**ANNUAL RATES OF SUBSCRIPTION.**—Farmers, Graziers, Horticulturists, and Schools of Arts, **One Shilling,** members of Agricultural Societies, **Five Shillings,** including postage. General Public, **Ten Shillings,** including postage.


Vol. L 1 OCTOBER, 1938 Part 4

# *Event and Comment*

**Rural Development.**

PROVISION for the co-ordination of the agricultural interests of the State is the main purpose of the Rural Development Transfer and Co-ordination of Powers Bill introduced in the present session of Parliament by the Minister for Agriculture and Stock, Hon. Frank W. Bulcock. In the course of his speech on the initiation of the measure, the Minister said that it had been evident for the past few years that the State had entered on its third phase of agricultural development.

The first phase was the pioneering phase, when to produce a crop was equivalent to the selling of it. In those days no consideration was given to the amount of labour involved in its production. Later came the application to rural industry of science in its various forms, and for a time agriculture made satisfactory advances in the Commonwealth and the world generally. But in the disastrous post-war period a new aspect of agriculture developed—economic agriculture—which became necessary because it had been demonstrated conclusively on the

markets of the world that cultivation and production, plus science, did not give everything that was required; hence the development of the economic phase of agriculture, involving the disposal of the crop in the most satisfactory market.

Mr. Bulcock went on to say that the question of economic agriculture became more acute with the passing of the years. Economic nationalism meant that the country that adopted it said in effect, "Let us produce our own requirements within our own territory." There were some who thought that this would be a passing phase of economic reconstruction, but, unfortunately, that assumption was wrong, and it could be said reasonably—figures supported the assertion—that economic nationalism was a more potent factor in national life to-day than ever before. Economic nationalism obviously meant contracted markets. For the last four or five years a considerable amount of the time of Parliament had been devoted to a discussion of the implications of trade treaties, quotas, restrictions, and rationing of markets. Things undreamt of ten years ago had come within the range of practical politics and were now accomplished facts. Restrictions, quotas, and import duties seemed to be established practices in the economic and social structure of many countries. It was obvious that the old days of indiscriminate production of primary commodities had passed, and rural organisation had to be moulded in such a way as to fit in with the altered conditions. If there was to be planned agriculture on the production side, there must be planned marketing as well.

Various methods had been adopted in an endeavour to overcome the many difficulties surrounding agriculture. They had, for example, the butter stabilisation plan, to which there could be no soundly based objection. In Biblical law the labourer is worthy of his hire, and if they were to maintain an Australian standard of living, it should not be applied to one, two, or three sections of the community, but be of general application to all sections. Hence right-thinking people throughout Australia readily agreed that it was desirable that they should have such a stabilisation scheme.

A stabilisation scheme was essentially different from a bounty scheme. When the bounties paid from time to time by the Commonwealth Government were reviewed, the conclusion was inescapable that many of them were paid because uneconomic and uncontrolled production in years gone by had caused an uneconomic situation at the marketing end. Consequently, the taxpayer was required to make a contribution for the purpose of enabling people overseas to obtain foods at a low market level, and for which otherwise there might be no market at all. Sooner or later the giving of bounties to industries for export might have to be discontinued because bounties are paid out of consolidated revenue and must therefore ultimately be paid by the taxpayer. Uneconomic agriculture involved a tremendous direct financial burden, and could not be continued indefinitely. A resolution was carried at the

last meeting of the Australian Agricultural Council that no bounty should be paid to any agricultural industry unless it was justifying its existence by taking advantage of modern methods and doing everything within its power to promote efficiency, so that in the course of time it would become a self-supporting industry. That view was not only the view of the Commonwealth Government, but the view, also, of responsible agricultural authorities throughout the Commonwealth.

On the other hand, agriculture must not be allowed to decay. He believed that the only title to land is its application to its economic use. "You must either use it or lose it." It became necessary, therefore, to endeavour to determine the best economic use for the lands of our State. It was obvious that our present system of production was capable of a great deal of improvement.

Probably, one of the most serious problems concerning the people was the preservation of their agricultural status, and that depended on economic land utilisation.

Continuing, Mr. Bulcock said, *inter alia*, that under the Bill finance, which had not been readily available to the land industries of the State, would be made so, and would be distributed more scientifically than in the past. The Crown would be able to give an impetus to industries worth developing. The measure was designed to co-ordinate the State's rural financial policy by bringing it under one control. A Rural Development Board, consisting of representatives of the Department of Agriculture and Stock, the Department of Public Lands, and of the Treasury, would be constituted. The Agricultural Bank would be dissolved and its business carried on by the Bureau of Rural Development. Provision had been made for a sinking fund. The corporation would be a local body under the Local Bodies' Loans Guarantee Acts, which would give it certain borrowing powers.

The bureau would administer all rural loans. Its powers would be so extensive that it would deal with fodder conservation, water conservation, irrigation, and all related agricultural practices.

The provisions enunciated were the provisions of a Bill that the position of agriculture in this State made necessary. The necessity of co-ordinating activities and services had plainly arisen. They could make conjointly, through the Department of Public Lands and Department of Agriculture and Stock, a more material contribution to the wellbeing of agriculture and stock-raising than if they continued to work as separate units. The final instrument of co-ordination between these two Departments was obviously the corporation which it was now proposed to set up, representing as it did, agriculture on the one hand and lands administration on the other. There was a certainty then that there would be not only a continuity of policy but a co-operative policy as between those two important Departments.

# The Control of Banana Rust Thrips.

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(*Continued from p. 316, Part 3, Vol. L.—Sept.*, 1938.)

## X. CONTROL EXPERIMENTS.

### (1) Basis for Experimental Work.

In arriving at a basis for control experiments many factors were taken into account. The fundamental relationship between host plant and insect pest suggests that some form of bunch treatment might be economically practicable. Previous investigators, viz., Girault (1925), Froggatt (1927, 1928), Weddell (1932, 1933) and Smith (1934), had accumulated a considerable amount of information on the subject from which it appeared that bunch protection with hessian bags and with fumigant or contact dusts was particularly worth detailed investigation.

As the crop is for the most part grown on hillsides of varying steepness, but generally of considerable ruggedness, the use of power-propelled or horse-drawn appliances is impracticable. This ruggedness also sets definite limitations to the weight of insecticidal apparatus which a man can carry and operate with reasonable comfort and rapidity.

The period of maximum thrips activity coincides with the wet season, when the rainfall is often 10-15 inches per month and frequently torrential in nature. Insecticides must, therefore, be applied to the bunch fairly frequently. As water is seldom readily available on the plantation, the relatively cumbersome sprays were eliminated from the control experiments.

The irregular distribution of the insect and the impossibility of predicting accurately the probable intensity of infestation on any plantation necessitated the wide scattering of experimental plots throughout the various districts. Only those insecticides available on the Queensland or Australian markets were used. As the financial returns to the grower were very low at the commencement of the work, the cost of probable control measures had to be carefully considered.

After reviewing the whole position it was decided that:—

(1) The experimental sites should be located in as many different centres as possible;

(2) Bunch treatment should comprise the major portion of the experimental programme which would naturally be put into operation during the spring, summer and autumn;

(3) Insecticidal dusts either alone or in conjunction with bags should be exploited in control work;

(4) The question of the efficacy of bagging alone as a means of control should be thoroughly investigated; and

(5) Other forms of control should be studied in conjunction with the main experimental programme as time and opportunity permitted.

### (2) General Experimental Technique.

(*a*) *Selection of Experimental Sites.*—Experimental sites were selected to conform as far as possible with the following requirements:—

(i.) The plantation must be in reasonably good condition and likely to produce fruit of at least good average quality;

(ii.) Plant development must be such as to ensure a sufficiency of newly-thrown bunches during the experimental period;

(iii.) The plantation should have previously experienced severe rust or, if a young plantation, either be in close proximity to a badly affected area or show a considerable thrips infestation fairly early in the spring, in order to ensure a reasonable chance of severe rust incidence;

(iv.) The plantation must be reasonably accessible in even the wettest weather.

These criteria were not always satisfied because, in the period of decline of an epidemic, it is difficult to determine the probable peak thrips population in any plantation. In both the 1933-34 and 1934-35 seasons, one experimental plot was of little value owing to the slight rust incidence which developed. However, some of the plots were among the most acutely infested in the several districts.

(*b*) *Marking of Bunches.*—Bunches were marked by attaching to the stalk or the base of one of the leaves a card of white millboard about 8 inches by 6 inches, lettered and numbered conspicuously with Indian ink and water-proofed by dipping in a bath of molten paraffin. The cards were suspended by about 2½ feet of string and were usually readily visible at a considerable distance. To facilitate the location of experimental bunches the position of each was plotted on a chart of squared paper.

This method of marking bunches proved very successful. The cards withstood the exposure so well that some were used for three seasons. The chart enabled the experimental bunches to be located quite easily, despite their random distribution over a large area.

Where necessary, a block of plants was conveniently marked by attaching cards to corner plants and also at intervals along the sides.

(*c*) *Arrangement of Experimental Material.*—In most experimental areas, the bunches were distributed at random throughout the plantation or part of the plantation. That is to say, the single plant was treated as a plot, the plots were scattered irregularly throughout the experimental area (the selection of a plant at any time being determined by its stage of growth) and the various treatments were allotted at random to the selected bunches. The actual procedure consisted of pursuing a more or less regular course up and down the rows within the prescribed area and, when a bunch at the correct stage of development was encountered, determining the treatment by the random selection of a lettered disc or label. The number of bunches at the right stage of development on any one day was strictly limited. As it was desirable to include bunches thrown at varying times throughout the period of marked insect activity, a certain number of bunches were selected for treatment on the occasion of most of the weekly visits.

The use of row plots suitably replicated as an alternative experimental method was considered impracticable on account of (1) the considerable variation in plant development, especially on plantations after the first cut and (2) the limited period of the year during which control measures must be applied. To ensure a comparable number of suitable bunches being available for each treatment on each selection day would have necessitated plots of unwieldly size and a prohibitive number of replications.

Where bunch treatment was the sole object of the experiment the unit plant plot was employed. In the case of whole plant treatment, plots of 100 or more plants were used, the same treatment being applied to all plants in the plot. The outside three or four rows were regarded as buffer rows and were not used in assessing the results. The control plants were selected outside the treated plot.

When field experiments were carried out on more than one plantation in any season, the various treatments were divided between the plantations in such a manner as to give the maximum number of comparisons between them.

(*d*) *Materials Used.—Bags.*—Bags were made to the special measurements 45 inches long by 27 inches wide. They were large enough to accommodate all but extremely big bunches, a type not encountered on any of the nine plantations on which experimental work was carried out.

Two grades of hessian were used in the manufacture of bags. The better quality was 11 oz. sugar hessian, a close mesh material which is, however, fairly light. The second quality was 10 oz. hessian which possesses a more open texture. The former had been advocated by certain growers in the Gympie district and had figured in previous experimental work carried out by Weddell (1932, 1933). The latter was tried only in the fourth season's experiments in an endeavour to reduce the cost of control measures.

*Cloaks.*—In the 1934-35 and the 1935-36 seasons, 11 oz. sugar hessian bags, which had been used on one bunch during the previous season, were cut along the bottom and one side for use as cloaks. Such cloaks measured 54 inches by 45 inches. In the 1936-37 season portions of the new second quality hessian, approximately 36 inches square, were used for this purpose. Although the once-used better quality material had deteriorated to a certain extent, it still remained closer-meshed than the new second quality hessian.

*Nicotine Dust A.*—This dust had a nicotine content of 2 per cent., as nicotine sulphate. The supplies procured varied enormously in appearance and physical properties. Never particularly good, the dust deteriorated into a thoroughly inferior product. In most samples a considerable proportion of the dust particles became aggregated into lumps which were difficult to break up satisfactorily. The dust was discarded after the first season's work.

*Nicotine Dust B.*—The nicotine content in early supplies of this dust varied considerably but was generally high. Later the specifications of the dust were standardised at 2·5 per cent. nicotine as nicotine sulphate, 0·3 per cent. nicotine as tobacco powder. By that time it had been established that, provided the physical properties of the dust are suitable, the nicotine content need not be particularly high, and, therefore, for experimental purposes, this change in composition was of no importance. The physical properties of the dust varied somewhat in samples purchased at intervals during the four seasons of experimental work, but were generally good. The early samples were superior to those obtained at a later date. On account of the uniform results obtained in the first season's work, this dust was subsequently adopted as the standard for comparing the value of the various bunch treatments.

*Nicotine Dust C.*—This dust contained 2½ per cent. nicotine, claimed to be in the free state and was used throughout the first season's work.

Its physical properties were excellent. However, it was discarded in favour of nicotine dust B before the unimportance of a high nicotine content was appreciated.

*Calcium Cyanide.*—The commercial Calcid brand of this dust was employed. Its physical properties were good. Though included in the first two seasons' experiments, it failed to demonstrate any superiority over the nicotine dusts, and was discarded on account of the slight tendency to burn the fruit and a comparatively high toxicity to man.

*Derris Dust A.*—This dust was specified to contain 15 per cent. derris on a colloidal spreader, the derris having an ether extract of 18 per cent. and a rotenone content of 0·5 — 0·7 per cent. It was in a finely divided state, which was maintained in all samples. A high degree of "fluffiness" and excellent "floating" powers made this insecticide extremely suitable for the purpose required. Derris dust A was used in the 1934-35 and 1935-36 seasons.

*Derris Dust B.*—The only information supplied with this dust was to the effect that the approximate total ether extractives were 3·63 per cent. It possessed similar physical properties to derris dust A and, as the results obtained in experimental work were identical with those of the latter dust, it was used only in the 1934-35 season.

*Derris Dust C.*—In the 1936-37 experiments, a few bunches were treated with a dust claimed by the manufacturer to have the following active constituents: 2 per cent. tuba toxin as pulverised derris, 0·1 per cent. total pyrethrins, 39 per cent. sulphur as ground sulphur. In common with other dusts containing sulphur, this sample was markedly deficient in "floating" power.

*Pyrethrum and Sulphur.*—A mixture of equal parts of precipitated sulphur and commercial pyrethrum powder was used in 1933-34 and 1934-35. Although the best grade of precipitated sulphur obtainable was used, the mixture rapidly lost its finely particulate nature and became coarse and lumpy. Its physical properties were thus most unsatisfactory and it was also apt to burn the fruit in exposed situations.

*Nicotine and Sulphur.*—This dust, prepared by combining two parts of nicotine dust B with one part of precipitated sulphur by weight, had the same undesirable physical properties possessed by other sulphur mixtures. It was used only in the 1934-35 season.

*Derris and Pyrethrum.*—To obtain a mixture in which the proportion of derris to pyrethrum was approximately two to one by weight, derris dust A and commercial pulverised pyrethrum flowers were mixed at the rate of 40 lb. of the former to 3 lb. of the latter. This dust retained the very good physical properties of the two constituent dusts. It was used only in the 1935-36 season, following recommendations made in another State for the control of *Thrips imaginis* (Davidson, 1935), but proved in no way superior to the simpler nicotine dusts and was subsequently discarded.

*Naphthalene and paradichlorobenzene.*—A simple mixture of equal parts by weight of these two materials was used in two experiments.

*Ovicide.*—This is a proprietary tar oil spraying material, of which the active constituents are not less than 48 per cent. tar oils, 10 per cent. phenols, and 20 per cent. mineral oils. For the purpose of dipping bags in one experiment, a dip containing four parts per hundred parts of water was prepared.

*Ostico.*—A commercial sticky banding material for trees was used to band the bunch stalk in sundry small experiments.

*Nicotine Sulphate Dip.*—For an experiment on the dipping of planting material, a commercial nicotine sulphate, guaranteed to contain not less than 40 per cent. nicotine, was used at a strength of one part of nicotine sulphate to 500 parts of water with soft soap added, equal to twice the weight of the nicotine sulphate.

*Paper Bags.*—Large brown paper bags, previously treated with a proprietary preparation, which seemed to be linseed oil and paraffin, were supplied by a commercial firm for a small scale experiment.

(*e*) *Methods of Treatment.—Bagging.*—The bag was slipped over the bunch and the mouth tied round the bunch stalk above the top hand with a piece of string (Plate 136; fig. 1). The stage of bunch development at which the bag was fixed in position was, of course, determined by the particular treatment concerned. In all of the bagging treatments, unless otherwise stated, the bag was fitted as soon as it could be conveniently placed in position. In a normal growing season, the emerging bunch thrown by plants of average vigour is slightly beyond the horizontal position before the bags can be attached. The bracts are then "lifting," but if the bunch is at all choked, the bracts will start to "lift" before the horizontal position is reached. Under these conditions, bagging was perforce deferred for a short time until the bunch was more accessible. In some cases it was found necessary to remove one or two leaves to facilitate the operation.

In practice the experimental plots were visited at approximately weekly intervals and all the available bunches within the prescribed area of the experiment were utilized. This ensured that bunches selected on any one day would have been too immature for use in the previous week. On the first selection day there would, of course, be no such guide and personal judgment was then necessary. However, with a little experience there is no difficulty in gauging fairly accurately the age of a young bunch. The time deviation from the optimum stage of bunch development for bagging probably never exceeded four or five days, which was far less than would occur under plantation conditions.

Unless otherwise stated, bags were removed a week or a fortnight after first being placed in position, depending on the rate of growth, fallen bracts were emptied out of the bottom of the bag, bracts still adhering to the bunches were removed, the flower buds broken off and the bag then replaced in position. Occasionally slowly developing bunches were not properly opened in a fortnight and the removal of bracts and bud had to be deferred. The removal of bracts and buds acts as a safeguard against fungus infection of the fruit and assists in the preservation of the bags, which rot rapidly if a mass of decaying material is permitted to remain inside.

*Cloaking.*—The cloaks were wrapped round the bunches and secured at the top in the same manner as bags (Plate 136; fig. 2). They were arranged so that the overlapping sides of the cloak were at the "back" of the bunch, i.e., next to the pseudostem. The bottom of the bunch was, of course, exposed.

The amount of uncovered fruit at the back of the bunch depended on the relative sizes of bunch and cloak but, except in the case of very small bunches, at least some of the lower hands were exposed, even with the larger cloaks.

As with bagged bunches, adhering bracts were removed when loose and, to ensure uniformity of treatment, the flower buds were broken off a week or a fortnight after selection of the bunch. It was unnecessary to remove the cloaks to perform these operations.

*Dusting.*—Where necessary, bunches were dusted with small hand dusters (Rega Bonza models). These dusters are of the plunger pump type and hold about half a pound of dust. Separate dusters were used for each type of dust, and, owing to their small size, it was possible to carry four of them together without undue inconvenience, when a number of dusts were being used on the same experimental plot.

To cut down the dust flow to the required proportions, the cross-sectional area of the outlet from the hopper, normally about one-ninth of a square inch, was reduced to at least one-sixth of that size by the insertion of a small cork with a V groove cut in it. The hopper was never filled completely and the plunger was always operated with a steady, even stroke. These precautions overcame the tendency in this type of duster to emit dust in far greater quantities than necessary for dusting banana bunches.

In experiments where the greater part of the pseudostem was dusted, a full-sized knapsack duster of the bellows type was used. As with hand dusters, it was necessary to reduce the size of the outlet aperture and an extra length of hose was used to increase the length of the feed arm to about twice that of the standard equipment.

In treating fully opened bunches the dust was blown into the bunch from all sides to ensure adequate penetration between the individual fruits. Particular attention was given to the top hands, especially in choked bunches. With half open bunches, bracts which were too green for removal aided considerably in retaining the dust between the fingers. When the bunches were in a very early stage of development the end of the feed arm could be inserted beneath the two bracts subtending the bunch and perhaps the bract covering the top hand. In all cases the bunch stalk immediately above the top hand was dusted in the first two or three treatments.

In dusting the pseudostem, the dust was directed downwards into each leaf axil. No attempt was made to treat the pseudostem below the base of the bottom-most leaves. In such experiments the bunches were dusted in the ordinary way while rather more attention was given to the treatment of the bunch stalk than in the bunch dusting alone.

The essence of good bunch dusting lies in securing adequate dust penetration into all parts of the bunch without the accumulation of heavy dust deposits. This was reasonably simple when dusts with good physical properties were used in the modified dusters. Nevertheless, some care was always necessary to avoid excessive deposits.

Flower buds were broken off and persistent bracts removed from dusted bunches at the appropriate time, just as in the case of bagged bunches.

*Bagging and Dusting.*—Bags were attached in the ordinary way. Dust was applied through a small slit about three inches long in the bottom of the bags. Care was taken to ensure that the dust was directed upwards and that the opening of the feed arm did not abut against fruit or the side of the bag, while the feed arm was moved in a circular path inside the bag to give as good a distribution as possible. The amount of dust used on each bunch was determined by experience. With the dusters adjusted in the manner described, six to eight puffs (depending on the size of the bunch), delivered with a full stroke of the plunger, were adequate. More care was necessary to avoid the accumulation of dust residues than in unbagged bunches, owing to the protection against normal weathering. Flower buds and bracts were removed as with bagged bunches.

A variation of this type of treatment was introduced in the 1936-37 experiments. Second quality hessian bags were fixed on bunches in the ordinary way and were dusted three times at weekly intervals. About two hours after the third dusting the bags were removed, dipped until thoroughly wetted in Ovicide, allowed to drain for an hour and then replaced on the bunches. No further dust treatment was given.

*Cloaking and Dusting.*—Cloaks were placed in position and the dust applied from the bottom and back of the bunch. More dust was required than with bagged bunches owing to wind drift. On the other hand, the accumulation of dust residues could be guarded against more easily. Flower buds and bracts were removed as in the other methods of treatment.

*Bunch Stalk Banding.*—On several occasions, in an endeavour to assess the importance of migration by flight in populating bunches, bands of Ostico about 3 inches wide were placed round the bunch stalk above the top hand as soon as possible after bunch emergence. In addition the bunches were dusted frequently for several weeks in an attempt to eliminate the initial population acquired before the application of the adhesive band.

*Repellent Bags.*—The naphthalene-paradichlorobenzene mixture was wrapped in small pieces of cheese-cloth—about 2 oz. of the mixture in each piece—which were then suspended by string within the bunch, the usual position being against the stalk and between the second and third hands.

*Control Bunches.*—In the case of control bunches, bracts were removed as soon as they had become detached from the bunch stalk. Flower buds were broken off as soon as the bunches were fully opened. In these respects, control and treated bunches received identical attention.

*Sucker Dipping.*—Suckers used in the experiment to determine the possibility of freeing planting material from thrips were pared and trimmed after the manner in general use amongst banana growers, though rather less severely. Those to be treated were placed in hessian bags, which had been thoroughly wetted beforehand, and then completely immersed for five minutes in a nicotine sulphate bath. They were retained in these bags until received at the glasshouses where they were planted.

(*f*) *Assessment of Results.*—The evaluation of rust incidence in experiments involving bunch treatment has proved a difficulty to all previous investigators. Smith (1934) made the first attempt to put the matter on a satisfactory basis, by setting up a series of arbitrary values for the measurement of rust incidence on the bunch. His system was followed, with slight modification, by Weddell (1933) and during the present investigation.

Smith's scheme involved the allocation of the numerical values 1, 2, 3, and 4 to varying degrees of rust incidence. Rust development was considered in an absolute sense; that is to say, a bunch entirely free from rust

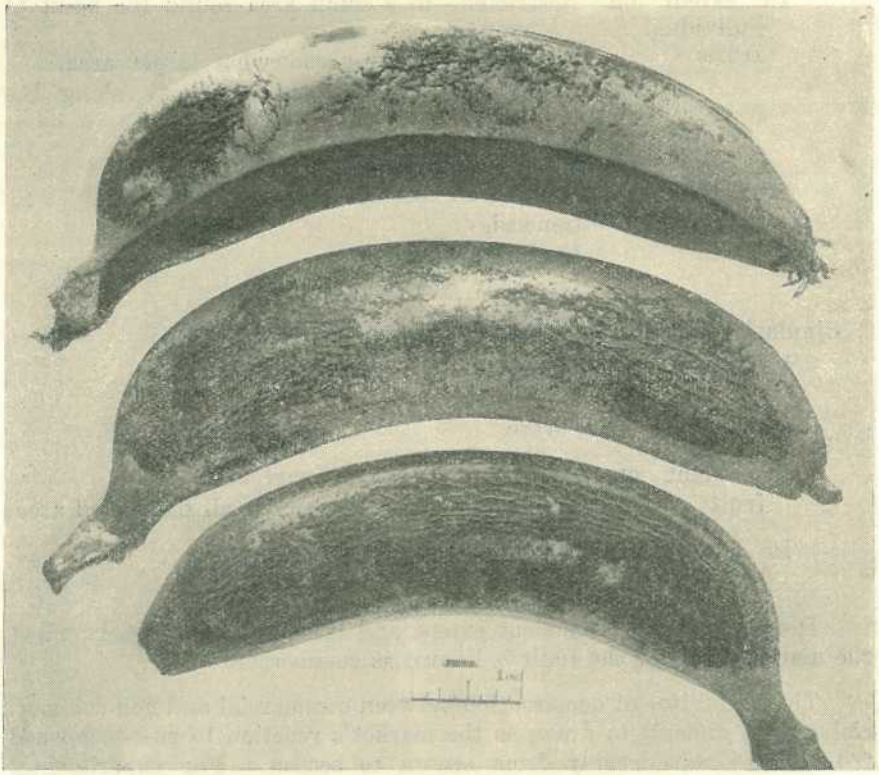

Plate 135.
Injury caused by the Banana Rust Thrips.

was allotted the value 0. Bunches falling into the category designated by the numeral 1 were commercially clean. The value 4 indicated bunches on which little or no fruit of good quality could be found.

Weddell modified Smith's system in that he allocated the value 0 to bunches which were commercially clean. The maximum value was thus 3. In addition, he introduced intermediate grades represented by the values ½, 1½, and 2½.

In the latest investigations Weddell's modified scheme was followed, rust being evaluated from the point of view of commercial, not absolute,

development. In an endeavour to clarify the position as much as possible and to eliminate the personal element in assessing the value of a bunch, a series of definitions was laid down, thus:—

Rust (Plate 135) may be—

| | |
|---|---|
| In colour | Smoky.<br>Red. |
| In intensity of colour | Slight.<br>Moderate.<br>Severe. |
| In extent on individual fruits | Restricted—to a small area round the point of contact.<br>Fairly restricted—a somewhat larger area.<br>Fairly extensive—up to half way along the fruit.<br>Extensive—beyond half way. |
| In extent on bunch | Restricted—to certain hands.<br>General.<br>Irregular and sparse.<br>Irregular and plentiful. |

Similarly, cracking may be—

| | |
|---|---|
| In intensity | Slight.<br>Moderate.<br>Severe. |
| In extent on fruit | Restricted—to contact surfaces.<br>Extensive—over more or less all the rusted area. |
| In extent on bunch | Restricted—to certain hands.<br>General. |

Discolouration of sufficient extent and intensity to adversely affect the market value of the fruit is known as commercial rust.

The actual line of demarcation between commercial and non-commercial rust is difficult to draw, as the market's reaction to rust-blemished fruit varies considerably from season to season. For experimental purposes it was eventually decided that commercial rust presumes:—

(1) Smokiness which is at least moderate and extensive or severe and fairly extensive;

(2) Redness which is at least moderate and fairly extensive, or, severe and fairly restricted.

On mature bunches, smokiness is normally much less important than redness and seldom requires consideration in the evaluation of rust incidence.

The value to be allotted to a bunch was then determined, partly by the severity of the rust blemishes on individual fruits and partly

by their extent on the bunch as a whole. To aid in this evaluation, the following table was drawn up:—

| Rust Categories (Fruits). | Range of Values. (Bunches.) |
|---|---|
| A. 1. Perfectly clean. | |
| 2. Smokiness—severe and fairly restricted; moderate and fairly extensive. | |
| 3. Redness—slight or moderate and fairly restricted; severe and restricted without cracking | 0 |
| B. 1. Smokiness—moderate or severe and extensive. | |
| 2. Redness—slight and extensive; moderate and fairly extensive; severe and fairly restricted with slight cracking; severe and restricted with severe cracking .. .. .. .. .. | ½–1 |
| C. 1. Redness—moderate and extensive; severe and fairly extensive without cracking; severe and fairly restricted with severe cracking .. .. .. .. | ½–2 |
| D. 1. Redness severe and extensive with cracking .. | ½–3 |
| E. 1. Redness severe and extensive with cracking and splitting .. .. .. .. .. | ½–3 |

Only the conditions representing the worst rust permissible in each category are mentioned. Intermediate types of blemish may be readily placed in their correct position. For instance, "smokiness severe and fairly extensive" obviously goes into category B.1.

Perfectly clean bunches were rarely found in the plantation during the experimental period, with the exception of an occasional treated bunch. Cracking and splitting are associated only with severe redness and provision for them is necessary only in the acute rust categories.

In assessing the value of a bunch only commercially rusted fruits were considered. It was further decided that only three or four such fruits were insufficient to justify an integral value being assigned to a bunch. This was necessary to exclude the effect of a few abnormally placed fruits which may not be typical of the whole bunch. Such blemished fruits are often found in an aborted hand at the top of the bunch and seldom have any commercial importance.

Four years' experience has shown that this system of rust evaluation is reasonably satisfactory. As all the assessments were made by the same observer, the results in all four seasons can be regarded as mutually comparable, though not sufficiently accurate for statistical analysis. At times an increased range of integral values to be allotted to bunches would have proved useful, especially in dealing with fruit showing only a small amount of commercial rust. However, an increase in the number of rust categories would not assist a visual estimation of

the extent of rust blemishes on the bunch and would be of value only if each individual fruit were examined and placed in a rust category, the value of the bunch being determined by the number of fruits in each category. This would necessitate the dissection of each fruit from the bunch and was obviously impracticable under the experimental conditions. As only large differences possess any significance from the point of view of practical control, the system adopted adequately demonstrated any worthwhile results. Actually the improvements in the appearance of bunches subject to some of the better treatments in this series of experiments was most striking.

The table of rust categories and values makes no provision for the normal variation of rust type within the one bunch. However, in practice this variation was not sufficient to prevent the more or less accurate evaluation of rust incidence on the average type of bunch.

The amount of fruit discarded on account of rust blemishes cannot be deduced from rust values allotted under this scheme. Bunches given a value of ½ may have on them a few fruits which are unmarketable, but many growers would pack all fruit on many bunches given a value as high as 1½. All growers would discard split and severely cracked fruit, but with other classes of rust there would be a great variation in the percentage waste, depending on the person packing. However, as a general rule, there would be some unmarketable fruit on bunches of value 1 with the amount of waste increasing to perhaps 50 per cent. on bunches value at 2½. No bunches to which the value 3 could be allotted were encountered during the experimental work.

Data collected in this manner will agree substantially with that based on Weddell's system. The elaboration presented represents an attempt to eliminate the personal element as far as possible in assessing the values allotted to bunches.

In practice rust values were assessed shortly before the fruit matured, as the plantations could seldom be visited on the day when the experimental bunches were being cut. As the age and rate of development of the experimental bunches was known, most of the bunch values were assessed approximately within a week before the probable date of harvesting. If the bunch was still hanging at a later visit, a further valuation was made. Some bunches were thus valued as many as four times when harvesting was delayed by adverse seasonal conditions or by faulty plantation management. This repetition afforded rather a good check on the observer, especially late in the season when rust development was practically at a standstill.

One of the experimental plots in the 1933-34 season could only be visited at three-weekly intervals, treatment in the meanwhile being carried out by other officers. Thus the interval between the valuation and harvesting of some bunches in this experiment was rather long. No allowance is made for this in the results shown, but in subsequent seasons the plots were so distributed that more frequent visits were always practicable.

### (3) Details of Experimental Plots and Results.

(*a*) *Main Experimental Series.*—Treatments, location, and results from the main experimental plots are summarised in Tables I., II., III., and IV.

TABLE I.

Details of Experimental Plots.

| Location. | Period of Selection of Experimental Bunches. | Period of Treatment of Experimental Bunches. | Total Period of Observation. |
|---|---|---|---|
| 1933–34. | | | |
| Plot No. 1—Beenleigh .. .. .. .. .. .. | 26–10–33 to 22–2–34 | 26–10–33 to 20–6–34 | 26–10–33 to 28–7–34 |
| Plot No. 2—Cootharaba .. .. .. .. .. .. | 1–11–33 to 27–3–34 | 1–11–33 to 27–6–34 | 1–11–33 to 29–8–34 |
| Plot No. 3—Kin Kin .. .. .. .. .. .. .. | 30–1–34 to 20–3–34 | 30–1–34 to 27–6–34 | 30–1–34 to 27–9–34 |
| Plot No. 4—Calico Creek .. .. .. .. .. .. | 26–2–34 to 10–4–34 | 26–2–34 to 26–6–34 | 26–2–34 to 26–9–34 |
| 1934–35. | | | |
| Plot No. 1—Cootharaba .. .. .. .. .. .. | 9–1–35 to 3–4–35 | 9–1–35 to 25–6–35 | 9–1–35 to 16–8–35 |
| Plot No. 2—Kin Kin .. .. .. .. .. .. .. | 10–1–35 to 20–3–35 | 10–1–35 to 26–6–35 | 10–1–35 to 16–8–35 |
| Plot No. 3—Calico Creek .. .. .. .. .. .. | 15–1–35 to 26–3–35 | 15–1–35 to 24–6–35 | 15–1–35 to 15–8–35 |
| Plot No. 4—Cootharaba .. .. .. .. .. .. | 31–1–35 to 28–2–35 | 31–1–35 to 25–6–35 | 31–1–35 to 16–7–35 |
| 1935–36. | | | |
| Plot No. 1—Wahpunga .. .. .. .. .. .. | 29–1–36 to 24–3–36 | 29–1–36 to 26–5–36 | 29–1–36 to 3–9–36 |
| Plot No. 2—Cedar Pocket .. .. .. .. .. .. | 12–2–36 to 23–3–36 | 12–2–36 to 25–5–36 | 12–2–36 to 3–9–36 |
| Plot No. 3—Cootharaba .. .. .. .. .. .. | 19–2–36 to 22–3–36 | 19–2–36 to 26–5–36 | 19–2–36 to 4–9–36 |
| 1936–37. | | | |
| Plot No. 1—Cedar Pocket .. .. .. .. .. .. | 26–1–37 to 9–3–37 | 26–1–37 to 4–5–37 | 26–1–37 to 23–6–37 |

TABLE II.

Treatments.

| | |
|---|---|
| B | Bag, first quality. |
| C | Control, untreated. |
| D | Nicotine dust A, weekly. |
| $D_2$ | Nicotine dust A, fortnightly. |
| E | Bag, first quality, plus nicotine dust A, weekly. |
| $E_2$ | Bag, first quality, plus nicotine dust A, fortnightly. |
| F | Nicotine dust B, weekly. |
| $F_2$ | Nicotine dust B, fortnightly. |
| G | Bag, first quality, plus nicotine dust B, weekly. |
| $G_2$ | Bag, first quality, plus nicotine dust B, fortnightly. |
| $G_3$ | Bag, first quality, plus nicotine dust B, weekly for three weeks. |
| H | Nicotine dust C, weekly. |
| I | Calcium cyanide, weekly. |
| J | Bag, first quality, plus calcium cyanide, weekly. |
| $J_2$ | Bag, first quality, plus calcium cyanide, fortnightly. |
| K | Pyrethrum and sulphur, weekly. |
| L | Bag, first quality, plus pyrethrum and sulphur, weekly. |
| M | Derris, weekly. |
| $M_2$ | Derris, fortnightly. |
| $N_2$ | Bag, first quality, plus derris, fortnightly. |
| $O_2$ | Nicotine dust B and sulphur, fortnightly. |
| P | Cloak. |
| $Q_2$ | Cloak, plus nicotine dust B, fortnightly. |
| $Q_3$ | Cloak, plus nicotine dust B, weekly for three weeks. |
| $R_2$ | Derris and pyrethrum, fortnightly. |
| $V_2$ | Bag, second quality, plus nicotine dust B, fortnightly. |
| $V_3$ | Bag, second quality, plus nicotine dust B, weekly for three weeks. |

TABLE III.

Type table (Plot No. 4, 1934–35):—Showing the Method by which results have been calculated for use in Table IV.

| Treatment. | Number of Bunches Assigned to Each Value. | | | | | | | Total Rust Incidence. | Number of Bunches. | Average Rust per Bunch. | Ratio of Rust Incidence (Control =100). |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | ½ | 1 | 1½ | 2 | 2½ | 3 | | | | |
| B .. .. | 4 | 16 | 4 | .. | .. | .. | .. | 12.0 | 24 | 0.50 | 30 |
| F .. .. | 22 | 3 | .. | .. | .. | .. | .. | 1.5 | 25 | 0.06 | 4 |
| $F_2$ .. .. | 9 | 16 | .. | .. | .. | .. | .. | 8.0 | 25 | 0.32 | 19 |
| $G_2$ .. .. | 20 | 3 | .. | .. | .. | .. | .. | 1.5 | 23 | 0.07 | 4 |
| $M_2$ .. .. | 8 | 17 | .. | .. | .. | .. | .. | 8.5 | 25 | 0.34 | 21 |
| C .. .. | .. | 1 | 8 | 17 | 16 | 4 | .. | 76.0 | 46 | 1.65 | 100 |

This table shows the manner in which the results for each experimental plot were set out for close examination of rust value distribution and total incidence.

