soil during a drought by means of the cracks creates conditions most favourable for growth as soon as the rain comes. This is probably one of the reasons why droughts are followed by bountiful seasons, despite the fact that so many of the roots must have been eaten out by the sheep, and many of the seedgrains swept away by the fierce westerly winds.

So, after all, we have to be thankful for what the dry spell does for our Western country. Let us count our blessings even during a drought.

THE SOIL EXPANDS.

We added in the gauges an equal volume of rain water to an equal volume of soil—

1. The soil from the surface swelled out by 20 per cent. (one-fifth);
2. The soil 6 inches below surface swelled out by 27 per cent. (one-fourth);
3. The soil 12 inches below surface swelled out by 33 per cent. (one-third).

Plate 194.

THE REALISATION OF A BOUNDARY RIDER'S DREAM.

The cleared track alongside the dingo- and vermin-proof fence serves as a firebreak as well as making boundary maintenance easier.

These are startling figures. That the subsoil should expand by one-fourth to one-third when thoroughly wetted appears almost unbelievable; we seem to lose the solid ground beneath our feet. Again let us remember that the earth is not encased in a gauge 8 inches high, with glass walls and glass bottom. *Before we accept such figures, we must go back to what we see in the paddocks under natural conditions.*

Two years ago, in December, 1934, after a lengthy dry spell, we had 1,116 points within ten days. It was the biggest rainfall within so short a time since we had been on Bybera. Fences were washed out, all the cracks filled up, and numerous green belahs, green pines, and an

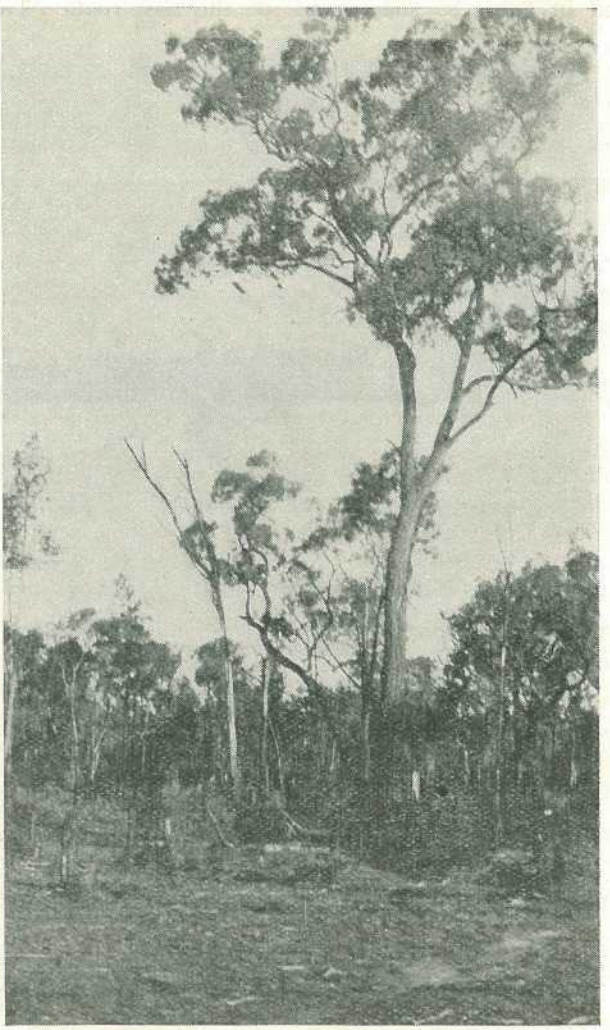

Plate 195.
ON THE EDGE OF THE CLEARING.

enormous ironbark were uprooted. Bybera is not hilly country, it looks almost level; but measured by the altimeter there is a difference of, at most, 40 feet between the highest and lowest point. So we cannot speak of a hillside erosion.

The filling up of the cracks supplies, we submit, the certain proof that the soil swells out after rain. Washing out of fences in level country seems most unlikely to anyone knowing the gluey nature of the brigalow and belah subsoil. What really took place was that the fence-posts were partly squeezed out by the expansion of the soil and the running water may have done the rest.

It seems an extraordinary thing that a storm should have the power of uprooting green trees, especially in the West, where scanty foliage offers less leverage to the wind. Of course, brigalow and belah are shallow-rooted trees with surface anchorage; but not so the ironbark. What probably happens is this: During a dry spell, the soil shrinks and cracks, and in doing so snaps some of the tree roots. This may not

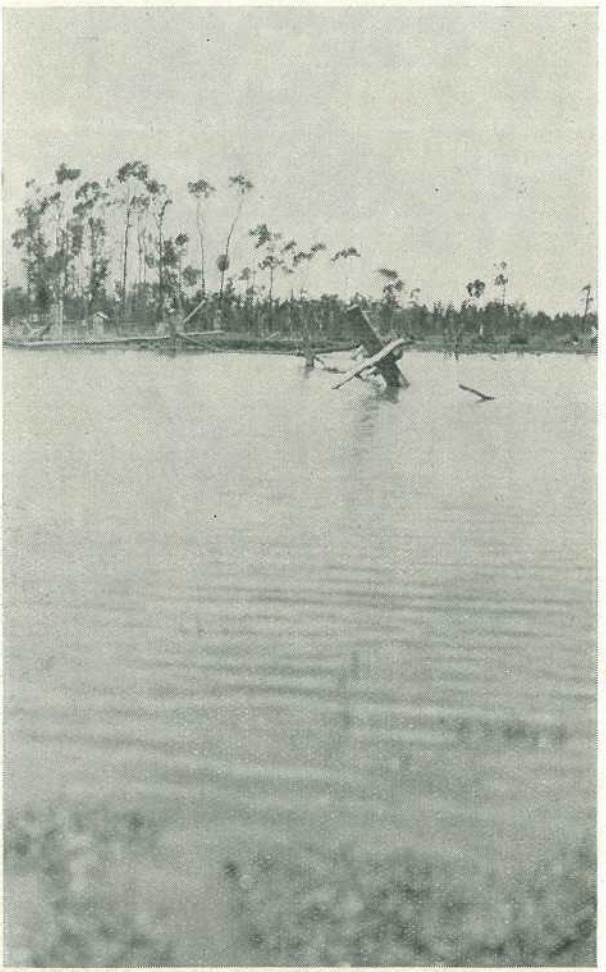

Plate 196.
A BRIGALOW-BORDERED DAM ON BYBERA.

always interfere with the well-being of the tree, but it certainly means that some of the "*moorings*" are slipped. Hence the tree is less able to resist the force of the wind, especially after wet weather, when the swelling of soil has loosened its texture.

Another proof of the expansion of the soil is furnished by the melon holes. We who live in this melon-holey country are faced all the time with the problems of this peculiar formation. It is the hole that at first takes everybody's eye and imagination. But we found on some, especially the larger holes, a marked buckling of the rim of the hole and a gentle sloping of this rim towards the level country on the far side. This seems to prove that in the making of these melon holes both shrinking and buckling of the soil are definite factors. There is another significant fact which bears out what we have just said. Most of the fallen timber in the brigalow and belah country is found around the melon holes, which are generally bridged by trees which have fallen across them. Evidently the shrinking and buckling of the soil have done their share in loosening the root-hold of the trees standing close to the melon holes.

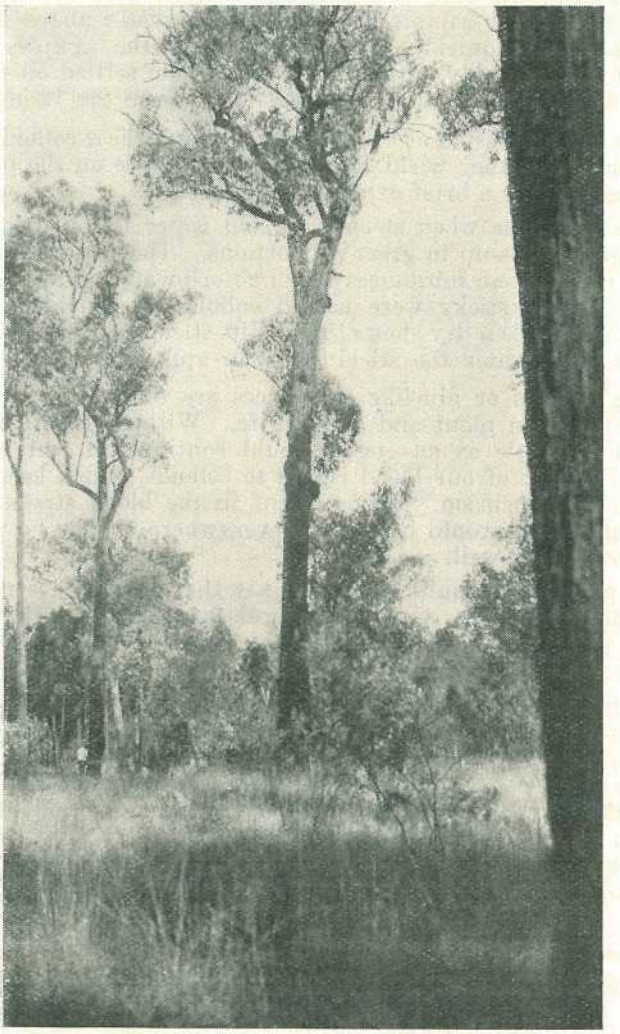

Plate 197.
AN "OLD MAN" IRONBARK ADDS TO THE PICTURESQUENESS OF A PARK-LIKE LAND.

There can be no doubt that in the brigalow and belah country shrinkage is followed by expansion, expansion is followed by shrinkage. The soil does not stand still, but is constantly moving under the influence of the changing conditions of the weather. What happens in the paddock under natural conditions confirms the trend of our experiments, though perhaps not the extent by which the soil in the gauges swells and shrinks. The main value of the experiments lies in the fact that we have been able to establish that the soils of different levels have different rates of expansion and shrinkage.

The Soil Stores Water and Minerals.

Returning to our experiments in the gauges.—We had added more water to the samples of the different soils than these soils were capable of taking up. The surplus water was left standing on top of each sample. The appearance of the water differed with the depth of the soil from which each sample was taken. The water above the surface-soil cleared fairly quickly. The water above the samples of subsoil looked cloudy to muddy, until finally a thin film settled on the six-inch specimen and a thicker film on the soil taken from the 12-inch depth.

These films consisted of colloidal matter, and these colloids had come from the soil. As they wield such a great influence on the productivity of our western soils a brief explanation is needed.