TABLE IV.

| Treatments. | B. | D. | $D_2$. | E. | $E_2$. | F. | $F_2$. | G. | $G_2$. | $G_3$. | H. | I. | J. | $J_2$. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1933–34. | | | | | | | | | | | | | | |
| Plot No. 1— | | | | | | | | | | | | | | |
| Number of bunches | 30 | 30 | .. | .. | .. | 30 | .. | 30 | .. | .. | .. | .. | .. | .. |
| Average rust per bunch | 0·03 | 0·12 | .. | .. | .. | 0·05 | .. | 0·03 | .. | .. | .. | .. | .. | .. |
| Ratio of rust incidence | 8 | 29 | .. | .. | .. | 13 | .. | 8 | .. | .. | .. | .. | .. | .. |
| Per cent. commercially clean bunches | 93 | 77 | .. | .. | .. | 90 | .. | 93 | .. | .. | .. | .. | .. | .. |
| Plot No. 2— | | | | | | | | | | | | | | |
| Number of bunches | 28 | 27 | .. | 29 | 17 | 30 | .. | .. | .. | .. | 29 | .. | .. | .. |
| Average rust per bunch | 0·07 | 0·17 | .. | 0 | 0·03 | 0 | .. | .. | .. | .. | 0·03 | .. | .. | .. |
| Ratio of rust incidence | 10 | 23 | .. | 0 | .. | 0 | .. | .. | .. | .. | 4 | .. | .. | .. |
| Per cent. commercially clean bunches | 86 | 67 | .. | 100 | 94 | 100 | .. | .. | .. | .. | 93 | .. | .. | .. |
| Plot No. 3— | | | | | | | | | | | | | | |
| Number of bunches | 18 | 17 | .. | .. | .. | 17 | 14 | .. | 15 | .. | .. | 13 | 15 | .. |
| Average rust per bunch | 0·17 | 0·15 | .. | .. | .. | 0·03 | 0·18 | .. | 0 | .. | .. | 0·23 | 0 | .. |
| Ratio of rust incidence | 13 | 11 | .. | .. | .. | 2 | .. | .. | .. | .. | .. | 18 | 0 | .. |
| Per cent. commercially clean bunches | 67 | 71 | .. | .. | .. | 94 | 64 | .. | 100 | .. | .. | 54 | 100 | .. |
| Plot No. 4— | | | | | | | | | | | | | | |
| Number of bunches | 18 | 20 | 20 | .. | .. | .. | .. | .. | .. | .. | 20 | .. | .. | .. |
| Average rust per bunch | 0·08 | 0·05 | 0·15 | .. | .. | .. | .. | .. | .. | .. | 0·02 | .. | .. | .. |
| Ratio of rust incidence | 10 | 6 | .. | .. | .. | .. | .. | .. | .. | .. | 2 | .. | .. | .. |
| Per cent. commercially clean bunches | 83 | 90 | 70 | .. | .. | .. | .. | .. | .. | .. | 95 | .. | .. | .. |
| 1934–35. | | | | | | | | | | | | | | |
| Plot No. 1— | | | | | | | | | | | | | | |
| Number of bunches | 19 | .. | .. | .. | .. | 19 | 19 | .. | 20 | .. | .. | .. | .. | 19 |
| Average rust per bunch | 0·18 | .. | .. | .. | .. | 0 | 0·16 | .. | 0 | .. | .. | .. | .. | 0 |
| Ratio of rust incidence | 27 | .. | .. | .. | .. | 0 | 24 | .. | 0 | .. | .. | .. | .. | 0 |
| Per cent. commercially clean bunches | 63 | .. | .. | .. | .. | 100 | 68 | .. | 100 | .. | .. | .. | .. | 100 |
| Plot No. 2— | | | | | | | | | | | | | | |
| Number of bunches | 14 | .. | .. | .. | .. | 28 | 28 | .. | .. | .. | .. | .. | .. | .. |
| Average rust per bunch | 0·04 | .. | .. | .. | .. | 0 | 0·09 | .. | .. | .. | .. | .. | .. | .. |
| Ratio of rust incidence | 4 | .. | .. | .. | .. | 0 | 10 | .. | .. | .. | .. | .. | .. | .. |
| Per cent. commercially clean bunches | 93 | .. | .. | .. | .. | 100 | 82 | .. | .. | .. | .. | .. | .. | .. |

TABLE IV.—*continued.*

| Treatments. | K. | L. | M. | $M_2$. | $N_2$. | $O_2$. | P. | $Q_2$. | $Q_3$. | $R_2$. | $V_2$. | $V_3$. | C. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1933–34. | | | | | | | | | | | | | |
| Plot No. 1— | | | | | | | | | | | | | |
| Number of bunches | 28 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 58 |
| Average rust per bunch | 0·34 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 0·40 |
| Ratio of rust incidence | 86 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 100 |
| Per cent. commercially clean bunches | 46 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 43 |
| Plot No. 2— | | | | | | | | | | | | | |
| Number of bunches | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 52 |
| Average rust per bunch | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 0.73 |
| Ratio of rust incidence | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 100 |
| Per cent. commercially clean bunches | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 10 |
| Plot No. 3— | | | | | | | | | | | | | |
| Number of bunches | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 32 |
| Average rust per bunch | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1·31 |
| Ratio of rust incidence | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 100 |
| Per cent. commercially clean bunches | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 0 |
| Plot No. 4— | | | | | | | | | | | | | |
| Number of bunches | 18 | 18 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 36 |
| Average rust per bunch | 0·42 | 0·06 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 0·83 |
| Ratio of rust incidence | 50 | 7 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 100 |
| Per cent. commercially clean bunches | 17 | 89 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 3 |
| 1934–35. | | | | | | | | | | | | | |
| Plot No. 1— | | | | | | | | | | | | | |
| Number of bunches | .. | .. | .. | .. | 20 | .. | .. | .. | .. | .. | .. | .. | 39 |
| Average rust per bunch | .. | .. | .. | .. | 0·02 | .. | .. | .. | .. | .. | .. | .. | 0·66 |
| Ratio of rust incidence | .. | .. | .. | .. | 3 | .. | .. | .. | .. | .. | .. | .. | 100 |
| Per cent. commercially clean bunches | .. | .. | .. | .. | 95 | .. | .. | .. | .. | .. | .. | .. | 5 |
| Plot No. 2— | | | | | | | | | | | | | |
| Number of bunches | 27 | .. | 28 | 27 | .. | 28 | .. | .. | .. | .. | .. | .. | 54 |
| Average rust per bunch | 0·11 | .. | 0 | 0·04 | .. | 0·19 | .. | .. | .. | .. | .. | .. | 0·88 |
| Ratio of rust incidence | 12 | .. | 0 | 4 | .. | 22 | .. | .. | .. | .. | .. | .. | 100 |
| Per cent. commercially clean bunches | 78 | .. | 100 | 93 | .. | 61 | .. | .. | .. | .. | .. | .. | 0 |

TABLE IV—*continued.*

| Treatments. | B. | D. | $D_2$. | E. | $E_2$. | F. | $F_2$. | G. | $G_2$. | $G_3$. | H. | I. | J. | $J_2$. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1934–35—*continued.* | | | | | | | | | | | | | | |
| Plot No. 3— | | | | | | | | | | | | | | |
| Number of bunches | 23 | .. | .. | .. | .. | 24 | .. | .. | .. | .. | .. | .. | .. | .. |
| Average rust per bunch | 0 | .. | .. | .. | .. | 0 | .. | .. | .. | .. | .. | .. | .. | .. |
| Ratio of rust incidence | 0 | .. | .. | .. | .. | 0 | .. | .. | .. | .. | .. | .. | .. | .. |
| Per cent. commercially clean bunches | 100 | .. | .. | .. | .. | 100 | .. | .. | .. | .. | .. | .. | .. | .. |
| Plot No. 4— | | | | | | | | | | | | | | |
| Number of bunches | 24 | .. | .. | .. | .. | 25 | 25 | .. | 23 | .. | .. | .. | .. | .. |
| Average rust per bunch | 0·50 | .. | .. | .. | .. | 0·06 | 0·32 | .. | 0·07 | .. | .. | .. | .. | .. |
| Ratio of rust incidence | 30 | .. | .. | .. | .. | 4 | 19 | .. | 4 | .. | .. | .. | .. | .. |
| Per cent. commercially clean bunches | 17 | .. | .. | .. | .. | 88 | 36 | .. | 87 | .. | .. | .. | .. | .. |
| 1935–36. | | | | | | | | | | | | | | |
| Plot No. 1— | | | | | | | | | | | | | | |
| Number of bunches | .. | .. | .. | .. | .. | .. | 20 | .. | 21 | .. | .. | .. | .. | .. |
| Average rust per bunch | .. | .. | .. | .. | .. | .. | 0·25 | .. | 0·05 | .. | .. | .. | .. | .. |
| Ratio of rust incidence | .. | .. | .. | .. | .. | .. | 23 | .. | 4 | .. | .. | .. | .. | .. |
| Per cent. commercially clean bunches | .. | .. | .. | .. | .. | .. | 55 | .. | 90 | .. | .. | .. | .. | .. |
| Plot. No. 2— | | | | | | | | | | | | | | |
| Number of bunches | 20 | .. | .. | .. | .. | 20 | 21 | .. | .. | .. | .. | .. | .. | .. |
| Average rust per bunch | 0·22 | .. | .. | .. | .. | 0·12 | 0·26 | .. | .. | .. | .. | .. | .. | .. |
| Ratio of rust incidence | 24 | .. | .. | .. | .. | 13 | 28 | .. | .. | .. | .. | .. | .. | .. |
| Per cent. commercially clean bunches | 55 | .. | .. | .. | .. | 75 | 52 | .. | .. | .. | .. | .. | .. | .. |
| Plot No. 3— | | | | | | | | | | | | | | |
| Number of bunches | 10 | .. | .. | .. | .. | 22 | 22 | .. | .. | .. | .. | .. | .. | .. |
| Average rust per bunch | 0·40 | .. | .. | .. | .. | 0·25 | 0·18 | .. | .. | .. | .. | .. | .. | .. |
| Ratio of rust incidence | 43 | .. | .. | .. | .. | 27 | 19 | .. | .. | .. | .. | .. | .. | .. |
| Per cent. commercially clean bunches | 40 | .. | .. | .. | .. | 50 | 68 | .. | .. | .. | .. | .. | .. | .. |
| 1936–37. | | | | | | | | | | | | | | |
| Plot No. 1— | | | | | | | | | | | | | | |
| Number of bunches | .. | .. | .. | .. | .. | .. | .. | .. | 22 | 22 | .. | .. | .. | .. |
| Average rust per bunch | .. | .. | .. | .. | .. | .. | .. | .. | 0·11 | 0·09 | .. | .. | .. | .. |
| Ratio of rust incidence | .. | .. | .. | .. | .. | .. | .. | .. | 10 | 8 | .. | .. | .. | .. |
| Per cent. commercially clean bunches | .. | .. | .. | .. | .. | .. | .. | .. | 77 | 82 | .. | .. | .. | .. |

TABLE IV.—*continued.*

| Treatments. | K. | L. | M. | $M_2$. | $N_2$. | $O_2$. | P. | $Q_2$. | $Q_3$. | $R_2$. | $V_2$. | $V_3$. | C. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1934–35—*continued.* | | | | | | | | | | | | | |
| Plot No. 3— | | | | | | | | | | | | | |
| Number of bunches | .. | .. | 25 | 24 | .. | .. | 23 | 24 | .. | .. | .. | .. | 48 |
| Average rust per bunch | .. | .. | 0·04 | 0·04 | .. | .. | 0·02 | 0 | .. | .. | .. | .. | 0·52 |
| Ratio of rust incidence | .. | .. | 8 | 8 | .. | .. | 4 | 0 | .. | .. | .. | .. | 100 |
| Per cent. commercially clean bunches | .. | .. | 92 | 92 | .. | .. | 96 | 100 | .. | .. | .. | .. | 10 |
| Plot No. 4— | | | | | | | | | | | | | |
| Number of bunches | .. | .. | .. | 25 | .. | .. | .. | .. | .. | .. | .. | .. | 46 |
| Average rust per bunch | .. | .. | .. | 0·34 | .. | .. | .. | .. | .. | .. | .. | .. | 1·65 |
| Ratio of rust incidence | .. | .. | .. | 21 | .. | .. | .. | .. | .. | .. | .. | .. | 100 |
| Per cent. commercially clean bunches | .. | .. | .. | 32 | .. | .. | .. | .. | .. | .. | .. | .. | 0 |
| 1935–36. | | | | | | | | | | | | | |
| Plot No. 1— | | | | | | | | | | | | | |
| Number of bunches | .. | .. | .. | 21 | .. | .. | .. | 22 | .. | 22 | .. | .. | 42 |
| Average rust per bunch | .. | .. | .. | 0·28 | .. | .. | .. | 0·11 | .. | 0·39 | .. | .. | 1·09 |
| Ratio of rust incidence | .. | .. | .. | 26 | .. | .. | .. | 10 | .. | 36 | .. | .. | 100 |
| Per cent. commercially clean bunches | .. | .. | .. | 43 | .. | .. | .. | 77 | .. | 23 | .. | .. | 2 |
| Plot No. 2— | | | | | | | | | | | | | |
| Number of bunches | .. | .. | .. | 21 | .. | .. | 21 | 21 | .. | .. | .. | .. | 41 |
| Average rust per bunch | .. | .. | .. | 0·36 | .. | .. | 0·40 | 0·14 | .. | .. | .. | .. | 0·93 |
| Ratio of rust incidence | .. | .. | .. | 39 | .. | .. | 43 | 15 | .. | .. | .. | .. | 100 |
| Per cent. commercially clean bunches | .. | .. | .. | 38 | .. | .. | 24 | 71 | .. | .. | .. | .. | 2 |
| Plot No. 3— | | | | | | | | | | | | | |
| Number of bunches | .. | .. | 20 | 22 | .. | .. | .. | .. | .. | 22 | .. | .. | 43 |
| Average rust per bunch | .. | .. | 0·30 | 0·27 | .. | .. | .. | .. | .. | 0·29 | .. | .. | 0·93 |
| Ratio of rust incidence | .. | .. | 32 | 29 | .. | .. | .. | .. | .. | 31 | .. | .. | 100 |
| Per cent. commercially clean bunches | .. | .. | 45 | 45 | .. | .. | .. | .. | .. | 41 | .. | .. | 7 |
| 1936–37. | | | | | | | | | | | | | |
| Plot No. 1— | | | | | | | | | | | | | |
| Number of bunches | .. | .. | .. | .. | .. | .. | .. | .. | 22 | .. | 22 | 21 | 40 |
| Average rust per bunch | .. | .. | .. | .. | .. | .. | .. | .. | 0·57 | .. | 0·16 | 0·29 | 1·05 |
| Ratio of rust incidence | .. | .. | .. | .. | .. | .. | .. | .. | 54 | .. | 15 | 28 | 100 |
| Per cent. commercially clean bunches | .. | .. | .. | .. | .. | .. | .. | .. | 32 | .. | 68 | 59 | 0 |

Some bunches of the first day's selection on Plot No. 4, 1934-35, were up to a week older than usual, a fact which may have influenced, to some extent, the ultimate rust development on treated bunches. This deviation from the usual practice was due to the late date of initiating the experiment and to the probable scarcity of newly-thrown bunches later in the season.

(*b*) *Subsidiary Experiments.*—(i.) In the first three seasons' experimental work, a number of bunches were dusted at either weekly or fortnightly intervals with nicotine dust B, the treatment being discontinued after varying periods. In practice, the bunches selected on any one day in these series were distributed equally amongst the time-treatment groups. In assessing the results, these bunches were compared with appropriate bunches in the main experimental series, viz., F and C bunches selected on the same days.

In the 1933-34 season, bunches selected on plots Nos. 2 and 3 between 1st November, 1933, and 14th March, 1934, were dusted at approximately weekly intervals for periods of 4, 6, 8, 10, or 12 weeks. Weather conditions prevented the strict adherence to a schedule involving either weekly dusting or an interval of a fortnight between treatment periods. In all cases rust development on the treated bunches was less than on the corresponding controls, but greater than on the bunches which had been treated at weekly intervals for the whole period of development (F bunches of the main experimental series). Nevertheless, under the seasonal conditions obtaining at the time, eight treatments at weekly intervals gave a reasonable degree of rust control.

In the 1934-35 season, bunches selected on plot No. 2 between 17th January and 21st February were dusted at weekly intervals for 6, 8, or 10 weeks. Ten treatments gave excellent control of rust, eight a degree of control comparable with that given by fortnightly treatments throughout the life of the bunch ($F_2$ bunches of the main experimental series), while six dustings effected a considerable improvement in the appearance of the bunches without giving commercial control.

In 1935-36, bunches selected on plot No. 1 on 4th and 11th February were dusted at either weekly or fortnightly intervals for eight weeks. The weekly treatment for eight weeks again gave results comparable with fortnightly dusting throughout the life of the bunch ($F_2$ bunches of the main experimental series), but fortnightly treatment for the limited period effected only about a 30 per cent. improvement on the untreated bunches.

Rust development on bunches in this set of experiments was checked after the cessation of treatment by observations on a series of untreated bunches selected up to the end of April in 1935 on Plot No. 2 and the end of May in 1936 on Plots Nos. 1 and 2. In the former season commercial rust did not develop on bunches thrown after the middle of April, in the latter season after the end of April. Some of the bunches in the above experiment were treated up to mid-April and, in the first two seasons, until after the end of April. The average results obtained from treatment for limited periods throughout the whole season were thus much more favourable than would normally be the case if the experiment had been restricted to bunches thrown earlier in the season.

Observations on bunches in Plot No. 2 during 1935-36, which had been maintained commercially clean for twelve weeks by weekly applications of nicotine dust B, showed that rust may develop on semi-mature

to mature bunches. Owing to dry seasonal conditions, the rate of fruit maturation was slow, and, in the ensuing four to eight weeks, measurable amounts of commercial rust developed on practically every bunch in the series.

(ii.) In 1935-36 on Plot No. 2 and again in 1936-37 a few bunches were treated with Ostico stalk bands in addition to frequent treatments with nicotine dust B for four and three weeks respectively. In both instances, commercial rust developed subsequent to the cessation of the dusting treatment.

(iii.) In 1937, derris dust C was applied at fortnightly intervals to a series of bunches selected on 23rd March. Little rust appeared on the fruit, but, owing to the late selection date of these bunches, no significance can be attached to the results.

(iv.) On the 1936-37 experimental plot, bags of second quality hessian were dipped in Ovicide after the bunches had been dusted three times at weekly intervals. The control of rust was no better than on bunches merely covered with the same quality bags and given the same number of dustings ($V_3$ bunches of the main experimental series).

(v.) The bags containing naphthalene and paradichlorobenzene were tried on Plots No. 1 and 2 in the 1935-36 season. The ultimate condition of the bunches in both cases was at most 25 per cent. better than the untreated control bunches. Those parts of the bunch with which the mixture came in contact showed distinct signs of burning.

(vi.) Brown paper bags were placed on a small number of bunches on Plot No. 2 in the 1935-36 season. Except where the bunch was well-shaded by the foliage of the plant and the bag was opened at the bottom, the fruit and bunch stalk were scalded so severely that the bunch did not mature. Where shade and aeration were provided, the colour of the fruit was very pale but it was not actually damaged. Moderate control of rust was obtained.

(vii.) Although the second quality hessian bag was known to be inefficient prior to these investigations, a few bunches were covered with these bags in 1936-37. Poor control of rust was demonstrated, though blemishing was appreciably less severe than on control bunches. At the same time, an increase in the area of rust on individual fruits was noted. The results suggest that the bags do not reduce the thrips population to any marked extent while creating favourable conditions for feeding at points of contact between bag and fruit.

(viii.) In the 1933-34 season, some experiments on Plot Nos. 3 and 4 involved the dusting of both pseudostem and bunch. On Plot No. 3 a $\frac{2}{5}$-acre triangular block, consisting of approximately 210 stools planted 9 feet by 9 feet, was marked out in one corner of the plantation. The whole block was treated with nicotine dust B four times at approximately weekly intervals during February and the first week in March. On Plot No. 4, the block of bananas consisting of about 234 stools planted at the same distance apart was treated with nicotine dust B three times in four weeks during January and February. Actually four treatments at weekly intervals were scheduled, but adverse weather conditions prevented strict adherence to this programme. Comparable bunches in the centre of the treated block, in the buffer rows and in the untreated portions of the plantation reasonably close

to the treated block, were selected at intervals and the effect of the treatment assessed by evaluating the rust on these bunches at maturity. On Plot No. 3, only bunches thrown subsequent to the first dusting were marked for examination of rust incidence, but on Plot No. 4 a representative sample of the bunches hanging at the time of the first treatment was also included in the material for examination. The inclusion of such bunches did not prejudice the value of the treatment as shown by the values, for rust incidence on them was much the same as that on bunches thrown after the first dust application (Table V.). Observations on bunches in the buffer rows were solely concerned with obtaining information on the rate of migration of thrips within a plantation.

TABLE V.

| — | Treated. | Buffer. | Untreated. |
|---|---|---|---|
| Plot No. 3— | | | |
| No. of bunches .. .. .. .. .. | 36 | 22 | 38 |
| Average rust per bunch .. .. .. | 0.36 | 0.45 | 0.99 |
| Ratio of rust incidence .. .. .. .. | 37 | 46 | 100 |
| Per cent. commercially clean bunches .. | 37 | 23 | 0 |
| Plot No. 4— | | | |
| No. of bunches .. .. .. .. .. | 51 | 29 | 46 |
| Average rust per bunch .. .. .. | 0.39 | 0.29 | 0.88 |
| Ratio of rust indicence .. .. .. .. | 44 | 33 | 100 |
| Per cent. commercially clean bunches .. | 39 | 55 | 15 |

(ix.) In the sucker dipping experiment conducted during the 1936-37 season, fifty-two suckers were obtained from a heavily infested plantation. All were undoubtedly thrips infested, a sample specimen yielding forty-seven adult and larval thrips in a rapid examination. They were divided into four classes, three of which comprised good suckers sorted into large, medium, and small types, and a fourth comprising poor type suckers. Each class was divided at random into two lots of equal size for treatment and control purposes. The control lots were railed to Brisbane on the day of digging, 15th December, 1936. The other lots were treated on the same day and railed to Brisbane on the following day. They were all planted on 17th December, some in pots, some in small tanks, the treated and untreated material being kept in separate isolated compartments of the glasshouse.

On 28th January, 1937, thrips in all stages were extremely numerous on the untreated plants, while small numbers, mostly larvæ, were found on an examination of six treated plants. A thorough examination was avoided at this stage owing to the risk of mutilating the recently established plants.

On 22nd April, 1937, a detailed examination was made of all plants. Of the treated plants, 48 per cent. were apparently free from thrips and the remainder carried an average insect population of about eleven per plant. The average population of the untreated plants was fourteen insects per plant. Infestation by aphis (*Pentalonia nigronervosa* Coq.) was extremely severe on the untreated plants and ants accompanying the aphis were very numerous. Some of the plants had died, possibly as a result of aphis attacks. Aphis and ant infestation of the treated plants was negligible and no plants had died.

The results of this examination were surprising. From the superficial examination made in January and also from the lesions on the leaves caused by thrips feeding, it was quite obvious that the population of insects on both treated and untreated plants had, at some previous time, been much greater than as observed on 22nd April. The reason for this decrease was not clear as there had been no comparable population diminution in the field at this time. However, the discovery of thrips on plants grown under protected conditions in the glasshouse from suckers treated with nicotine sulphate is sufficient proof that such treatment does not completely free planting material from the pest.

### (4) Discussion of Experimental Work.

(*a*) *Bagging* (Treatment B.).—It will be noted from the table of results that bagging with the first quality bags gave excellent results for the first two years but was not so satisfactory in the two final seasons of experimentation. However, only a few bunches were allotted a value greater than ½ and none greater than 1.

The manner in which bags of this nature affect rust development is somewhat puzzling. Thrips in all stages could, if necessary, pass through even the close-meshed material of which they are fashioned, though whether they do so or not is unknown. The shade conditions produced by the bag, as shown by laboratory studies, should increase rather than retard reproduction. All the evidence of four years' observations indicates that the initial population of the bunch, acquired before the bag is placed in position, is unaffected by the covering and that the bag prevents any further infestation. Presumably the larvæ present when the bag is fitted to the bunch together with the progeny of adults enclosed within it reach maturity and either leave the bag or else fail to find suitable conditions for pupation in it and die. At all events one must infer that the bag almost completely breaks the sequence of events on which continuous infestation of the bunch during its development depends. The protection of the bunch from further colonisation by the pest after the bag is fitted may be due to the masking of the bunch attraction to the pest by a "hessian odour" together with a partial or complete mechanical exclusion of the insect by the closely woven fabric. As evidence in favour of this view it was noted that rust on mature bagged bunches was obviously never of recent origin and that many bagged bunches showing considerable rust development were quite free from thrips at maturity, even in mid-summer, a condition never encountered in untreated bunches.

The above thesis may explain the variability of the results obtained in experimental control work. The amount of rust which develops on a bagged bunch would vary with the size of the thrips population on the bunch at the time the bag is placed in position. This, in turn, hinges on the time of bagging relative to bunch eversion, the density of thrips infestation and the rate of bunch eversion.

The unsatisfactory results on Plot No. 4, 1934-35, were probably due to the very severe infestation on the plantation together with slow eversion of the bunches, for though the season was a good one, the plants were not particularly vigorous. Slight differences in the age of the bunches when the bags were first fitted did not appear to militate against the efficacy of the treatment. Similar unsatisfactory results with bags in 1935-36 were undoubtedly due to retarded bunch eversion consequent on adverse seasonal conditions, the population of the bunches

Fig. 1.
Banana bunch with hessian bag attached.

Fig. 2.
Banana bunch with hessian cloak attached.

Plate 136.

at the time of bagging being high. The 1933-34 season was a normally good one and plant growth followed its usual rapid course during the rust season.

Previous investigators had had extremely variable results with the same quality bags and it is highly probable that conditions similar to those outlined above were encountered.

The results obtained on Plot No. 4, 1935-36, where the most severe test was given, definitely turned the scales against bagging alone as a measure of rust control. Although a very considerable improvement was effected in the appearance of the majority of the treated bunches, the treatment must be regarded as a failure in the light of its cost. Bagging alone will, in southern Queensland, always affect some improvement in the rust position and, under conditions of light to moderate thrips infestation and vigorous plant growth, it will undoubtedly often give excellent commercial control. These conditions are, however, rather ill-defined and it is impossible to make recommendations on such a basis. Under some circumstances, such as severe infestation and slow growth, it is conceivable that bagging alone would be economically disastrous.

The more open mesh of the second quality bags would appear not to prevent the ingress of thrips on to the bunch. The degree of rust development under such bags is usually greater than could be attributed to the initial population when the bags are attached. Previous experience in the Gympie district and in North Queensland with these bags has been disastrous, very severe and extensive rust developing on practically all bunches concerned.

The bagging of banana bunches has many incidental advantages. The general quality of the fruit is improved very appreciably under all conditions; the fruit matures more evenly all over the bunch and also "fills out" satisfactorily in spite of cold weather; sun scald, very prevalent when the plants have been more or less defoliated by leaf diseases during the autumn and winter, is completely eliminated; cracking of the mature fruit, associated with the first cold snap in the autumn, is materially reduced; damage due to incidental pests such as fruit-eating caterpillars, grasshoppers, birds, opossums, wallabies, and flying foxes is reduced to negligible proportions. Black pit, a disease of the fruit, which was rather serious in 1933-34 on Plot No. 3, appeared to be completely controlled by the bags.

On Plot No. 1 in 1933-34, cigar end and black finger, two other fungous diseases of the fruit, were fairly prevalent but bagging did not appear to affect their incidence.

The only disadvantage of bagging is a very slight tendency to rub the ends of the fruit on bunches exposed to winds.

(*b*) *Cloaking* (Treatment P.).—Little rust developed on cloaked bunches during 1934-35, but rust incidence in the one experimental plot concerned was too slight for the test to be a rigorous one. In 1935-36, under conditions of heavier infestation, results were not so satisfactory, though, even in this case, rust incidence was not severe. As the more efficient bags proved unsatisfactory in this season, it was obvious that cloaking could never be satisfactory and no further attention was paid to this treatment.

Cloaking has a beneficial effect on the quality of the fruit, but observations were not sufficiently detailed to show if, as commonly believed, these benefits are less than those obtained by bagging.

(c) *Dusting* (Treatments D, $D_2$, F, $F_2$, H, I, K, $M_1$, $M_2$, $O_2$, $R_2$).—Weekly treatment with nicotine dusts throughout the life of the bunch gave uniformly good results in all experimental plots. Fortnightly treatment with the same class of dust also gave a fair degree of control, though appreciably less than the more frequent applications. In both cases, nicotine dust B showed a slight superiority over nicotine dusts A and C. Treatment at either weekly or fortnightly intervals for limited periods was shown to be unreliable because its success is dependent on other variable factors, such as the rate at which the bunch matures.

Derris dusts applied at weekly or fortnightly intervals gave results not obviously worse than the nicotine dusts. Observations on their toxicity to *S. signipennis,* however, indicated an undesirable variation from sample to sample.

Sulphur mixtures exhibited very unsatisfactory physical properties; all showed a tendency to burn the fruit on exposed bunches and none gave a degree of control as great as that achieved by nicotine dusts. Calcium cyanide also showed no superiority over nicotine dusts.

It was therefore concluded that nicotine dusts were the most satisfactory for banana rust thrips control, and that only applications at intervals of not more than a week throughout practically the whole life of the bunch could be relied upon to give good commercial control under practical plantation conditions. At the same time there was no evidence to indicate that more frequent treatments are justified. During experimental work, weather conditions at times interfered with the dusting schedule and in commercial practice the same thing would occur.

The rapid but ephemeral action of the nicotine dusts as compared with the slower but more prolonged effects of derris dusts was fully appreciated. However, frequent and heavy falls of rain, to which most banana districts are subject during the rust season, exert a marked "cleansing" effect on bunches and may largely nullify any benefits to be derived from the more lasting toxicity of derris dusts. In fact, in the event of rain very shortly after dusting, the value of the treatment might be negligible. On the other hand, the almost instantaneous effect of nicotine on the thrips must be an important factor in effecting control in showery weather. There was no evidence that the purely mechanical effect of the dust cover, investigated by Smith (1934) was of any practical service in the control of rust.

During these experiments, the importance of the physical properties of dusts for treating banana bunches became increasingly obvious. Heavy, quick-settling dusts are quite unsuitable; the material must be light and "fluffy."

The dust residue is of some importance, particularly in the weekly treatment of bunches. Theoretically, the promotion of dust residue formation is desirable (Smith, 1934) but, in practice, some care had to be exercised to avoid an excessive residue at the time of bunch harvesting. In the markets a reduced price may be paid for fruit carrying an appreciable residue. Cleaning is a laborious task and adds significantly to the cost of rust control. Dusts of poor quality, i.e., with poor physical properties, have a tendency to leave heavy residues. Dusters

wrongly adjusted or inefficiently manipulated are apt to cause trouble, while the dusting of damp bunches results in a caked residue which even torrential rain will sometimes not remove. On the other hand, the normal rains play an important part in keeping bunches reasonably clean. The correct adjustment of the dust outlet, the careful manipulation of the duster and the choice of reasonable weather for treating the bunches should, under commercial plantation conditions, obviate any dust residue problem.

(*d*) *Bagging and Dusting* (Treatments $E_1$, $E_2$, G, $G_2$, $G_3$, J, $J_2$, L, $N_2$, $V_2$, $V_3$).—The use of the better quality bags with either weekly or fortnightly treatments throughout the life of the bunch with any of the dusts used gave excellent control of rust in these experiments (Plate 137). The appearance and quality of the fruit were good, while rust blemishes were negligible. The nicotine dusts, particularly nicotine dust B, were subjected to rather more severe tests than the others and consistently gave slightly superior results. Calcium cyanide was inclined to cause burning, while heavy residues of both this dust and the pyrethrum-sulphur mixture tended to accumulate on the bunch.

Weekly dustings for three weeks with a nicotine dust under the better quality bags, tried only in the last season's experiments, gave very promising results. This method requires further testing under severe conditions. Nevertheless, the supposed action of bags as already discussed, suggests that, for practical purposes, it will be as efficacious as any other.

The use of the second quality bags combined with three dustings at weekly intervals offers little promise of a cheaper method of control, in the light of the results obtained in 1936-37 under conditions of only moderate rust incidence. Fortnightly dustings throughout the life of the bunch gave better results. However, it appears obvious now that the most important time to arrest rust development is during the first month after the bunch is thrown and thus more frequent treatments during this period seem highly desirable. As second quality bags apparently do not prevent subsequent reinfestation of the bunch, numerous treatments with a dust would be necessary. The matter then resolves itself into one of relative costs of the two methods, viz., good quality bags with the restricted number of dustings and second quality bags with frequent treatments. On this score the former is preferable.

The treatment of the second quality bags with the tar oil preparation did not materially affect the degree of control attained. It must be conceded that negative results on this occasion do not close this avenue of approach to the problem. Closer attention to the selection of possible repellents might be worthwhile. Cost and applicability to Queensland plantation conditions would be dominant points for consideration.

Dust residues have also to be considered in this method of control. With good quality dusts there was generally less residue than on bunches dusted alone despite the complete absence of cleansing effects of natural agencies. This was no doubt due to the smaller quantity of dust used per bunch and to the method of applying it. Even dusting under damp conditions did not usually cause the caking effect often seen on exposed bunches. Poor quality dusts, on the other hand, were responsible for a more acute form of the problem. Nicotine dusts, with good physical properties, showed out to best advantage in this respect, for it was found that only small quantities need to be applied.

The bag is presumed to function as a fumigation chamber, the efficiency of which depends on the quality of the hessian used. The greater efficiency of the nicotine dusts can thus be easily understood. The concentration of nicotine in the atmosphere of the bag must become fairly high and may prove lethal to thrips in the more sheltered parts of the bunch, where they escape actual contact with dust particles. Second quality bags permit rapid leakage of both dust and fumes through the fabric, especially under windy conditions. This leakage, particularly in new bags, is less obvious with the better quality article.

The beneficial effect of covering the fruit is just as marked as in the case of bagging alone and provides an additional argument in favour of bagging and dusting as compared with dusting alone.

(*e*) *Cloaking and Dusting* (Treatments P, $Q_2$, $Q_3$).—The use of cloaks and only three dustings with nicotine dust B was definitely not efficient. Fortnightly dustings throughout the life of the bunch, in addition to cloaking, gave very fair results and may provide a relatively cheap form of fair control, especially if supplies of cheap material suitable for cloaks are available. At the same time control is far below that obtained by good quality bags plus dusting. The incidental beneficial effects on fruit quality, characteristic of bagging, are perhaps less marked, but they warrant the use of this method in preference to weekly dusting alone. The dust residue problem is comparable with that arising with bagging and dusting.

(*f*) *Bunch and Pseudostem Dusting.*—The results obtained from this method of treatment were not satisfactory. Considerable rust developed during the season both before and after treatment. The quantity of dust used is considerable and the operation of dusting is extremely unpleasant. The sheltered habitat frequented by the pest species renders efficient treatment of a great part of the population virtually impossible. The method offers little prospect of economic practicability.

(*g*) *Sucker Dipping.*—The dipping of suckers treated in the manner described offers no solution to the problem of obtaining clean planting material. The advisability of dipping "bits" or heavily pared suckers is still an open question. Theoretically, "bits" are most likely to be free from thrips and in view of the increasing popularity of this type of planting material, further investigations are desirable.

(*h*) *General Remarks.*—None of the other methods of bunch treatment gave results worth further discussion.

On several occasions the control programme was interfered with by wet weather, particularly in the 1933-34 and 1934-35 seasons, the rainfall in which was more or less normal. The seasons 1935-36 and 1936-37 were abnormally dry and experimental work proceeded practically without interruption. The weekly interval between treatments was sometimes extended to a fortnight or the fortnightly intervals to three weeks on account of rain. No allowance is made for these facts in the results. In all cases the irregular attention was prejudicial to the success of the treatments, though some treatments may have been affected more than others. At the same time such interference could normally be expected under commercial conditions.

During the dusting of bunches there was naturally a dust drift across on to neighbouring plants. In some cases bunches subject to other treatments would have been in the path of such drift. Tests with

nicotine dusts applied to the open bunch showed that the thrips were affected at a distance of 10-15 feet. It is unlikely that very good penetration into the bunch would be secured by a mere drift of dust and thus only the more exposed insects would have been affected. Owing to their random distribution, bunches of all treatments, including controls, would have been affected in the same proportion.

The experimental bunches comprised only a small proportion of the bunches in the plantation and, with the exception of Plot No. 1 in 1933-34, no treatment was given to the rest of the plantation by the owners. Treated experimental bunches may therefore have been subjected to greater reinfestation than would have been the case had all bunches in the plantation been effectively treated. Bunches, however, harbour only a small proportion of the total thrips population in the plantation, and this increased reinfestation factor cannot have been of great importance.

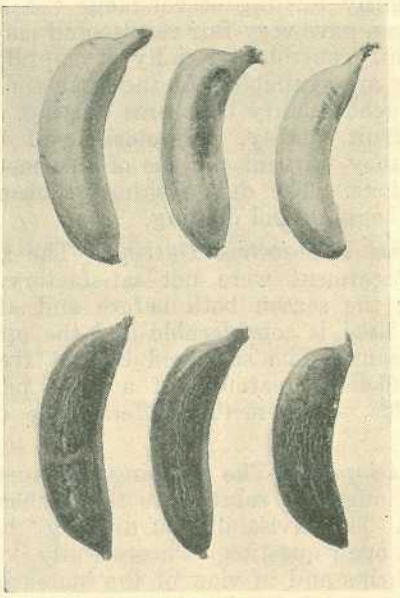

Plate 137.

Typical fruits from treated and untreated bunches. Upper row—from a bagged and dusted bunch. Lower row—from an untreated bunch cut at the same time.

The application of dusts under very windy conditions is apt to make efficient treatment difficult. In commercial practice little notice could be taken of wind, and deviations from the dusting schedule can only be justified by wet weather.

No account was taken of the probable optimum conditions during the day for the application of control measures. Temperature and humidity may have some effect on the efficiency of the nicotine and other dusts. Dusting was carried out any time between about 9 a.m. and 5 p.m. and, as all treatments were applied simultaneously, there should have been no differential effects between dusts attributable to the time factor. In commercial plantation control operations, no cognisance could be taken of optimum conditions for treatment during the day.

During these experiments it became quite clear that the first month or so after the bunch is thrown is the most important in rust control.

This can be easily understood. In the first place, the initial population of adults and their progeny is much greater than that acquired later on in bunch development. Secondly, effective measures directed against this early population prevent, to a large extent, the establishment of larval colonies which on account of their numbers undoubtedly cause more damage than adults. Thirdly, the young bunch is more susceptible to injury than more mature fruit. It is essential, therefore, that rust control measures should be applied as soon as possible after bunch throwing and that early treatments should be particularly thorough.

[TO BE CONTINUED.]

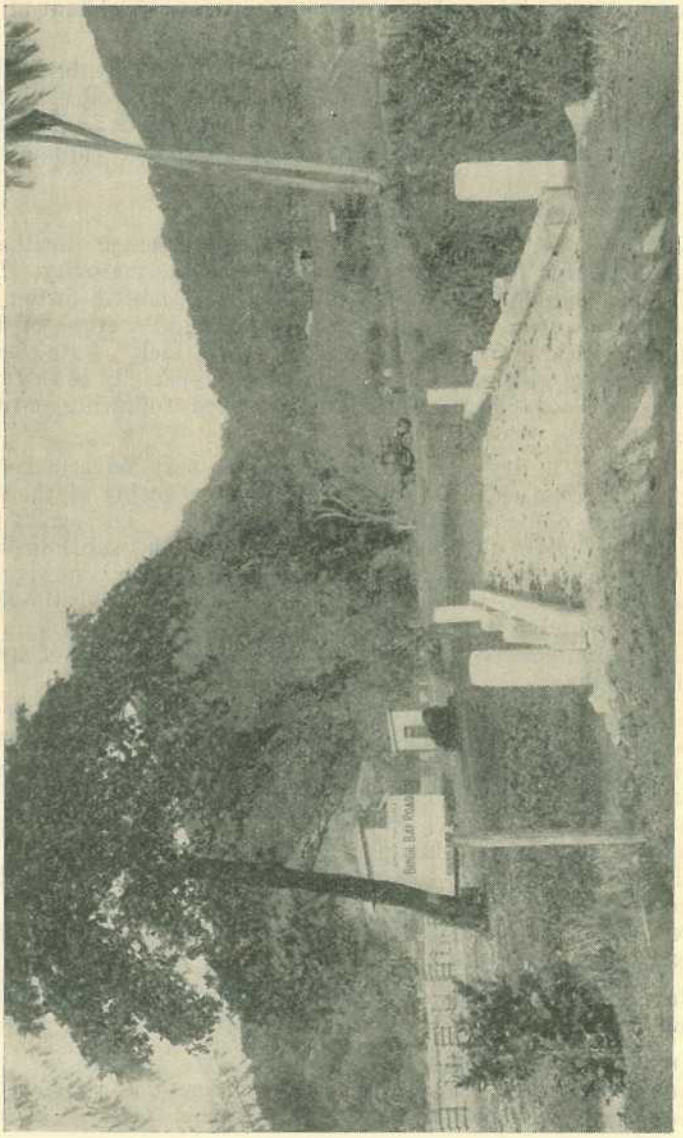

Plate 138.
On the road to Bingil Bay, North Queensland.

# Cotton Jassids or Leafhoppers.

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JASSIDS were recorded as pests of cotton in Queensland some years ago, but were not considered very important, though crops growing on red scrub soils were frequently attacked. In recent years the insects have been troublesome in areas which were previously unaffected, and numerous crops on the hitherto free forest alluvial soils have been heavily infested and damaged.

Many countries have reported jassids as pests of cotton. They have been particularly destructive in parts of Africa, where they seriously restricted production prior to the introduction of jassid-resistant strains of cotton.

Cotton jassids in the Upper Burnett, Callide, and Dawson Valleys have been assigned to the genus *Empoasca*. Material collected from cotton at Biloela some years ago was described by Paoli as *Empoasca terra-reginoe*, but other unidentified species are probably implicated.

## Injury.

Normally the pest does not cause noticeable damage until after the February or March rains, when the crop is nearing maturity. Even when jassids are abundant, September or October-planted cotton frequently produces a good yield, for bottom and middle crops of bolls are formed and matured before the peak of the attack. Late-planted cotton, however, may give only a very light crop, especially if the small bolls, flowers, and squares on the plant are shed following corn-ear worm attacks or dry weather.

Occasionally in a dry period, young plants may be attacked by jassids migrating from nearby dying weeds. The stunting of the seedlings caused by low soil moisture is then accentuated. The leaves wilt, the growth of the main terminal is distorted, and the seedlings may die. Good rain will reinvigorate the plants should they survive the combined effects of dry weather and jassid injury and, though a moderate jassid population may persist, the crop will recover. Any rapid increase in the pest population as the crop matures will, of course, cause further injury.

In the early stages of an attack on a maturing crop, adult and nymphal jassids are common on the under surface of the leaves. These acquire a slight yellowish or brownish marginal discoloration which is particularly noticeable in the older leaves. The leaves curl, the younger ones markedly so. In heavy infestations the leaves may brown quickly and die, but more commonly the top surface of the leaf turns red from the margin inwards, and an affected field presents a dull red appearance when seen from some distance away. Occasionally the lower leaves show a white spotting similar to that which typically follows jassid feeding on many other plants.

Attacked plants tend to shed their leaves, particularly during showery weather, when moulds appear on the injured foliage.

Shortly after the curling of the younger leaves and the first signs of discoloration in the older leaves, plant development is retarded, and almost ceases with the general reddening of the foliage. Squares,

flowers, and young bolls are shed, immature bolls develop poorly and produce wasty lint or may dry up altogether, and only mature bolls or those near maturity open up satisfactorily.

A mild outbreak may not prevent the maturing of both bottom and middle crops. Should a top crop form, however, the quality of the lint is not as good as that from uninfested plants.

The injury caused by jassids can scarcely be due simply to the removal of sap during feeding—the after-effects are too severe. Aphids, which also suck plant juices, may exist on cotton in very large numbers without causing injury comparable in severity with that due to jassids. It appears (Parnell, 1926; Peat, 1927) that jassids not only remove sap when feeding but also inject toxins which are the chief cause of injury. These toxins are secreted by both adults and nymphs, but the injury varies not only with the amount of feeding but also with the age of the insects infesting the plants, the younger insects being the more harmful.

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**Factors Influencing Jassid Populations and the Susceptibility of Cotton to Infestation.**

*Climatic Conditions.*—Dry weather may cause jassid migration from weeds or crops to young cotton, which wilts less readily.

The pest is present in cotton fields shortly after the seed germinates, but normally large populations do not appear until after prolonged rains in February or March, when the crop is approaching maturity. Excessive rains accompanied by long periods of dull, showery weather during these months tend to promote sappy growth in the American varieties, which comprise the bulk of the cottons grown in Queensland. Such growth appears to be very attractive to jassids. Plants developing slowly without excess vegetative growth suffer less severely. Thus, when the crop matures in dry conditions in late summer the plants carry few jassids, but under humid conditions the plants may make sufficient new growth to attract the pest in injurious numbers.

In the absence of frosts, small numbers of both adults and nymphs may persist on cotton until midwinter, and it is therefore probable that jassids continue to breed slowly on fields of standover cotton throughout a mild winter.

*Age of Plants.*—During the last four seasons jassids have been noted in cotton of all ages, but normally they are most abundant in late summer, when the crop matures. Late-sown, vigorously-growing crops are particularly susceptible.

*Soil Effects.*—Some years ago jassid outbreaks were apparently confined to crops grown on red scrub soils, but recently the pest has also been destructive elsewhere, particularly on the rich alluvials. Cotton grown on ironbark slopes is less heavily infested. The importance of the pest in any district apparently depends on the type of plant grown, heavily foliaged vegetative crops being attacked more severely than sturdy, evenly grown, fruiting crops. As the growth habit of the plant is largely determined by soil type and cultural treatment, the recent increase in the importance of the pest and the extension of the area subject to infestation are probably associated with soil changes brought about by cultivation and cropping practices.

The sporadic incidence of jassids has been explained in various ways. Ballard (1927) suggested that potash and phosphoric acid deficiencies in red scrub soils created an unhealthy state of growth which contributed to the onset of severe jassid injury in cotton. As jassids are now serious on a number of soil types in the cotton growing areas, deficiencies peculiar to one soil type scarcely account for the present importance of the pest. In any case, increases in yields from manurial trials in Queensland have been insufficient to warrant the use of fertilizers.

Soil analyses at the Cotton Research Station, Biloela, indicate an abnormally high rate of nitrification during the early summer months in alluvial soils cropped for some years with cotton. The supply of nitrate nitrogen then exceeds the requirements of the cotton plant, more particularly in wet seasons, and bushy jassid-susceptible crops are produced. Rhodes grass rotations offset this tendency, and crops grown after pasture produce a better fruiting type of bush which carries less foliage and is less susceptible to jassid injury.

In Queensland, jassid attacks are associated with heavy rains during periods of cloudy weather, and occur on various soil types. Hence, though soil improvement methods, e.g., the use of Rhodes grass in the rotation, would undoubtedly increase the chances of a larger crop before the onset of jassids in the cotton areas, the bulk of the top crop, in late-sown areas at least, may still be lost if weather conditions are conducive to the rapid breeding of the pest.

Inadequately drained or drought-susceptible soils are said to produce plants more subject to jassid attacks, probably by lowering the resistance of the plant (Haines, 1925; Parnell, 1926; Russo, 1932; Hargreaves, 1934). Some of the jassid resistant strains of cotton are certainly less susceptible to the effect of dry weather than other strains.

*Cotton Varieties.*—During early investigations in India and South Africa (Worrall, 1923; Parnell, 1925) certain cotton varieties were found to be more resistant to jassid than others, and particular plants within varieties exhibited a high degree of resistance and tolerance to the pest. In spite of the frequent association of severe jassid attacks with crops grown on unsuitable soils, the selection of jassid resistant cottons was considered much more important in combating the pest than the amelioration of soil conditions.

Resistance appears to be partly due to the unsuitability of the plant for jassid breeding and partly to its ability to tolerate the pest. Small blocks of resistant strains of cotton imported from South Africa and grown in Queensland carried adults and nymphs, but did not show the pronounced symptoms of jassid injury. Under reasonable climatic conditions some of these strains grew well and gave good yields of seed cotton. Unfortunately, the size of the boll and the character of the lint compared unfavourably with the American Upland varieties grown in Queensland.

Though resistant plants are typically very hairy on the under surfaces of leaves, leaf stems, stems, and involucral bracts, all hairy plants are not necessarily resistant. Resistance apparently depends largely on the type and numerical density of the hairs. A highly resistant variety, Cambodia, an Indian cotton, has very long hairs,

and there is apparently a much closer relationship between hair length and resistance than between numerical density of the hairs and resistance.

The true relation between resistance and hairiness has not yet been satisfactorily established. The acidity of the cell sap may be involved, though the mechanical effect of the hairs is probably more important, for the hairy midribs and petioles may hinder egg laying (Parnell, 1937).

Unfortunately, short lint and hairiness appear to be linked genetically. In breeding work, a longer staple cotton may be evolved at the expense of either or both reduced yield and greater susceptibility to jassid attacks. Similarly, resistance may be increased at the expense of yield or desirable lint characters. These factors seriously complicate the breeding of suitable resistant varieties.

## Life History and Habits.

Cotton jassids are tiny, active, fly-like insects which breed on cotton and feed by sucking the plant juices.

The sickle-shaped eggs are entirely embedded in the plant tissue, and are of a light greenish colour. They are laid in the midrib, larger veins, and petioles of the leaves, and in the younger growth of the stems. From the egg emerges a nymph similar in appearance to the adult, but without wings and much smaller. The nymphs are at first creamy white in colour, but later become greenish. When disturbed they hop actively or move round on the under surfaces of the leaves with a characteristic sideways movement. Feeding takes place chiefly on the under surfaces of leaves.

At each of the several stages of growth the nymph moults, i.e., casts its skin, and finally reaches the winged adult form. Numerous cast skins remain attached to the under surfaces of injured leaves.

Observations at Bowen (Atherton, 1933) between May and August showed that the incubation period of the egg of a related *Empoasca*, which breeds on tomatoes, is 10 to 14 days. The average duration of the total nymphal period for males in June was 15·8 days, and in July 19·6 days; for females the period was 13 days in June and 20·6 days in July. The development of the cotton jassid is probably similar. As with most insects, the various life history stages would be much shorter in summer and autumn, when the pest is injurious to cotton.

## Control.

If cultural improvements and the use of resistant varieties of cotton will permit the production of payable crops where jassids are at present troublesome, other control methods will be unnecessary. Should control be impracticable in this way, the value of insecticides must be further investigated.

In Queensland, soil and climatic conditions frequently favour both the growth of the generally-used American Upland cottons and the rapid breeding of jassids. During the hot months of January, February, and March, cotton must have ample rain to set and mature a good crop. Without these rains the crop may be a partial failure, particularly if planting is late, and with them jassids usually become prevalent and cause extensive losses.

*By Insecticides.*—Preliminary trials have been made in Queensland of various insecticides for jassid control. Flowers of sulphur, nicotine dusts of 2 per cent. and 3 per cent. strength, a proprietary dust containing 1 per cent. nicotine and 5 per cent. creosote, and one containing 3·2 per cent. tubatoxins as derris and 0·13 per cent, pyrethrins as pyrethrum were used in experimental work. The dusts were applied at the rate of 15 to 20 lb. per acre, and with the exception of sulphur, all checked the pest. However, frequent applications are required to ensure control, necessitating a considerable and usually uneconomic expenditure on materials and labour. Bordeaux dusts and sprays gave negligible results in earlier work with the related species on tomatoes at Bowen. Insecticides are, therefore, not considered a solution to the control problem at the present time.

*By Cultural Methods.*—Proper cultural attention is unquestionably of major importance in increasing the resistance of the plant to pests and diseases. Consideration should, therefore, be given to improving present standards of cultivation. On the average of seasons, good farming practices are amply repaid by reduced losses from pests.

Early preparation of the land is essential if the crop is to be sown with the first suitable planting rains, and thus given a chance of escaping severe jassid injury in late summer.

Land cropped for many successive years with cotton seldom produces a payable crop. Yields will have dropped to unpayable levels and Rhodes grass rotational treatment is required in order to readjust the cultural properties of the soil to the needs of the cotton plant. When this is done, the risk of planting failures is reduced and the prospects of an early crop improved.

Weedy paddocks and stand-over cotton in which jassids may overwinter should either be cultivated or planted with Rhodes grass.

*By Resistant Varieties.*—In South Africa, the discovery that jassid resistance is associated with certain types of hairiness made possible the production of jassid-resistant and jassid-tolerant strains of cotton. Without these strains the successful establishment of the cotton industry in some areas, would have been extremely difficult, if not impossible.

The development of the jassid-resistant cotton U4 and its derivatives was made through single-plant selections, based on hair characteristics as a measure of jassid resistance. Great care was needed in the final selection of strains for distribution, owing to the frequent linkage of resistance with short staple and low yields. Selections from local cottons gave the most promising results and one of these strains, U4, is the parent plant from which many selections have since been made.

The final selections released to the industry were not so immune to jassids as some other strains and varieties, but they did possess a high degree of resistance, and were described as "tough, hardy, and capable of withstanding all vicissitudes better than the average plant" (Parnell, 1925). To still further increase its resistance, U4 has been crossed with Cambodia, a very hairy cotton, and the progeny back crossed to the U4 in an endeavour to combine the exceptionally high resistance of Cambodia with the lint qualities, free fruiting habits, earliness, and drought resistance of U4.

The American Upland varieties, in common use in Queensland, have not exhibited any marked resistance or tolerance to the pest, though crops planted early on new or Rhodes grass conditioned land may escape severe attacks. Good yielding, desirable types of plants have, however, been observed within infested fields of these varieties.

As the control of jassids in cotton by any of the available insecticides does not appear to be economically possible in the field, the pest will probably be important until resistant strains have been bred in Queensland for local use. Any such jassid-resistant cottons must possess lint characters suitable for the Australian market; must have good picking qualities; and must be able to yield well under the very variable seasonal conditions characteristic of the cotton belt. An ability to recover from a corn ear worm attack is also essential.

*By Biological Means.*—No information has been collected on the natural enemies of jassids in the cotton-growing areas of Queensland, but from an allied species, *Empoasca viridigrisea* Paoli., which attacks tomatoes at Bowen, two egg parasites, *Anagrus armatus* Ashm. var. *australiensis* Gir. and *Aphelinoidea howardii* Gir., have been recorded (Atherton, 1933). The occurrence of similar parasites on jassid eggs in the cotton is highly probable.

Partial control by parasitic fungi, egg parasites, and capsid predators, has been noted in other countries, but little reliance can be placed on biological control as a solution to the jassid problem in Queensland.

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# Notes on the Genus Flindersia with Keys for the Determination of the Rain-forest Species.

W. D. FRANCIS, Botanist.

[Flindersia is a group of trees the name of which commemorates Matthew Flinders, the famous navigator. It is preponderantly Australian, and contains some of our most important timbers, such as Crow's Ash, Hickory Ash or Cairns Hickory, Maple Silkwood or North Queensland Maple, Yellow-wood or Yellow-wood Ash, Rose Ash, Silver Ash, and others. The following account by Mr. Francis should be of value for the identification of the different species in the field.—Ed.]

FROM the economic point of view, the genus Flindersia is a very important one. The majority of the Australian species produce timber which is or has been used commercially. Two of the best-known timbers provided by the genus Flindersia are Queensland Maple and Crow's Ash. These two timbers have conspicuous properties which have made them highly valuable in a purely commercial sense.

The latest revision of the genus Flindersia known to the writer is that by C. T. White, in "The Proceedings of the Linnean Society of New South Wales," Vol. 46, p. 324, 1921. White states that eighteen species are known, and of these only three are found outside Australia. These extra-Australian species are *Flindersia amboinensis* (Amboina), *Flindersia Fournieri* (New Caledonia), and *Flindersia papuana* (Papua). Since the publication of White's paper, a further species, *Flindersia macrocarpa,* has been described from Papua.

All of the Australian species except two are denizens of the rain forests, and they conform in all cases to the usual type of rain-forest tree.

The two species which are not rain-forest trees are *Flindersia maculosa* and *Flindersia Strezeleckiana.* These two species are found in the dry western parts of the State. *Flindersia maculosa* also occurs in similar areas of New South Wales.

*Flindersia maculosa* is known popularly as Leopard Tree. The bark is smooth, pale or green, and in parts there are roundish or irregular depressions often of a different colour from the surrounding bark. These depressions are apparently left by scales of shed bark. The leaves are simple and not pinnate (consisting of several leaflets) as in other species.

*Flindersia Strezeleckiana* is sometimes known as Spotted Tree. The bark is similar to that of *F. maculosa.* This species is distinguished from *F. maculosa* by the fact that the leaves are pinnate and generally consist of 3-5 leaflets, although these are occasionally reduced to one. The leaf rhachis (the axis to which the leaflets are attached) is generally expanded into a narrow green wing as in *Flindersia collina.*

Both *Flindersia Strezeleckiana* and *F. maculosa* appear to be allied to *Flindersia collina.* There is a marked resemblance in the appearance of the bark in the three species. The winged leaflet-axis of *F. Strezeleckiana* and the shape of its leaflets are characters which are shared by *F. collina.* In the choice of its habitat *Flindersia collina* also shows translations towards *F. maculosa* and *F. Strezeleckiana,* as it is only found in rain forest of a dry type in which the rainfall is low as at Nanango, with an annual average of 32 inches.

Normally the leaves in the genus Flindersia are placed opposite to each other on the branchlets. Occasionally they are alternate and crowded at the ends of the branchlets as sometimes happens in the Crow's Ash, *Flindersia australis*.

Keys for the approximate determination of the rain-forest species are given below. The separation of the southern or extra-tropical species is shown in a separate key. A much more rapid and more reliable method of determining these southern species is provided by the illustrations in "Australian Rain-forest Trees." All of the southern rain-forest species are depicted there by photographs of the trees in the field and of herbarium specimens.

Perhaps it should be explained that the key to the tropical species was originally constructed for the writer's own use in the rain forests of the Atherton Tableland. It is not so free of technicalities as might be desired, and the writer is also aware that the leading analytical characters are not quite free of ambiguity. However, many analytical keys employed by botanists must be used with caution and exacting literal interpretations must at times be abandoned.

**A Key as a Guide to the Determination of the Rain-forest Species of Flindersia in Tropical Australia.**

Leaflets very unequal-sided.

- Leaflets ovate, acuminate or prominently acuminate, venation more prominent below where there are 9-14 primary nerves sometimes with subsidiary nerves and indistinct reticulations. Capsule densely prickly, about 4 inches long .. .. .. .. .. .. *F. Pimenteliana.*

Leaflets unequal-sided (not so much as in *F. Pimenteliana*).

- Leaflets ovate, shortly acuminate, 7-10 primary nerves on each side of midrib, sometimes subsidiary nerves but rarely, if ever, are reticulate nerves visible. Capsule about 4 inches long with scar-like marks instead of prickles on back .. .. .. .. .. .. *F. Brayleyana.*
- Leaflets lanceolate or narrow and long, veinless or only indistinctly showing primary nerves, acuminate or long acuminate. Fruit almost smooth, scarcely exceeding 1 inch long .. *F. laevicarpa.*
- Leaflets lanceolate or narrow and long; primary nerves 8-13, underside showing at times numerous transverse nerves joining the primary ones, sometimes pubescent below, acuminate or long acuminate. Capsule 3-75-5 inches long, crowded with large prickles .. *F. acuminata.*
- Leaflets broadly or narrowly lanceolate or elliptical, the narrower ones curved or sickle-shaped, densely hairy on raised veins below with felted star-shaped hairs, midrib and primary nerves (15-30) alone visible above. Leaflets 4-12 inches long. Capsule 4 to over 5 inches in length, densely prickly .. .. *F. pubescens.*

Leaflets equal-sided or nearly so.

Leaflets ovate or lanceolate, primary nerves (15-36) and some reticulate veins visible, apex obtuse, acute or slightly acuminate. Fruit about 3 inches long with obtuse prickles .. .. .. .. .. .. *F. Ifflaiana.*

Leaflets narrowly elliptical or lanceolate, often long and narrow, sometimes pubescent below. Venation obscure or primary nerves (15-18) alone visible, narrowed towards the apex and sometimes slightly acuminate. Capsule 4 inches long, densely prickly .. .. .. *F. Bourjotiana.*

**A Key as a Guide to the Determination of the Rain-forest Species of Flindersia in Extra-tropical Australia.**

Boat-shaped valves of capsule united at base even in age.

Leaves alternate or less frequently opposite, crowded towards the ends of the branchlets. Leaflets 3-13. Midrib and primary nerves alone prominent above .. .. .. *F. australis.*

Boat-shaped valves of capsule eventually separating completely.

Leaf rachis (the axis to which the leaflets are attached) extended into a narrow green wing. Leaflets 3-7, mostly broadest at apex. Capsule 1½-2 inches long .. .. .. .. *F. collina.*

Leaf rachis never extended into a narrow wing, mostly rounded or angular.

Midrib and primary nerves (but not the net veins) visible on both leaf surfaces.

Leaflets 9-17, mostly very unequal-sided and often ear-shaped or rounded at base. 3-5 inches long on adult trees. *F. Schottiana.*

Leaflets 4-11, distinctly stalked, tapering into the stalklet and not rounded or ear-shaped on one or both sides, 2-4 inches long .. .. .. *F. Oxleyana.*

Midrib, primary nerves, and net veins visible on both leaf surfaces. Leaflets 3-8, almost equal-sided at base, 3½-6 inches long, 2-3 times as long as broad *F. Bennettiana.*

# Right Methods in Dairy Practice.

M. J. GRIFFITHS, B.Sc. (Dairying), Dairy Research Laboratory (Dairy Branch).

MANY dairy farmers—especially those who have only recently established dairy herds—are unaware of the essential points for the satisfactory and cleanly production of milk and cream. With the object of assisting these, and of forming a reminder for more experienced dairy farmers, this article outlines the absolutely necessary precautions to be taken and discusses the general principles which must be followed consistently, if the best results possible on each farm are to be obtained.

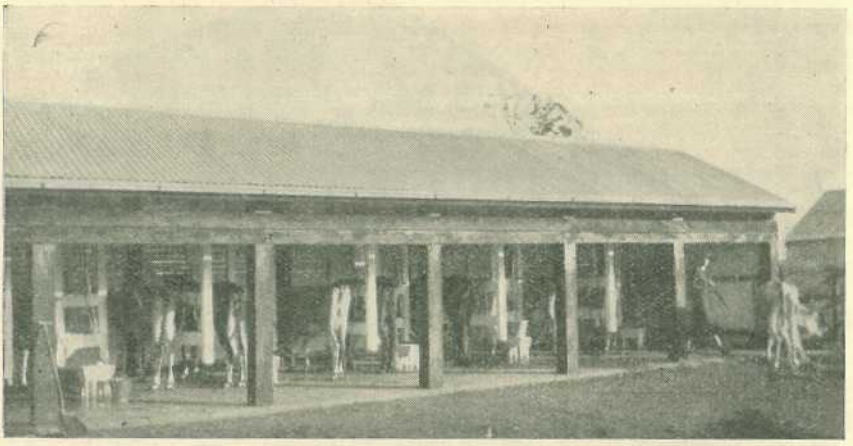


Plate 139.
Well-arranged and soundly-constructed milking shed.

The bacteria responsible for the spoilage of milk and cream are to be found in large numbers on every farm, and, even on carefully managed and well conducted premises, if correct dairying methods are not used, they may enter from any or all of the following sources—

(*a*) The udder, if the animal is not absolutely healthy, and if foremilk is not discarded.

(*b*) The cow's coat and skin, if not wet-groomed before milking, or if the surroundings are neglected.

(*c*) Dust in the cowshed or dairy.

(*d*) The milker's hands, clothes, or person.

(*e*) Milk buckets and equipment imperfectly cleaned, or not sterilised.

(*f*) Impure water, if used in the cowshed or dairy.

The health of the cow is, of course, of first importance, and the farmer must assure himself that every animal in his herd from which milk is being produced is in fit condition and free from any signs of disease.

Suitable buildings, as provided for under the Dairy Regulations, are essential. These need not be elaborate or expensive, but they must be hygienic in construction—that is, capable of being kept clean.

Cement or concrete, being impervious, washable, and durable, makes the best flooring. For cowsheds, working it to a very smooth finish on which the animals may slip, should be avoided.

The inside of the milking shed, including walls and bails, should be lime-washed frequently in order to keep it sweet, and manure should not be allowed to accumulate in the sheds or in the adjacent yards. The cows should not have to wade through a mire when approaching the sheds.

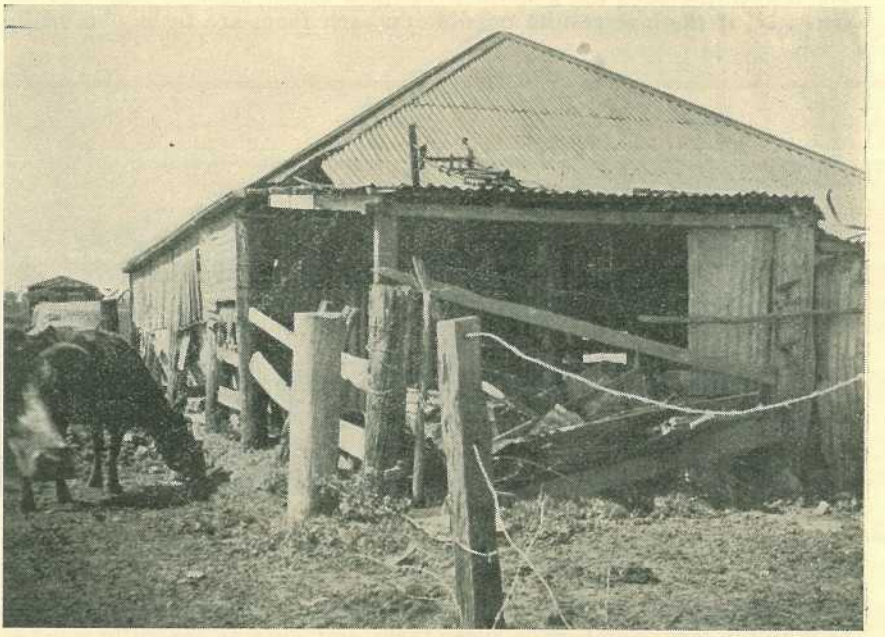


Plate 140.
This shed, over sixty years old, is not suitable in its present condition for milk production.

Dust should be kept down as far as possible in the milking shed; therefore dusty feed should not be given during milking, and if there is a fodder room attached, it should be divided off by a proper wall in which any opening is fitted with a tightly-closing door—a sliding door is very suitable.

### Grooming the Cow.

Some preparation of the cow before commencing to milk is necessary, in wet weather to remove the mud and dung splashed on the udder and teats, and, under summer or drought conditions the dried dust, which is equally dangerous to milk quality.

The flanks and tail should be kept free from caked mud and dung by the occasional use of a currycomb, and the dust removed as often as necessary by grooming with a stiff brush dipped in clean water. It is a common practice on "model" farms to keep the hair on the flanks as well as the udder clipped short to avoid the collection of dust and dirt. Occasional clipping and regular grooming will make the daily routine

of keeping the udder clean a very simple task. It is only when cows have been neglected that the washing of udder and flanks takes any great length of time.

The udder and teats should be washed before each milking. This is best done with a cloth (preferably of the woven type) kept for the purpose, and a bucket of clean water, using a separate cloth, with a second lot of clean water if necessary, for finishing off the udder. A small amount of potassium permanganate (Condy's Crystals), or some chlorine compound added to the water is an extra precaution observed by many

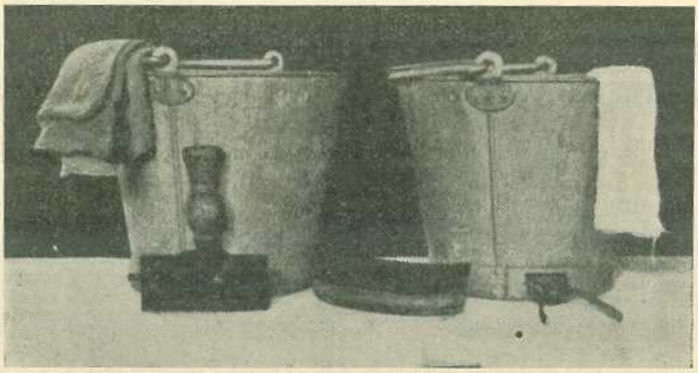


Plate 141.
Outfit required for keeping cows clean and well groomed.

farmers, which is advisable if there are any cases of sore teats, or where the water used is of doubtful purity. The teats are left damp, but not dripping, so that any remaining dust or loose hairs will adhere to the surface and not fall into the milk. Udder cloths must be washed out and boiled every day, otherwise they become a dangerous source of bacteria and the object of washing the udder will be defeated. Both cloths and bucket should not be used for any other purpose.

With practice, this routine preparation of the cow for milking can be very quickly and yet thoroughly carried out. It can be done by a boy, and the time spent—one minute or less per cow—is negligible compared with the reduction in the number of bacteria gaining entrance to the milk and cream from this source.

### Discarding the First-drawn Milk.

The first step towards clean and, therefore, profitable milking is the washing of the cow's udder and teats to remove dust and dung particles and loose hairs, which, if they fall into the milk, carry with them enormous numbers of bacteria. The second is the removal of the first-drawn or "foremilk," which is a less commonly recognised source of troublesome organisms. The small quantity of milk left after milking within the narrow canal leading from the udder to the outlet of each teat forms a good breeding ground, where nourishment, moisture, and a suitable temperature are available for growth.

On account of their minute size, bacteria can penetrate past the "sphincter" muscle, which closes the teat when milk is not being drawn, and, especially in the case of older cows, where this muscle has become

slack, large numbers may enter and become established in the teat canal between milkings. Thus it is advisable, before milking is begun, to remove into a separate vessel—a small pail or billycan is suitable, but *not* a milking bucket—the first two or three streams from each teat. This will wash the teat canal free or almost free from contaminating organisms.

Plate 142.

Animals awaiting milking on a dairy farm producing clean milk. A clean well-made yard means clean cows, and manure can be easily collected from it for distribution on the land.

Experiments have shown that the foremilk, compared with the middle milk and strippings from the same cow, contains by far the largest proportion of the total bacteria, and, when it is considered that these may be from pasture, dung, soil, or contaminated, stagnant water, which contain particularly obnoxious types, the value of rejecting the first-drawn milk can be better realised. This has been found to be an important contributory factor in lengthening the life of milk, whether it is intended for human consumption, cheesemaking, or separation of cream for butter-making, and in avoiding bacterial taints and troubles such as ropiness and sweet curdling.

A far more important reason, however, why every farmer should make a practice of removing the foremilk regularly at each milking is that it enables him to notice anything abnormal in the appearance of the milk. Early indications of mastitis usually show up in the form of tiny clots or strings in the first-drawn milk, which if observed may mean the detection of animals having one or more affected quarters, before the disease becomes serious. Special care can then be taken to milk the infected cows last, their milk can be isolated from the rest, and the spread of the disease to other cows in the herd prevented.

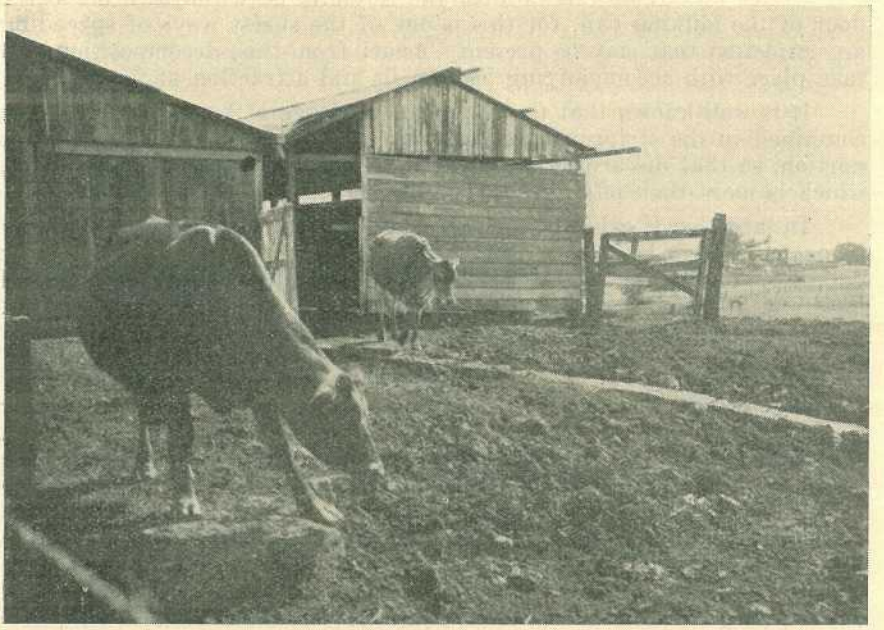


Plate 143.

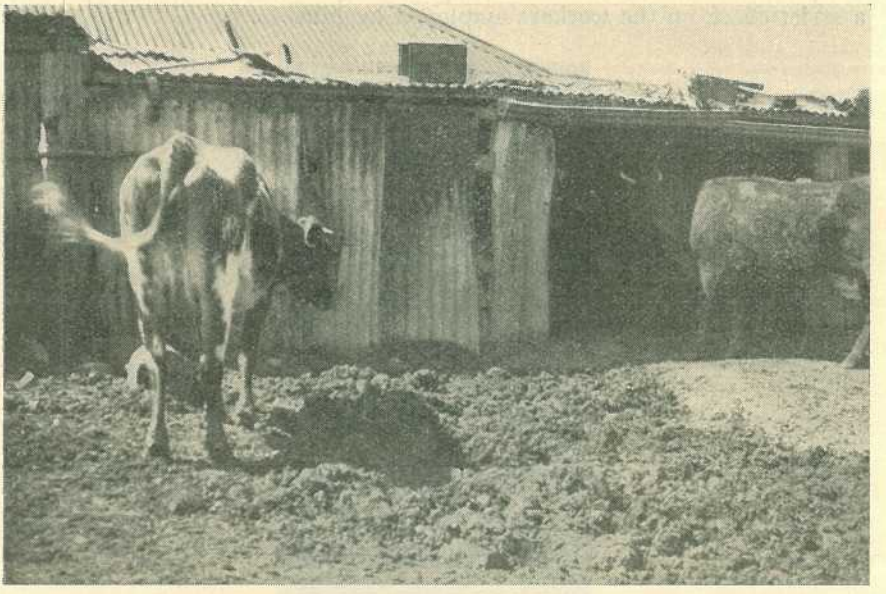


Plate 144.

These photographs show (in contrast with Plate 139) two neglected farmyards which in wet weather become foul and miry. Apart from contaminating the cows' coats, this means that the manurial value of any droppings is lost, for they cannot be removed.

Under no circumstances must the foremilk be withdrawn on to the floor of the milking bail, for this is one of the surest ways of spreading any infection that may be present. Apart from this, decomposition will take place with accompanying bad smells and attraction of flies.