A piece of glue when steeped in cold water takes up a lot of the moisture and swells up to great proportions. The Greek word for glue is kolla. Hence these substances which absorb water and other materials and then become sticky were named colloids or gluelike. Colloidal matter like glue when dry shows little of its stickiness; but when brought in contact with water the stickiness soon appears.

These colloids or gluelike substances are of enormous importance in Nature; both in plant and animal life. Without them life could be carried on as little as an engine could continue to run without oil. The sticky nature of our blood is due to colloids, which keep the blood corpuscles in suspension, floating about in the blood stream. But for these colloids there would be friction everywhere. They have, however, other functions as well.

It is perhaps not quite correct to say that colloids are restricted to animal and plant life. Certain minerals are also of colloidal nature, *but these minerals require protection by plant colloids to keep them in the proper colloidal state.*

The most common example of a mineral colloid is clay. On account of its colloid nature, clay when damp becomes sticky, and can be moulded by the potter. Anyone driving over black soil roads in wet weather knows the stickiness of clay clinging to the wheels. Roads are not passable till the clay has dried and become again a dry colloid. But the clay, even on the surface, holds water ever so much longer than sandy country, which is deficient in colloids. The deeper layers of black soil shielded as they are from exposure and evaporation retain their moisture longer.

The clayey subsoil, on account of its colloidal nature, is capable of holding water for a long time.

How is it that clayey soil will hold water long after the ordinary soil has parted with it? The clayey subsoil consists of a mass of fine particles surrounded by a thin film. These films act like a bladder as

soon as the soil is wetted. They admit the water while the soil is dry, and prevent its escape as soon as it is wet. They are of the same nature as the films we saw rise to the surface in the gauges.

The colloidal subsoil parts with its moisture but slowly, even when close to the surface. But plants that send their roots down to the subsoil are capable of profiting by it. Digging up Mitchell grass roots three or four feet deep is a tedious business. The soil closely adheres to the roots. The soil sticks to the root-fibres in the form of lumpy rings, which are arranged on the fibre almost like beads on a rosary. One could see how the roots had burrowed their way into the subsoil. Roots secrete carbonic acid which dissolves and pierces the film till they are free to enter and plunder the store of water, minerals, and humus laid up within.

Now vision the dense brigalow and belah country. It is an old and long untroubled land. In its virgin state this country will carry barely one beast to fifty acres. Day by day, and year by year, the leaves are falling to the ground mouldering and setting free humus and their rich mineral contents. Trees crash down and decay, enriching the earth. Now comes the rain. A heavy downpour forces water, minerals, and humus into the clayey subsoil, where they remain stored. *Thus is added that much-needed protection of organic matter which is required to keep the colloidal clay in its proper condition.*

At a depth of nine to twelve inches below the surface we found lumps of the clayey subsoil coated here and there with white chalk—carbonate of lime—which perhaps ages ago had been part of the brigalow leaves. The lime in which this country abounds is of great value; it *renders the colloidal film more resistant. Thus the brigalow and belah subsoil becomes the storehouse of water, minerals, and humus, and will continue to show green shoots of grasses long after they have vanished from the rest of the country.*

Conclusion.

Now to the practical application of the foregoing.

The brigalow and belah soil conserves moisture longer than any other country, owing to the peculiar colloidal condition of its subsoil. Of that we have ample proof. What we do not know is this: If this soil is cultivated, how deep should it be ploughed so as not to interfere with the colloidal subsoil? Only field experience can tell us.

We have proved that lucerne and prairie, Mitchell and Flinders grasses thrive on Bybera. We have never tried any cereal crop, yet the depth to which the ground ought to be ploughed is a matter that urgently requires settling. We may destroy the water-holding capacity of the colloidal subsoil by breaking it up too deeply.

The planting of lucerne and prairie grass by the grazier and dairy farmer offers great prospects. Prairie has the great advantage of being a winter grass. On Bybera it lasted longer during the drought than any other grass in the winter months. The planting of prairie and lucerne would secure feed during the winter months, and, possibly, *a continuing supply of baby beef for export.* But the burning question remains, *how deep ought we to go down in cultivating the land.*

Only the field experiment on a comparatively large scale can tell.

Fifteen to twenty million of acres of brigalow and belah country are estimated to exist in Queensland. A new kingdom waits to be conquered.

Cotton.

The favourable climatic conditions which were reported as ruling throughout all districts during April have continued through May, with the result that the cotton crops have been harvested rapidly, and excellent grades have been obtained. The volume of cotton received at the Glenmore Ginnery was so great during the early part of May that it was necessary to forward several train-loads to the Whinstanes Ginnery. An analysis of the grades of cotton being obtained at both ginneries indicates that not only is the average of the cotton of decidedly better quality than was the case during the corresponding period of last year, but there is definitely less spotting, which has resulted in a markedly higher percentage of the cotton going into the mature grades.

Although the dry conditions favoured the obtaining of cotton of high grades, the development of the top crop has been severely retarded, so that it is obvious many areas will produce only a very light top crop, if one at all. The result will be a marked reduction in the total crop that will be obtained for this season compared with what was anticipated following on the March rains.

The yields that are being obtained by farmers who have planted on newly broken up grassland indicate, however, the marked benefit that is realised where this practice is followed. In every district farmers on all types of soil are obtaining satisfactory yields from plantings even as late as mid-December on grassland in its first or second year of cultivation, whereas adjacent cotton crops on cultivations of four or more years of age are producing extremely low yields. On the average it appears that a conservative estimate of the benefit being realised by planting on grassland in its first or second year of cultivation will be at least 50 per cent. gain, and in many instances as much as 100 per cent. gain, except in the case of extremely late planted cotton. Many crops on old land will not produce 300 lb. of seed cotton per acre, whereas adjacent crops in the first year following grassland are producing as much as 700 lb. per acre, and in a few outstanding instances around 1,000 lb. Undoubtedly all cotton growers should practise the grassland-cotton rotation, especially as the newly-sown grass paddocks on the old cotton cultivations have given clearcut evidence this season of producing heavier yields of grass, and of greater feed value, than have adjacent old

grass paddocks. As most cotton growers practise dairying as well, the grassland-cotton rotation is of marked assistance to them in their two major industries.

Sugar.

Weather conditions for the month of May were not at all favourable for cane growth; warm and cool weather alternated, but no beneficial rains were received in any area.

It now seems certain that the provisional estimate of a month ago must be substantially modified. This is particularly true for the Central and Southern areas. A more accurate forecast will be available in the course of a week or two.

STACKING SILAGE.

The best results are obtained by building stacks at the latter end of summer, when suitable crops such as maize and sorghums are available, and using the silage during the winter or spring months. Stack silage is not intended to last indefinitely, although it has been known to keep for several years in a well-built stack without serious deterioration. The essential points to observe in stack silage building will therefore be of interest.

The site should be naturally drained and, where possible, close to the crop, the dimensions of the base being estimated on a basis of 54 cubic feet to the ton, allowing for a height of 15 feet in the completed stack. Shallow drains are then opened around the site, using the earth removed for levelling off. For a rectangular stack, a framework is constructed 15 feet high, using poles 17 feet 6 inches long and 5 to 6 inches in diameter at the butts. The poles should be placed 2 feet in the ground at intervals of 3 feet. An extra pair of uprights is erected 1 foot from each end of the stack framework to hold the crosspieces which support the ends of the fodder before trimming. The framework is braced on all sides, in addition to the top centre, twitching securely close to the top of the uprights.

For hand work it is convenient to construct a whip hoist, using a clamp to prevent slipping at the point of suspension.

Before stacking, place a 1-foot to 2-foot covering of waste green grass on the ground as a foundation, stacking thereon, keeping all the stalks laid lengthwise with the stack. Load from alternate sides each day, placing the ends of the fodder well over the supports, reversing heads and butts with each layer.

As stacking proceeds, a board is placed flush with the stack end uprights, trimming off surplus fodder and throwing it back on to the top of the stack, taking care to see that no crossing of stalks occurs.

After the first two days, stack a minimum of 2 feet 6 inches each day, keeping the centre high, as heating soon causes the silage to settle. The layers are stacked so as to avoid bumps, placing fairly straight stalks along the sides, then firming down and joining heads or butts at the posts. After each day's work weighted wires are placed over the stack to assist the settling.

When finished to a full camber, a layer of soft green grass is placed on top and watered well, after which the framework of logs holding the weighting material can be placed in position. If earth is utilised, a minimum thickness of 1 foot should be used on top of the stack, topping off with bush hay held by weighted wires.

—*H. W. Ball.*

Celery Growing.

H. BARNES, Director of Fruit Culture.

CELERY is classed as a cool climate crop, and it is probably mainly on this account that Queensland orchardists have never given it serious consideration. It is a crop also which demands very exacting care and attention to detail. Increasing quantities of celery, chiefly grown in South Australia, are being used in Queensland, and there appear to be prospects of producing at least a portion of local requirements on alluvial flats in the Stanthorpe district.

In the *Journal of The Department of Agriculture of South Australia* for January, 1937,* and in the *New South Wales Agricultural Gazette* for April and May, 1937,† appeared articles on celery growing in those States, and the following information is largely extracted from those articles. The blocks also have been kindly loaned by the South Australian Department of Agriculture, and copies have been made of illustrations in the New South Wales Agricultural Gazette.

"Celery, known botanically as *Apium graveolens* (Linn), is indigenous to Britain, Europe, and the temperate parts of Western Asia, Africa, California, and New Zealand; the garden form has been grown by the French since the seventeenth century."

"From the indigenous types, modern delectable strains have been raised, and today are used for salads, soups, and as a cooked vegetable. The edible portion is the enlarged leaf stalk, this stalk usually being bleached white by exclusion of the sunlight."

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* "Celery Growing," by N. R. Quinn, Assistant Horticultural Adviser, Jour. Dept. Agric. South Aust., Vol. XL., No. 6, Jan., 1937.

† "Grow Celery for the Sydney Market," by John Douglass, H.D.A., H.D.D., Senior Agricultural Instructor, The Agric. Gaz. of N.S.W., Vol. XLVIII., Parts 4 and 5, April-May, 1937.

SOIL.

"The greater portion of the celery produced in South Australia is grown on the Adelaide Plains within 10 miles of the capital, where the crop does well on all types of soils, comprising deep red sand in the western district, alluvial silt on the banks of the River Torrens, chocolate loam overlying a stiff red clay, and the stiff black Bay of Biscay soil at the foothills of the Mount Lofty Ranges."

For the guidance of Queensland growers, it is emphasised that the soil should be very rich, particularly in organic matter, and a good supply of water for irrigation should be available.

In the United States, where celery growing has assumed enormous proportions, practically the whole of the crop is produced on reclaimed swamp lands, which are composed almost wholly of decayed organic matter.

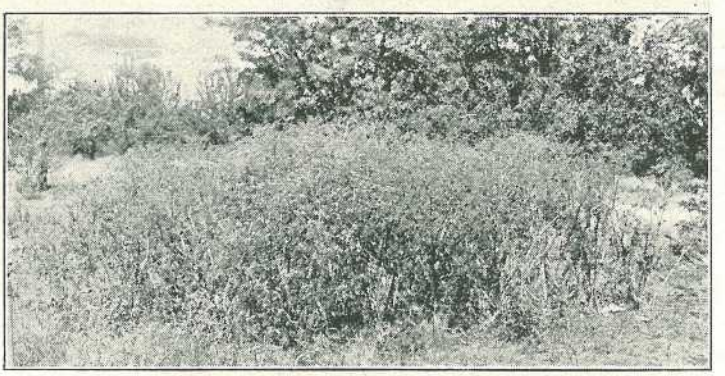

Plate 198.
Selected celery heads for seed.
[*Photo.: E. W. Pritchard, S.A. Jour. Ag.*

CLIMATE.

"The climatic conditions on the Adelaide Plains are regarded as being most favourable to the growth of celery—warm sunny days with low humidity being frequent during the growing period."

SEED.

Seed selection plays an important part in the celery industry in South Australia. "A majority of prominent growers have by careful selection of seed built up strains of their own which are not obtainable from seedsmen. The usual method of selecting seed is to mark well-shaped and vigorous plants in the field at the time of harvesting. When convenient, these selected plants are transplanted to a place in the garden where they will not be disturbed until the seed has matured in January or February. Seed matures too late for use in the following year's crop and two years supply is usually kept in hand. The plants selected for supply of seed should be sprayed consistently to reduce 'Leaf Spot' infection. When the seed has matured, it should be thoroughly dried by spreading on canvas sheets, and when dry placed in airtight containers until required. Owing to the possibility of carry-over of Leaf Spot on seed, it is a good practice to disinfect the seed in some manner. One method of disinfection is known as the hot water treatment."

Hot Water Treatment for Disinfection.

"The required amount of seed for the season's planting is placed in a muslin bag and submerged for ten minutes in a large vessel containing water heated to a temperature of 136 deg. F. (The maintenance of the temperature is very important.) After removal from the hot water the seed is placed in cold water for two minutes. Seed intended for planting at some future date should be thoroughly dried prior to storing. The hot water treatment has been reported to retard, and also reduce the germination slightly. (J. C. Niell, N.Z. Journal of Agriculture, vol. 46, page 289.)"

"There are approximately 60,000 seeds in an ounce of celery seed, and approximately 75 per cent. is usually germinable."

Plate 199.
The seed-bed.

[*Photo.: E. W. Pritchard, S.A. Jour. Ag.*

The Seed-bed.

"Fresh soil of an open textured nature should be used if possible for the seed-bed in order to avoid trouble with root fungus diseases such as 'damping off.' The seed-bed should be thoroughly prepared by working in heavy applications of decayed organic matter several weeks before the time of planting the seed. The bed should be kept well watered to permit weed seeds to germinate, and be periodically forked over, reducing the soil to a fine tilth. If it is not possible to use fresh soil for the bed, partial sterilization may be achieved by treating the soil with a solution of formalin consisting of 1 pint of formalin in 6 gallons of water, distributed evenly over 24 square feet. This method will prove more effective if bags saturated with the solution are placed over the treated seed-bed to retain the active fumes. The bed should remain thus covered for forty-eight hours, and sowing of the seed should not take place until all fumes have disappeared after several days. Dissipation of the gas may be hastened by loosening the surface of the treated bed."

When completed, the soil in the seed-bed should have been worked down very finely.

Sowing the Seed.

"The difficulty of sowing such fine seed evenly over the bed may be overcome by mixing it with whiting or by sprinkling it with an ordinary household pepper-pot. When the seed is evenly distributed over the seed-bed, it is covered very lightly, first, with fine soil, and then with a mulch of stable manure. Watering should be carried out daily during dry periods."

"First seedings in South Australia take place during September and October, and extend into January and February in order to make provision for a continuous supply of seedlings. During the growing period the seedlings must be weeded and sprayed with 6:4:50 Bordeaux Mixture. When the seedlings are from eight to ten weeks old, the tops are cut back and the tap roots are cut before planting out in the field." (N. R. Quinn S.A. Journal of Agriculture.)

Outlining the conditions in New South Wales where a first seeding is made in August, Douglass† recommends that the seed be planted in shallow furrows, spaced 6 inches apart. These furrows are ¼-inch deep, and are made by pressing the edge of a board into the soil. The board is flopped over on its other edge for the next furrow. If the board is 6 inches wide, the furrows will be spaced correctly. The seed, after being sown thinly, is then covered by dragging the edge of the planting board across the bed, and the soil is then firmed over the furrows by pressing it with the flat of the board. The bed is watered thoroughly with a fine spray, and then mulched with rotted manure. If the weather is fine it is then watered each morning to assure a supply of moisture in the surface soil. "Germination will take place in one week during warm weather, and up to three and a-half weeks in frosty weather.

Some growers place light hessian covers over the beds in hot weather to protect the plants from sun scald. It is much better practice, however, to irrigate regularly, even twice daily, and grow hardy seedlings in the sun, than to risk soft, cover-grown seedlings, which may be destroyed by hot weather at a later date.

Should the seed come up thickly in the beds, the plants should be thinned out. In the United States the growers prick out the seedlings into other beds in order to obtain sturdy plants suitable for transplanting. The furrow or row method of sowing the seed does away with this operation.

PREPARATION OF THE LAND AND MANURING.

Several textbooks on the subject of celery-growing refer to the necessity for heavy applications of rotted animal manure—up to 25 tons per acre—to the land. In New South Wales, poultry manure is regarded as good for this crop in heavy soils, although equal parts of poultry and cow manure are more suitable for open textured soils.

It is realised that growers may find some difficulty in obtaining sufficient supplies of animal manures, and in this event the land should be enriched in organic matter by growing and turning under bulky green cover crops. The Queensland Agricultural Chemist refers to the necessity of using large quantities of well-rotted stable manure, and, in addition, the use of a heavy dressing of an artificial fertiliser of the formula 4:8:10, using about 6 cwt. per acre previous to planting out,

and two or three top dressings of 1 cwt. each; or instead of the ready-mixed fertiliser, the following mixture may be used with advantage, per acre:—

2 cwt. sulphate of ammonia,
3 cwt. Nauru phosphate-superphosphate mixture,
1½ cwt. muriate of potash,

at the time of planting, followed by two top dressings with a mixture per acre of

1 cwt. nitrate of soda,
1 cwt. superphosphate,
½ cwt. muriate of potash.

Plate 200.
Celery planted out in the field in double rows.
[*Photo.: E. W. Pritchard, S.A. Jour. Ag.*

In South Australia it is advised that, in addition to the basal dressing of 20 to 25 tons of stable manure, the young seedlings require dressings of some nitrogenous artificial manure from time to time. The gardener has to use his experience in this matter, and no definite programme can be set down. Celery is a voracious feeder, as can be seen from the large number of feeding roots that develop from a healthy vigorous plant. The usual dressings of nitrogenous fertiliser are from 3 to 4 cwts. of sulphate of ammonia per acre. This is distributed along the rows as close as possible to the rooting system, lightly hoed in, and followed by an irrigation. The growth of the celery plants after replacement in the field should never receive a check as a result of insufficient moisture or plant food.

Planting.

The seedlings are large enough to plant when 4 inches high, the tap root being removed and the tops cut back before setting out. If the soil is inclined to dryness at the time of planting, the seedlings should be watered as soon as possible after placing.

Some difference of opinion exists in regard to the best method of planting. In South Australia the double row system of planting is most commonly used, and is as follows:—The seedlings are set in the soil with a "dibber," and are placed 10 inches apart in double rows also 10 inches apart. The seedlings are not placed directly opposite each other in the double rows, but are staggered. The double rows are spaced 3 feet apart in the field. This system of planting necessitates approximately 26,000 plants per acre. The double rows of plants are set out in a shallow furrow to facilitate irrigation.

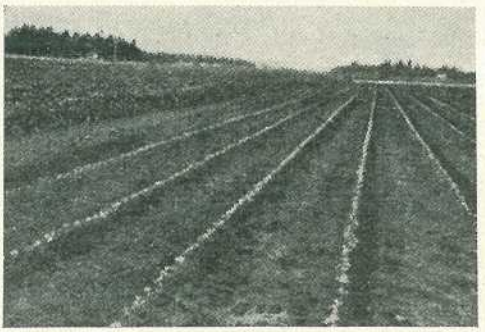

Plate 201.
The method of planting celery in single rows.
—*N.S.W. Ag. Gaz.*

In New South Wales, it is contended that, in that State, double-row planting is responsible for poor ventilation between the rows, encouraging the development of both fungous and bacterial diseases and leading to the production of much second-grade celery. Single-row planting is recommended for preference. The seedlings are set out in rows spaced 3 feet apart, the plants being spaced 6 to 8 inchs apart in the rows. The drills should be struck out and 4 cwt. of superphosphate and 2 cwt. of sulphate of ammonia per acre worked into the soil. If irrigation is available, it is advisable to run water down the drill before setting the plants out. The seedlings are usually set into the mud no deeper than 2 to 3 inches below the original soil level. The objection to deep planting lies in the danger of the plants being destroyed by disease, which attacks the stem and heart when covered with soil. It is a mistake to trench celery in this country.

Cultivation.

Once the young seedlings have been planted it is upon subsequent cultivation and care that the success of the crop depends. The plants must be kept growing vigorously all the time. A stoppage of growth, due to lack of moisture or other cause, is liable to result in hollow stems, pithiness, premature seed formation, loss of quality, and excessive stringiness. Regular watering, therefore, is of the greatest importance in fine weather.

Furrow irrigation is considered preferable to overhead spraying. In New South Wales, in the early stages of growth, flooding three times weekly is advocated during fine weather; and, in the later stages of growth, it is absolutely necessary to water twice a week to maintain quality. It is stated by Douglass that the ideal practice is to make a water furrow right down the rows close to the plants in the early stages of growth. As the plants develop the furrow can be re-made until it is out in the middle of the land between the rows of plants. This method not only encourages the spread of the roots, but also enables the farmer to cultivate between the rows, thus creating a dusty, dry mulch which is an advantage. Single-row planting and the furrow method of watering a crop allows the grower most effectively to spread and work fertiliser into the soil.