It is well known that the highest percentage of butterfat in milk is contained in the strippings and that the first-drawn milk is the poorest portion, so that discarding it will involve only a small loss in quantity, which is more than offset by the improvement in keeping quality.

In large herds, where the quantity of foremilk is considerable, it can be pasteurised or boiled and used for calf, pig, or poultry feeding, unless definitely known to be infected. If it contains milk from diseased quarters, it should be disposed of by adding some disinfectant and emptying well away from cowbails and water supply.

## The Milker.

Much contamination of a serious nature may enter milk if the milker happens to be careless as to personal cleanliness, or if he be unhealthy. No person who is known to be suffering from an infectious or contagious disease is allowed by law to handle milk or cream, for many of the common disease germs are known to survive in milk, and some are able to multiply, if conditions are favourable, with the result that the infection may be transmitted to the consumer. Large scale milk-borne epidemics are not common, but they have been known to become widespread and far-reaching in their effects before the cause is discovered; whilst it is probable that many small outbreaks or single cases remain undiscovered and unreported. In the interests of hygiene and national health, the dairy farmer should realise his responsibility in this direction, and keep a strict check on the workers employed by him.

Plate 145.

Milkers suitably dressed in washable caps and suits. They have hygienic metal milking stools.

He should also see that proper clothing is available for milking. The clothes of the milker may constitute a source of danger to milk quality, if, for instance, the same clothes are worn as for pig-feeding, fodder mixing, grooming the cows, and removing manure. A pair of overalls, or a sugar-bag apron, worn for milking only, and washed at least once a week, is within the reach of all, whilst a washable cap is an added protection.

The milker should wash his hands thoroughly before commencing to milk and after completing each cow. This avoids transferring bacteria picked up from the cow's coat, leg ropes, stool, or surroundings to the freshly-washed udder of the next cow. Adequate provision for washing the hands in the cowshed is essential—a basin or sink should be placed in a convenient position, and, if towels are used, care should be taken to see that they are an asset to the hygiene of the milking shed.

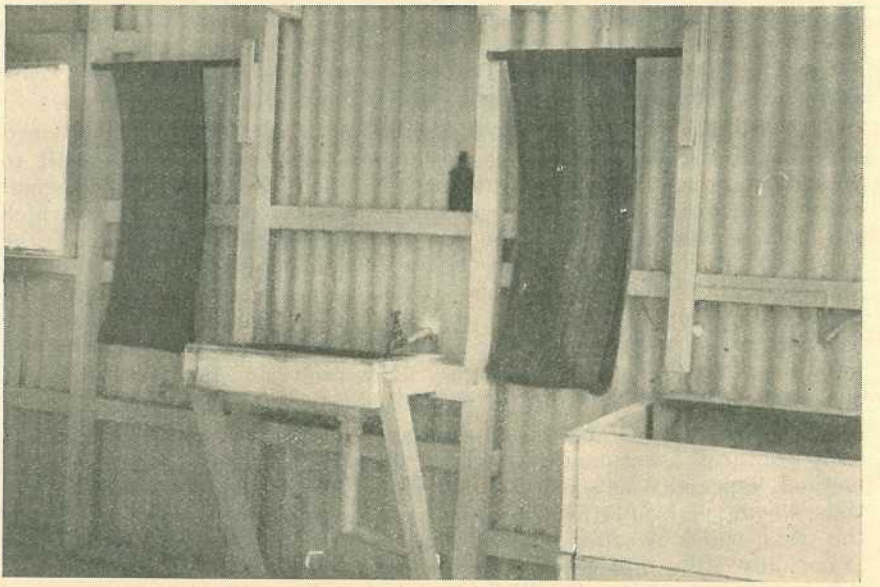


Plate 146.

Convenient sink with running water provided in the cowshed for the use of milkers. The towels receive daily washing and boiling.

On one farm recently visited, in the Brisbane area, the cowshed has a built-in sink and clean towels are provided daily for the use of milkers. This is an excellent arrangement.

## Wet or Dry Milking?

Many milk producers, careful in every other way to avoid contamination, still continue the unhygienic practice of wet-handed milking. Moistening the hands with milk direct from the teat, or, worse, by dipping into the milk pail, is a deplorable habit, which is responsible for much contamination as well as loss of quality of milk and cream. It is, of course, more serious if washing of the udder and of the milker's hands have been neglected, for then the dirt becomes intimately mixed with and well distributed throughout the milk. A glance at the

accumulation between the fingers of a worker engaged in milking an unwashed cow wet-handed will be sufficient evidence of the truth of this statement.

Where washing of the udder and teats and discarding of the fore-milk have been carried out and the milker's hands have been washed, "wet" milking is less objectionable, but the fact remains that all the cleanest and most efficient up-to-date dairy farmers milk dry handed, and this is a necessity for the production of milk for sale as "Tuberculin Tested" or "Accredited" in England, and for the majority of organised milkers' competitions. "Dry" milking means that the hands are washed immediately before starting to milk and after completing each cow, being left slightly moist after washing, and are kept as free from milk as possible.

Some farmers, mostly those who have not persevered with dry milking long enough to give it a fair trial, object to it as being slow and difficult, especially as regards stripping. It has, however, been found by hundreds of others to be equally rapid and simple, after a little practice, provided that the hands are left damp and the teats sufficiently moist after washing to make them pliable.

It is true that there are individual cows with badly-formed abnormal teats, or with one or more sore teats, which are difficult to milk dry-handed. For dealing with these, the clean milker uses a small quantity of ordinary vaseline applied to each teat after washing, which not only serves as a lubricant but also assists in the healing of the damaged skin, and helps to prevent particles being rubbed off into the milking pail. Teat sores should be treated with some antiseptic ointment between milkings. This also prevents their becoming more serious through being worried by flies. Great care should be taken by the milker to wash his hands thoroughly after each cow, for, obviously, this is a great factor in checking the spread of infectious sores.

Vaseline may be found of assistance to the man who has made a long practice of wet-handed milking when he first attempts the "dry" method, especially in stripping. It is preferable to use vaseline if, by thus easing manipulation, it prevents excessive downward jerking of the teats, which is often resorted to by an impatient milker, and which is not only quite unnecessary, but ruinous to the delicate udder tissues. After a time, however, it will be found that dry milking can be carried out easily and rapidly with no lubricant other than the moisture supplied by washed teats and hands.

This is being done on hundreds of modern dairy farms, where greater efficiency and increased keeping quality are aimed at, and, once established, this method is seen to be far superior to the old, which appears unhygienic, messy, and insanitary by comparison.

### Straining, Cooling, and Storage of Milk and Cream.

Temperatures on the average farm present a difficult problem in summer, but good dairy management depends largely on their regulation and control. The removal of animal heat from milk and cream as soon as possible after milking or separating, followed by storage in cool surroundings, will greatly lengthen their useful life by delaying the growth and multiplication of bacteria. Together with straining, which serves to remove the visible dirt and so reduce the numbers of micro-organisms, control of temperature forms a method whereby the farmer can definitely increase the value of his product.

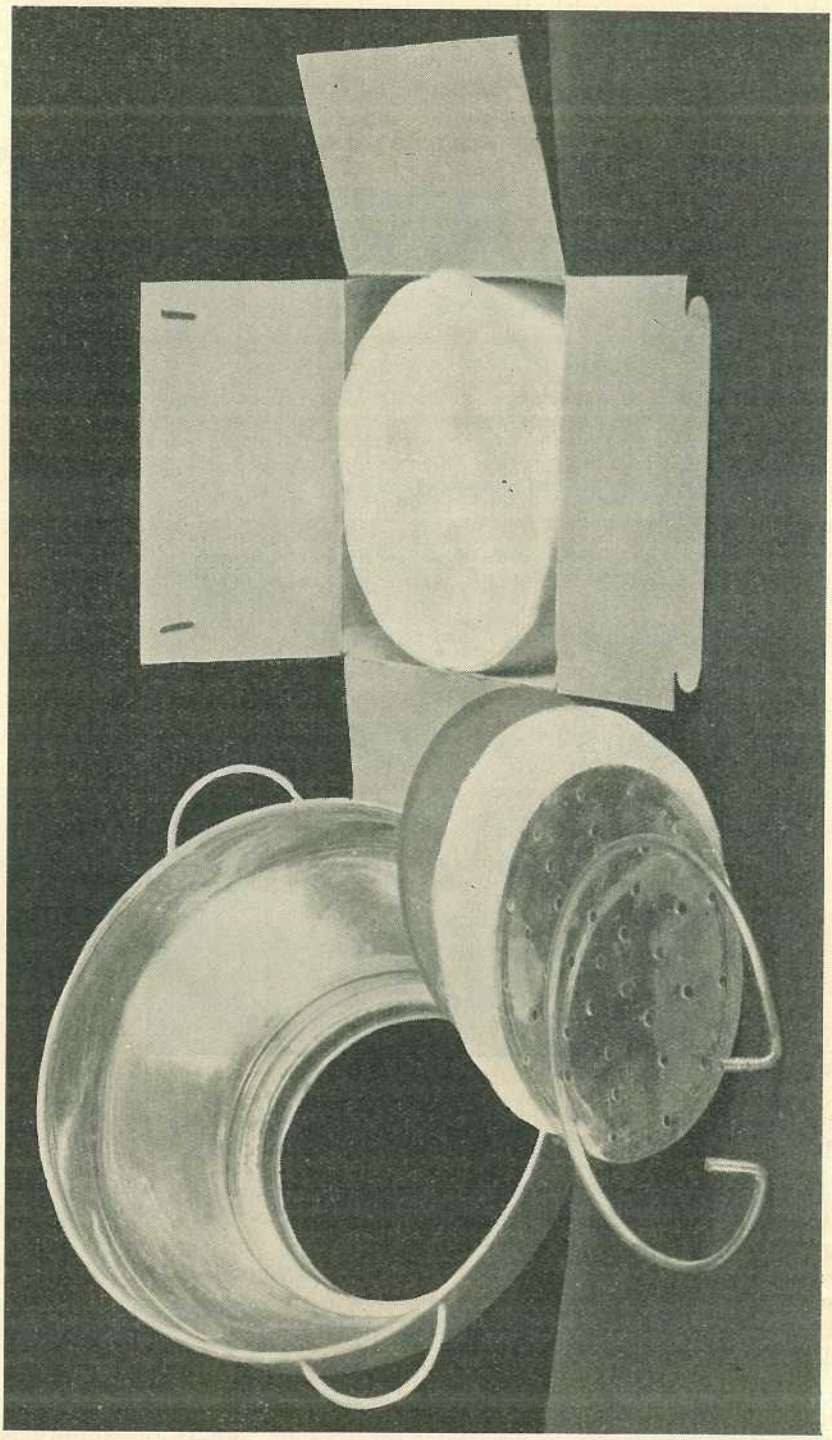


Plate 147.
Excellent type of strainer, easily cleaned and conforming to the Dairy Regulations.

*Straining.*—Cow-hairs, flies, dust, and dung particles and other foreign matter carry with them enormous numbers of bacteria, and should be kept out of milk by every possible means, for no amount of straining can remove bacteria once they have become free in the milk. Should some visible dirt gain entrance, however, the straining of each cow's milk through a cotton-wool disc immediately after milking will minimise the damage that may otherwise be caused.

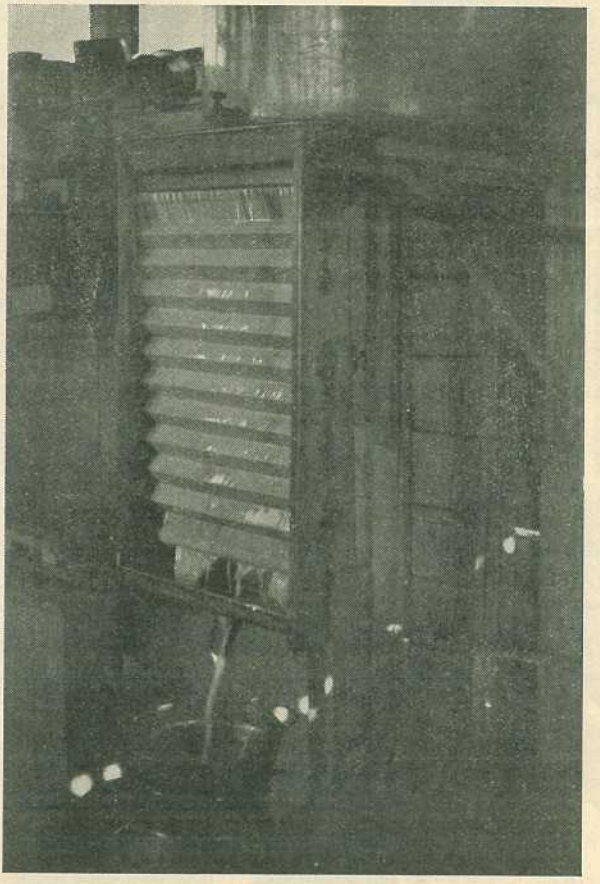


Plate 148.

An effective type of milk cooler circulating water which is then run to the stock trough.

Straining should be done once only, and should take place before cooling or separating. The disc type strainer prescribed by the Dairy Regulations is preferable to any other, since each disc is discarded after use; provided that the metal parts are scrubbed and sterilised, there is no risk of recontaminating the milk as with a cloth which has not received thorough washing and boiling; also, the finer mesh of the wad will trap smaller particles than will a cloth.

*Cooling.*—Some form of cooling is necessary to counteract rapid bacterial development, and the most usual medium for the purpose is water. Adequate water is necessary for cooling, and if the supply is

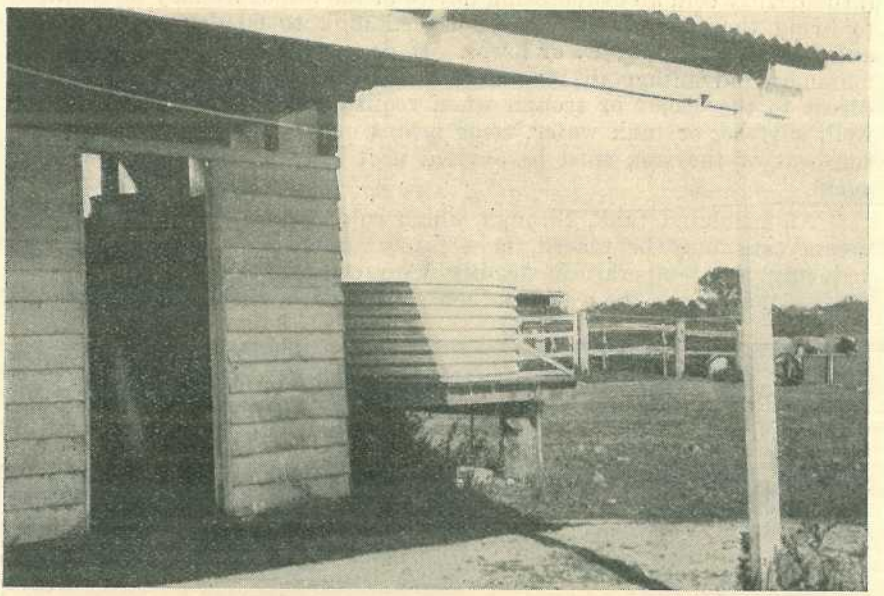


Plate 149.

Utilising cooling water for stock. The tank receives the water after it has passed through the milk cooler. The water is subsequently run to a stock trough in the paddock (see Plate 150).

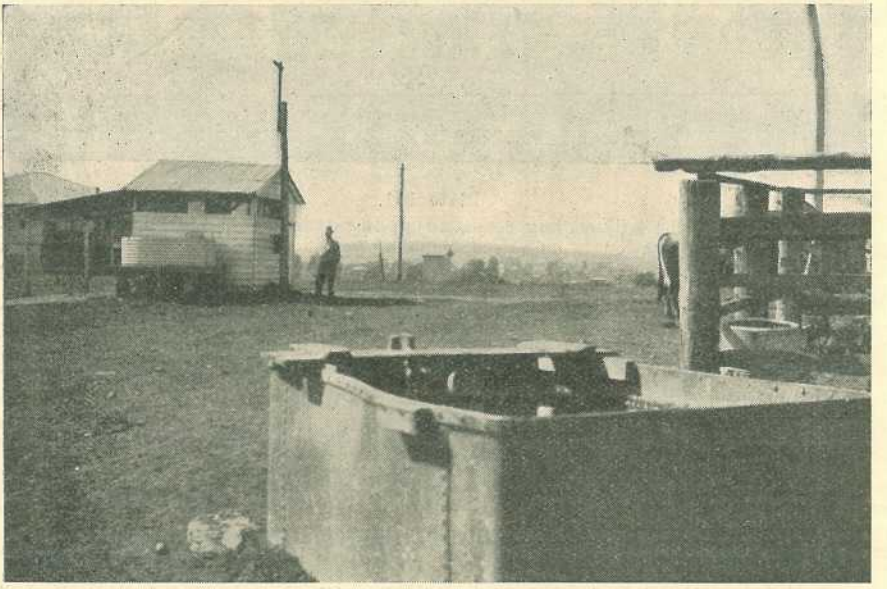


Plate 150.

Showing stock trough connected with the tank. Water from a supply main is available on this farm.

insufficiently cold an evaporating device or the use of ice may be required to bring the temperature of the cooled milk to 60 deg. F. or lower, and cream to 70 deg. F. or lower. If deep well water is available the maximum advantage in temperature can be obtained by pumping it direct to the cooler or trough when required. In the case of shallow well, surface, or tank water, some means of storing it, protected from the heat of the sun, must be devised if it is to be useful as a cooling agent.

An insulated tank, through which cold water flows and in which cream cans may be placed, is a fairly satisfactory arrangement for reducing the temperature steadily with constant stirring, which also aerates the cream; the water is then run to a trough for watering stock.

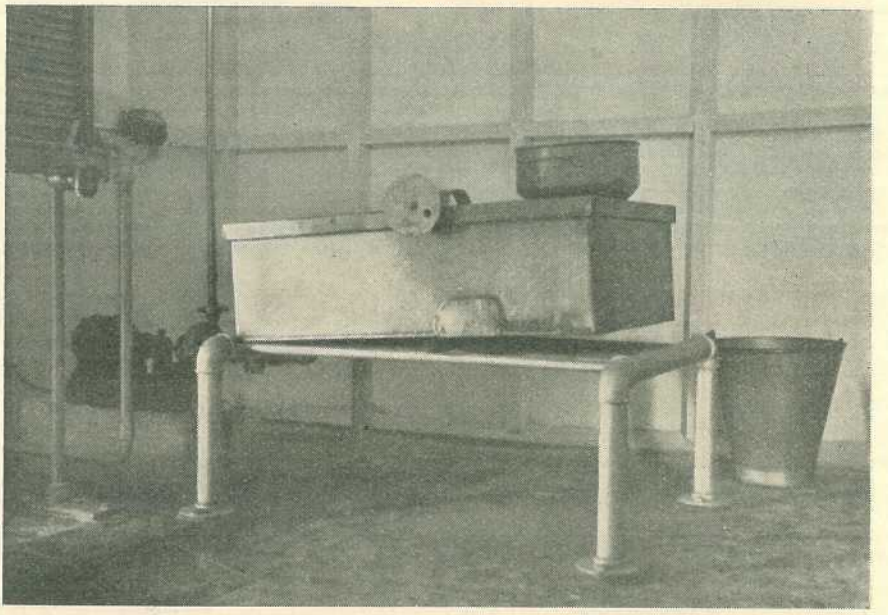


Plate 151.

A corner of the milk-cooling room, adjacent to the cowshed, on a well-managed farm where refrigeration is employed, showing strainer and covered receiving vat, milk pump, part of the cooler, and the thermometer.

For cooling and aerating milk, the best type of cooler is the endless corrugated type, which can be used in conjunction with a water-bag evaporator (filled after each cooling in preparation for the next), or with a fixed tank to which water is pumped and flows through the cooler by gravity, or with a refrigerating unit using brine. Such a cooler, having wide corrugations, can be easily cleaned with a brush and has no awkward crevices. Porous cylindrical containers large enough to hold a single can, working on the evaporation principle, are being used in some districts successfully, and have the advantage of being transportable and economical of water.

Refrigerating is a sure and certain way of improving quality, for, although it actually does not kill harmful bacteria, it renders them dormant and unable to cause deterioration of milk or cream. Many farmers are coming to the conclusion that the improvement in grade

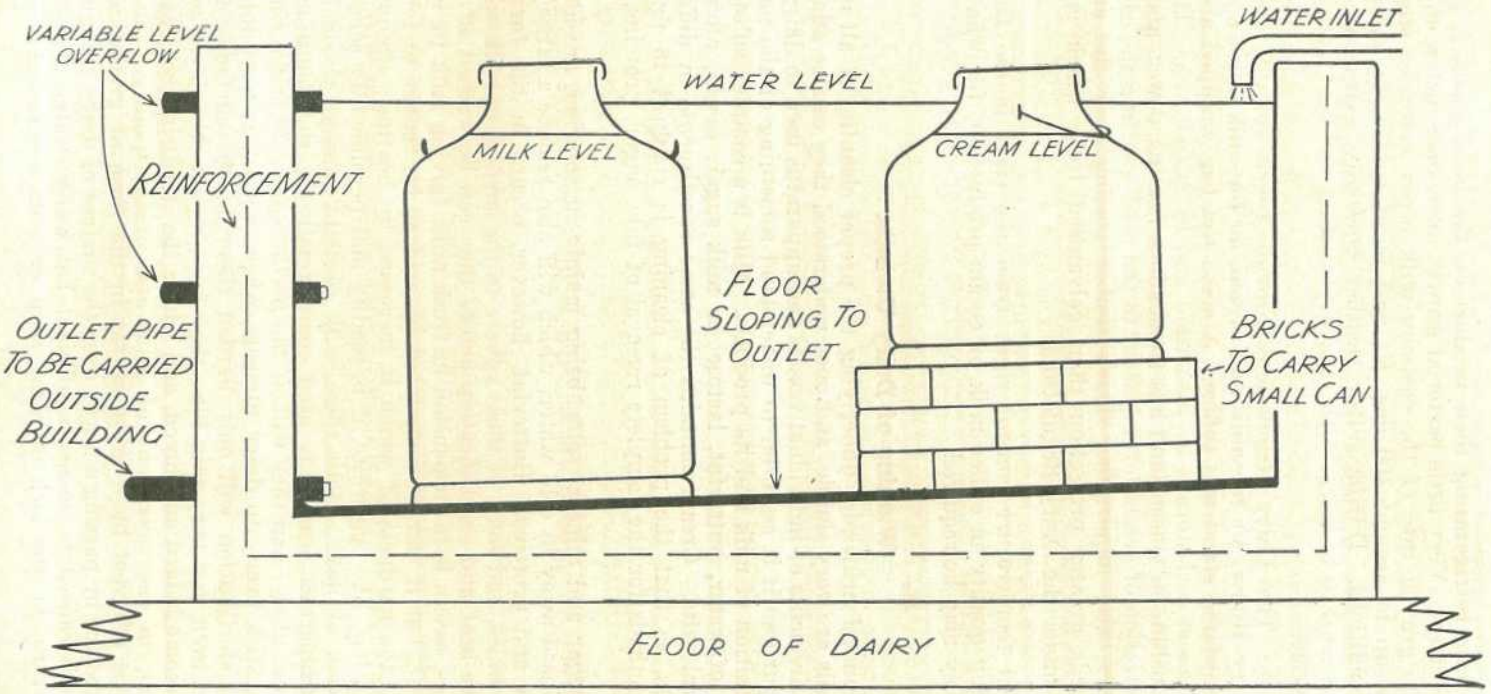



Plate 152.
Concrete trough for keeping cream cool in the dairy house.

resulting from refrigerating their product on the farm makes it financially economical. Very little bacterial growth takes place below 45 deg. F., but the growth rate of the common milk types increases steadily above this, up to around 100 deg. F., and is, of course, favoured by summer conditions. During sultry weather especially, extra care and precautions need to be taken with regard to cooling and cool storage of milk and cream.

*Storage.*—The Dairy Regulations provide for a suitable storage room (Dairy House A) for milk and cream, or for milk only, a well-covered ventilated stand will suffice. A clean wet bag wrapped around a can will assist cool storage by insulation and by evaporation. Direct summer sunshine in Queensland has tremendous heating power, and the proper protection of cream left adjacent to the road awaiting the carrier is, therefore, also important. Thick timber roofing over the cream stand affords greater protection than galvanised iron, which is not permitted under the Dairy Regulations.

Careful temperature control right from the start is the key to safeguarding quality in either milk or cream production, for whatever purpose they may be required.

## Washing of Dairy Utensils.

The general principles underlying the proper cleaning of all metal milk utensils are very simple, and once understood they can be adapted to the requirements of individual vessels and apparatus used in dairying. For this purpose it is essential to understand something of the nature and composition of milk and its products. Milk is a complex substance consisting of water, butterfat, lactose or milk sugar, casein, albumin, and mineral salts. Cream contains the same constituents in different proportions, so that the problem of cleaning is confined to finding effective methods for the complete removal of fats, sugar, proteins, and salts.

The sugar and mineral salts, being mainly in solution, are almost entirely rinsed away in cold water, which will also remove a large part of the fat and proteins. Butterfat, however, occurs in the form of minute globules, and some of these adhere to the surface of milk vessels and require heat and emulsification before they can be washed off. Of the proteins, casein is in suspension in fresh milk (giving milk its white appearance), but it can be coagulated by acid or by rennet to form a solid curd, the hardness of which is increased by heating; albumin is in solution, but, like egg-white, it is readily and permanently solidified by the action of heat. Both these milk proteins possess considerable adhesive properties (casein is used commercially in the manufacture of paints and glues) and they will, *if the preliminary cold-water rinsing is omitted,* stick firmly to dairy utensils, where hot water washing and subsequent sterilisation will only harden them on the surface. Once fixed there, even in a very thin film, they form a protective layer where bacteria become lodged and breed, and where the sterilising heat cannot reach them, to the detriment of milk and cream quality. Similar protection is afforded by a layer of fat in the form of grease, which can be tested for by passing a finger over the surface of dairy equipment, and which is caused by using insufficient hot water, water at too low a temperature, or the lack of some soap or soda compound to free the fat.

There are, then, three stages necessary to the thorough cleaning of dairy utensils, as distinct from the sterilising, which must follow in order to destroy the harmful bacteria. These three stages are as follows:—

(1) *Cold Water Rinsing.*—Utensils should be well-rinsed as soon as possible after use. This is very important, for milk once allowed to dry is much harder to remove completely. Soaking in cold water for a reasonable time is advisable if washing is not to be done immediately—this will loosen all milk solids and facilitate washing.

(2) *Hot Water and Soda.*—Washing soda, caustic soda, soap, or soap powder are suitable cleansers for farm use (besides many proprietary preparations sold under trade names). Care should be taken to avoid cleansers containing any gritty substance, for this will permanently damage the surface by scratching, and will rapidly remove tinning. The water should be really hot, and enough soap or soda should be used to emulsify the grease, so that no globules of fat can be seen floating on the surface of the water. A stiff brush should be used on each utensil and all loose parts such as taps and strainer discs should be dismantled for scrubbing.

(3) *Hot Water Rinsing.*—A final rinse, using fresh hot water, is needed to remove the soda water before sterilising.

Milk utensils, if not properly cleaned and sterilised, are by far the most fruitful sources of contamination in the course of milking and handling milk and cream, and it should be remembered that both processes are equally essential, for satisfactory and complete sterilisation is not possible without first thoroughly cleansing along the right lines.

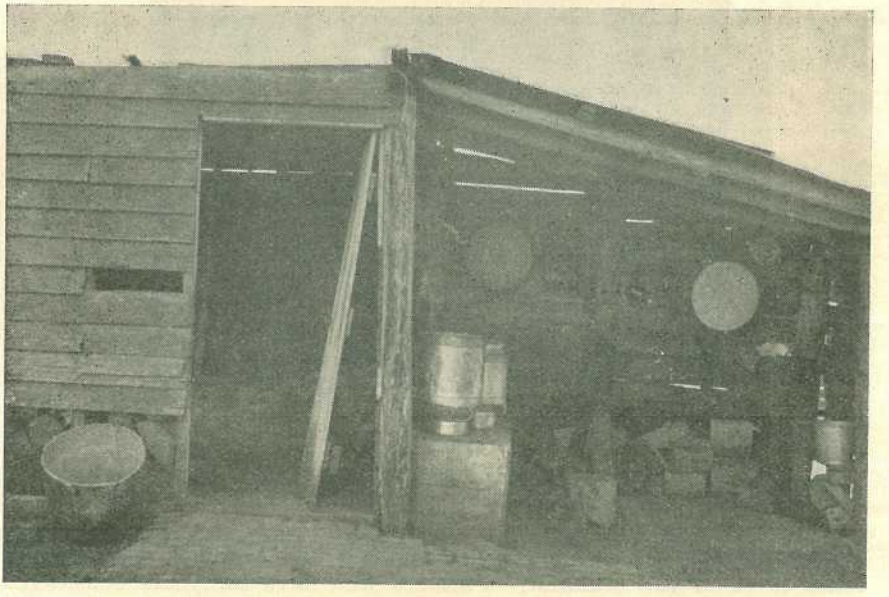


Plate 153.

This shed, used for chopping wood and as a laundry, is not a proper place for storing clean milk utensils.

## Sterilising Dairy Utensils.

The use of clean sterilised equipment at every stage from the time that milk leaves the cow to the time of delivery to the customer or to the factory is considered the most vital single factor in lengthening the life of milk and cream. Some objections have been made to the Dairy Regulation dealing with the provision of a boiler on the farm to heat water for dairy use, but this is a minimum requirement in a country where warm or hot weather favours bacterial growth over nine months of the year. In Britain and other countries where dairies are required to be provided with a steam chest for sterilising milk utensils, this has resulted in a high standard, reliable product of good keeping quality.

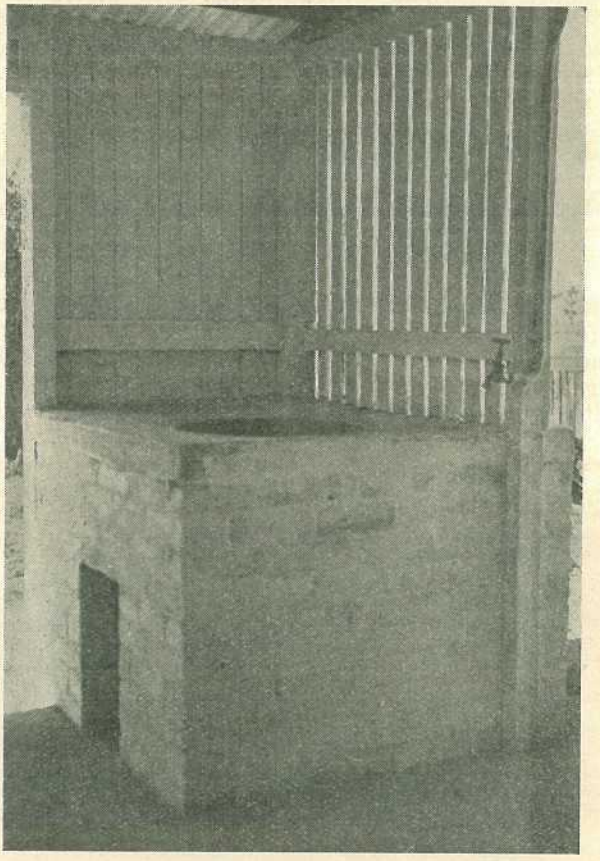


Plate 154.

Boiling water is essential for successful dairying. A convenient built-in boiler on a milk-producing farm; racks for utensils are nearby.

The initial expense is an investment, which has been proved countless times to be of the soundest. Farmers who have for years considered steam on the farm to be an extravagance have been completely converted, after installing a boiler, by the enormously improved grading and longer keeping of their product.

It is important to remember, however, firstly, that it is impossible to sterilise an inadequately cleaned vessel, whatever the method used, therefore the washing process must be thorough and complete before sterilising is attempted; secondly, that a worn or badly-constructed vessel cannot be either properly cleaned or sterilised. It is *essential* for good production that every utensil shall be free from rust, cracks, dents, open (that is unsoldered) seams—and for this reason kerosene tins are unsuitable—or other crevices, no matter how small, where traces of milk solids or moisture may collect and remain.

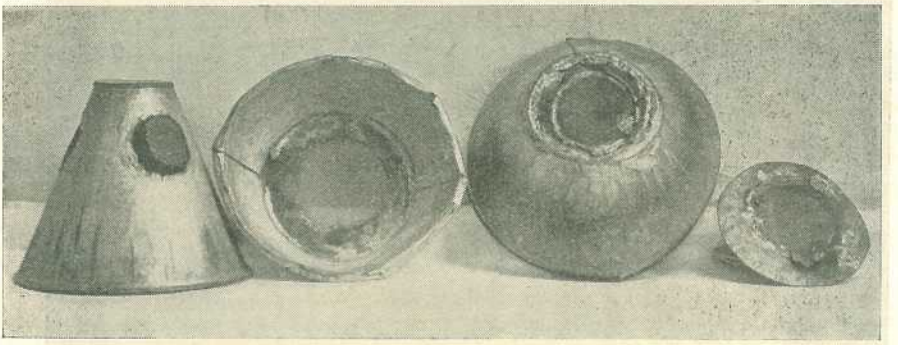


Plate 155.
It is impossible to clean or sterilise utensils such as these, which will seriously contaminate milk.

*Chemicals.*—Chemical sterilisers are on the market and there are some which are sold especially for dairy use. For milk utensils, however, chemicals are not, on the whole, recommended. Only a few are really suitable, if carefully used, and the risk of absorbed odours, of an error in quantity being made, or of some of the chemical gaining entrance to the milk or cream, are so great that heat sterilisation is considered generally more satisfactory and more efficient in every way.

*Scalding.*—"Scalding" is almost useless as a method of sterilising dairy utensils. If done with really boiling water, which is seldom achieved on the average farm, a proportion of the bacteria will be killed, but it is not a sufficiently severe treatment. Water which has boiled but which has lost some of its heat through standing is not a sterilising agent.

*Steaming.*—Steam is the ideal sterilising medium, and applied for fifteen to twenty minutes after washing is completed it will kill the majority of bacteria on all ordinary dairy utensils.

A small square chest with steam inlet and a tightly-fitting door, capable of holding cans, buckets, milking machine and separator parts, is an ideal sterilising unit. A thermometer, fitted in the side, enables the farmer to make certain that the temperature is actually 212 deg. F. for the required time. A simpler and inexpensive home-made steam chest can be made from an ordinary galvanised iron dust bin, by perforating the bottom, or from a 40-gallon oil drum used in conjunction with a wooden lid made to fit over the dairy boiler. A number of holes are bored in the lid, over which the drum is placed, the ends having been carefully removed. One end forms the lid of the "chest," into which utensils can be packed, and provided plenty of water is kept

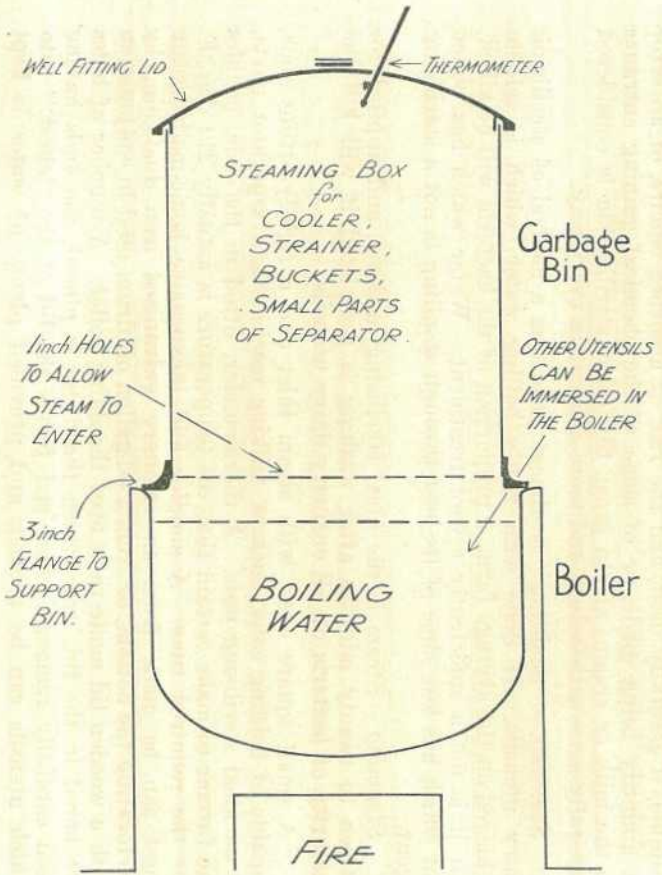



Fig. 1.

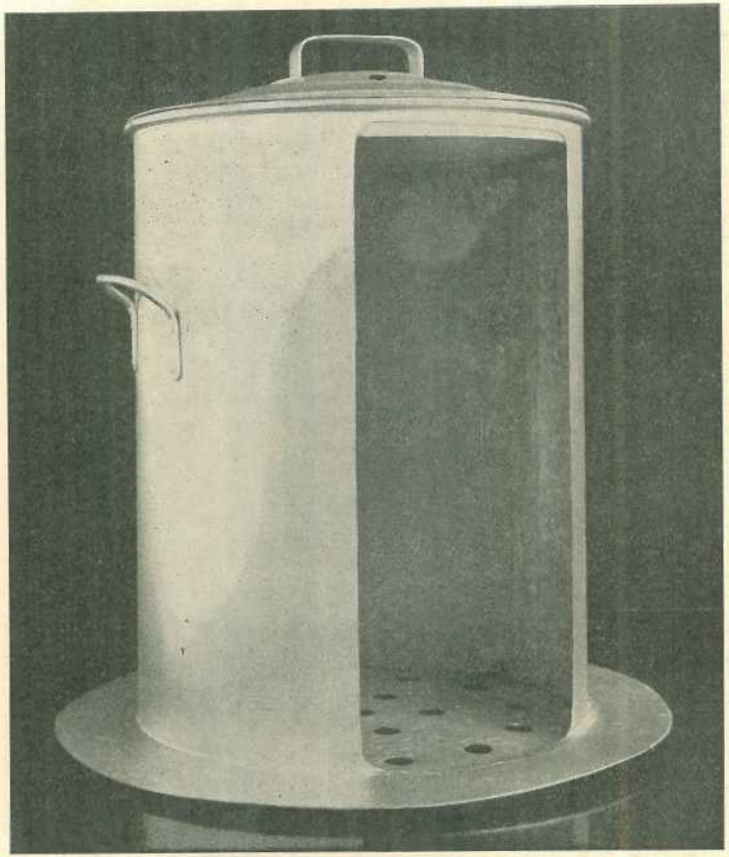


Fig. 2.