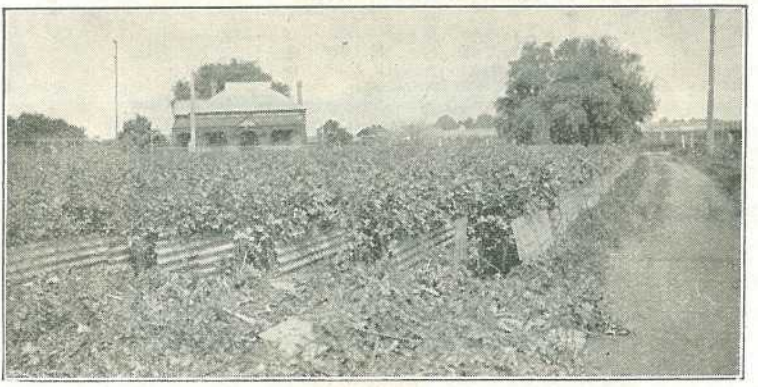

Plate 202.
Celery "Boarded-up."

[*Block: S.A. Jour. Ag.*

BLANCHING.

Celery is approximately a five months crop. When it is about three weeks from maturity, the light should be excluded from the leaf stalk in order to effect blanching. The old method of hilling up the soil round the stalks is not now practiced. The usual method is to place light-proof boards on each side of the rows. The boards are pressed in tightly against the plants and held in position by stakes driven into the soil. Sometimes sheets of corrugated galvanised iron are used, the sheets being cut in half lengthwise. New South Wales experience of galvanised iron, however, is that in that State it is too heating, and causes physiological defects as well as encouraging fungous and bacterial diseases.

The board method is recommended as likely to be most suitable for Queensland. Boards should be about 12 inches wide and 12 feet long, and may be made of old or second-class timber. Widths of less than 12 inches may be nailed together with laths. The method of fixing the boards is described in New South Wales as follows:—"Lay the boards flat on either side of the plant rows, force the inside edge against the plants and then raise to a vertical position, bringing up all outside leaves and trash. The boards, which are then parallel with the celery between them, are kept in position by means of a wire clip or short stake. Tarred paper is also extensively used for blanching and has proved fairly satisfactory."

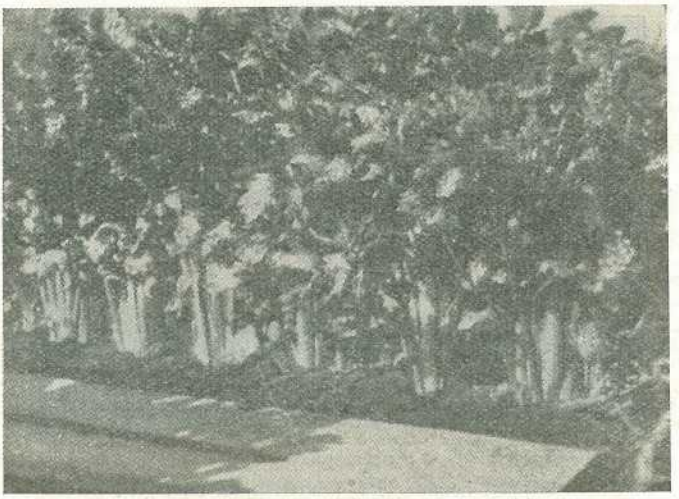

Plate 203.
Celery blanched with boards, N.S.W.

N.S W. Ag. Gaz.

Following boarding, the practice is to apply a dressing of nitrogenous fertiliser such as nitrate of soda between the rows and to water heavily every three days. It will be found that the nitrogen and the water force the heart leaves and stems up through the boards which exclude the light and produce the blanched effect.

The celery is usually boarded up for two or three weeks, the vigour of the plant at the time of planting governing the actual period. If the plants are boarded up for a longer period, the stalks become pithy and greatly reduce the quality of the product. It will thus be noted that only the quantity of plants which can be marketed each week should be boarded up at one time. The following week another lot of the plants

Plate 204.
Harvesting celery.

[*Block: S.A. Jour. Ag.*

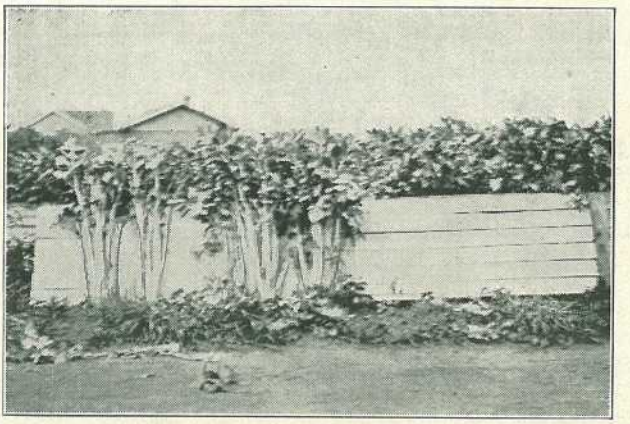

Plate 205.
Stripped heads (left); unstripped on right.
[*Block: S.A. Jour. Ag.*

should be boarded up with a second lot of boards. The third week probably some of the boards removed from the first boarded plants could be used, as after removal of the boards the plants are ready for immediate harvesting.

HARVESTING.

The method of harvesting is to cut the plant off at ground level with a sharp spade or knife where the outer leaf stalks stool out from the plant. The outer ragged leaf stalks are stripped off until the remainder has an attractive appearance. The outer leaves are of poor quality. After stripping, all soil is washed from the plants.

The celery imported from South Australia is usually packed in cases about the size of the local tropical fruit case, i.e., 24¾, x 12 x 12, though the boards are spaced to allow ample ventilation. If provision is made for the latter requirement, the tropical fruit case would serve for local market.

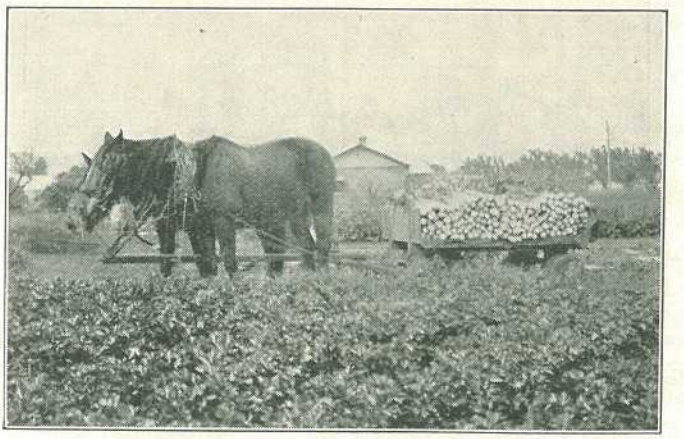

Plate 206.
Carting celery to the packing shed.
[*Block: S.A. Jour. Ag.*

Plate 207.

FIELD OFFICERS OF THE FRUIT BRANCH.

Front row (left to right)—Messrs. S. F. Kajewski, M. A. Hannigan, E. L. Miles, E. L. V. Filer, K. King, S. C. Schindler, E. S. Keehn, E. P. Williams, J. R. Horsley.

Seated (left to right)—Messrs. W. C. Armstrong, J. H. Gregory, R. L. Prest, S. E. Stephens, H. Barnes (Director), H. J. Freeman, W. J. Ross, H. St. J. Pratt, H. Collard.

Back row (left to right)—Messrs. H. G. Crofts, F. L. Jardine, A. M. Richardson, E. F. Duffy, C. N. Morgan, K. D. Hoffmann, H. Grimes, P. Mitchell, J. H. Mitchell, J. McG. Wills, W. E. Hamley, C. G. Williams, W. G. Hancock.

VARIETIES.

Varieties recorded by Douglass as suitable for New South Wales conditions and which may be worth trial in this State are:—

Export White—This is the long Adelaide type. It is a non-hearting variety with exceptionally long, clear stems which blanch to a fine golden-cream colour. It is outstandingly disease resistant under Australian conditions.

Golden Self Blanching—An American heart celery from Eastern U.S.A., where it is grown without blanching boards. The heavy outer leaves give enough protection with slight soil hilling to give perfect blanching. This celery is of outstanding quality, but it is rather subject to Chocolate Leaf Spot.

Golden Plume—Very similar to Golden Self Blanching, is reputed to be of French origin. This variety is slightly better quality than the lastmentioned variety and is much stronger in stem.

Utah—A green-stemmed celery of outstanding disease resistance which should do well in this country. The stems are fibrous, medium in length, and have a strong characteristic flavour.

Fruit Marketing Notes.

JAS. H. GREGORY, Instructor in Fruit Packing.

DURING the past month values for most fruits have been maintained. The continued dry weather is, to a great extent, retarding the development of large-sized fruits. Custard apples and strawberries are now coming into season, adding variety to the excellent range of fruits available in Brisbane.

BANANAS.

Bananas have reached high prices on all markets, growers finding it hard to decide which market actually will give the best returns. The dry conditions experienced over the last twelve months have increased the supplies of the smaller grades. Much under-grade fruit is being marketed, very often being used as fillers or peg bananas in the centres of the packed cases. Numerous lines of undersized fruit have been removed from the market. The inclusion of a smaller grade of fruit for local market supplies is now receiving consideration. The inclusion of a smaller grade will necessarily mean the strictest enforcement of the standard, and nothing under the minimum size prescribed will be allowed on the market.

Brisbane prices were—For Cavendish, sixes 10s. 3d. to 14s., sevens 11s. 6d. to 16s., eights and nines 15s. 6d. to 16s. 6d. per tropical case; prices for bunch fruit, Cavendish, ranged from 2½d. to 8½d. per dozen, and Lady's Fingers from 5¾d. to 9d. per dozen.

In Sydney prices ranged for sixes from 14s. to 17s. per tropical case, sevens 17s. to 19s. per tropical case and 7s. to 11s. per bushel case, eights 19s. to 21s. per tropical case and 10s to 12s 6d. per bushel case, and nines 21s. to 23s. per tropical case.

In Melbourne prices for bananas in tropical cases were—sixes 14s. to 16s., sevens 17s. to 18s., eights and nines 19s. to 20s.; and in the bushel case, sixes 10s. to 11s., sevens 11s. 6d. to 12s., and eights 12s. to 13s.

Consignments in bushel cases showed satisfactory results on the Melbourne market, but were very unsatisfactory in Sydney. It is apparent that the wholesale trade on these markets does not show any enthusiasm for suggested improvements to the grower's end of the handling.

PINEAPPLES.

Pineapple values are sound. With the advent of the cool weather closer attention must be paid to maturity of the fruit.

Prices for Smoothleaf pines in Melbourne ranged from 10s. to 15s. per tropical case, in Sydney, from 8s. to 14s., and in Brisbane 5s. to 10s.; loose fruit in Brisbane sold at from 1s. to 6s. per dozen. Ripleys brought from 6s. to 9s. per case, and 2s. to 5s. per dozen.

PAPAWS.

Good quality papaws are scarce, and well-coloured fruit is meeting with a ready demand. Brisbane prices for Yarwun fruit were from 10s. to 12s. per tropical case, for Gunalda fruit 6s. to 7s. per bushel case, and for locals 4s. to 6s. per bushel case. In Sydney prices ranged from 10s. to 12s., while in Melbourne, although up to 20s. per large case has been obtained, prices are now easier at from 14s. to 18s.

CUSTARD APPLES.

Increased supplies of custard apples are now on the market, with a consequent easing of prices. Prices in Brisbane ranged from 3s. to 3s. 6d. per half-bushel, in Melbourne from 3s. to 5s., and in Sydney from 4s. to 5s. Green immature fruit which ripens black is not wanted on any of the Interstate markets.

AVOCADOS.

A steady demand is maintained for avocados on Brisbane and Melbourne markets, with prices ranging from 7s. 6d. to 10s, and from 12s. to 13s. per half-bushel respectively.

CITRUS FRUITS.

Good quality oranges are still in short supply and sell readily, but lemons lack a firm demand.

Oranges.

Brisbane prices for Commons were from 7s. to 9s., for Navels, from 8s. to 11s., and for Benyenda fruit, from 11s. to 14s. per case. In Sydney local Navels sold at from 6s. to 10s.

Mandarins.

Brisbane prices—Glens, Gayndah 10s to 13s., Benyenda 14s. to 16s., local 7s. to 13s., Emperors 6s. to 10s., Scarlets 7s. to 10s., Fewtrells 6s. to 8s. Melbourne prices were from 9s. to 14s. per bushel.

Lemons.

Brisbane prices for Gayndah fruit were from 7s. to 11s., Benyenda 11s. to 14s., and locals 6s. to 9s.; Sydney prices were from 3s. to 9s. per bushel.

Grapefruit.

Brisbane prices were from 6s. to 8s. per bushel, and Melbourne prices from 7s. up to 13s. per bushel for special quality.

Cumquats.

This fruit realised in Brisbane from 4s. to 5s. per half-bushel case.

BERRIES.

Prices for Cape gooseberries were generally from 6d. to 8d. per lb.

Prices for strawberries ranged from 8s. to 18s. per dozen boxes, with special quality berries higher.

DECIDUOUS FRUITS.

Plentiful supplies of apples are arriving from the South. Values are not high although steady returns are being received by growers.

Apples.

Prices were as follows—Granny Smith, Stanthorpe, 6s. to 9s., Southern 6s. to 8s., Jonathan 6s. to 8s., King David 5s., Alfristan 5s., Cleopatra 5s. to 7s., French Crab 5s. to 7s., Sturmer 5s. to 7s.

Pears.

Winter Cole 6s. to 9s., Winter Nelis 7s. to 10s., Packham's 6s. to 8s., Gleau Morceau 6s. to 8s., Josephine 9s. to 10s.

Grapes.

Ohanez and Cornichon sold at from 8s. to 10s. per case.

PASSION FRUIT.

In Brisbane up to 9s. per half-bushel case was obtained for specials, while first grade fruit ranged from 6s. to 7s., and second grade from 4s. to 5s. Sydney prices were from 3s. to 7s. per half-bushel case.

TOMATOES.

Increased supplies have reduced the price considerably during the last month. Growers would be well advised to keep green fruit off the market. Ripe fruit realised from 2s. 6d. to 4s. per half-bushel, coloured fruit from 3s. to 4s. 6d., and green fruit from 2s. to 4s.

VEGETABLES.

Beans sold in Melbourne at from 10s. to 20s. per 50 lb., or from 2½d. to 5d. per lb. In Brisbane, 3s. to 4s. per sugar bag was obtained for choice quality, and 1s 6d. to 2s. 6d. for small and second quality.

Brisbane prices for lettuce were from 6d. to 1s. per dozen.

PUBLICATIONS.

"Banana Packing" is now available, while pamphlets on passion fruit, strawberry, and peach marketing are in the press. Copies may be obtained free upon application to the Under Secretary, Department of Agriculture and Stock, William Street, Brisbane, B.7.

PRODUCTION RECORDING.

List of cows and heifers officially tested by Officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Books of the Australian Illawarra Shorthorn Society, the Jersey Cattle Society, and the Guernsey Cattle Society, production charts for which were compiled during the month of April, 1937 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORNS.				
MATURE COW (OVER 5 YEARS), STANDARD 350 LB.				
Lemon Grove Ruby 7th	J. Phillips, Sunnyview, Wondai	15,501·0	685·607	Dan of Greyleigh
Honey 8th of Sunnyside (365 days)	P. Moore, Wooroolin	15,955·75	647·632	Bruce of Avonel
Rosebud 7th of Oakvilla	W. G. Marquardt, Springlands, Wondai	14,859·5	609·409	Victory of Greyleigh
Fussy of Alfa Vale	W. H. Thompson, Alfa Vale, Nanango	14,331·2	537·095	Reward of Fairfield
JUNIOR, 4 YEARS (UNDER 4½ YEARS), STANDARD 310 LB.				
Alfa Vale Gentle 2nd (365 days)	W. H. Thompson, Nanango	17,369·15	818·088	Reward of Fairfield
SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD 290 LB.				
Model VI. of Alfa Vale	W. H. Thompson, Alfa Vale, Nanango	11,961·1	490·341	Reward of Fairfield
SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.				
Laura of Alfa Vale	W. H. Thompson, Alfa Vale, Nanango	13,755·7	450·54	Reward of Fairfield
College Buttercup 3rd	Queensland Agricultural High School and College Gatton	9,270·32	391·371	College Robin
Sunnyview Bess II.	C. C. Stumer, Cooranga, Mundubbera	8,226·32	285·164	Burradale, Byron
College Rascal 4th	Queensland Agricultural High School and College, Gatton	6,547·89	277·134	College Robin
JUNIOR 2 YEARS (UNDER 2½ YEARS), STANDARD 240 LB.				
Trevor Hill Iris	G. Gwynne, Umbiram	6,748·83	263·066	North Glen Emblem

JERSEY.

MATURE COW (OVER 5 YEARS), STANDARD 350 LB.

Fauvic Rejoice	H. Cochrane, Kin Kin	6,992·65	407·994	Zingara King
Diamond 2nd of Southbrook	H. T. C. Gibson, Kingaroy	6,331·75	369·632	Werribee Twylish Starbright King

SENIOR, 4 YEARS (OVER 4½ YEARS), STANDARD 330 LB.

Glenview Sultane's Majesty	F. P. Fowler and Sons, Coalstoun Lakes	10,344·35	552·569	Trinity Officer

SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD 290 LB.

Fauvic Gaiety	H. Cochrane, Kin Kin	6,505·35	341·264	Oxford Ringboy

JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.

Brooklands Royal Rosina	W. S. Conochie, Sherwood	9,135·86	417·152	Retford Earl Victor
Oxford Best's Rosina	S. H. Caldwell, Walkers Creek, via Bell	4,334·38	239·949	Oxford Best

GUERNSEY.

SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.

Lilac Pearl	W. R. Snell, Peeramon	6,817·15	297·653	Spurfield Bruce

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. C. T. White, F.L.S.

Barley Mitchell Grass.

L.D.C. (Brisbane)—

The specimen forwarded from Hughenden represents a form of the barley Mitchell (*Asterbla pectinata*). This particular species of Mitchell shows considerable variation, some forms approaching in appearance the bull Mitchell, this being much smaller. In some parts of Queensland during the past year, the barley Mitchell seems to have come back in many localities; in fact, it has made its appearance in many places where we did not know it existed before.

C.F.P. (Calen)—

We have no records of pandanus being poisonous or harmful to cattle in any way, and it is not known to possess any poisonous properties. Grass trees have been suspected, at different times, of causing the symptoms reported by you, but feeding tests with grass trees in Queensland have always yielded negative results, and the theory has been that it is purely a deficiency disease due to the poorness of the country on which grass trees grow. This idea is supported by the fact that on better class forest country, grass trees have been looked on as quite an important fodder during times of drought.

Wild Tomato or Potato Bush.

A.J.R. (Oorindi)—

The specimen represents the wild tomato or potato bush, *Solanium esuriale*. It has sometimes been suspected of poisoning stock in Queensland, but actual feeding tests in New South Wales gave negative results. We have a number of solanums in Queensland, and, generally, the fruits of solanum—in the green state at any rate—can be regarded as harmful. As the fruits ripen, they usually lose entirely, or for the greater part, their poisonous properties. At Muckadilla, some years ago, this berry was blamed for losses among sheep after some days of heavy rain. Post-mortems showed the stomachs full of berries, but in that case, distinct fermentation had set up, yellow froth being most pronounced.

A plant that is reputed to cause symptoms similar to those you describe is the so-called wild sunflower of the North-west, *Medelia asperrima*. You might have a look for this in your paddocks.

Texas Grass—Guinea Grass.

N.E.B. (Kilcoy)—

The plant with the smooth leaves and pale-coloured seed-head is *Panicum bulbosum*, sometimes called Texas grass. This grass has been grown on a limited scale in New South Wales and Queensland, but is quite rare. As a matter of fact, the only plot we knew in Queensland was one at the Queensland Agricultural College.

The larger grass with hairy leaves and darker-coloured seed-head is a variety of Guinea grass (*Panicum maximum*). Guinea grass is undoubtedly an excellent fodder, but does not stand up to heavy stocking. Several varieties of this grass have been introduced in recent years, and some are said to stand grazing much better than the older types, particularly one known as green panic, and another known as *coloratum*. We think the latter is one of your particular variety.

General Notes

In Memoriam.

The death of Mr. Atkinson Robert Wilkin, which occurred at his home in Brisbane on 4th May, is regretfully recorded.

The late Mr. Wilkin was born at Tilba Tilba, New South Wales, in 1869, and was educated at the Bega (N.S.W.) High School. Twenty-six years ago he came to Queensland from New South Wales to join the staff of the Department of Agriculture and Stock (Dairy Branch) as senior instructor in cheesemaking, a position he held until his recent retirement on reaching the age limit.