Plate 156.

Photograph and diagram showing construction of a cheap and effective steam steriliser.

boiling—twenty to thirty minutes time should be allowed—steaming can be satisfactorily carried out. A piece of sacking placed over the top will assist in conserving the heat.

*Boiling.*—Boiling by complete immersion in water which is actively bubbling is the only effective and satisfactory alternative if steam is not available. This should be done for *not less than ten minutes,* and on no account should any attempt be made to dry utensils by wiping after sterilisation. If they are drained in a clean, airy place, preferably on a rack where air can circulate, the heat of boiling will dry off most of the surface moisture in a few minutes.

The application of a cloth or any handling of the inside of a vessel which has been sterilised will result in recontamination and should be guarded against. A wire basket can be constructed, with a little ingenuity, from fine mesh netting, in which small parts of utensils can be held for boiling and can be allowed to dry, without handling.

Sunlight is an aid to drying and sterilisation, and where there is reasonable freedom from dust, the storage of clean utensils in a sunny spot is all to the good.

### Care of Milking Machines.

Milking machines although they have revolutionised dairying methods, may, if mishandled or neglected, constitute one of the biggest menaces to milk and cream quality that the dairy farmer has to face. Many people hold the opinion that clean milk of good keeping quality and choice grade cream cannot be produced with a machine, but this has been investigated fully and both research work and practical experience have proved that it is wrong. As good a quality of milk can be produced by machine as by hand, provided the correct procedure is followed in care and cleaning.

Another objection often brought forward is that the machine tends to increase udder trouble. This is, of course, true if the farmer fails to notice cases of infection as soon as they occur and allows diseased cows to be milked by the machine. The great importance of inspecting the foremilk for any abnormal appearance has already been discussed, and any cow showing signs of mastitis in the first-drawn streams should be milked out by hand and the milk isolated from that used for human consumption. Cows with sore teats should also be milked by hand, although the machine may safely be used if they are left until last. A machine is very unlikely to cause teat sores—in fact, one Queensland dairy farmer with a large herd has experienced complete freedom from them over six months since he started machine milking—but it is liable to transfer the infection if used subsequently, without sterilisation, on other cows.

The solution of most milking machine troubles lies in proper cleaning and sterilising after each milking. It is essential that cleaning should be done promptly after milking is completed before the milk solids have time to dry on the rubber parts, for once dry they are far more difficult to remove completely. The first machines were crude inventions made with ordinary rubber parts which were easily cracked and pitted by the action of fat and hot water, making them excellent breeding places for contaminating bacteria. Nowadays the modern machines are solidly built and the rubbers are of the very best quality resistant to high temperatures, so that they can safely be boiled and even sterilised regularly by steam, without injury.

The method of dealing with milking machines, using a weak solution of caustic soda in boiling water, is well adapted to Australian conditions, and has proved economical, rapid, and successful. This method is as follows:—

(1) One gallon of clean *cold* water is drawn through each set of teat cups by suction, lifting the unit up and down in a bucket of water to allow air to mix with it.

(2) The outsides of teat cups and rubber tubing are then washed and brushed in *warm* water and caustic soda.

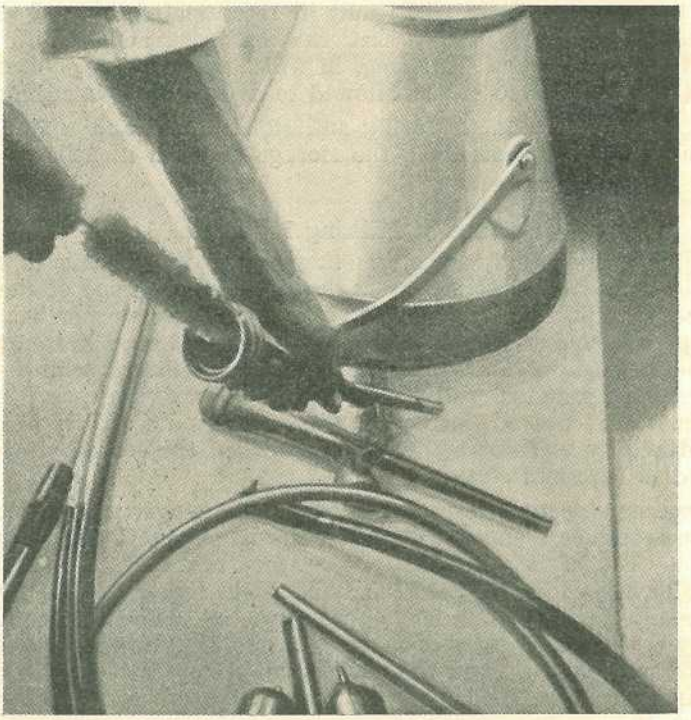


Plate 157.
Method of cleaning dismantled machine rubbers and small parts.

(3) At least one gallon of *boiling* caustic soda solution is drawn through each separate set of teat cups, holding them so that all receive equal treatment.

(4) The solution is removed completely by drawing at least 2 gallons of *boiling* water through each set of cups.

(5) If steam is available this is applied for five minutes to complete the sterilisation.

*Strength of Solution.*—One full teaspoonful of caustic soda added to every 4 gallons of boiling water is the correct amount and, provided this strength is not exceeded, no damage will be done to the machine, and satisfactory results will be obtained. Used carelessly, however, caustic soda is dangerous in its action, and care is needed in handling it

and in making up the solution. The water used must be really boiling to achieve proper cleansing and sterilisation, and by this treatment the resistance of the rubber parts to cracking is actually increased.

The vacuum line is often a source of trouble, and should receive a complete flushing once each day with boiling water, care being taken not to flood the pump. All taps should be left open when the machine is not in use, and the teat cups should be hung up in a cool dust-free place. The use of chemicals other than in the washing process has

Plate 158.
Method of cleaning milking machine units after each milking.

been found to give less certain results than boiling water and steam, and there is great danger of traces of them finding their way into the milk and cream and causing taints.

Whatever method of cleaning machines is employed, they must be completely dismantled at least once, preferably twice, a week for satisfactory results.

## Farm Water Supply.

It is extremely important that the supply of water on the dairy farm should be of pure quality and sufficient for requirements. Many farmers fail to realise that a contaminated water, if used for washing the cows' udders, the hands of the milker, or the utensils, may result in dangerous bacterial infection of the milk or cream. If cows and other stock are allowed access to foul or polluted water, not only will they wade collecting unclean bacteria on the coat and udder, but they will drink it if a good fresh and pure supply is not available in adequate

quantity, and in this way the spread of disease will be increased. The average milking cow is estimated to need 12-15 gallons of drinking water daily—this amount may not be sufficient in summer or in the case of heavy milkers—and experiments have proved that where cows have been allowed unlimited fresh drinking water, the milk yield has shown an increase.

Deep well water, provided it is not heavily mineralised, is the most satisfactory type of supply, for coming from far below the surface it is usually very pure and has the advantage of a low temperature all the year round. This is especially useful for cooling purposes in the dairy.

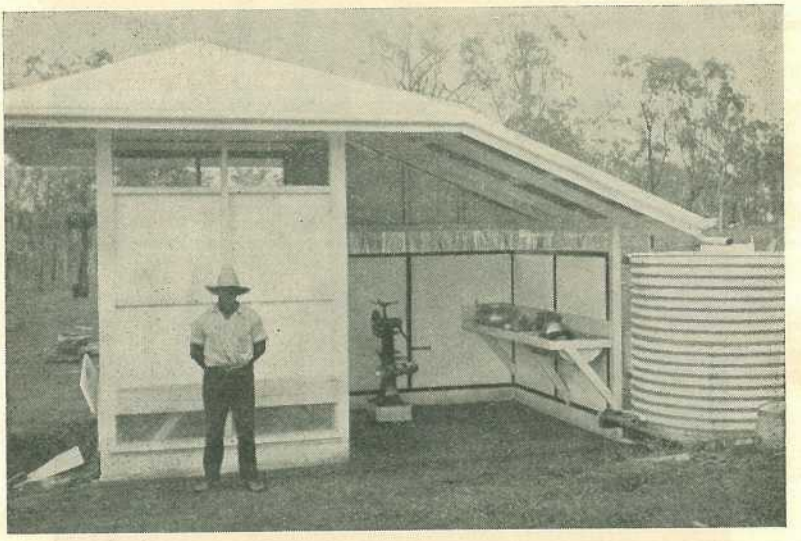


Plate 159.

Well-planned and constructed dairy house with veranda for washing and storage of utensils, and tank water supply.

Shallow wells may yield a good quantity of water which is usually soft, but it is frequently impure owing to its proximity to the surface; surface rain water cannot receive sufficient filtration through the soil layers by the time it reaches the shallow well level to free it completely from contamination. Pollution from surface drainage is commonly found in shallow well water, but this does not mean that it cannot be made use of on the dairy farm. It does mean, however, that either chemical sterilisation or boiling must be resorted to in order to purify it.

Tank water is the most common form of supply on Queensland farms, and in comparatively dust-free areas this water may be of a high standard of purity, but this is not always so, for where much dust settles on roofs or after a dry spell, the water is bound to wash off a great deal of sediment and with it undesirable bacteria. This applies especially to tanks attached to the milking bails, for water collected from these roofs is liable to be contaminated with manure dust and particles blown from the stock yard, making it unsuitable without treatment for dairy purposes. The practice of rinsing clean cans on their return from the factory with such cold untreated water

has been known to contaminate them seriously; instead they should be thoroughly scalded out with boiling water and allowed to drain dry.

Farm water treatment must be simple and cheap, and two methods are recommended.

(1) *Boiling.*—Boiling is the simplest method of purifying a suspected supply. If water is brought up to the boil (210 deg. to 212 deg. F.) before use, the bacteria causing ropiness and other faults will be destroyed, together with coliform (dung) types and disease organisms. Every farmer should provide himself with a dairy thermometer so that he can check temperatures, for the correct heating of water and utensils and cooling of milk and cream are the secret of successful dairy management.

(2) *Chlorination.*—Sterilisation of water by means of some chlorine compound is quite satisfactory provided the right amount is used. A quantity giving 1 *part of chlorine in* 2 *million parts of water* will sterilise any ordinary supply, leaving no excess. Where cloudiness or sediment are present, as may be the case if tanks are not cleaned, or with shallow well water, a larger amount of the compound may be needed than with a clear water, but care must be taken not to overdose with this powerful chemical since any excess will cause a bad taint in milk and cream. Addition of the chemical to water in the tank once a week, and after rain, should serve to keep the supply in good condition.

The periodic cleaning out of all water tanks is essential to maintaining a pure supply, and should not be neglected.

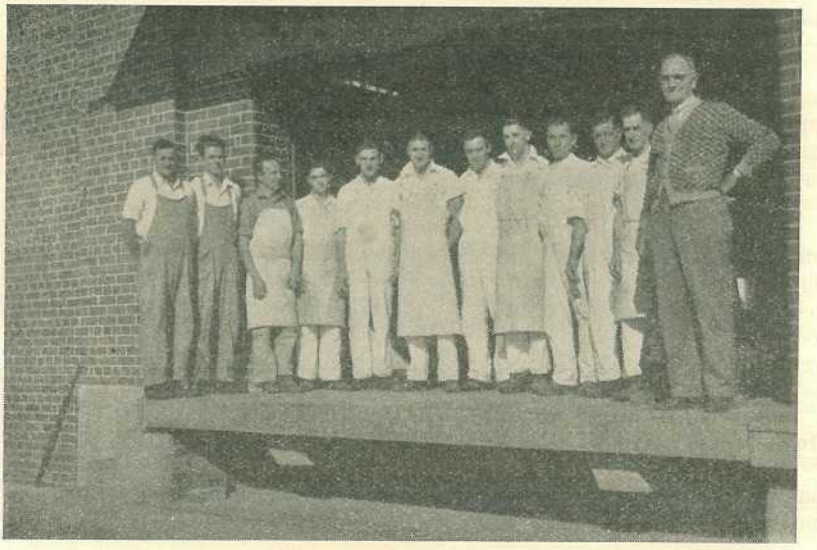


Plate 160.
Group of operatives at a Queensland butter factory.

# New Rural Legislation.

LEGISLATIVELY, the present session of Parliament is an important one for farmers. No fewer than five measures have been introduced for the purpose of improving the conditions of country life in Queensland. They are: The Rural Development Bill, The Dairy Produce Acts Amendment Bill, Veterinary Medicines Act Amendment Bill, Apiaries Bill, and the Sugar Experiment Stations Acts Amendment Bill.

The Rural Development Bill is a measure to provide for the co-ordination of the administration of provisions regarding State advances to co-operative companies, associations, and primary producers, and advances generally in aid of primary production by the creation of the Corporation of the Bureau of Rural Development; and for other incidental purposes.

The Dairy Produce Bill is really the result of experience gained since the Dairy Act of 1935 was passed. That Act aimed to improve the quality of dairy produce and to ensure proper supervision over the production, handling, and treatment of milk and cream.

While the existing law has succeeded within the scope of its application, it has been found that it does not cover every contingency. Therefore, it has become necessary to strengthen the section dealing with cream transport, and provide for more effective control over the carriage of cream.

The production of choice grade butter has greatly increased in Queensland, but it is sought under the Bill to still further improve butter quality. To do that, of course, some control over the health of of dairy herds is necessary. So the Bill provides for widening the scope of the veterinary officers of the Department of Agriculture and Stock to enable them to test dairy stock for disease.

The object of the Veterinary Medicines Bill is to tighten up the control of the sale of veterinary medicines in Queensland. Lists of approved medicines will be published from time to time, and will be a guide to stock owners as to whether a stock medicine is true to label and has the virtues claimed for it.

The Apiaries Bill aims to make some differentiation between the commercial and amateur beekeeper and it is a concrete recognition of the principle that the man who makes his living keeping bees must receive first consideration in any legislation governing the honey production industry. The districts in which the new measure will take effect are Moreton, Darling Downs, Wide Bay, and Burnett.

The Bill relating to the sugar industry is designed to provide more effective control over the introduction and spread of cane diseases by declaring disease-infected areas and constituting cane disease control boards on the same lines of the existing cane pest boards, and with similar powers.

Every one of these Bills was welcomed by both sides of the House as an important contribution to the well-being of the rural industries of the State.

# Export Bacon Pigs at the Brisbane Show.

## REPORT ON THE 1938 COMPETITION.

THE class provided by the Royal National Association at its 1938 exhibition for export bacon pigs suitable for the English market was conducted on similar lines to the 1937 competition, a report of which was published in the *Queensland Agricultural Journal,* October, 1937.

Prize money of £40 was again provided for the class, of which £25 was presented by the Department of Agriculture, by direction of the Honourable the Minister, Mr. F. W. Bulcock, plus a special prize of £10 presented by Dr. Graham Brown, of Brisbane, for the exhibitor of the pen of pigs attaining the highest aggregate of points awarded in the two judgings.

Ten entries of three pigs each were exhibited and were first judged alive at the showgrounds on the 15th August, the judge, Mr. D. C. Cameron, using a score card which provided 70 points for condition, 20 points for uniformity and type, and 10 points for general appearance.

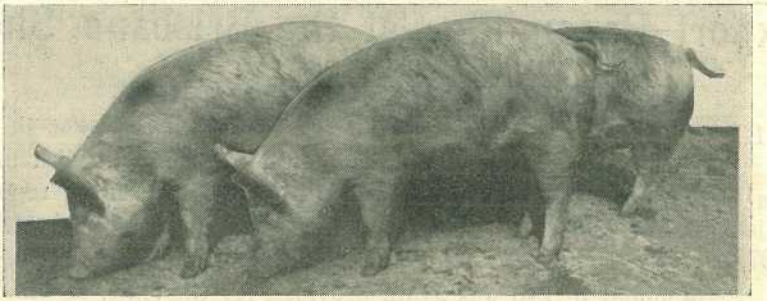
On the 22nd August the pigs were slaughtered at the Brisbane Abattoir, and after being chilled were judged on the adopted English system of carcase appraisal (see the *Pig Breeders' Annual,* 1936-37, or the *Queensland Agricultural Journal,* August, 1937).

In the report on the previous year's competition there appears the following statement: "When it is possible to judge carcases, there is little, if anything, to be gained by judging the pigs alive, for in judging the live pig the judge must use his imagination to some extent and in the class under review it must be considered somewhat fortuitous that the pens awarded first and second alive gained the same awards in the carcase competition"; this contention (i.e., that there is no advantage in this competition in judging the live pigs) is borne out in the results of the 1938 competition where none of the first, second, and third prize pens of live pigs is among the first three places in the carcase-judging.

In last year's competition the majority of the pigs were much too fat; this year, whilst there was a fair amount of the same trouble the marks gained for backfat show an improvement.

The most obvious fault with the majority of the pigs in this competition is the deficiency in body length, the average marks gained by the thirty pigs for this feature being only 33 per cent.

The detailed awards for each pen of live pigs and for each individual carcase are shown in the tables herein, the percentage marks for each feature of the carcase giving the best indication of value. The photographs of each entry as live pigs, whole carcases, and as one side and the section of the opposite side at the last rib, provide information of value to interested people.



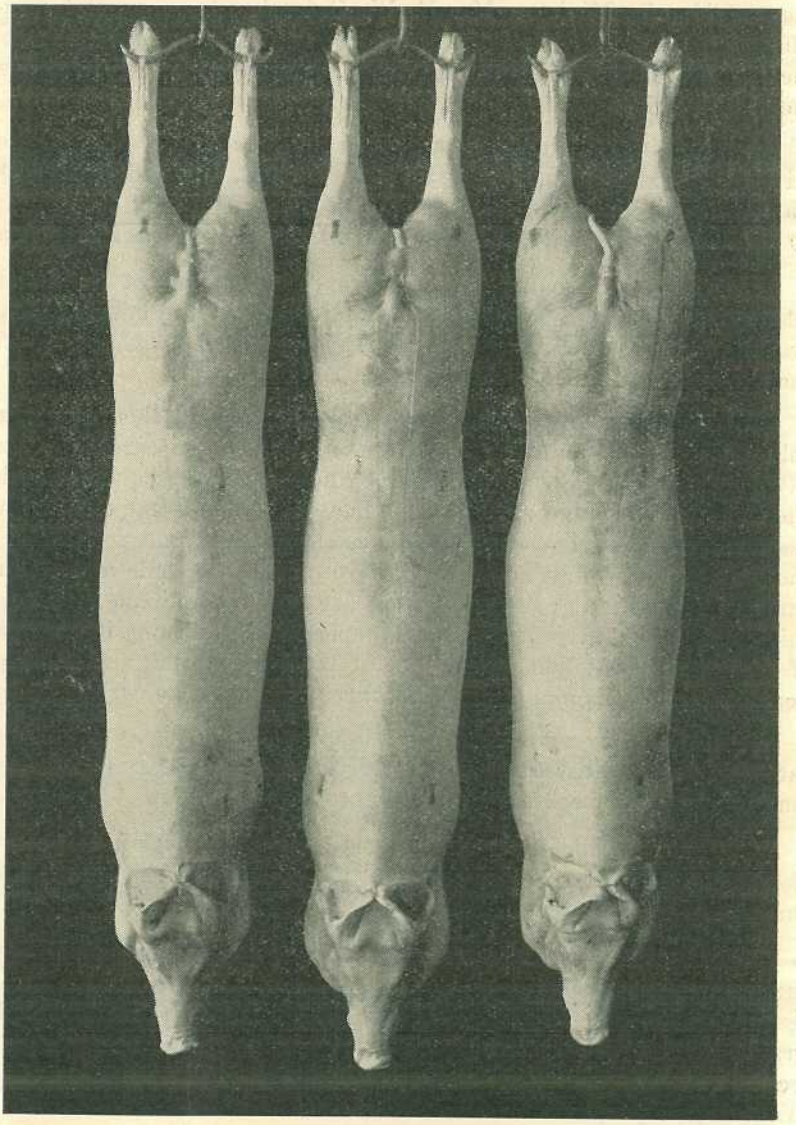


Plate 161.
Catalogue No. 521 (see opposite page).

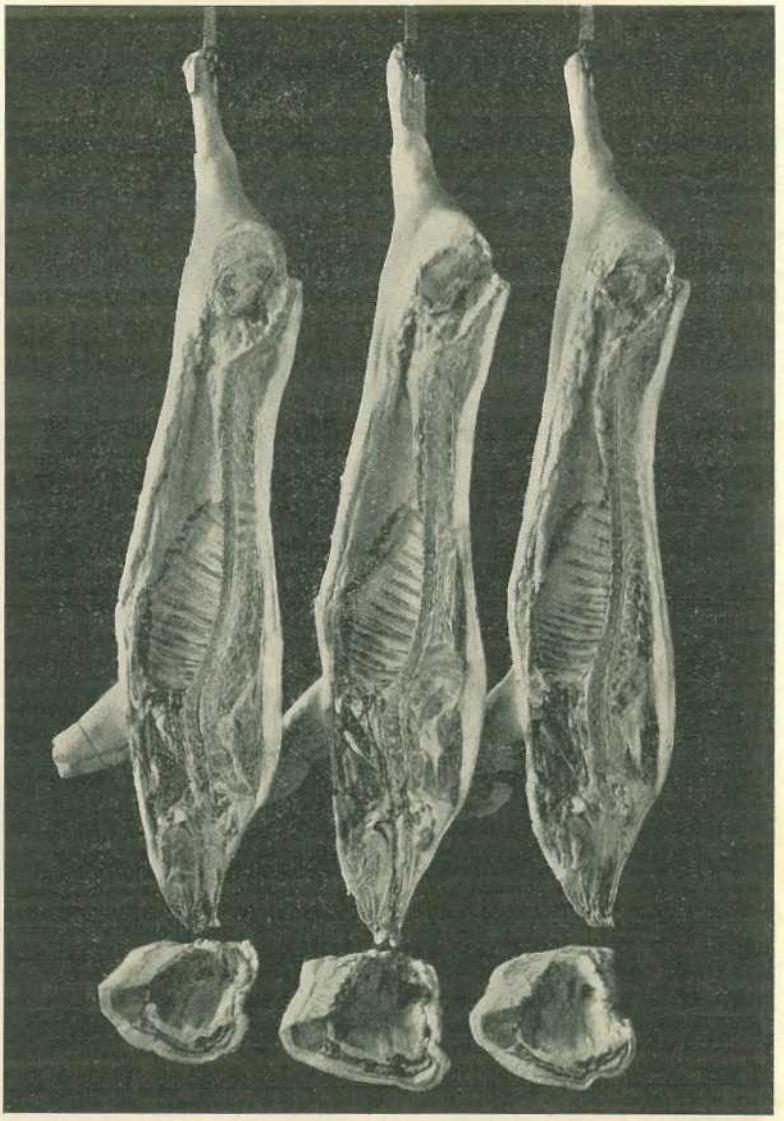
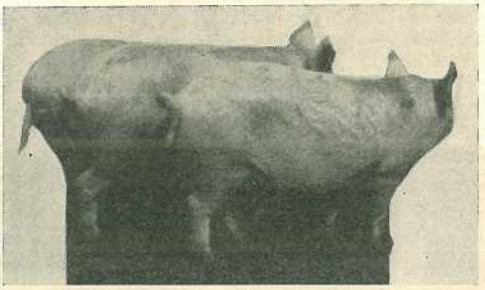


Plate 162.

Catalogue No. 521, the first prize exhibit in the carcase section and winner of the aggregate prize, exhibited by Mr. S. S. Appleby, Maroon. These were Large White pigs which, when dressed, were uniformly good and measured consistently well in all respects excepting body length, which was their weakest feature.

The dressed carcase weights from left to right are 129 lb., 137 lb., 137 lb. These carcases show the correct degree of finish and a good distribution of fat and lean.

Mr. Appleby's entry of Large Whites won this class last year.



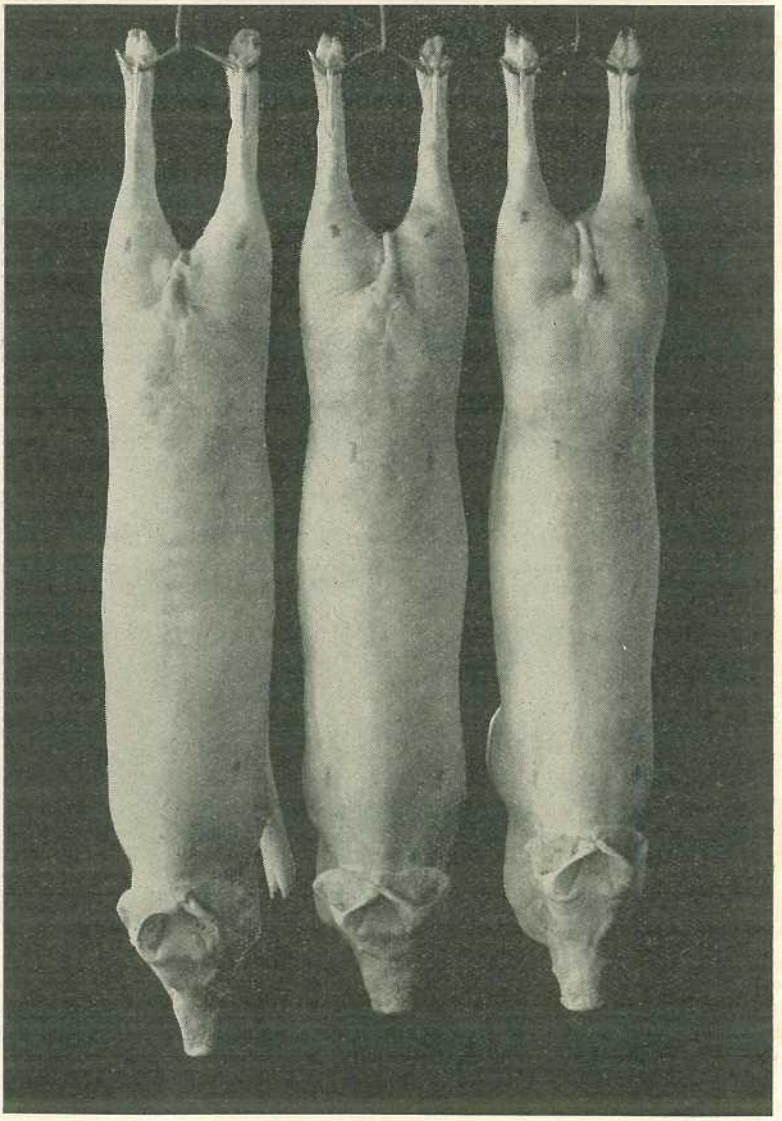


**Plate 163.**
Catalogue No. 522 (see opposite page).

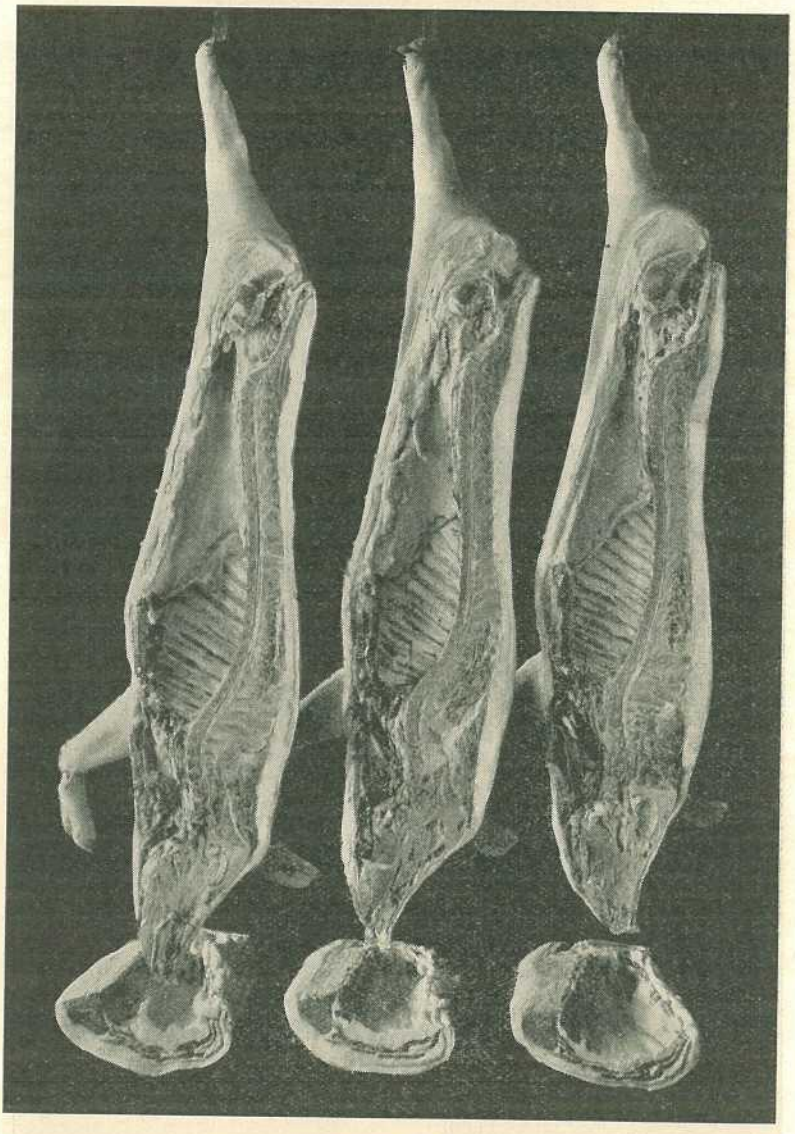
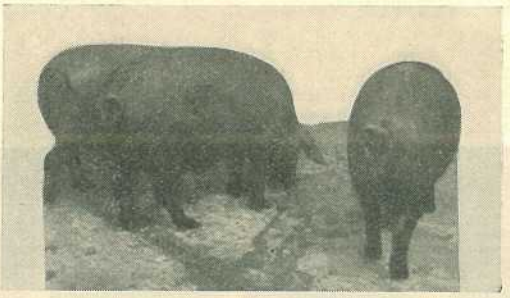


Plate 164.

Catalogue No. 522, entry of Large White x Duroc Jersey-Tamworth, shown by Mr. H. E. Badke, Beaudesert. These pigs were placed first when judged alive, but when their carcases were measured they were found to be much too short in the body in proportion to their weight. One pig was also very deficient in muscle development and too long in the legs.

The dressed carcase weights from left to right are 159 lb., 155 lb., 155 lb.



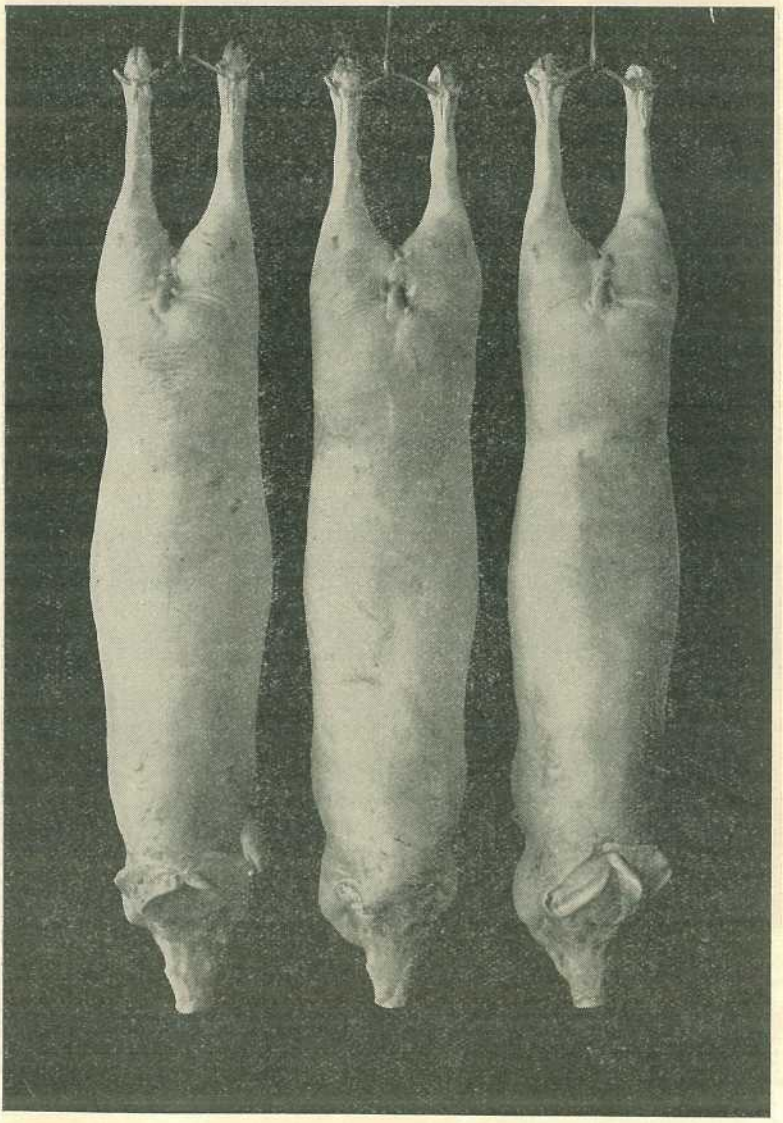


Plate 165.
Catalogue No. 523 (see opposite page).

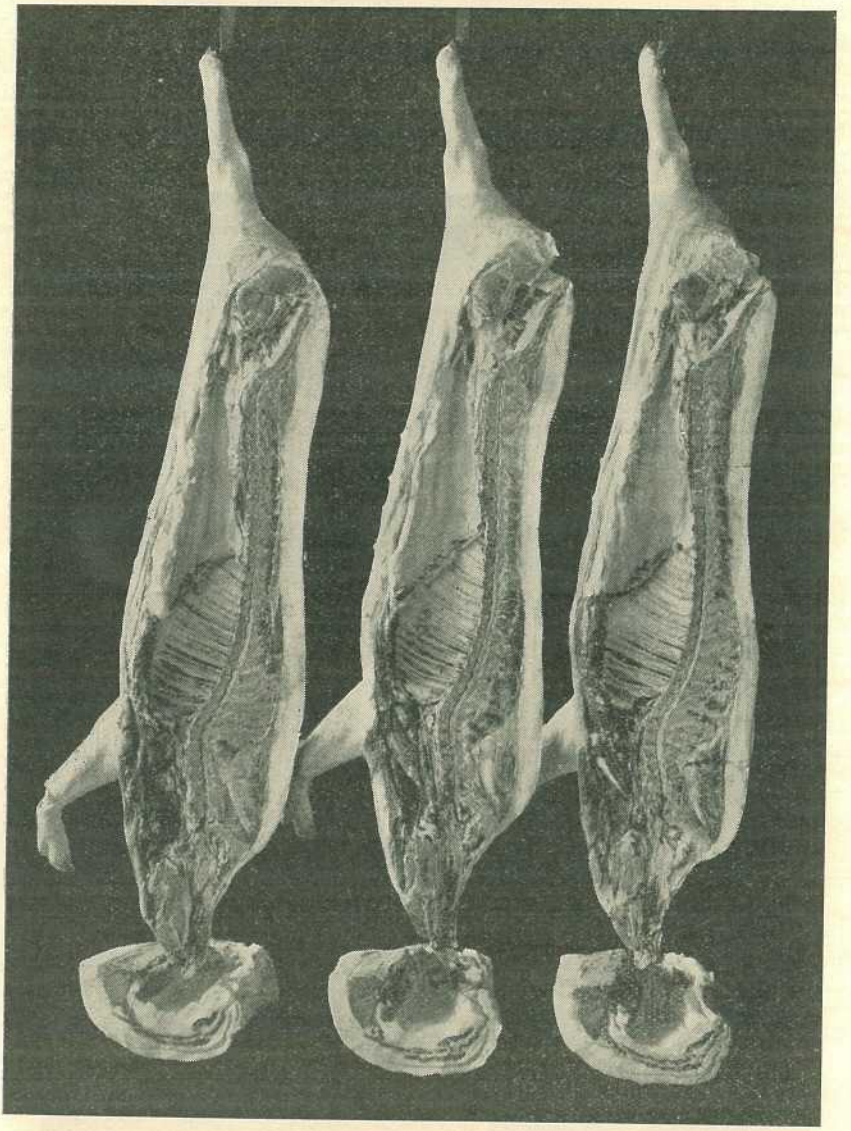
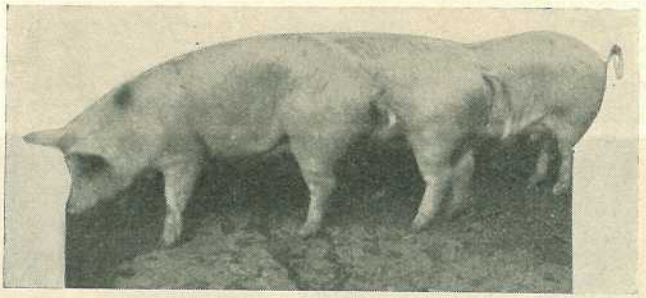


**Plate 166.**

Catalogue No. 523. This was a pen of Large Black or Large Black crosses entered by Mr. H. E. Buhle, Boonah. These pigs were very much too fat and so lost many marks in the streak, backfat thickness, and body length.