He had devoted practically the whole of his career to the dairying industry, possessing an expert knowledge of cheesemaking. He was recognised as a keen judge of dairy produce and was called upon to adjudicate in many competitions throughout the State. His services were requisitioned from time to time in the official grading of Queensland products. His lengthy association and wide experience in cheesemaking enabled him to conduct with much credit the supervision of the manufacture of the largest cheese exported from this State.

The late Mr. Wilkin took a keen interest in cricket and tennis.

He is survived by his widow and six daughters, to whom deep sympathy is extended.

Staff Changes and Appointments.

Constable T. O. Hawkins (Jackson) and Constable C. G. Rattenbury (Nerang) have been appointed also inspectors of slaughter-houses as from the 15th May.

The following persons have been appointed Members of Stallion Boards for the coming year:—

Darling Downs North—J. C. J. Maunder, B.V.Sc. (Chairman), W. C. Jeffrey, and J. H. Salmon.

Darling Downs South—A. F. S. Ohman, M.V.Sc. (Chairman), Gavin Elliot, and J. H. Wall.

East Moreton—J. C. J. Maunder, B.V.Sc. (Chairman), Wm. Frood, and R. J. F. O'Bryen.

West Moreton—A. F. S. Ohman, M.V.Sc. (Chairman), Wm. Frood, and R. J. F. O'Bryen.

Wide Bay—P. F. A. Hardman, B.V.Sc. (Chairman), M. F. Yore, and H. S. Handley.

Burnett—P. F. A. Hardman, B.V.Sc. (Chairman), M. F. Yore, and H. S. Handley.

Central Coast—M. R. Irving, B.V.Sc. (Chairman), T. J. Turkington, and G. H. Stokes.

Northern Coast—M. R. Irving B.V.Sc. (Chairman), David Jackson, and W. A. Coady.

Northern—A. L. Clay, B.V.Sc. (Chairman), Gavin Elliot, and C. F. G. Collins.

Mr. O. L. Hassell, Senior Instructor in Agriculture, has been transferred from Mareeba to Atherton.

The resignation of Mr. R. W. Greville, Assistant Veterinary Surgeon on probation, Townsville, has been accepted as from the 26th June, 1937, and Mr. R. E. Churchward, Government Veterinary Surgeon, Cloncurry, has been transferred to Oonoonba, Townsville, in place of Mr. Greville.

Constables A. R. K. Pearson (Duaringa) and L. X. Skelly (Mount Mulligan) have been appointed also inspectors of slaughter-houses as from the 22nd May, 1937.

Mr. F. A. Williams, of Upper Cedar Creek, Dayboro' Line, has been appointed an honorary ranger under the Animals and Birds Acts as from the 22nd May, 1937.

Rural Topics

Feeding Dairy Cattle in Winter.

Many farmers conserve enough roughage to last their dairy herds through a severe winter, but few understand why the milkers fail to keep up production. Mastication and digestion of dry roughage use up at least 60 per cent. of the energy value of the feed. With concentrates, less than 20 per cent. is used. It follows that very often on poor quality roughage, a cow is either unwilling or unable to consume enough to meet the requirements of full lactation. The trouble might be met in two ways. Extra consumption can be stimulated by increasing the palatability of the food. Molasses thinned out with water is excellent for this purpose. Bran and other milling by-products may also be used when prices are reasonable, but it appears unlikely that, for this year, cereals or their by-products will be able to compete with other concentrates.

Seed cake preparations are excellent for dairy cattle. On account of its slightly laxative nature, linseed has found greatest favour. There is a growing tendency to replace vegetable proteins by animal protein. Meat and animal protein meals are used extensively when analyses and prices are sufficiently attractive. By consulting the registered analyses and comparing costs, the farmer can determine which product is the cheapest to buy. All farmers who have overcome the cow's natural dislike for meat and animal protein meals have been amply repaid by the money saved and by the increased production. Under certain conditions, however, it may be uneconomical to feed such concentrates. This is usually the case with poorer milking herds.

The farmer should add a mineral supplement to the ration of all milkers, as well as heavy-in-calf cows. A mixture of two parts sterilised bone meal and one of salt should be kept in a convenient place, and about one eggcupful mixed in each feed. With heavy milkers, the allowance might be doubled.

The Management of the Bull.

The bull should be kept away from the rest of the herd in a separate run which is securely fenced and provided with water and shelter. A small service yard and a crush to facilitate the handling of the bull when necessary should also be provided.

The advantages gained by keeping the bull away from the herd are:—

1. Calving can be regulated.
2. It is easier to decide whether or not the cow is in calf.
3. The bull's services are controlled and not wasted.
4. There is less likelihood of the cows having to return to the bull.

If the run is not erected alongside a road the annoyance caused by a neighbour's cows breaking into the bull or the bull breaking out is avoided. There is always the danger that other cattle may be suffering from contagious abortion or vaginitis, which are dangerous to the farmer's own herd.

Selection of Cuttings for the Propagation of Grape Vines.

Now is the time, while grape vines are still in leaf, to select and tag those vines from which cuttings are to be taken. Don't leave it to chance in the winter, and merely take the cuttings at random from a row of the variety to be propagated. Select them from vines of outstanding merit which have proved to be consistent croppers of good quality fruit over a number of years, and which have set bunches of even-sized berries, and at the same time have maintained a healthy and vigorous constitution. Avoid the runts or vines which are inconsistent croppers, and any which persist in setting their fruit in an erratic manner.

While the behaviour of the vines in the vineyard is still fresh in their minds, growers should carefully consider their planting programme, and decide which non-commercial vines are to be grafted over with better sorts.

Select varieties suited to the district, and above all don't plant more than a few new or unknown types for observation purposes.

A vineyard should be a valuable asset for many years. Careful selection of both varieties and cuttings can often save considerable expense and time in later years.

Orchard Notes

JULY.

THE COASTAL DISTRICTS.

THE marketing of citrus fruits will continue to occupy the attention of growers. The same care in the handling, grading and packing of the fruit that has been so strongly insisted upon in these monthly notes must be continued if satisfactory returns are to be expected. It is pleasing to note that citrus fruits coming on to the Brisbane market and elswhere show great improvement in grading, packing, and quality as compared with the citrus products of previous years.

Where the crop has been gathered, the trees may be given such winter pruning as may be necessary, such as the removal of broken or diseased limbs or branches, and the pruning of any superfluous wood from the centre of the tree. Where gumming of any kind is seen it should be at once attended to. If at the collar of the tree and attacking the main roots, the earth should be removed from around the trunk and main roots—all diseased wood, bark, and roots should be cut away, and the whole of the exposed parts painted with Bordeaux paste.

When treated, do not fill in the soil around the main roots, but allow them to be exposed to the air for some time, as this tends to check any further gumming. When the gum is on the trunk or main limbs of the tree cut away all diseased bark and wood till a healthy growth is met with, and cover the wounds with Bordeaux paste.

Towards the end of the month all young trees should be carefully examined for the presence of elephant beetles, which, in addition to eating the leaves and young bark, lay their eggs in the fork of the tree. When the young hatch out they eat their way through to the wood and then work between the wood and the bark, eventually ringbarking one or more of the main limbs, or even the trunk. A dressing of strong lime sulphur to the trunk and fork of the tree, if applied before the beetles lay their eggs, will act as a preventive. In the warmer localities a careful watch should also be kept for the first appearance of any sucking bugs, and to destroy any that may be found. If this is done systematically by all growers the damage done by this pest will be very much reduced.

Citrus trees may be planted throughout the month. Take care to see that the work is done in accordance with the instructions given in the June notes. All worn-out trees should be taken out, provided the root system is too far gone to be renovated; but when the root system is still good the top of the tree should be removed till sound, healthy wood is met with, and the portion left should be painted with a strong solution of lime sulphur. If this is done the tree will make a clean, healthy growth in spring.

The inclusion of a wide range of varieties in citrus orchards is to be deprecated. Even in new plantings there is a tendency to follow the same unprofitable lines. Far too much consideration is given to the vendor's description for the purchaser's appreciation of a particular variety or varieties. Individual tastes must be subordinated to market requirements, and the selection of varieties to the best available kind of early, medium, and late fruits. Amongst oranges Joppa should be placed first, Sabina for early fruit, and Valencia for late markets.

In mandarins local conditions influence several varieties, and since the introduction of the fungus known as "scab" the inclusion, particularly on volcanic soil, of the Glen Retreat and Emperor types is risky. In alluvial lands, Emperor and Sovereign (an improved Glen Retreat) are the most profitable, though Scarlet in many places is worth including, with King of Siam as a late fruit.

Land intended for bananas and pineapples may be got ready, and existing plantations should be kept in a well-cultivated condition so as to retain moisture in the soil.

Bananas intended for Southern markets may be allowed to become fully developed, but not coloured, as they carry well during the colder months of the year.

The winter crop of smoothleaf pines will commence to ripen towards the end of the month, and when free from blackheart (the result of a cold winter) or from fruitlet core rot, they are good for canning, as they are of firm texture and stand handling. Where there is any danger of frost or even of cold winds, it pays to cover pines and also the bunches of bananas. Bush hay is used for the former and sacking for the latter.

Strawberries should be plentiful during the month, provided the weather is suitable or their development, but if there is an insufficient rainfall, then irrigation is required to produce a crop. Strawberries, like all other fruits, pay well for careful handling, grading, and packing, well-packed boxes always realising a much higher price than indifferently packed ones on the local market.

When custard apples fail to ripen when gathered, try the effect of placing them in the banana-ripening rooms, and they will soon soften instead of turning black.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

JULY is a busy month for the growers of deciduous fruits, as the important work of winter pruning should, if possible, be completed before the end of the month, so as to give plenty of time for spraying and getting the orchard into proper trim before the spring growth starts.

In pruning, follow the advice given in the May number; and if you are not thoroughly conversant with the work, get the advice of one of the Departmental officers stationed in the district.

Pruning is one of the most important orchard operations, as the following and succeeding seasons' crops depend very largely on the manner in which it is carried out. It regulates the growth as well as the number and size of the fruit, as if too much bearing wood is left there is a chance of the tree setting many more fruits than it can properly mature, with a result that unless it is rigorously thinned out it is under-sized and unsaleable. On the other hand, it is not advisable to unduly reduce the quantity of bearing wood, or a small crop of overgrown fruit may be the result.

Apples, pears, and European varieties of plums produce their fruits on spurs that are formed on wood of two years' growth or more; apricots and Japanese plums on new growth and on spurs; but peaches and nectarines always on wood of the previous season's growth. Once peachwood has fruited it will not produce any more from the same season's wood, though it may develop spurs having a new growth or new laterals which will produce fruit.

The pruning of the peaches and nectarines, therefore, necessitates the leaving of sufficient new wood on the tree each season to carry a full crop, as well as the leaving of buds from which to grow new wood for the succeeding year's crop. In other words, one not only prunes for the immediately succeeding crop, but also for that of the following season.

All prunings should be gathered and burnt, as any disease that may be on the wood is thoroughly destroyed. When pruned, the trees are ready for their winter spraying.

All kinds of deciduous trees may be planted during the month provided the ground is in proper state to plant them. If not, it is better to delay planting until August, and carry out the necessary work in the interval. The preparation of new land for planting may be continued, although it is somewhat late in the season, as new land is always the better for being given a chance to mellow and sweeten before being planted. Do not prune vines yet on the Granite Belt; they can, however, be pruned on the Downs and in the western districts.

Trees of all kinds, including citrus, can also be planted in suitable situations on the Downs and western districts, and the pruning of deciduous trees should be concluded there. If the winter has been very dry, and the soil is badly in need of moisture, all orchards in the western districts, after being pruned and ploughed, should receive a thorough irrigation (where water is available) about the end of the month, so as to provide moisture for the use of the trees when they start growth. Irrigation should be followed by a thorough cultivation of the land to conserve the water so applied. As frequently mentioned in these notes, irrigation and cultivation must go hand in hand if the best results are to be obtained, especially in our hot and dry districts.

VEALER CALVES.

Provided a calf is kept on the mother to allow it to reach a live weight of about 80 lb., a satisfactory return is assured when marketed. Large numbers of calves are being slaughtered annually for export as boneless veal, and the trade has reached such proportions that buyers are usually operating in all dairying districts. Even if the mother is to be dried off early, it is well worth while to keep the calf for a few days before selling for slaughter. A calf responds quickly to a few days suckling, and this can quite easily mean the difference between an underweight and overweight calf—a matter of at least 5s. in its value.

Farm Notes

JULY.

FIELD.—Practically the whole of the work on the land for this month will be confined to the cultivation of winter crops, which should be now making good growth, and to the preparation of land for the large variety of crops which can be sown next month. Early maturing varieties of wheat may be sown during the month Florence, Seaspray, and Novo all being suitable. When seasonal rains are delayed, and the main sowing is not effected until July, the medium early varieties, such as Three Seas, Flora, Pusa, and Clarendon, may also be sown with every prospect of success, but during normal seasons it is preferable to sow such varieties prior to July. Sow late maturing varieties early and early maturing varieties late. The harvesting of late-sown maize will be nearing completion, and all old stalks should be ploughed in and allowed to rot. Clean up all headlands of weeds and rubbish, and for this purpose nothing equals a good fire. Mangels, swedes, and other root crops should be now well away, and should be ready for thinning out. Frosts, which can be expected almost for a certainty this month, will do much towards ridding the land of insect pests and checking weed growth. Cotton-picking should be now practically finished and the land under preparation for the next crop. The young lucerne should be becoming well established; the first cutting should be effected before the young plants reach the flowering stage, as although such an early mowing is seldom worth gathering, it has the effect of stimulating root growth, to the benefit of subsequent cuttings, which are usually made when approximately one-third of the plants have reached the flowering stage. If weed growth is prevalent during the spring months, frequent cutting is often necessary as a control to prevent seeding.

QUEENSLAND SHOW DATES FOR 1937.

June.

Bundaberg	3rd to 5th
Biloela	3rd to 5th
Lowood	4th and 5th
Boonah	9th and 10th
Gladstone Jubilee Show	10th and 11th
Marburg	18th and 19th
Rockhampton	22nd to 26th
Mackay	29th June to 1st July

July.

Kilcoy	1st and 2nd
Proserpine	2nd and 3rd
Bowen	7th and 8th
Ayr	9th and 10th
Rosewood	9th and 10th
Pine Rivers	9th and 10th
Cleveland	9th and 10th
Townsville	13th to 15th
Nambour—	
Show	15th and 16th
Campdraft	17th
Esk	16th and 17th
Charters Towers	20th to 22nd
Laidley	21st and 22nd
Maleny	22nd and 23rd
Cairns	27th to 29th
Gatton	28th and 29th
Barcaldine	28th and 29th
Emerald	28th and 29th
Caboolture	30th and 31st

August.

Crow's Nest	4th and 5th
Home Hill	6th and 7th
Royal National, Brisbane	16th to 21st
Wynnum	27th and 28th

September.

Imbil	3rd and 4th
Ingham	3rd and 4th
Pomona	10th and 11th
Tully	10th and 11th
Rocklea	11th
Innisfail	17th and 18th
Malanda	22nd and 23rd

October.

Ravenshoe	8th and 9th
Millaa Millaa	1st and 2nd

November.

Murwillumbah	3rd and 4th

OUR BABIES.

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

WINTER DANGERS.

COUGHS and colds and sore throats occur all the year, but are more common in winter. At this season also they are more serious and more often followed by bronchitis and pneumonia, which are formidable diseases, and may cause death even in the robust, but much more often in those who are weakly from poor nutrition or from any other cause. It must be remembered that any sore throat in a child may be the commencement of an attack of diphtheria, which also prevails most often in the colder months. Therefore, although the great majority of these attacks are mild or even trivial occurrences, many of them are dangerous, and the mortality that they cause is not inconsiderable. This is true, not only in countries that experience severe cold, but even in Queensland, whose mild winter season should be the healthiest time of the year.

It is most important that all mothers should clearly understand that all these diseases, including the "common cold," are caused by disease germs, that spread from one person to another. They are spread chiefly by those suffering from mild attacks, or who have recently recovered from an attack, but are not yet free from the infectious germs, and even by those who appear perfectly well, but are carrying these germs in their throats and noses. Whenever these persons cough, and even during speaking, these germs are thrown out in a fine, invisible spray, which floats around them, and so easily enter other peoples' throats or noses. Another method of spread is due to the bad habit, unfortunately so common in children, of putting their fingers in their

mouths or to their noses, and smearing the secretions containing the germs on to other children's hands and faces. Babies should be protected from those who wish to kiss them.

It is easy to understand why these diseases are more common in winter, for in that season people are most crowded together in rooms often very poorly ventilated. The greatest risks are run in crowded halls, where there are sure to be some carriers of these diseases when they are prevalent. In schools also epidemics occur, and are not always avoidable, but children before school age, and especially babies, should never be exposed to unnecessary risks by taking them to picture-shows and such like. Exposure to cold by itself can never cause these troubles, though it may temporarily lower the resistance of those who may happen to be carrying the germs in their throats. In young children these diseases are almost invariably contracted from another person. Fatigue may also temporarily lower the resistance, and this is an additional reason for keeping young children at home in the evenings, and giving them a good night's rest.

The mother's great aim should be not only to protect her children from infection, but to increase their resistance. For this good nutrition is of the greatest importance, giving plenty of the protective foods—milk, butter, eggs, vegetables, fruit, wheatmeal, or cerevite, and in the case of weakly children cod liver oil in some form. All rooms should be well ventilated. The best sleeping places are rooms with windows wide open or verandas so long as the children are well covered and sheltered from cold winds. From diphtheria they may be protected by inoculation.

When the child is suffering from a cold or cough, unless very trivial, he should be kept in bed. This is imperative if the thermometer shows a rise of temperature. Compared with this all treatment by medicines is of comparatively small importance.

IN THE FARM KITCHEN.

STEWS, WHITE AND BROWN.

THERE are two kinds of stews—a white stew, such as Irish stew, which has a thin white gravy, or a brown stew, which has a thick brown gravy. A brown stew can be cooked on top of the stove or in the oven, whichever place is most convenient.

Stewed Steak and Dumplings.

Take 2 lb. stewing steak, flour, pepper, salt, and water.

For the dumplings, take ½ lb. flour, ¼ lb. suet, 1 small teaspoonful baking powder, water to mix. Wipe the steak and cut into six or eight pieces. Flour them well and season with pepper and salt, then put them into a casserole and cover with water. Put the casserole into the oven, bring to the boil, skim it if required, then let it simmer gently for about three hours. To make the dumplings, chop the suet finely and mix it with the flour (to which the baking powder has been added). Add cold water and mix to a stiff paste, then divide it into portions and make into dumplings. Add these to the stew when it is half-cooked, allowing them about one hour and a half. Serve the stew on a hot dish with the dumplings round.

Exeter Stew.

Take 1½ lb. stewing beef, 2 oz. dripping, 2 carrots, turnip (if liked), 1 tablespoonful vinegar, 3 onions, 1 tablespoonful flour, salt and pepper, dumplings.

Cut the meat into neat cubes and fry in hot fat for five minutes. When brown all over, remove the meat to a plate, then brown the sliced onions slightly, in the fat. Stir in the flour and season to taste and thin down with stock or water. When the mixture is boiling, return the meat to the saucepan, add the sliced carrots and turnip, cover, and simmer for two hours. Add six or eight dumplings and cook another half-hour. Serve the meat and vegetables on a very hot dish garnished with the dumplings.

Haricot Mutton.

Take 2 lb. neck of mutton, 2 carrots, 6 small turnips, 2 oz. butter (or dripping), 1 dessertspoonful flour, a little parsley, thyme, bayleaf, 1 small clove or garlic, ½ pint boiling water, salt, and pepper.

Divide the mutton into cutlets, and, if very fat, remove some of it. Heat about half of the butter or dripping in a stewpan, fry the meat quickly until the entire surface is lightly browned; sprinkle it with flour, so as to make it brown more quickly. When ready, add the boiling water, garlic, a little salt and pepper, and the parsley, thyme, and bayleaf. Cover with a close-fitting lid, and cook very slowly for one hour. In the meantime heat the remaining butter, peel the turnips, cut into thick slices, and fry them brown, then drain them and put into stewpan containing meat, also the carrots previously scraped and cut into neat pieces. Continue to cook slowly until both meat and turnips are tender, then pile the meat in the centre of a hot dish and arrange the pieces of turnip round the base. Skim well to remove some of the fat, then strain the gravy over the meat and serve.

Irish Stew.

Take 1½ lb. scrag and middle neck mutton, ½ lb. onions, 1 lb. potatoes, water, pepper, and salt.

Wipe the meat and divide into portions. Peel and slice the onions. Put them into a large saucepan with the meat, add a little pepper and salt and just sufficient water to cover it. Bring it to the boil and remove the scum from the top, then leave the stew to simmer gently for from one and a-half to two hours, keeping it skimmed as required. Peel the potatoes, wash, split into halves, and cut them across again if they are large. Place these on top of the stew (when the latter is about half-cooked) and sprinkle them with salt. When the meat is ready the potatoes should be soft. To serve the stew, place the meat and onions in the centre of a very hot dish and the potatoes round the edge to form a border. Pour some gravy round, making quite sure first that it is free from grease.