The carcase weights from left to right are 173 lb., 176 lb., 171 lb.

These pigs were last in the awards.



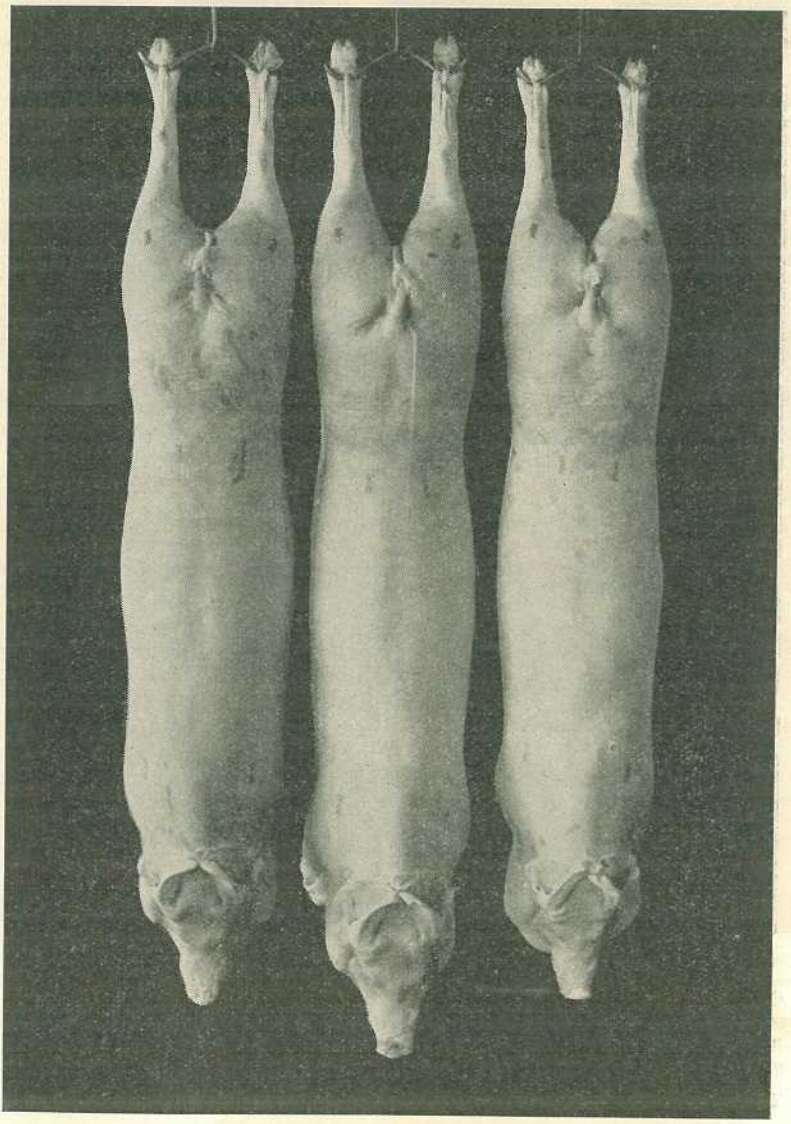


Plate 167.
Catalogue No. 524 (see opposite page).

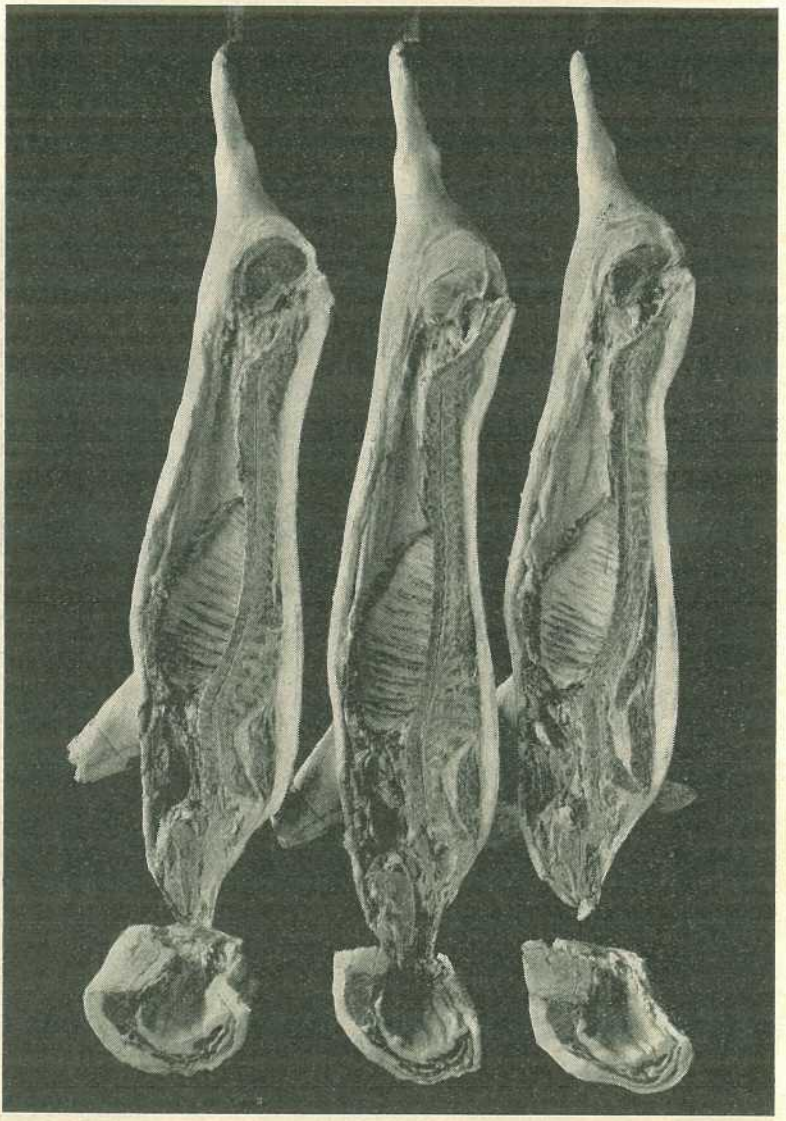
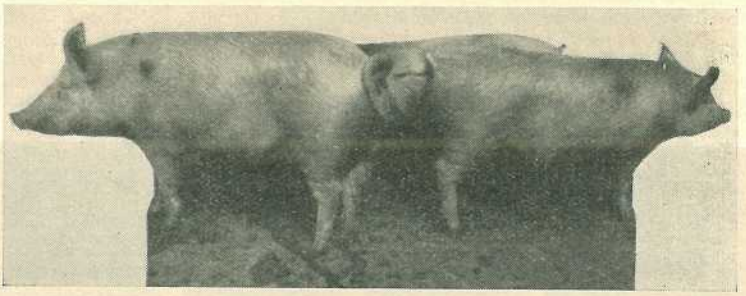


Plate 168.

Catalogue No. 524, an entry of Large Whites exhibited by Mr. J. A. Heading, Murgon. These pigs gained third place in the live judging, but after slaughter the pigs weighing 152 and 147 lb. were found to be too fat, and these two carcases lost heavily in marks for backfat and body length. The other carcase scored well, gaining a total of 71.8 per cent.

The carcase weights from left to right are 152 lb., 155 lb., 147 lb.



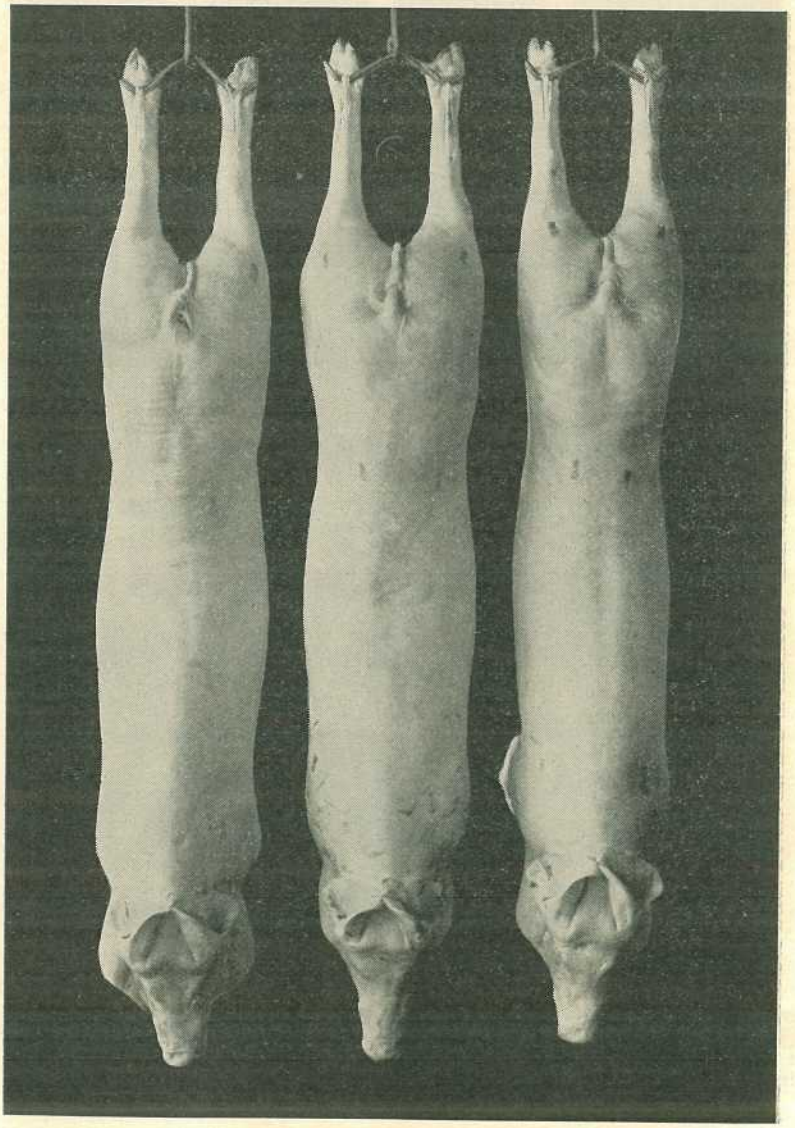


Plate 169.
Catalogue No. 525 (see opposite page).

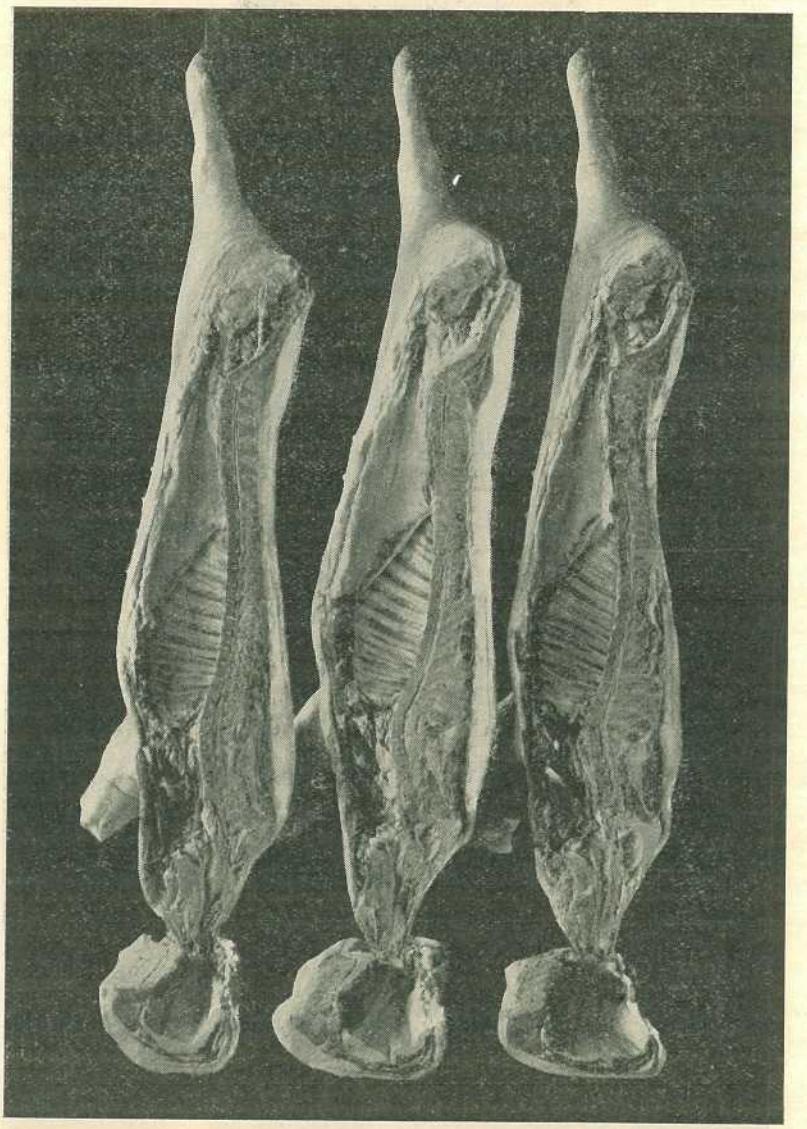
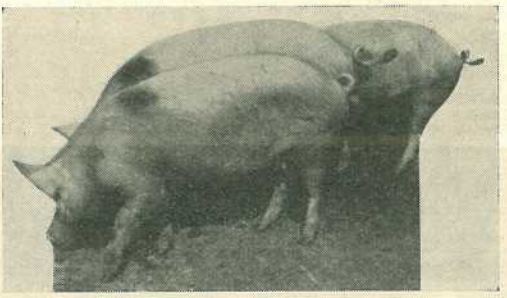


Plate 170.

Catalogue No. 525, an entry of Large Whites exhibited by Mr. J. M. Newman, Caboolture.

These carcases were somewhat uneven and came sixth in the carcase section.

The carcase weights from left to right are 152 lb., 168 lb., 143 lb. The 168-lb. carcase is too fat, and the 143-lb. carcase is too thin.



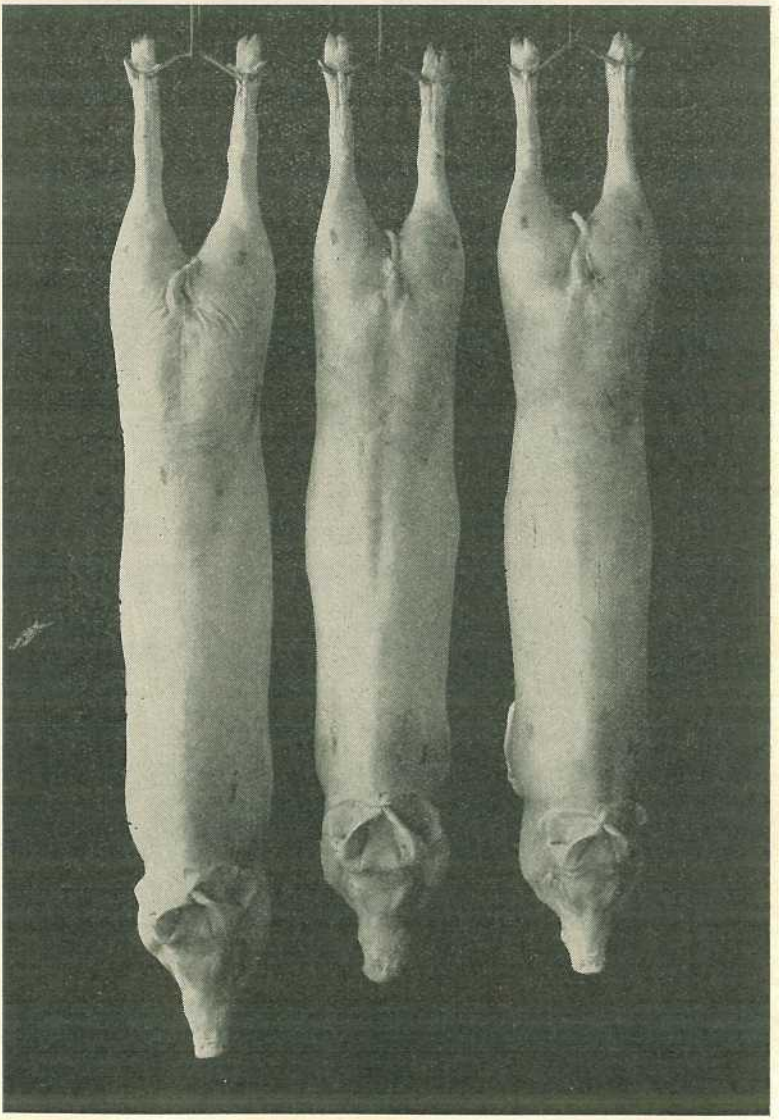


Plate 171.
Catalogue No. 527 (see opposite page).

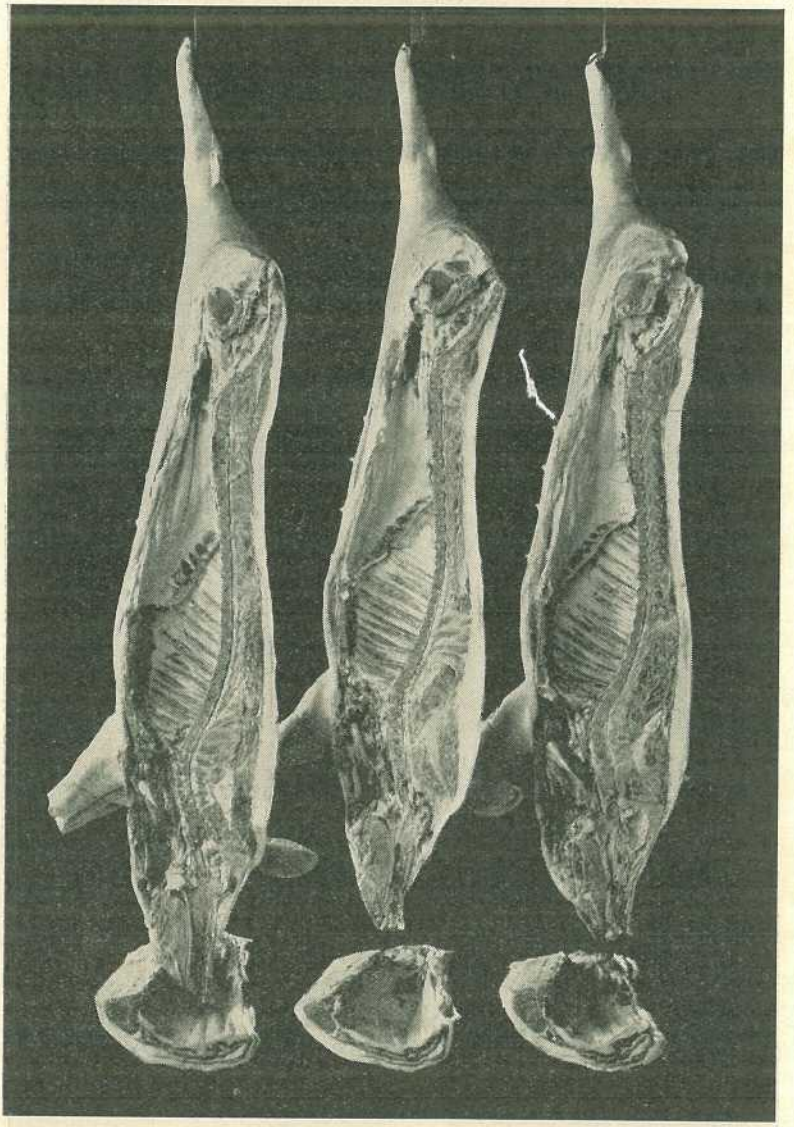
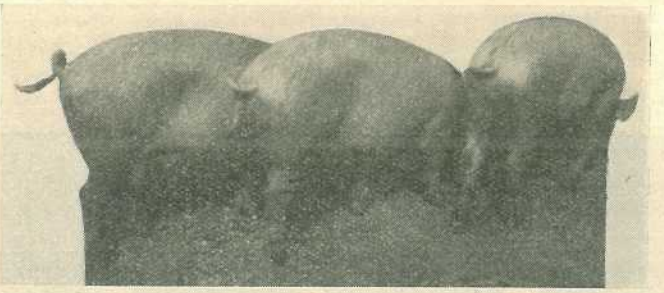


Plate 172.

Catalogue No. 527 were Large White x Middle White, exhibited by Messrs. C. W. Thiele and Sons, Bundaberg. These pigs were deficient in the hams but scored well for their light shoulders. They were long, lean pigs and came second in the carcase class and in the aggregate.

The dressed carcase weights from left to right were 142 lb., 123 lb., 134 lb.

These pigs scored the highest marks for body length and for backfat thickness; the lightest pig was somewhat immature and so lost points on muscle development.



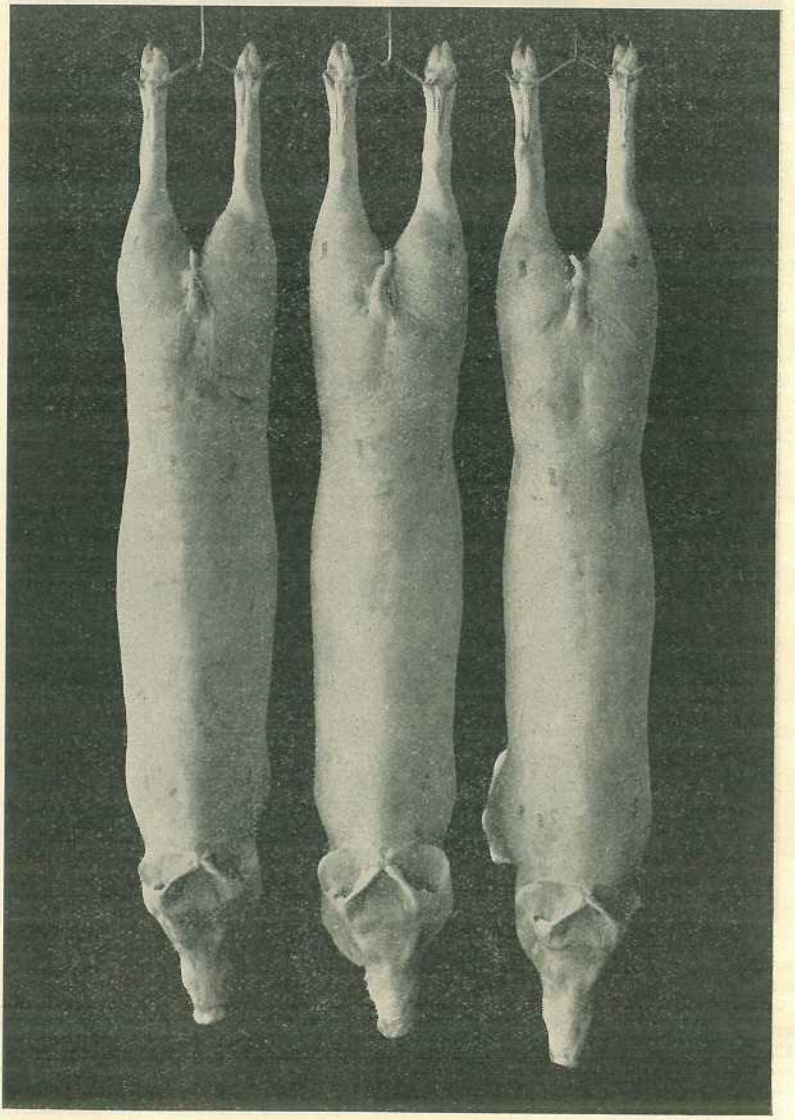


Plate 173.
Catalogue No. 528 (see opposite page).

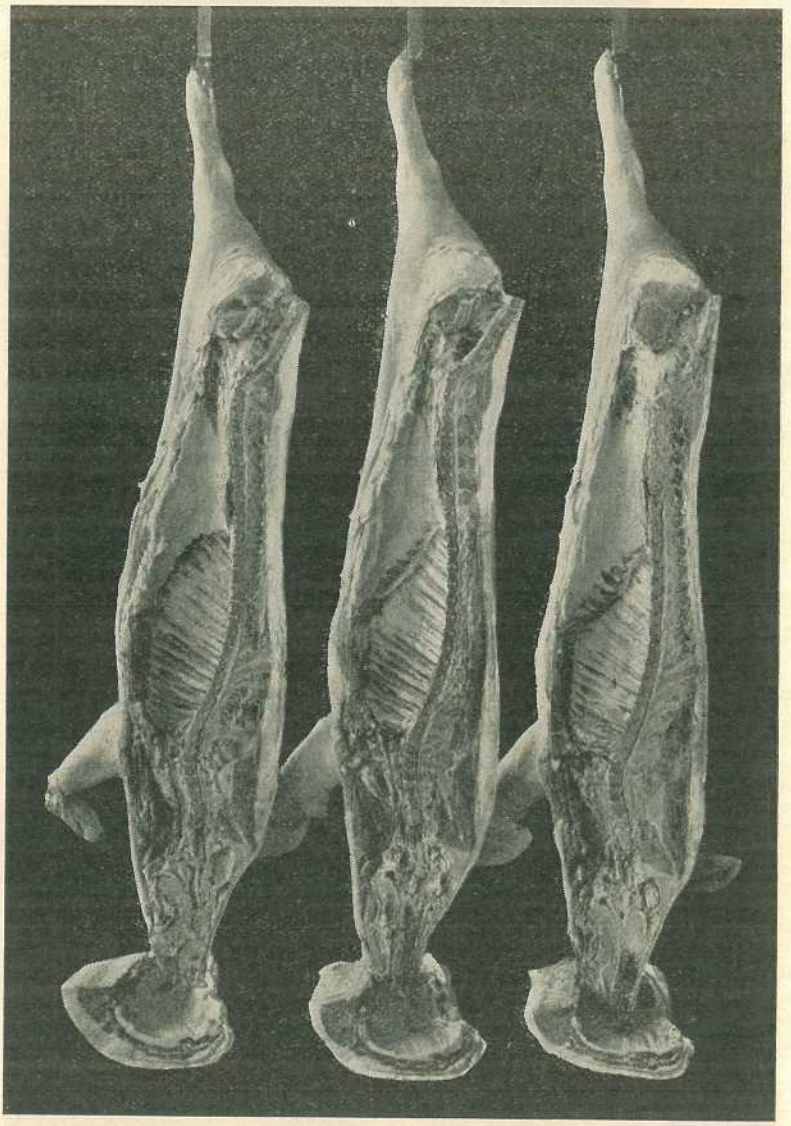
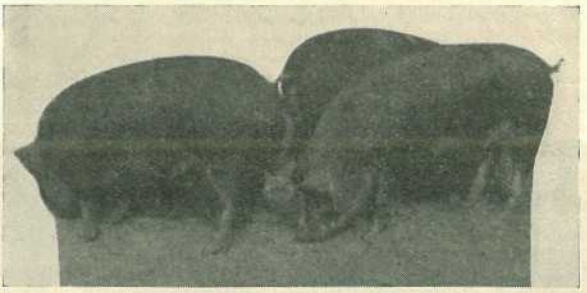


Plate 174.

Catalogue No. 528 were Large White grades, shown by Messrs. C. W. Thiele and Sons, Bundaberg; they were placed third in the carcase class and in the aggregate.

The dressed carcase weights from left to right are 143 lb., 148 lb., 151 lb.

These pigs scored fairly well throughout, their best features being the backfat thickness and the streaks.



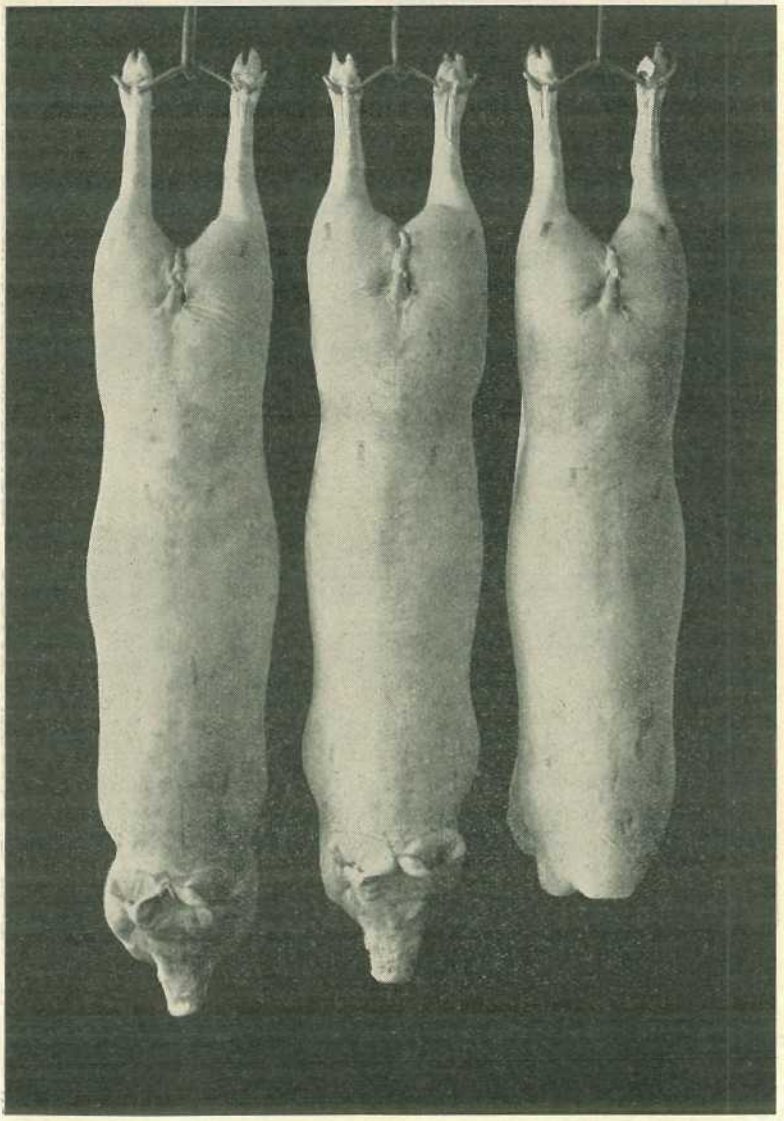


Plate 175.
Catalogue No. 529 (see opposite page).

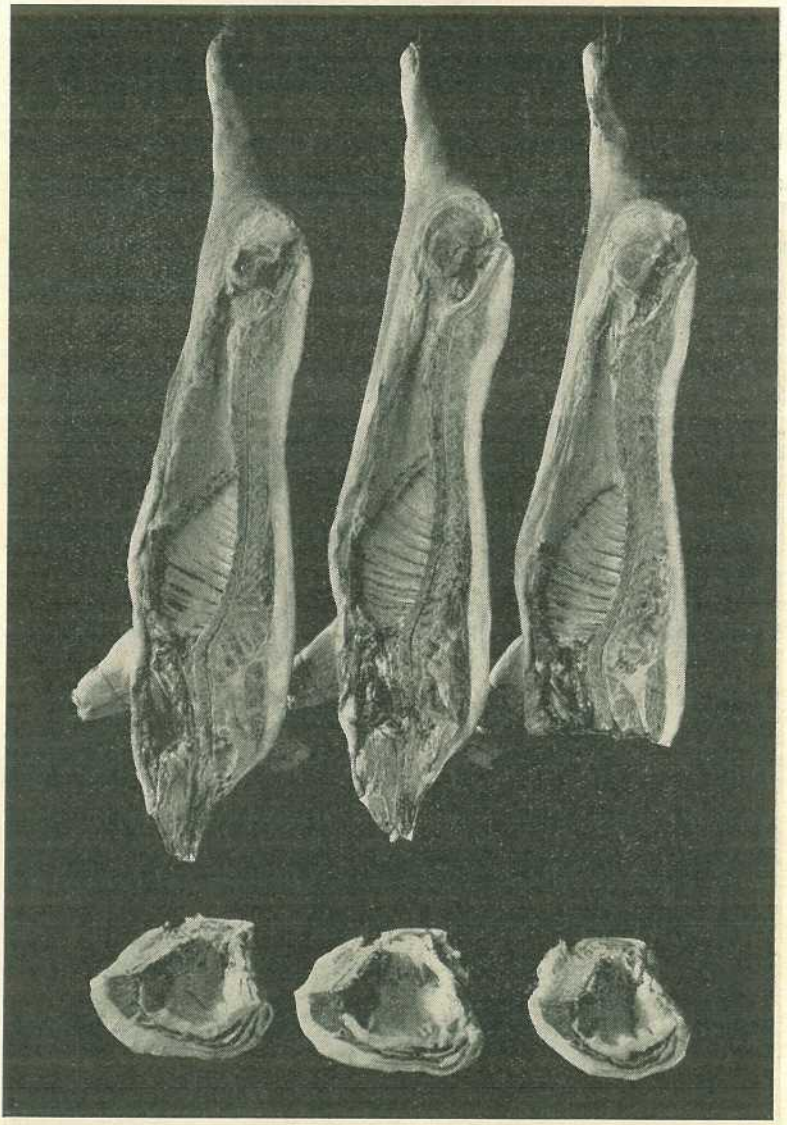
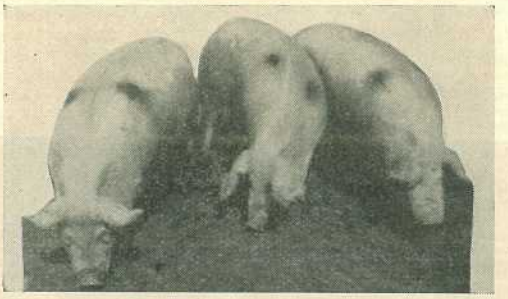


Plate 176.

Catalogue No. 529 were an entry of Berkshire x Tamworth from Mr. H. Thomas, Tabooba. The dressed weights were 138 lb., 138 lb., 131 lb.

These pigs were too fat and very much too short. The carcases were placed 9th.



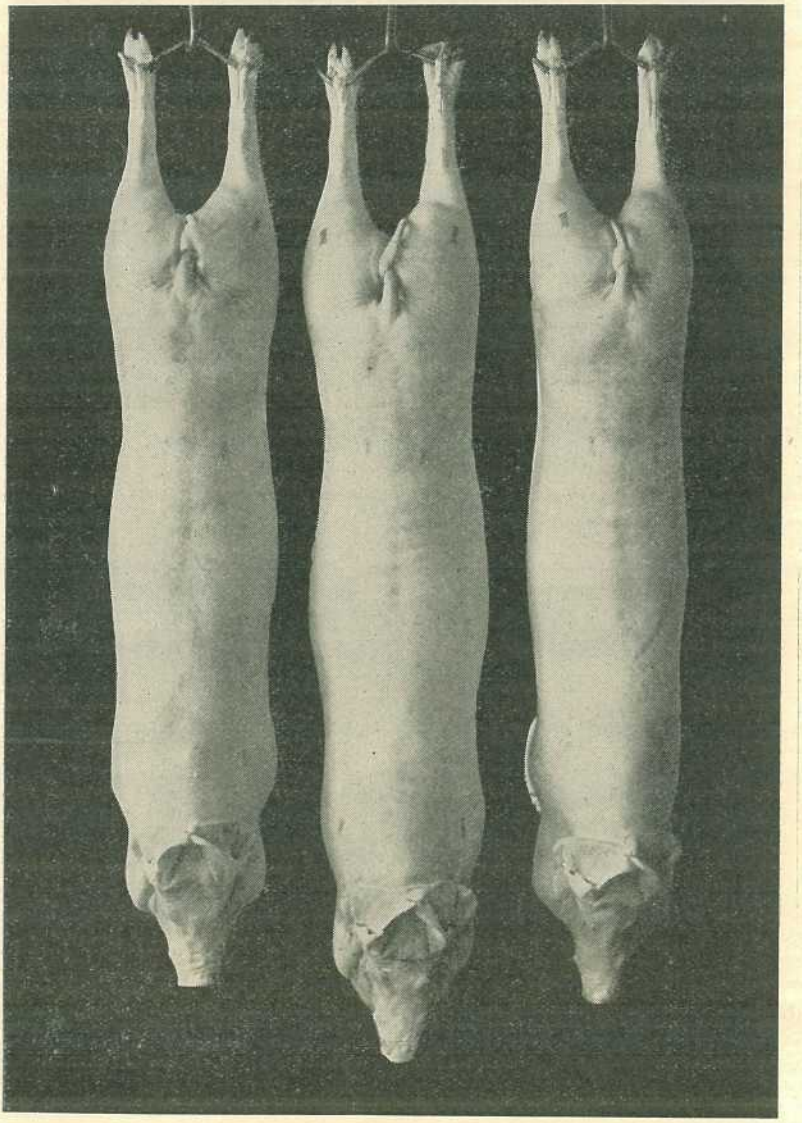


Plate 177.
Catalogue No. 530 (see opposite page).

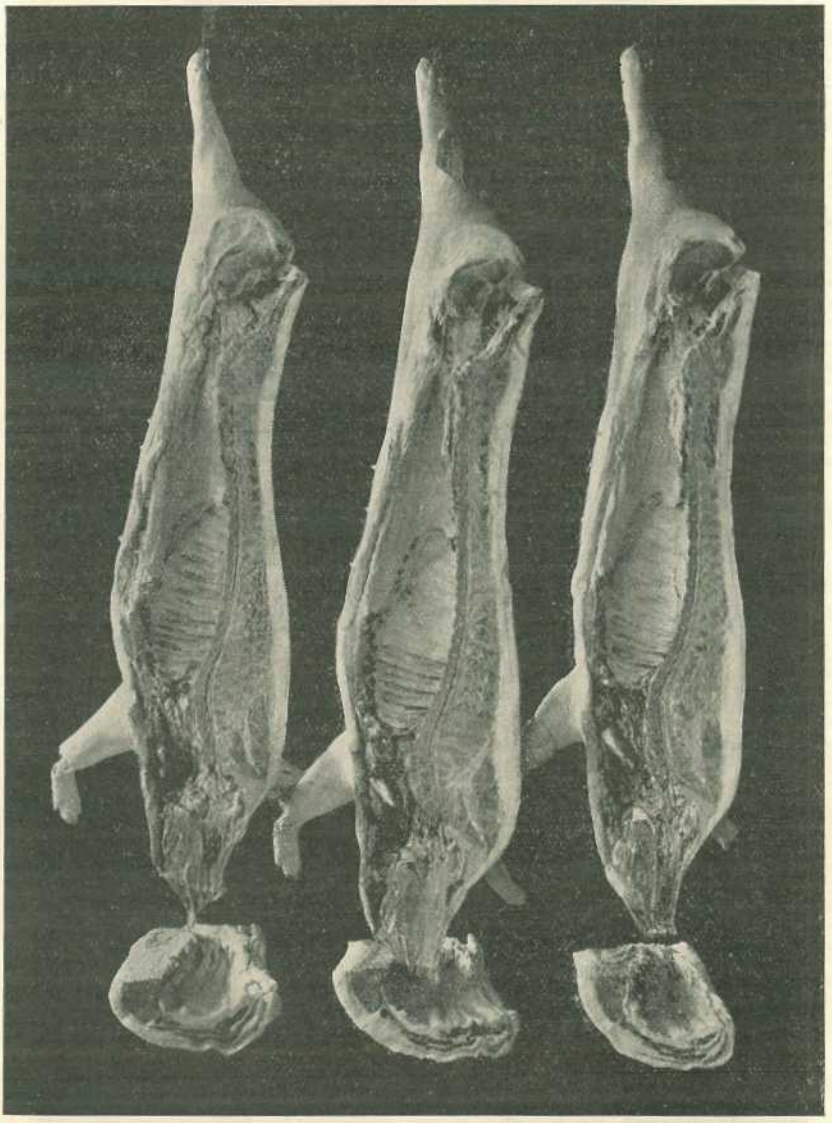
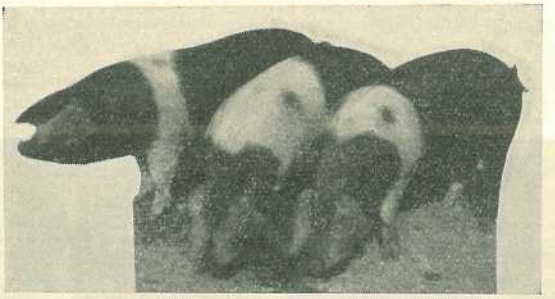


**Plate 178.**

Catalogue No. 530 were Mr. H. Thomas's entry, described as Large White x Berkshire. They were placed fifth. The carcase weights from left to right are 151 lb., 172 lb., 147 lb.

The 147-lb. pig was much too fat for its weight, and the carcases were all too short.



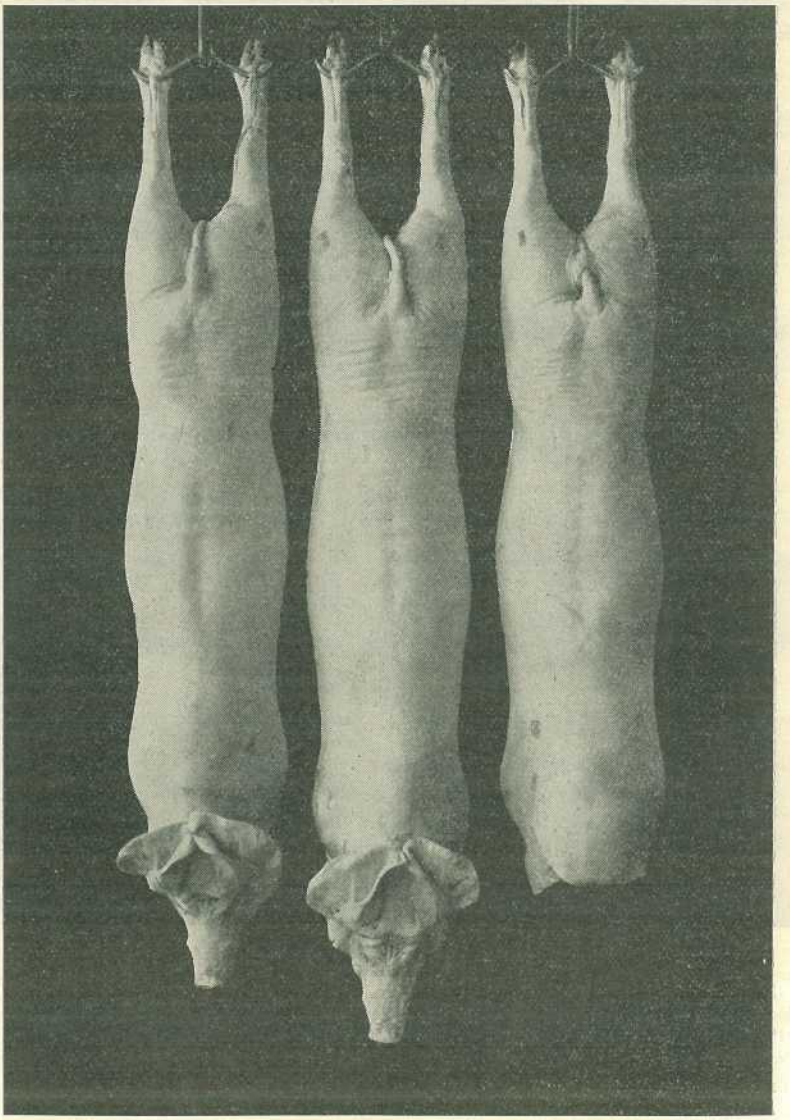


Plate 179.
Catalogue No. 531 (see opposite page).

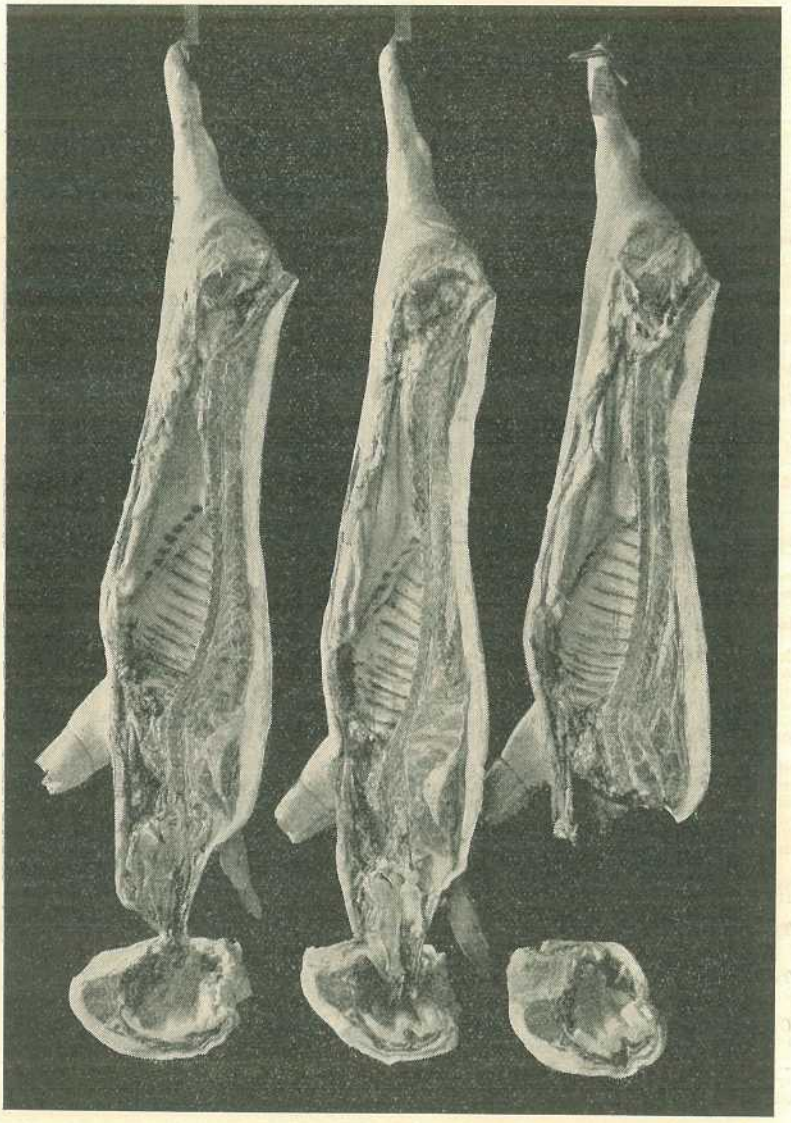


Plate 180.

Catalogue No. 531 were Mr. R. Turpin's entry of Wessex Saddlebacks. These pigs came fourth in the competition.

The carcase weights from left to right are 145 lb., 161 lb., 163 lb.

TABLE I.

| | Maximum Marks. | Catalogue No. 521. Tattoo 521. Carcase Weights on 22-8-38. | | | Total Per Cent. of Three Pigs. | Catalogue No. 522. Tattoo 052. Carcase Weights on 22-8-38. | | | Total Per Cent. of Three Pigs. |
|---|---|---|---|---|---|---|---|---|---|
| | | 129 | 137 | 137 | | 159 | 155 | 155 | |
| AWARDS FOR LIVE PIGS. | | | | | | | | | |
| Condition .. .. .. | 70 | | 68 | | 97·1 | | 69 | | 98·5 |
| Uniformity and type .. | 20 | | 18 | | 90·0 | | 19 | | 95·0 |
| General appearance .. .. | 10 | | 8 | | 80·0 | | 10 | | 100·0 |
| Total .. .. | 100 | | 94 | | 94·0 | | 98 | | 98·0 |
| AWARDS FOR CARCASES. | | | | | | | | | |
| A. By inspection— | | | | | | | | | |
| Skin—Smooth and fine.. | 5 | 4½ | 4½ | 4½ | 90·0 | 4 | 4 | 4 | 80·0 |
| Fat—Firm .. .. | 10 | 7½ | 7½ | 7½ | 75·0 | 7 | 8½ | 8½ | 80·0 |
| Hams—Well-filled and fine-boned .. .. | 8 | 5 | 5½ | 5½ | 66·6 | 4 | 6 | 5 | 62·5 |
| Shoulders—Light .. | 7 | 5 | 5½ | 4½ | 71·4 | 4½ | 4½ | 4½ | 64·2 |
| Streak—Thick, full of lean meat .. .. .. | 12 | 9 | 7½ | 9 | 70·8 | 5½ | 7½ | 10½ | 65·2 |
| B. By measurement (in mms.)— | | | | | | | | | |
| Eye muscle of loin—Thick | 28 | [44] 19 | [47] 22 | [42] 17 | 69·0 | [35] 5 | [41] 15 | [50] 24 | 52·3 |
| Back-fat thickness—Correct proportion to weight .. .. .. | 20 | [20] 17 | [18] 19 | [22] 17 | 88·3 | [24] 17 | [24] 17 | [20] 19 | 88·3 |
| Body—Long, in proportion to weight .. | 20 | [723] 10 | [747] 10 | [740] 9 | 48·3 | [743] 2 | [735] 0 | [725] 0 | 3·3 |
| Leg length—Short, in proportion to weight .. | 5 | [559] 3 | [564] 4 | [534] 5 | 75·0 | [610] 0 | [570] 5 | [576] 4 | 60·0 |
| Total .. .. | 115 | 80 | 85½ | 79 | | 49 | 67½ | 79½ | |
| Total (three carcases) | 345 | | 244½ | | First 70·86 | | 196 | | Eighth 56·81 |
| Grand Total (live pigs and carcases) | 445 | | 338½ | | First 76·06 | | 294 | | Equal Seventh 66·06 |

NOTE.—Measurements for eye muscle, back-fat thickness, body length, and leg length are in millimetres, indicated by the black figures in brackets, *e.g.* [44].

TABLE II.

| — | Maximum Marks. | Catalogue No. 523. Tattoo 523. Carcase Weights on 22-8-38. 176 | 173 | 171 | Total Per Cent. of Three Pigs. | Catalogue No. 524. Tattoo 524. Carcase Weights on 22-8-38. 152 | 155 | 147 | Total Per Cent. of Three Pigs. |
|---|---|---|---|---|---|---|---|---|---|
| AWARDS FOR LIVE PIGS. | | | | | | | | | |
| Condition .. .. .. | 70 | | 68½ | | 97·8 | | 69 | .. | 98·5 |
| Uniformity and type .. | 20 | | 18 | | 90·0 | | 18 | | 90·0 |
| General appearance .. .. | 10 | | 10 | | 100·0 | | 10 | | 100·0 |
| Total .. .. | 100 | | 96½ | | 96·5 | | 97 | | 97·0 |
| AWARDS FOR CARCASES. | | | | | | | | | |
| A. By inspection— | | | | | | | | | |
| Skin—Smooth and fine.. | 5 | 4 | 4 | 4 | 80·0 | 4½ | 4½ | 4½ | 90·0 |
| Fat—Firm .. .. | 10 | 9 | 9 | 9 | 90·0 | 10 | 9 | 9½ | 95·0 |
| Hams—Well-filled and fine-boned .. .. | 8 | 6 | 5½ | 4 | 64·5 | 6 | 5 | 6 | 70·8 |
| Shoulders—Light .. | 7 | 5½ | 5½ | 5½ | 78·5 | 5 | 5 | 5 | 71·4 |
| Streak—Thick, full of lean meat .. .. .. | 12 | 3½ | 3 | 3½ | 27·7 | 7 | 6½ | 6 | 54·1 |
| B. By measurement (in mms.)— | | | | | | | | | |
| Eye muscle of loin—thick | 28 | [50] 23 | [43] 16 | [45] 18 | 67·8 | [44] 18 | [47] 21 | [40] 14 | 63·0 |
| Back-fat thickness—Correct proportion to weight .. .. | 20 | [37] 0 | [41] 0 | [40] 0 | 0·0 | [29] 7 | [18] 17 | [30] 1 | 41·6 |
| Body—Long, in proportion to weight .. | 20 | [743] 0 | [760] 0 | [772] 1 | 1·6 | [732] 1 | [791] 11 | [737] 4 | 26·6 |
| Leg length—Short, in proportion to weight .. | 5 | [571] 5 | [584] 5 | [537] 5 | 100·0 | [560] 5 | [588] 3 | [544] 5 | 86·6 |
| Total .. .. | 115 | 56 | 48 | 50 | | 63½ | 82 | 55 | |
| Total (three carcases) | 345 | | 154 | | Tenth 44·63 | | 200½ | | Seventh 58·11 |
| Grand Total (live pigs and carcases) .. | 445 | | 250½ | | Tenth 56·29 | | 297½ | | Sixth 66·85 |

NOTE.—Measurements for eye muscle, back-fat thickness, body length, and leg length are in millimetres, indicated by the black figures in brackets, *e.g.* [44].

TABLE III.

| — | Maximum Marks. | Catalogue No. 525. Tattoo 525. Carcase Weights on 22-8-38. 168 | 152 | 143 | Total Per Cent. of Three Pigs. | Catalogue No. 527. Tattoo 527. Carcase Weights on 22-8-38. 142 | 123 | 134 | Total t Per Cen. of Three Pigs. |
|---|---|---|---|---|---|---|---|---|---|
| AWARDS FOR LIVE PIGS. | | | | | | | | | |
| Condition .. .. .. | 70 | 67 | | | 95·7 | 67½ | | | 96·4 |
| Uniformity and type .. | 20 | 17 | | | 85·0 | 19 | | | 95·0 |
| General appearance .. .. | 10 | 9 | | | 90·0 | 9½ | | | 95·0 |
| Total .. .. | 100 | 93 | | | 93·0 | 96 | | | 96·0 |
| AWARDS FOR CARCASES. | | | | | | | | | |
| A. By inspection— | | | | | | | | | |
| Skin—Smooth and fine .. | 5 | 4 | 4 | 3½ | 76·6 | 4 | 4 | 4 | 80·0 |
| Fat—Firm .. .. | 10 | 9 | 9 | 7½ | 85·0 | 8 | 8½ | 9 | 85·0 |
| Hams—Well-filled and fine-boned .. .. | 8 | 6 | 5 | 5½ | 68·7 | 2 | 3 | 4 | 37·5 |
| Shoulders—Light .. | 7 | 4½ | 5 | 5 | 69·0 | 6½ | 6½ | 6½ | 92·8 |
| Streak—Thick, full of lean meat .. .. | 12 | 9½ | 9½ | 7 | 72·2 | 9 | 8 | 10 | 75·0 |
| B. By measurement (in mms.)— | | | | | | | | | |
| Eye muscle of loin—Thick | 28 | [44] 17 | [39] 13 | [47] 21 | 60·7 | [45] 19 | [36] 9 | [40] 15 | 51·1 |
| Back-fat thickness—Correct proportion to weight .. .. | 20 | [31] 4 | [25] 16 | [10] 4 | 40·0 | [16] 16 | [17] 20 | [19] 20 | 93·3 |
| Body—Long, in proportion to weight .. | 20 | [755] 0 | [770] 9 | [762] 11 | 33·3 | [772] 13 | [730] 13 | [765] 16 | 70·0 |
| Leg length—Short, in proportion to weight | 5 | [572] 5 | [584] 3 | [567] 4 | 75·0 | [625] 0 | [565] 2 | [557] 4 | 40·0 |
| Total .. .. | 115 | 59 | 73½ | 68½ | | 77½ | 74 | 88½ | |
| Total (three carcases) | 345 | 201 | | | Sixth 58·26 | 240 | | | Second 69·56 |
| Grand Total (live pigs and carcases) .. | 445 | 294 | | | Equal Seventh 66·06 | 336 | | | Second 75·5 |

NOTE.—Measurements for eye muscle, back-fat thickness, body length, and leg length are in millimetres, indicated by the black figures in brackets, *e.g.* [44].

TABLE IV.

| —— | Maximum Marks. | Catalogue No. 528. Tattoo 528. Carcase Weights on 22-8-38. 143 | 151 | 148 | Total Per Cent. of Three Pigs. | Catalogue No. 529. Tattoo 529. Carcase Weights on 22-8-38. 138 | 131 | 138 | Total Per Cent. of Three Pigs. |
|---|---|---|---|---|---|---|---|---|---|
| AWARDS FOR LIVE PIGS. | | | | | | | | | |
| Condition .. .. .. | 70 | | 67½ | | 96·4 | | 68 | | 97·1 |
| Uniformity and type .. | 20 | | 19 | | 95·0 | | 18 | | 90·0 |
| General appearance .. .. | 10 | | 9½ | | 95·0 | | 9 | | 90·0 |
| Total .. .. | 100 | | 96 | | 96·0 | | 95 | | 95·0 |
| AWARDS FOR CARCASES. | | | | | | | | | |
| A. By inspection— | | | | | | | | | |
| Skin—Smooth and fine | 5 | 4 | 4 | 4 | 80·0 | 4 | 4 | 4 | 80·0 |
| Fat—Firm .. .. | 10 | 8 | 7 | 7½ | 75·0 | 8 | 8½ | 8½ | 83·3 |
| Hams—Well-filled and fine-boned .. .. | 8 | 4½ | 4 | 4½ | 54·1 | 7 | 7 | 8 | 91·6 |
| Shoulders—Light .. | 7 | 6 | 6 | 6 | 85·7 | 4 | 4½ | 3½ | 57·1 |
| Streak—Thick, full of lean meat .. .. | 12 | 10 | 9½ | 9 | 79·1 | 6½ | 6 | 6 | 51·3 |
| B. By measurement (in mms.) — | | | | | | | | | |
| Eye muscle of loin—Thick | 28 | [40] 14 | [43] 17 | [46] 20 | 60·7 | [46] 21 | [38] 13 | [45] 20 | 64.2 |
| Back-fat thickness—Correct proportion to weight .. .. | 20 | [24] 16 | [16] 15 | [21] 19 | 83·3 | [26] 10 | [22] 17 | [28] 4 | 51·6 |
| Body—Long, in proportion to weight .. | 20 | [765] 12 | [790] 13 | [770] 11 | 60·0 | [690] 0 | [712] 5 | [688] 0 | 8·3 |
| Leg length—Short, in proportion to weight | 5 | [583] 2 | [632] 0 | [580] 3 | 33·3 | [498] 5 | [525] 5 | [528] 5 | 100·0 |
| Total .. .. | 115 | 76½ | 75½ | 84 | | 65½ | 70 | 59 | |
| Total (three carcases) | 345 | | 236 | | Third 68·4 | | 194½ | | Ninth 56·38 |
| Grand Total (live pigs and carcases) .. | 445 | | 332 | | Third 74·6 | | 289½ | | Ninth 65·05 |

NOTE.—Measurements for eye muscle, back-fat thickness, body length, and leg length are in millimetres, indicated by the black figures in brackets, *e.g.* [44].

TABLE V.

| — | Maximum Marks. | Catalogue No. 530. Tattoo 530. Carcase Weights on 22-8-38. 147 | 151 | 172 | Total Per Cent. of Three Pigs. | Catalogue No. 531. Tattoo 531. Carcase Weights on 22-8-38. 163 | 145 | 161 | Total Per Cent. of Three Pigs. |
|---|---|---|---|---|---|---|---|---|---|
| AWARDS FOR LIVE PIGS. | | | | | | | | | |
| Condition .. .. .. | 70 | | 68½ | | 97·8 | | 70 | | 100·0 |
| Uniformity and type .. | 20 | | 18 | | 90·0 | | 19 | | 95·0 |
| General appearance .. .. | 10 | | 10 | | 100·0 | | 8½ | | 85·0 |
| Total .. .. | 100 | | 96½ | | 96·5 | | 97½ | | 97·5 |
| AWARDS FOR CARCASES. | | | | | | | | | |
| A. By inspection— | | | | | | | | | |
| Skin—Smooth and fine .. | 5 | 4½ | 4 | 4 | 83·0 | 4½ | 4½ | 4½ | 90·0 |
| Fat—Firm .. .. | 10 | 8 | 8 | 8 | 80·0 | 8 | 8½ | 8½ | 85·0 |
| Hams—Well-filled and fine-boned .. .. | 8 | 5½ | 5½ | 5½ | 68·7 | 5 | 4½ | 4 | 56·2 |
| Shoulders—Light .. | 7 | 5½ | 4 | 4½ | 66·6 | 4 | 4½ | 4½ | 61·9 |
| Streak—Thick, full of lean meat .. .. | 12 | 9½ | 11 | 7½ | 77·7 | 6 | 6 | 7½ | 54·1 |
| B. By measurement (in mms.)— | | | | | | | | | |
| Eye muscle of loin—Thick | 28 | [45] 19 | [43] 17 | [48] 21 | 67·8 | [45] 18 | [48] 22 | [45] 18 | 69·0 |
| Back-fat thickness—Correct proportion to weight .. .. | 20 | [30] 1 | [22] 19 | [27] 16 | 60·0 | [28] 12 | [26] 12 | [26] 16 | 66·6 |
| Body—Long, in proportion to weight .. | 20 | [745] 6 | [752] 5 | [813] 10 | 35·0 | [787] 8 | [756] 8 | [805] 12 | 46·6 |
| Leg length—Short, in proportion to weight | 5 | [554] 5 | [530] 5 | [542] 5 | 100·0 | [578] 5 | [538] 5 | [585] 4 | 93·3 |
| Total .. .. | 115 | 64 | 78½ | 81½ | | 71 | 75 | 79 | |
| Total (three carcases) | 345 | | 224 | | Fifth 64·92 | | 225 | | Fourth 65·18 |
| Grand total (live pigs and carcases) .. | 445 | | 320½ | | Fifth 72·02 | | 322½ | | Fourth 72·47 |

NOTE.—Measurements for eye muscle, back-fat thickness, body length, and leg length are in millimetres, indicated by the black figures in brackets, *e.g.* [44].

# The Queensland Sugar Industry.

## Bureau of Sugar Experiment Stations.*

### STATISTICS OF THE 1937 CROP.

The yield of raw sugar in Queensland for the 1937 crop was 763,325 tons of 94 n.t. This was an all-time record, exceeding that of the previous record of 1936 by some 18,677 tons.

The area harvested was 249,683 acres, which represents an increase of 4,531 acres over the area harvested in 1936.

The yield per acre was 20·6 tons of cane and 3·06 tons of sugar. The latter is a record figure, as is also the tons of cane required to make a ton of 94 n.t. sugar—6·73. The average area harvested per planter was 30 acres.

Over 440,000 tons of sugar were exported; this represents about 30,000 tons in excess of the annual Australian export quota. No. 1 pool sugar averaged £17 11s. per ton, while the value of *all* sugar (including excess) was £15 6s. 5d. This is the second lowest average value recorded since 1914. The total value of the crop was £11,686,640—an all-time record.

### MOLASSES PRODUCTION.

During 1937, some 20½ million gallons of molasses were disposed of by the raw sugar mills; in view of the growing interest in the utilization of this product for the production of alcohol, the accompanying graph (Plate 181) is presented. It will be observed that the quantity absorbed by distilleries (7 million gallons) is the highest used for this purpose; an increased quantity was employed as manure (3,360,000 gallons), while 3,910,000 gallons were disposed of as stock feed. The amount required by the mills as fuel was 5½ million gallons. The amount run to waste was negligible, being less than 500,000 gallons, or 2½ per cent. of the total production.

### ADVISORY BOARD.

The Advisory Board held two meetings during the year. A new Board was constituted in March, and is now composed of Messrs. N. H. Wellard (Mossman) and C. W. Thiele (Bundaberg), representatives of canegrowers; Messrs. J. Smith (Mackay) and A. V. Thorp (Nambour), representatives of millers; with the Government nominees, the Hon. F. W. Bulcock (Minister for Agriculture), as Chairman, and the Director (Dr. H. W. Kerr).

During the year the Board gave close attention to a number of matters affecting the work of the Bureau, and notably in devising plans for the more effective working of this phase of sugar production. Disease control, improvement of the field service, the utilization of by-products, and the work of the Pests Boards, were amongst the subjects discussed and dealt with. The work of the Board has assisted very materially in promoting increased efficiency in the operation of the Bureau.

* Each year the Director is required to prepare for Parliament a report of the work of the Sugar Experiment Stations, of which this article is a summary.

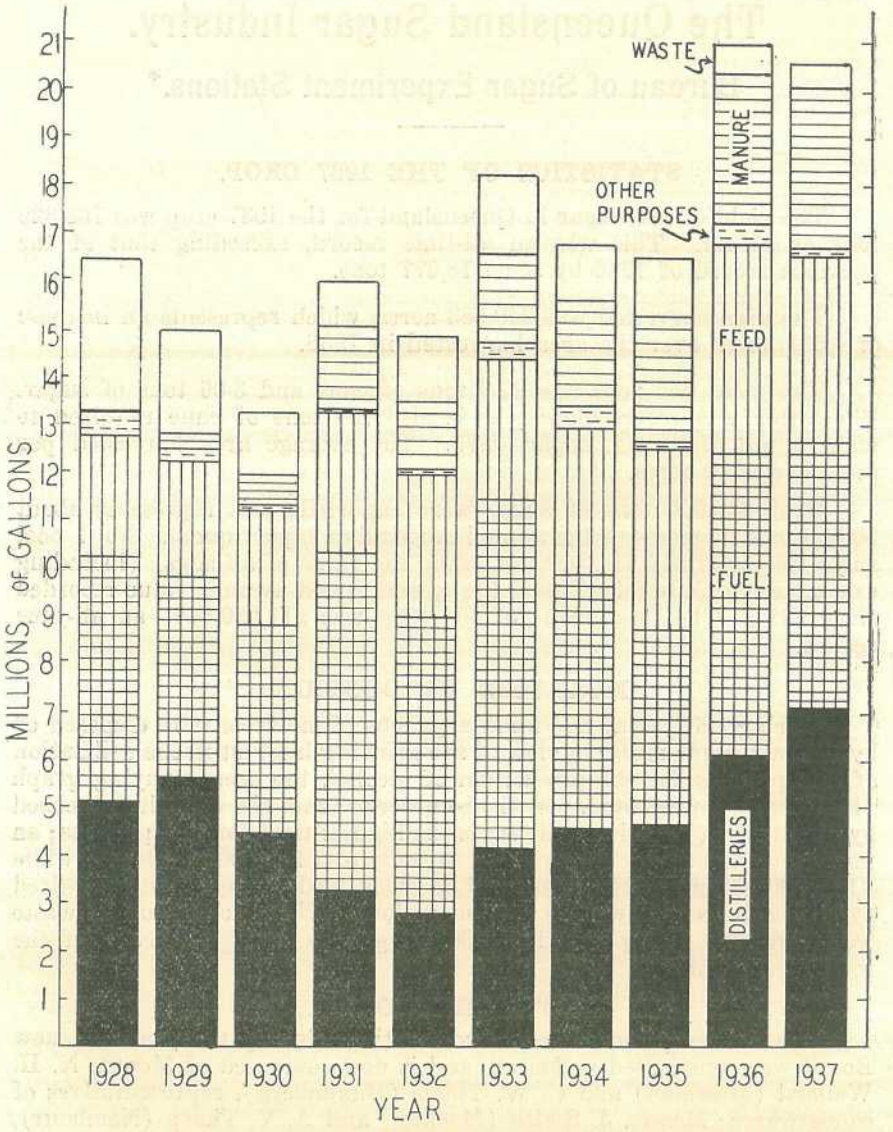



Plate 181.

Illustrating the trends in molasses utilization over the past ten years. The amount now run to waste is insignificant.

## SOILS AND AGRICULTURE.

### Additional Field Staff.

In order to provide a more effective field service, it was agreed by the Advisory Board that three cadets should be appointed and trained, provided suitable men are offering. It is anticipated that such appointments will be finalised in the near future. Doubtless this action will be warmly welcomed by canegrowers.

**Farm Trial Work.**

Farm experimental work continues to be a major feature of the extension service. Fertility plots have been continued, while there has been a marked increase in the proportion of farm varietal trials, consequent upon the release of a series of new varieties for trial purposes, in North Queensland.

**Soil Surveys.**

The agricultural chemists of the Bureau have recently completed an investigation which has been pursued for the past ten years, and which has demonstrated that the laboratory fertility tests on soils agree very closely with field experience with fertilizers. This finding paves the way for systematic soil fertility surveys, leading eventually to a thorough knowledge of the fertilizer needs of every cane field of the State.

The submitting of soil samples by growers, for analysis and fertilizer advice, is increasing in popularity as the value of this advice becomes appreciated; during the year 528 soils were tested in the Brisbane laboratories of the Bureau. This service is provided free of charge to canegrowers.

**Experiment Station Field Days.**

Annual field days at the Sugar Experiment Stations are well supported by canegrowers. Functions of this nature were held at Bundaberg and Mackay during the past year; in the future, Meringa will also have its field day. The increased standard and greater breadth of the work which it is now possible to carry out at the stations holds much of interest to farmers, and the field day provides an excellent opportunity for the officers of the Bureau to meet growers, and demonstrate their work.

**Legume and Fodder Crops.**

Considerable work has been done in an attempt to provide for canegrowers, more suitable legumes than are at present available, and fodder grasses which may prove useful for paddocks in which stock are grazed, or which could be harvested for fodder or hay-making purposes. Doubtless canegrowers could save considerable expenditure on horse feed if they would devote closer attention to the production of crops for the purpose: even where the use of a supplementary ration of concentrated protein meal were necessary, the utilization of molasses as a source of energy food would reduce feeding costs very substantially.

Of the legumes under tests, clovers, lespedezas, and soybeans were found to be generally unsuitable, but very encouraging results have been recorded with two species of Crotalaria. Sunn hemp (*C. juncea*) is a vigorous grower, which gave good yields at Meringa and Bundaberg: but it is probably not so suitable as *C. goreensis,* which will be known in future, as Gambia pea. For long fallow purposes it appears to be very useful, and further plantings on the Experiment Stations and on selected farms will be made towards the end of the year.

Of the fodder grasses tested, white panicum, *Panicum coloratum,* and fine-stemmed Guinea grass showed promise, and will be further experimented with; white panicum was specially favoured by stock.

**Cultures for Legumes.**

The culturing of highly-efficient strains of root nodule bacteria is now being carried out in the Brisbane laboratories, and cane farmers desirous of obtaining cultures with which to inoculate legume seeds prior to planting were invited to apply for them. This service is being keenly availed of, and doubtless benefits will be derived from the practice as has been the case in overseas countries.

**Maturity Testing of Cane.**

Some years ago the officers of the Bureau were actively associated with the investigation of methods for determining the maturity of cane crops, so that the farmer would be assured of maximum returns for his product. Unfortunately, growers have not responded in a manner which would demonstrate that they fully appreciate the value of such a service. The experiment stations are not able to cope with any systematic campaign of this character, but they are willing to conduct tests for those farmers who submit regular samples taken systematically from their several fields.

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## EXPERIMENT STATION PLOT TRIALS.

Several interesting trials were harvested during 1937 on the Mackay and Bundaberg Stations. The main features of these experiments are recorded below.

**Fertility Trial, Mackay Station.**

Although the plant crop yields showed little benefit from the fertilizers applied, the ratoons exhibited unmistakable gains for top dressings of sulphate of ammonia. On all old lands the humus supply is greatly depleted, and almost without exception, substantial crop increases are regularly obtained from the use of this material. The use of the correct fertilizer in adequate amounts is one of the first essentials in the production of successful ratoons under these conditions.

The actual yields for the first ratoon crop of this trial were—

| | | |
|---|---|---|
| "No manure" plots | .. .. | 11·4 tons per acre |
| Fully fertilized plots | .. .. | 19·5 tons per acre |
| Gain from manure | .. | 8·1 tons per acre |

**Irrigation and Nitrogen Trial, Bundaberg.**

The benefits of irrigation on the red volcanic soils of the Bundaberg area are demonstrated by the results of this trial to date. The plant crop (varieties P.O.J. 2725 and P.O.J. 2878) averaged 58 tons of cane per acre (despite early frost damage), while the first ratoon yield was 42 tons per acre, although the cane received water only in alternate interspaces for the first six months of its growth, and none thereafter.

Despite these heavy crops, no outstanding gains were recorded for sulphate of ammonia, which shows quite clearly that these soils, when moderately and consistently manured, are capable of heavy yields if given the necessary moisture supply.

Of the two varieties, P.O.J. 2725 was much superior to P.O.J. 2878 under these conditions.

The averages were—

| Variety. | Plant Crop. | First Ratoons. |
|---|---|---|
| | Tons. | Tons. |
| P.O.J. 2725 .. .. .. .. .. .. .. | **63·0** | **46·6** |
| P.O.J. 2878 .. .. .. .. .. .. .. | 50·5 | 35·6 |

**Trash Trial, Bundaberg.**

An experimental block was selected in 1933, and subdivided into four plots, on two of which all trash and tops were to be conserved and ploughed under, while in the remaining two, all crop residues were to be burned annually.

For the first two cane crops, no benefits from the treatment were detected, but it is of interest to note that in 1937, the plant cane from the trash plots was slightly heavier than that for the "no trash" plots. It will be interesting to observe whether this advantage will be maintained.

This experiment will be continued for a number of years to demonstrate the cumulative effects of the treatment.

**Potash Trial, Bundaberg.**

It is recognised that crops on the red volcanic loam frequently show response to application of potash, particularly where this plantfood has not been applied consistently. On the other hand, regular applications of even moderate amounts of this material soon eliminate such deficiencies. It was therefore decided to institute a "permanent" potash trial, on some plots of which dressings of different magnitude would be applied, while on others potash would be withheld.

The first plant crop from the trial was seriously affected by the droughty conditions, and no significant effects were recorded for any of the treatments.

**Cultivation Trial, Bundaberg.**

It has been reported on frequent occasions that cultivation appears to be without influence on crop yield on the red volcanic soil, except in-so-far as it controls weeds. A trial was instituted in 1934, which combined deep grubbing (subsoiling) with surface cultivation. Three crops have now been harvested, and in no instance could any benefits from the several operations be detected. Doubtless old-established opinions in this regard must not be accepted without careful examination, in the light of specific soil types and local conditions.

**Varietal Trial, Mackay.**

The first series of three finally selected seedlings, raised on the Mackay Station since this project was initiated, have been under yield trial for the past three years. The results for the plant and first ratoon crop are now available:—

**YIELDS.—Plant and First Ratoon Crops.**

| Variety. | Plant Crop. | | First Ratoons. | |
|---|---|---|---|---|
| | Cane per Acre. | C.C.S in Cane. | Cane per Acre. | C.C.S. in Cane. |
| | Tons. | Per cent. | Tons. | Per cent. |
| Q. 813 .. .. .. | 32·0 | 16·6 | 30·4 | 16·6 |
| C. 57 .. .. .. .. | 30·6 | 17·6 | 34·3 | 18·4 |
| C. 83 .. .. .. .. | 40·0 | 16·4 | 42·7 | 16·5 |
| C. 85 .. .. .. .. | 32·8 | 16·8 | 37·9 | 16·4 |

It will be noted that C. 83 has far outyielded Q. 813 in both years, while the C.C.S. was also satisfactory. Unfortunately both C. 83 and C. 85 (which are seedlings of P.O.J. 2878) are too highly susceptible to downy mildew disease to make further plantings desirable. The variety C. 57 (now called **Q. 20**) is at least equal to Q. 813, but shows in addition a particularly high C.C.S. This variety is now in farm propagation plots, and it is anticipated that it may be released for general planting in 1939.