WHEAT VARIETIES.

The census of wheat varieties sown in Queensland during the 1936-37 season, compiled by the Queensland State Wheat Board, Toowoomba, disclosed the fact that Florence still maintains its position as the most popular variety with an area of 71,903 acres, representing 20·5 per cent. of the total acreage sown. This wheat has been popular for many years on account of its ability to yield well over a wide range of soils and climatic conditions. If seasonally sown, it will usually escape rust. Its chief defect is a tendency for the grain to scatter in the field when ripe, rendering it susceptible to storm damage.

Flora, a short-stemmed grain wheat of high quality, maintains its position with 41,160 acres. In this connection, it is interesting to note that Puora—a Pusa-Flora crossbred recently introduced by the Department of Agriculture and Stock—secured the championship at the recent Sydney Royal Show in the medium strong class.

The varieties Pusa, Three Seas, Gluyas, Cedric, and Seafoam are all represented by areas in excess of 18,000 acres, ranging from 10·8 per cent. of the total area in the case of Pusa, to 5·2 per cent. in regard to Seafoam.

The high proportion of superior hard milling wheats grown in Queensland—such as Florence, Flora, Pusa, Cedric, Ford, and Novo—is an interesting factor in the local wheat industry. Flora, Cedric, Novo, Seafoam, and Three Seas were all bred at the Roma State Farm, and introduced into general cultivation by the Department of Agriculture and Stock through the medium of trial plots established throughout the Darling Downs wheat areas.

—*H. W. Ball.*

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF APRIL IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1937 AND 1936, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Apr.	No. of Years' Records.	Apr. 1937.	Apr. 1936.		Apr.	No. of Years' Records.	Apr. 1937.	Apr. 1936.
North Coast.	In.		In.	In.	*Central Highlands.*	In.		In.	In.
Atherton	4·32	36	1·63	4·55	Clermont ..	1·59	66	0·94	Nil
Cairns	11·36	55	6·57	9·15	Gindie	1·15	38	..	Nil
Cardwell	8·87	65	0·76	11·06	Springsure ..	1·54	68	0·51	Nil
Cooktown ..	8·88	61	2·01	18·66					
Herberton ..	3·84	51	0·35	2·67					
Ingham	7·64	45	0·59	7·02					
Innisfail	20·09	56	12·47	19·10					
Mossman Mill ..	8·29	24	..	5·54	*Darling Downs.*				
Townsville ..	3·38	66	0·15	2·04					
Central Coast.					Dalby	1·40	67	0·93	0·13
					Emu Vale ..	1·41	41	0·57	0·42
					Hermitage ..	1·43	31	..	0·16
Ayr	2·49	50	0·60	2·52	Jimbour ..	1·39	49	0·78	0·05
Bowen	2·69	66	1·21	0·26	Miles	1·46	52	0·77	0·26
Charters Towers ..	1·51	55	0·03	1·70	Stanthorpe ..	1·78	64	1·44	0·64
Mackay	6·18	66	1·02	0·65	Toowoomba ..	2·65	65	0·85	0·68
Prosperine ..	5·80	34	1·22	2·04	Warwick ..	1·66	72	0·31	0·47
St. Lawrence ..	2·76	66	3·04	Nil					
South Coast.									
					Maranoa.				
Biggenden ..	2·19	38	0·58	0·84					
Bundaberg ..	3·32	54	0·60	0·93					
Brisbane	3·81	85	0·92	0·21	Roma	1·30	63	0·32	0·02
Caboolture ..	4·57	50	1·45	0·58					
Childers	2·88	42	0·28	1·20					
Crohamhurst ..	6·81	44	..	2·64					
Esk	3·04	50	1·31	0·31					
Gayndah	1·46	66	0·47	0·25					
Gympie	3·50	67	0·54	1·14	*State Farms, &c.*				
Kilkivan	2·29	58	0·80	0·18					
Maryborough ..	3·88	66	3·03	1·42	Bungeworgorai ..	1·20	22	..	Nil
Nambour	6·32	41	1·97	2·66	Gatton College ..	1·92	38	..	0·34
Nanango	1·98	55	0·27	0·32	Kairi	4·31	21	..	..
Rockhampton ..	2·55	66	1·58	0·20	Mackay Sugar Experiment Station	4·72	40	..	0·21
Woodford	4·70	50	1·83	0·64					

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—APRIL, 1937.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Mean Atmospheric Pressure at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.				Total.	Wet Days.
		Max.	Min.	Max.	Date.	Min.	Date.		
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·89	82	72	86	24	62	20	212	5
Herberton	..	77	56	82	19	47	19	35	6
Rockhampton	29·98	84	61	87	7, 16	53	22, 25	158	3
Brisbane	30·02	79	59	85	8	54	22	92	7
Darling Downs.									
Dalby	30·01	77	48	85	1	39	25	88	3
Stanthorpe	..	70	43	80	1	32	22	144	10
Toowoomba	..	72	50	78	1, 8	44	9, 16, 20, 24	86	7
Mid-Interior.									
Georgetown	29·91	88	60	91	23	49	24	49	1
Longreach	29·98	86	55	92	27	49	21	Nil	..
Mitchell	30·03	78	45	84	1	36	21, 25	15	1
Western									
Burketown	29·91	92	65	95	2, 3, 4	58	18, 19	Nil	..
Bulia	30·02	87	30	94	25	52	21	Nil	..
Thargomindah	30·02	80	56	87	2, 3	46	25	Nil	..

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	June. 1937.		July. 1937.		MOONRISE. June. 1937.	July. 1937.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	a.m.
1	6.37	5·2	6.45	5·7	11·11	12·1
2	6·37	5·2	6·45	5·7	—	—
					a.m.	
3	6·38	5·2	6·45	5·7	12·10	1.3
4	6·38	5·2	6·45	5·8	1·9	2·7
5	6·39	5·2	6·45	5·8	2·11	3·13
6	6·39	5·2	6·45	5·8	3·18	4·21
7	6·39	5·2	6·45	5·9	4·25	5·25
8	6·40	5·2	6·45	5·9	5·35	6·23
9	6·40	5·3	6·44	5·9	6·39	7·13
10	6·40	5·3	6·44	5·10	7·42	7·58
11	6·41	5·3	6·44	5·10	8·36	8·38
12	6·41	5·3	6·44	5·11	9·23	9·15
13	6·41	5·3	6·43	5·11	10.6	9.47
14	6·42	5·3	6·43	5·12	10·44	10·25
15	6·42	5·3	6·43	5·12	11·25	10·58
16	6·42	5·3	6·43	5·13	11·51	11·32
					p.m.	p.m.
17	6·43	5·4	6·42	5.13	12.25	12·12
18	6·43	5·4	6·42	5·14	1·0	12·52
19	6·43	5·4	6·42	5·14	1·35	1·36
20	6·43	5·4	6·41	5·15	2·14	2·24
21	6·44	5·4	6·41	5·15	2·54	3·15
22	6·44	5·4	6·41	5·16	3·40	4·7
23	6·44	5·4	6·40	5·16	4·29	5·7
24	6·44	5·4	6·40	5·17	5·23	6·3
25	6·44	5·5	6·39	5·17	6·18	7·0
26	6·45	5·5	6·39	5·18	7·13	7·58
27	6·45	5·5	6·38	5·18	8.9	8·56
28	6·45	5·5	6.38	5·19	9·6	9·55
29	6·45	5·5	6·37	5·19	10·4	10·56
30	6·45	5·5	6·36	5·20	11·1	11·58
31			6·35	5·21		

Phases of the Moon, Occultations, &c.

2 June	☽	Last Quarter	3	24 a.m.
9 ,,	●	New Moon	6	43 a.m.
16 ,,	☾	First Quarter	5	3 a.m.
24 ,,	○	Full Moon	9	0 a.m.

On 9th June, at 6.40 a.m., the New Moon will arrive at that part of its orbit where it will be in a direct line between the Sun and Earth. Being nearest the Earth, our satellite will apparently be of the same size as the Sun; its cone-shaped shadow will entirely obscure the face of our great luminary and a total eclipse will occur within a limited area—a rare occurrence, because the Moon can wander as much as 5 deg. north or southward from the ecliptic, the apparent path of the Sun—for any one part of the Earth a very rare spectacle indeed. Unfortunately this marvellous phenomenon will not be seen in Australia, but all but our next-door neighbours in the Solomon Islands will see a partial eclipse. Further eastward the path of totality will cross the Pacific Ocean through some of the Ellice and Phœnix Islands and through Fanning and Christmas Islands, ending at the western coast of South America, near Lima in Peru A partial eclipse will be seen in the southern part of North America, Mexico, and the central part of South America from north to south. The duration of the total phase varies for different places—in this case from 3 min. 54 sec. to 7 min. 4 sec. Its path may be 150 miles wide and, incidentally, Fanning and Christmas Islands, opposite each other, lie directly on its border lines.

On the 21st June the Australian winter solstice will occur, when the Sun, having reached its greatest northern latitude, will seem to be stationary, after which it will begin to turn southward.

Venus on the 27th will attain its greatest distance west of the Sun, rising about three hours and a-half before it.

Mars, which since 14th April has been moving with retrograde motion from Scorpio into Libra, will, on the 27th, resume its normal eastward course.

Mercury rises at 4.51 a.m., 1 hour 46 minutes before the Sun, and sets at 3.50 p.m., 1 hour 12 minutes before it, on the 1st; on the 15th it rises at 4.56 a.m., 1 hour 46 minutes before the Sun and sets at 3.45 p.m., 1 hour 18 minutes before it.

Venus rises at 3.21 a.m., 3 hours 6 minutes before the Sun, and sets at 2.42 p.m., 2 hours 20 minutes before it, on the 1st; on the 15th it rises at 3.13 a.m., 3 hours 29 minutes before the Sun, and sets at 2.24 p.m., 2 hours 39 minutes before it.

Mars rises at 3.58 p.m. and sets at 5.23 a.m. on the 1st; on the 15th it rises at 2.48 p.m. and sets at 4.13 a.m.

1st July	☽	Last Quarter	11	3 p.m.
8th ,,	●	New Moon	2	13 p.m.
15th ,,	☾	First Quarter	7	36 p.m.
23rd ,,	○	Full Moon	10	46 p.m.

Perigee, 6th July, at 7 p.m.
Apogee, 18th July, at 8 p.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.