**Varietal Trial, Bundaberg.**

A varietal trial which included Co. 290, P.O.J. 234, P.O.J. 2725, and P.O.J. 2878 has been in progress at Bundaberg for three years. The plant and first ratoon crops both showed the outstanding value of P.O.J. 2725 in yield and C.C.S. Even during the droughty conditions of 1937, it yielded a ratoon crop of almost 20 tons per acre.

**Varietal Trial, Bundaberg.**

An experimental block, the results from which should prove of interest to Southern Queensland growers, was harvested as a plant crop in 1937. It contained all the gum-resistant P.O.J. varieties and Co. 290; the year was, however, far from favourable, due to the light rainfall, so that the results mainly reflect drought resistance. The heaviest tonnage was given by P.O.J. 2875 (22 tons per acre), but P.O.J. 2883 and P.O.J. 2878 were very little inferior. Co. 290 suffered severely from the dry conditions. In C.C.S content, P.O.J. 2883 was the best of all the high yielding canes, although it was inferior to P.O.J. 2725. The ratoons from this field, to be harvested this season, should be particularly interesting.

**Varietal Trial, with Single *v.* Double Planting, Bundaberg.**

In this trial, the varieties were Co. 290 and P.O.J. 2878: plots of "single" and "double" plantings were also provided. There was no great difference between the yields of the two varieties, but P.O.J. 2878 gave the higher C.C.S. The results for double sett planting, as against single setts in the furrow, were a net gain for the former of 3·7 tons of cane per acre, from the plant and first ratoon crops combined. This emphasises the desirability of the practice with canes which are liable to give a poor germination.

**Rotational Grazing Block, Mackay Station.**

This block of rather inferior soil is some 16 acres in area, and it has been subdivided into eight plots, each of 2 acres. These plots will be worked in an eight-year rotation, as follows:—(1) Plant cane, (2)

first ratoon, (3) grass, (4) grass, (5) grass, (6) grass, (7) grass, (8) grass. The plant cane will be preceded by a green manure crop, while a similar crop will also be planted and ploughed under before seeding to grass after the ratoon crop. In this way an attempt will be made to determine the value of such a programme in restoring the fertility of old soils. All trash and tops will be conserved, also, and returned to the soil.

While the land is in pasture it will be grazed by sheep. A flock of Merino-Corriedale ewes has been purchased, and these are mated with a Romney Marsh ram for the production of cross-bred lambs. The ewes from this mating will be retained for further cross-breeding purposes.

The results of the experiment to date are very interesting. The plant crop from Plot No. 1 yielded 26 tons of cane per acre in 1937: Plot No. 2 was planted in the spring of 1937, and Plot No. 3 in the autumn of 1938. The sheep yielded wool to an average value of 5s. 2d. per head; as there are the equivalent of 37 sheep grazing an 8-acre block throughout the entire year, the carrying capacity of the land can be gauged. The chief pasture crop to date has been *Panicum muticum*.

During the drier months of the year, before and after the lambing season, the ewes were given the following supplementary ration per week:—

1 oz. sterilized bone meal.
12 oz. linseed (*later*, peanut) meal.
32 oz. molasses.

The first wether lambs to be slaughtered were found to be of good quality, and it may be concluded that the experiment has established the possibilities of fat lamb raising on this area of the tropical coast.

## CANE BREEDING.

### General Methods.

The germination, propagation and testing of new cane seedling varieties is carried out at the three field stations of the Bureau, viz.—Meringa, Mackay, and Bundaberg. As the cane flower sets seed only within the wet tropical belt of Queensland, all cross-pollination has to be carried out at the northern station; the ripened seed is then sent to Mackay and Bundaberg in sealed containers for germination. These three stations represent the wet tropical, dry tropical, and sub-tropical regions of the Queensland sugar belt, and crosses are planned accordingly and the selection of seedlings is made under each set of conditions. It is obvious that it would be useless trying to raise all seedlings at Meringa and to try and select canes for Bundaberg under these conditions. On the other hand any promising seedlings raised at any one station are sent to Brisbane, grown in quarantine, and then sent to the other districts for field testing. Consequently the results obtained at any one station are eventually made available to all districts.

Our present programme provides for the raising of about 10,000 seedlings per annum at Meringa and 5,000-6,000 at Mackay and Bundaberg. A certain number of crosses are always made with the object of providing canes for the selection of parents for future crossing, and these are made at Meringa. The particular crosses forwarded to

each Station depend on the requirements of the district and the known behaviour of the progeny of a particular cross. For example, it is known that P.O.J. 2878 when used as a parent confers high resistance to gumming disease on a very high proportion of its progeny; P.O.J. 2878 is therefore used to a considerable extent in the crosses intended for Southern Queensland.

**Trends in Selection.**

The outstanding requirements of new canes in the northern and central districts at the present time are varieties which will have stronger rooting systems which will enable them to resist grub attack better, and harder rinds which will give greater resistance to borer attack. As a result of these requirements we are compelled to work towards a somewhat increased fibre content of cane. It is likely therefore that the canes of the future will have a somewhat higher fibre than the canes they replace.

Early maturity is continually sought, but is a most difficult character to couple with reasonable vigour. We have obtained some cane-sorghum hybrids, and are experimenting in the hope of developing early maturing varieties from these. Disease resistance trials are continuously carried out, and very many seedlings are discarded on account of their failure to possess a sufficiently high standard of disease resistance.

**1938 Cross Pollination Season.**

It is unusual to have two very bad arrowing years in succession, but the extraordinarily dry autumn and early winter conditions of the past two years greatly depressed arrowing in the Cairns district. This year, owing to little or no arrowing in such varieties as Oramboo, Korpi, 1900 Seedling, Q. 813, E.K. 28, S.C. 12/4, D. 1135, P.O.J. 2878 and Badila, we were unable to make many of the matings which were planned. Nevertheless over sixty different crosses were completed and have provided seed from a wide and interesting range of parent canes. A considerable amount of this seed is the product of cane $\times \frac{1}{2}$ sorghum crosses, and the resultant seedlings should therefore contain one-fourth sorghum "blood." As may be imagined their growth will be watched with great interest. We also succeeded in obtaining a good lot of seed from crosses with P.O.J. 213; this variety is often very difficult to cross, but its high Fiji disease resistance makes it attractive for trial.

**"Original" and "Selected" Seedlings.**

Every seedling produced is a new and distinct variety, so that when we speak of raising 20,000 seedlings we actually mean the production of 20,000 new varieties. Although the seedlings produced from any one cross may often be very similar in type the chances of any two being identical are but one in many millions.

A stool of cane which is produced from the germination of a tiny seed is known as an *original* seedling. When these stools are about a year old they are carefully inspected, and the most promising are selected for further planting—the rest are rejected and milled. Those seedlings which are retained for further trial are known as *selected* seedlings. The practice in Queensland is to grow the seedlings on the stations for about 4-5 years—testing, re-selecting, and discarding—before the final selections are sent out for farm trial.

**Varieties Under Trial at Experiment Stations.**

There are, of course, many hundreds of selected seedlings under trial at the three stations where they are tested for vigour, type of growth, germination, coverage, sugar content, time of maturity, ratooning, fibre content, hardness of rind, resistance to disease, and so on. However, these varieties do not hold much direct interest for the cane farmer, whose chief concern is naturally with those survivors which ultimately go out on to the farms for field trial.

The most interesting seedling from last year's batch is one obtained from crossing a cane-sorghum hybrid (Co. 515) with P.O.J. 2940. The small planting of this newly-introduced hybrid gave rise to a couple of arrows very early in the season, and the only material available for crossing with it was an early arrow of P.O.J. 2940. One lone seedling resulted from the cross, but it has proved quite vigorous, and is, we hope, a sample of what might be expected from this cross in the future; as noted elsewhere we have this year a fairly large quantity of seed from this cane-sorghum hybrid crossed back on to cane of several varieties.

**Q. Seedlings.**

Seedlings which go out into farm trials are given a "Q" number to distinguish them permanently. Since the adoption of this system of naming, four years ago, some twenty-seven of the Q. series have been set out in farm trials. One, Q. 2, has been approved for commercial planting, some have been discarded, two will probably be approved for planting next year, while others are still in the early stages of farm testing. For the information of farmers we append a brief note on such of these twenty-seven canes as are being propagated for commercial planting or are still under field trial.

**Q. 2.**

This variety was approved for commercial planting in the northern district in 1937, and a considerable tonnage will be harvested this year. This is not a general purpose cane, but should prove useful in special locations; it has a very erect habit, is free-trashing, and has high resistance to top rot, borer attack, and good resistance to flood damage, is a latish maturer with medium to good sugar content, and produces a good plant crop under conditions of adequate moisture. On the other hand it does not do well under dry conditions, is a slow ratooner, and should not be harvested before about mid-September.

Propagation plots of this variety have been established in Mackay and the Lower Burdekin, where it will be fully tested; it is too susceptible to gumming disease to be considered, at present, in the southern districts.

**Q. 4 and Q. 12.**

Q. 4 and Q. 12 were planted in a number of farm yield trials in North Queensland, but will be discarded on account of low sugar, brittle nature, and lodging under farm conditions in the case of Q. 4, and unsatisfactory stooling and sprawling habit in the case of Q. 12. The yield of cane in both instances was fairly good, but both are definitely inferior to Q. 10.

**Q. 10.**

Q. 10 has performed well during the past season when grown in competition with S.J. 4 and Clark's Seedling, and we hope that this variety, being resistant to gumming, will serve as a satisfactory substitute for S.J. 4 and Clark's Seedling in the Mulgrave area. Sugar content is good, and to date, strike and ratooning have been satisfactory. Propagation plots have been established in each of the northern mill areas, and the variety is at present growing in quarantine in Brisbane preparatory to transfer to other districts for trial.

Q. 10 is faily resistant to gumming and leaf-scald, and in the northern areas, is considerably more resistant to top rot and borer damage than is Badila.

**Q. 13 and Q. 19.**

These two varieties have been set out in farm yield trials in the northern areas this year, but little is known of their performance to date. Q. 13 has an excellent sugar content and appears to germinate well, but, unfortunately, recent indications are that it ratoons weakly.

**Q. 21, Q. 26 and Q. 27.**

These three vigorous canes have been planted in farm observation trials, and will be advanced to farm yield trials in 1939 if they continue to show promise. Maturity tests now being carried out indicate that they are rather low in sugar, and they may have to be discarded on this account.

**Q. 20.**

Q. 20 was bred at the Mackay Experiment Station, and some twenty-five propagation plots will have been set out on farms in the central district by the time this report appears in print. It is a medium cropper, giving a plant crop of similar tonnage to Q. 813, but ratoons considerably better than this variety; sugar content has been consistently high and maturity early to mid-season. A propagation plot of this variety has also been established in the Lower Burdekin district, and supplies will be transferred to the northern and southern areas next year.

**Q. 22, Q. 23, Q. 24, Q. 25.**

Of four seedlings tested at Bundaberg during the past season Q. 25 appears definitely the best yielding variety. Unfortunately it has exhibited susceptibility to Fiji disease and, in view of the Fiji and downy mildew disease situation in Southern Queensland, its further propagation has been postponed pending confirmatory disease resistance trials.

**Varietal Statistics.**

In Table I. are set out the percentages of the varieties crushed in each of the four major districts during the four years 1934-1937. It will be of interest to review this table again in three or four years time, when some of the new Q. series seedlings will have had time to become established, should they prove suitable to local conditions. It will be seen that over the four-year period the greatest changes have taken place in the southern district where the gumming disease resistant canes, P.O.J. 2878, P.O.J. 213, and Co. 290, are rapidly replacing

Q. 813 and Uba and the susceptible 1900 Seedling, D. 1135 and Black Innes. The rise of the thin Indian cane Co. 290 has been especially rapid, increasing from less than 1 per cent. in 1935 to 15 per cent. in 1937; this variety may be grown to some extent in the Mackay district, but trials have shown that it is definitely unsuitable for more northern districts.

TABLE I.—DISTRICT CANE VARIETY CENSUS, 1934-37.

**Varieties which have constituted one per cent., or more, of District Crops, Grouped according to Country of Origin. Returns recorded to the nearest one per cent.**

| District .. .. | North of Townsville. | | | | Burdekin and Giru. | | | | Central. | | | | Southern. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Variety. | 1934. | 1935. | 1936. | 1937. | 1934. | 1935. | 1936. | 1937. | 1934. | 1935. | 1936. | 1937. | 1934. | 1935. | 1936. | 1937. |
| | % | % | % | % | % | % | % | % | % | % | % | % | % | % | % | % |
| Badila (N.G. 15) .. | 65 | 61 | 60 | 59 | 33 | 49 | 51 | 55 | 16 | 15 | 12 | 13 | .. | 1 | .. | 1 |
| Korpi .. .. | 1 | .. | .. | 1 | 5 | 5 | 6 | 6 | .. | .. | .. | .. | 1 | 1 | 1 | 2 |
| Oramboo .. .. | .. | .. | .. | .. | 1 | 1 | 1 | .. | .. | .. | 1 | 1 | 3 | 4 | 4 | 4 |
| Mahonia (N.G. 22) .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 3 | 2 | 1 | 1 |
| N.G. 16 .. .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | 1 | 1 | .. |
| Clark's Seedling (H.Q. 426) .. | 7 | 7 | 8 | 8 | 13 | 9 | 9 | 8 | 11 | 10 | 9 | 9 | .. | .. | .. | .. |
| H.Q. 409 .. .. | 12 | 14 | 12 | 13 | .. | .. | .. | .. | 2 | .. | 1 | 1 | 5 | 1 | 3 | 1 |
| H.Q. 285 .. .. | 3 | 2 | 3 | 2 | .. | .. | .. | .. | 12 | 1 | 9 | 8 | 10 | 4 | 8 | 6 |
| Q. 813 .. .. | .. | .. | .. | .. | .. | .. | 1 | 2 | .. | .. | .. | .. | 1 | 10 | 2 | 1 |
| Q. 1098 .. .. | 3 | 7 | 8 | 7 | .. | .. | .. | 2 | .. | .. | .. | 2 | .. | 1 | .. | .. |
| S.J. 4 .. .. | .. | .. | .. | 2 | .. | .. | .. | 1 | .. | .. | 1 | 2 | 5 | 10 | 17 | 22 |
| S.J. 2 .. .. | 1 | 1 | 1 | .. | 1 | .. | .. | 1 | 7 | 8 | 6 | 5 | 4 | 5 | 4 | 3 |
| P.O.J. 2878 .. | .. | .. | .. | .. | .. | .. | .. | .. | 2 | 2 | 2 | 1 | 8 | 11 | 17 | 15 |
| P.O.J. 2714 .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | 1 | 1 | 3 | 4 |
| P.O.J. 213 .. | .. | .. | .. | .. | .. | .. | .. | .. | 12 | 11 | 11 | 12 | 13 | 11 | 9 | 6 |
| P.O.J. 234 .. | .. | .. | .. | .. | 23 | 18 | 23 | 22 | 33 | 38 | 46 | 45 | 7 | 18 | 12 | 8 |
| E.K. 28 .. .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | 1 | .. | .. | 22 | 4 | 2 | .. |
| M. 1900 Seedling .. | 1 | .. | 1 | .. | .. | .. | .. | .. | 1 | .. | .. | .. | 7 | 9 | 5 | 4 |
| Black Innes (M. 189) .. | 4 | 4 | 3 | 2 | 15 | 13 | 8 | 5 | .. | .. | .. | .. | 5 | 5 | 3 | 2 |
| D. 1135 .. .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 5 | 15 |
| B. 208 .. .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Uba .. .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Co. 210 and 213 .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 7 | 9 | 5 | 4 |
| Co. 290 .. .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | 5 | 5 | 3 | 2 |
| Pompey (7R. 428) .. | 2 | 2 | 2 | 3 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 15 |

## Origin of Varieties.

Most canegrowers will doubtless be interested to know the composition of the Queensland cane crop according to the country of origin of the varieties concerned, and we have accordingly worked out the following table for the 1937 crop:—

| | Per cent. |
|---|---|
| New Guinea .. .. | 43·5 |
| Queensland .. .. | 23·0 |
| Java .. .. .. | 14·5 |
| Mauritius .. .. | 11·0 |
| West Indies .. .. | 3·5 |
| India .. .. .. | 3·0 |
| Fiji .. .. .. | 1·5 |

It is satisfactory to note that approximately one-fourth of the crop is produced from seedling canes raised in this country, and that these seedlings, together with varieties obtained from New Guinea by Australian expeditions, constitute two-thirds of the crop.

**Storage of Cane Seed.**

Sugar cane produces a very delicate little seed which soon loses its power to germinate when stored in moist air or at ordinary temperatures. This season we constructed an electrically-heated drying-box which rapidly and efficiently dries the "fuzz," which can then be transferred to sealed containers; a little calcium chloride is placed in the containers to absorb any traces of free moisture which may be left. Experiments carried out with the assistance of the North Australian Brewery showed that the germination of such dried fuzz was very greatly improved if it was stored in a chilling room. Under these conditions samples of fuzz were stored for a period of ten months and then germinated as well as the day they were stored.

## CANE DISEASES.

**Gumming Disease in Cane.**

Gumming disease has become still more difficult to find in Southern Queensland, due to the rapid elimination of the old susceptible varieties and their replacement with the resistant varieties P.O.J. 2878, P.O.J. 213, Co. 290, and to a less extent, P.O.J. 234. It is expected that in about two years the disease will be virtually extinct in the Bundaberg-Isis district. In fact the only district where this disease is now causing appreciable losses is the Mulgrave area. Here the disease has continued to spread into the highly susceptible S.J. 4 and Clark's Seedling, and for the protection of adjoining districts it has been necessary to declare the whole Mulgrave area a quarantine area and to prohibit the growth of S.J. 4 or Clark's Seedling therein. As soon as these two varieties have been eliminated it is expected that Q. 2 may be grown with safety throughout the area, but its growth would be unsafe in the poorly drained areas so long as it might be exposed to heavily infected crops of S.J. 4 and Clark's Seedling. The new seedling Q. 10 is gumming disease resistant, and has performed well this year in competition with S.J. 4 and Clark's Seedling. Several other resistant seedlings raised by the Bureau and also some raised by the C.S.R. Company are now in yield trials in the gumming area.

**Gumming Disease in Other Plants.**

During the past three years we have conducted an investigation into the possibility of gumming disease being carried over in plants other than sugar cane. If other plants can carry the disease then it follows that it would be unwise to release any highly susceptible varieties for

planting on an area where gumming disease has been present at one time or another. Upon inoculation the following plants were found to contract gumming disease:—A number of maize varieties including those most widely grown in Queensland, sweet and grain sorghums, Sudan grass, Guinea grass, bastard sorghum, Para grass, Elephant grass, and Johnson grass. Some of the sorghums, in particular, proved highly susceptible and oozed gum as freely as susceptible cane varieties. It seems likely then, that we have growing in and around our cane-fields a number of plants which can contract gumming disease, and our future policy must be influenced by this finding. It is of interest to note that in some of the above listed plants the symptoms of gumming disease are quite unlike those in cane.

**Fiji Disease and P.O.J. Varieties.**

As is well known by most canegrowers the higher numbered P.O.J. canes (P.O.J. 2714, 2725, 2875, 2878, 2883, 2940, &c.) all contain a certain amount of wild cane in their ancestry. This wild "blood" gives these canes their vigorous growth, strong rooting systems, strong ratooning and resistance to mosaic and gumming diseases. At the same time however, it confers high susceptibility to Fiji disease in the case of all the varieties mentioned; there is not much to choose between them and the only commercial variety which exhibits greater susceptibility is Uba.

Increased susceptibility to such insect-borne diseases expresses itself in an interesting way. Whereas a stool of a resistant variety may require to be fed upon by, say, eight or ten infective insects before it will contract the disease, susceptible varieties may require only one insect per stool. When these insects are blown out of a diseased field by a high wind it is obvious that many stools will receive one hopper whereas very few would receive, say, five or six. Herein lies the danger of a susceptible variety in that it can become diseased when fed upon by a single infective insect.

Fiji disease constitutes a very grave threat to the continued growth of P.O.J. 2725 and 2878; the seriousness of the situation cannot be over-emphasised and we cannot urge too strongly that *now* is the time to take action to save these varieties.

**Fiji Disease in the Bundaberg-Isis District.**

A small amount of Fiji disease has been present in the Bundaberg-Isis district for a number of years and had persisted on irrigated lands particularly. Several small outbreaks were found by Bureau officers and cleaned up and little damage was caused in the old varieties. With the planting up of P.O.J. 2878 however, the picture begins to tell a different story. The disease spreads into this very susceptible variety with great readiness and strenuous efforts will be necessary if this remarkable cane is to be saved for cultivation. During the year new outbreaks were discovered on the Woongarra, Paddy's Island and the Elliott, and as far as is known the disease is now present on three plantations and about thirty-five farms in Bundaberg and about twenty farms in the Isis.

In an effort to clean up this disease a number of disease eradication orders are being issued and it is hoped that there will be no trouble in enforcing these since the steps taken are all for the common good. The District Executives have also earnestly co-operated by employing gangs to inspect cane and dig out diseased stools.

**1938 Season has Favoured Spread of Downy Mildew and Fiji Diseases.**

Although caused by widely different agents and spread in entirely different ways downy mildew and Fiji diseases have a good deal in common. Actually Fiji disease is caused by a virus which is spread from plant to plant by the sugar-cane leaf hopper while downy mildew is caused by a fungus, the spores or "seeds" of which blow from plant to plant. On the other hand both are spread mainly during the warm moist months of summer and early autumn; both spread very little during the normal dry months of winter and early spring; and the symptoms of both may remain invisible for long periods after infection.

The long protracted late rainy season coupled with the late and mild winter in the Southern areas provided conditions which were favourable to the spread of both these diseases for an unusually long period. Indeed many cane crops carried very heavy leaf hopper infestation all through the winter in locations where normally it would have been very hard to find any hoppers at all at the end of June. Owing to the masking of symptoms of both diseases for long periods late infection may not show up until about November, but we may be certain that a very much greater amount of spread will have taken place than would have occurred during the late autumn and winter of a normal year.

**Downy Mildew Disease.**

Like Fiji disease downy mildew owes its chief importance to the fact that the leading P.O.J. canes P.O.J. 2878, P.O.J. 2714 and, in this instance, P.O.J. 213, are highly susceptible. Downy mildew is caused by a fungus and is spread from plant to plant by wind-borne spores of the fungus; thus it can spread considerable distances at a comparatively rapid rate.

Of the old varieties B. 208 was the most susceptible and as a result of its heavy infestation with downy mildew it has been necessary to disapprove its cultivation in the Lower Burdekin area for the purpose of protecting other varieties like E.K. 28.

The disease has now made its appearance in P.O.J. 2878 in the Mackay district and, to a less extent in the Bundaberg district. Since P.O.J. 2878 is only a minor variety in the Mackay district its further growth has been disapproved as it is feared that it would become a menace to other varieties. In Bundaberg, however, the infestation is lighter and, in addition, P.O.J. 2878 is now the major variety; accordingly every effort is being made to save the variety and a number of plough-out and disease eradication orders have been issued to farmers who have the disease on their properties.

**Dwarf Disease.**

The mysterious dwarf disease still continues to be found to a slight extent in the lower lying fields of the Rosella district of Mackay. As far as is know this is the only part of the world where this disease occurs and its origin, cause, and the manner in which it is spread remain a mystery. It is, however, a very destructive disease and Mackay farmers should be careful to see that they on no occasion obtain plants from this part of the district. The disease has occurred chiefly in the varieties P.O.J. 2714 (particularly), Malagache and Clark's Seedling, but the first two have now almost disappeared from this section of the district.

Recent plantings have included Co. 290, E.K. 28 and P.O.J. 2878, but our observations indicate the susceptibility of both E.K. 28 and P.O.J. 2878. P.O.J. 2878 in particular seems susceptible under these conditions and, even if it were not disapproved as a result of downy mildew disease, its further growth would be undesirable.

**Rind Disease.**

Rind disease is one of the oldest known diseases of sugar-cane; its name is really misleading since the formation of pustules on the rind is one of the final stages of the disease. Prior to the appearance of these pustules on the rind it causes a sour reddish rot of the flesh of the stem and appears very similar to red rot disease. Generally it attacks cane some 6-8 joints above the ground and extends upwards for a few joints; thus the mid-part of the stalk may be rotted and dead while the top and butt appear sound. This disease was very prevalent last year in S.J. 4 in the Cairns area, 1900 Seedling at Mackay and standover P.O.J. 2878 in Bundaberg. Considerable losses resulted from the dead cane and reduced C.C.S. content.

The condition responsible for the widespread occurrence of the disease was the unusually dry autumn and winter causing over-maturity of the cane. The control of the disease lies in preventing over-maturity or false maturity and this may be done in part by change of variety, late planting, late applications of nitrogenous fertilizer or irrigation.

Autumn and winter weather conditions in the Cairns-Mossman district have been such as to lead us to expect a recurrence of the trouble this year in S.J. 4 but it is not expected that rind disease will again be prevalent at Mackay and Bundaberg.

**Introduction of Varieties from Overseas.**

The following varieties have recently been imported from overseas:—

31-1389 is an Hawaiian seedling, bred from P.O.J. 2878; it is reputed to be a rapid grower in the early stages, drought resistant, average sugar content and has a fairly hard rind.

B. 726, a Barbados seedling, which has shown considerable promise as an early-maturing cane in the better rainfall areas.

B. 2933, also from Barbados, is a mid to late season maturing cane suited to the lower rainfall districts of the island.

In addition, we have made arrangements to receive from the C.S.R. Company the following seedlings raised in the Northern Rivers of New South Wales, viz., 30 S.N. 225, 451, 673, and 874, 33 S.N. 1160 and 30 G. 1759. These varieties are nearly all resistant to Fiji and gumming diseases and thus they may be of special use in the southern districts although, of course, they will be tried in all districts.

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## CANE PESTS.

**Northern Cane Grub—Damage in 1938 Season.**

Infestations by the northern cane grub, the grub of the "greyback" beetle, were not particularly heavy this year. In the Cairns area the pest has not yet recovered from the severe set-back it received during the heat waves of 1934 and 1935; reduced infestation also occurred throughout the Johnstone district generally, where there was only one

flight of beetles. Weather conditions favoured a big beetle flight in the Invicta area and the Lower Burdekin district, but dry conditions followed the hatching out of the young grubs, causing heavy mortality and, as a result, heavy grub infestations survived only in those fields which were subsequently irrigated.

On the other hand, owing to the short rainy season, the dry conditions intensified the damage done by the smaller number of grubs present and in a number of cases it was later found necessary to fumigate fields where the number of grubs per stool would not normally warrant fumigation. Consequently the area fumigated from Tully northwards (517 acres) was about the same as that fumigated last year.

In the Mackay area the amount of damage caused by this pest promises to be very much less than last year, when some 40,000 tons of grub damaged cane was delivered to the mills.

**Long Flights of Greyback Beetles from Feeding Trees.**

At times we find heavy infestations of cane grubs in fields although during the previous beetle flight period it was almost impossible to find a single beetle in the neighbourhood of such fields. Such a state of affairs existed this year at Greenhill Plantation when scarcely a beetle was observed on the feeding trees growing on or near the plantation. A search on the hills 1 to 1½ miles away revealed fair numbers on forest trees and these beetles were evidently responsible for the grub infestation which occurred at Greenhill. Such beetles would not have been touched by any beetle collecting campaign.

**Fumigation in the Lower Burdekin District.**

Following the relatively heavy losses from grub damage which occurred in the Lower Burdekin in 1937 the Pest Boards in that area decided upon a fumigation campaign for 1938. The Boards provided farmers with injectors free of charge and fumigant at reduced cost and also made available the services of temporary supervisors. As this was the first year in which fumigation had been undertaken the Bureau made available the services of Messrs. Buzacott and Knust in order that the supervisors might be instructed in methods of surveying grub infestations and conducting fumigation campaigns. A number of fields in the Kalamia and Inkerman areas were successfully fumigated. Naturally some small mistakes occurred, such as fumigation when the soil was too dry, but with the experience gained from this year's operations the Boards and farmers concerned should be in a position to take care of infestations in future years.

**Control of Wireworms.**

Wireworm damage to sugar-cane in Queensland is caused mainly by the lowland wireworm which, in turn, is a pest of appreciable importance only in the Mackay and Proserpine areas. It is quite the most important pest of cane in the Mackay area. This worm has a number of moults before it finally attains the beetle stage; in the early moults it is very sensitive to drying out and requires a water-logged soil in order to survive; later on it can withstand extremely dry conditions. The only satisfactory method of control is to have fields well drained before the commencement of the rainy season so that soils do not become water-logged and the young wireworms do not survive in

large numbers. If suitable drainage is not provided then, if wireworms are present, it is very inadvisable to plant susceptible fields until the wireworms have ceased their activities—that is about late September. Many farmers object to such late planting, and it is freely admitted that it has many disadvantages; it must be emphasised, however, that in wireworm years many early plantings actually do become late plantings because of continued replanting and supplying and, in the course of events, are much more expensive and no more satisfactory than a single late planting.

**Forecasting Wireworm Infestations.**

It has been pointed out on innumerable occasions that the survival of wireworms in the field depends on the extent of the water-logging of the soil around February-March, when the young worms are particularly sensitive to drying out. It follows, therefore, that the liability to wireworm damage is greatly dependent upon the length and intensity of the wet season. On the basis of a number of years of observation it is now possible for the Entomologist at the Mackay Station to forecast the probable intensity of damage, and farmers who have not provided adequate drainage may thus be guided in the making of a decision regarding late or early planting of susceptible fields. Following the heavy rainy season of 1937, warnings were issued in June of that year that damage would be extensive in undrained fields unless plantings were delayed until late September. This forecast proved quite correct, as did that of the previous year. The 1938 rainfall records indicated that relief could be expected and in the Quarterly Bulletin for 1st July, it was anticipated that in early planting damage would be confined to very low lying areas.

**Trial Sett Plantings as an Indication of Probable Wireworm Damage.**

The wireworm pest in the Mackay district is sufficiently important to warrant continuous attention on those farms where previous experience has indicated that damage by this pest is a possibility. In such places the best possible drainage should be provided prior to the commencement of the rainy season, but this may be supplemented by the planting of trial setts. Commencing early in the season such setts are planted at intervals in the field and later dug up and the eyes examined. The percentage of damaged eyes and shoots, taken in conjunction with the Bureau's forecast, may be used to determine whether earlier planting of that particular block may reasonably be undertaken.

**The Rat Pest of Sugar Cane.**

Damage to crops in Queensland canefields by rats has now returned to normal proportions in contrast to the great damage caused during the plagues of a few years ago. A special investigation of the habits of the various types of rat which attack cane in Queensland is now being undertaken by the Bureau; amongst other things the investigation is directed towards trying to ascertain the conditions under which these plagues occur and whether they may be forecast. During the course of the period April, 1937, to December, 1937, some 2,333 rats were trapped in the course of rat population studies and for the purpose of obtaining rats for the study of the effects of various poisons, &c. For

this purpose a special live trap was designed and has proved very effective; the chief feature of this live trap is a false floor against which the trigger is set, the weight of the rat being responsible for the release of the trigger and trap door.

**Rat Baits.**

The attractiveness of baits to rats depends a great deal on the food which forms the base of the bait. Of the foods tested rolled oats proved much more acceptable to the field rats than any others; the order of preference by the rats was: (1) Rolled oats, (2) cracked corn, (3) whole corn, (4) wheatmeal, (5) whole wheat, (6) barley, and (7) bread. There is not much difference between the attractiveness of cracked corn, whole corn, wheatmeal and whole wheat, but barley is not very much desired by the field rat and there is always a poor take of bread. Consequently if bread is used as a food base in a bait it should only be used with a highly effective poison such as phosphorus. No advantage was gained by adding linseed oil to baits; this oil attracts rats, and is excellent for attracting them to traps, but it is not an appetiser and will not improve the take of an unattractive bait.

**Poisons Used in Rat Baits.**

A large number of rats was caught and caged for the purpose of determining the comparative effectiveness of the poisons commonly used in rat baits. The following poisons were investigated:—Thallous sulphate (thallium), yellow phosphorus, strychnine alkaloid, strychnine hydrochloride, zinc phosphide, red squills, white arsenic, and barium carbonate. With the exception of the first three all must be condemned as being quite unsuitable for use in the poisoning campaigns as conducted in Queensland canefields. Of these three, phosphorus is the most poisonous and thallium least. Since a comparatively large dose of thallium is required to kill a rat it should be used only in conjunction with an attractive food base; it is considered that under present methods of distribution in Queensland the most economical bait strength is 1 part of thallium to 300 parts of food base. On the other hand phosphorus, being very highly poisonous, may be used on an unattractive bait base like bread since so very little needs to be eaten to kill a rat.

**Comparing Different Rat Baits.**

The tests described above were carried out in cages or in fields where the number of rats present was accurately known. The effects of the poisons were judged, therefore, not by the amount of bait taken, but by the immeasurably better test of the number of rats killed. This is a very important point and, in fact, the amount of bait taken in the fields is a very unreliable guide to its effectiveness. For example, it has been shown that there may be a comparatively large "take" of thallium treated grain without appreciable death of rats following; this is especially so in the case of weak baits such as 1:1000 thallium treated wheat. On the other hand the take of phosphorus bait may be so low as to be barely noticeable, yet it is so highly poisonous that there is a heavy mortality among the rats.

**Rat Population Studies.**

It very early became obvious that some method of estimating rat populations in the field was an important necessity. If we are to judge the effect of poison baits laid in a field then we must have some method

of estimating the number of living rats present before and after the baits were laid. As stated above the observed "take" of baits may be very misleading; the rats might even carry off the baits to line their nests or, on the other hand, a bait which contains a fatal dose for one rat might be shared by five rats and they all survive. Two methods of determining rat populations were developed but the one now used is to trap rats in a "live" trap, chloroform them and place a numbered bracelet on the hind leg and let them go. These traps are set out at intervals through the field and a record is kept of the number of rats tagged. A certain number of these tagged rats are retrapped each night and from the proportion which tagged rats form of the total number trapped in any particular night we may calculate the total population. The field rats, it might be mentioned, do not appear to be scared away from traps by the fact that they have been chloroformed

**Rind Hardness and Rat Resistance.**

It is found under existing normal conditions that a hard rind affords considerable protection to the larger barrelled canes. It remains to be seen, however, whether this would afford sufficient protection to reduce damage in rat plague years. Hardness of rind does not seem to confer any appreciable resistance on thin canes such as P.O.J. 213 and Co. 290; in these varieties, because of their thinness, even a small amount of feeding on one joint is sufficient to cause the stalk to break off at this point and fall to the ground.

**The Giant Toad.**

The giant toad has continued to breed rapidly in North Queensland, especially around Gordonvale, where they were first liberated. In this district there should be a large population of big toads, capable of eating cane beetles, towards the end of this year and consequently when the next beetle flight occurs we should be in a position to judge whether this animal is likely to be an important aid in the control of the cane grub. Reports indicate that the toads are breeding in the Isis district, young toadlets having been seen emerging from dams in that area.

**Trashing for Beetle Borer Control.**

Trashing has often been advocated for borer control and last year we carried out a series of experiments to test this idea on a sound basis. In these trials the cane was trashed more thoroughly than is the case in field practice but it was our desire first of all to test the value of trashing and later to go into the economic aspect. Cane trashed three times had much less borer control damage than untrashed cane and a somewhat higher tonnage was recorded. These trials have been repeated this year in order to study the effects of a less amount of trashing, of the type usually practised by farmers and, when these have been completed, later in the season, we should have a pretty good idea of what the exact effects of trashing are. At the present time our opinion is that trashing will certainly greatly reduce borer damage in places where the damage is great but, at the same time, we are also of the opinion that the same amount of reduction could more profitably be brought about by improved field practices such as have been outlined in previous reports.

**What Gives Certain Cane Varieties Resistance to Borer Damage?**

Each year trials of new varieties are carried out in order to test their resistance to borer attack. As a result of several of these trials we can now say that an erect, free trashing variety, with a medium to hard rind, will definitely be resistant to borers. Each of these factors is important and is necessary for high resistance. For example, by hand trashing Badila we may get an erect and trash-free crop, but it will still be moderately susceptible to borers on account of its soft rind, although less susceptible than if it were not trashed. Similarly free trashing and fairly hard rinded canes may become susceptible if they lodge badly. Q. 12 has as least as hard a rind as Q. 2 but yet an erect crop may at times suffer a moderate amount of borer damage, due to clinging trash. Trashing of cane, contrary to general belief, does not increase the hardness of the rind but acts favourably because it removes the shelter which the borers like so much.

**Rind Hardness Tests.**

With a view to possibly simplifying the determination of borer resistance by cutting out the necessity for field resistance trials we have had constructed a small hand instrument for measuring rind hardness. This instrument has a blunt pointer which works against a spiral spring. As the spring is compressed the pressure increases and finally is sufficient to force the pointer through the rind; when this penetration takes place the pressure is read off on a scale on the instrument. These readings can be made at a very rapid rate and the rind hardness of dozens of sticks can be determined in a day. By this means it is hoped that it will be possible to test large numbers of seedlings and obtain a good idea of their probable borer resistance without resorting to cumbersome field tests.

**Fumigation Not Satisfactory for Control of the Frenchi Grub.**

Experiments carried out with carbon-bisulphide, alone and mixed with para-dichlorbenzene or ortho-dichlorbenzene, failed to achieve a satisfactory control of the Frenchi cane grub. These experiments confirmed previous experience. Control of this pest is best obtained by observing the following points:—(1) Restrict ratooning and, if possible, fallow for a year after ploughing out; (2) plough infested land during the summer, when the grubs are feeding in the upper layer of soil, so that they may be killed by ploughing operations or exposed to the attack of birds and other insect eaters.


## VITAMIN "A" DEFICIENCY.

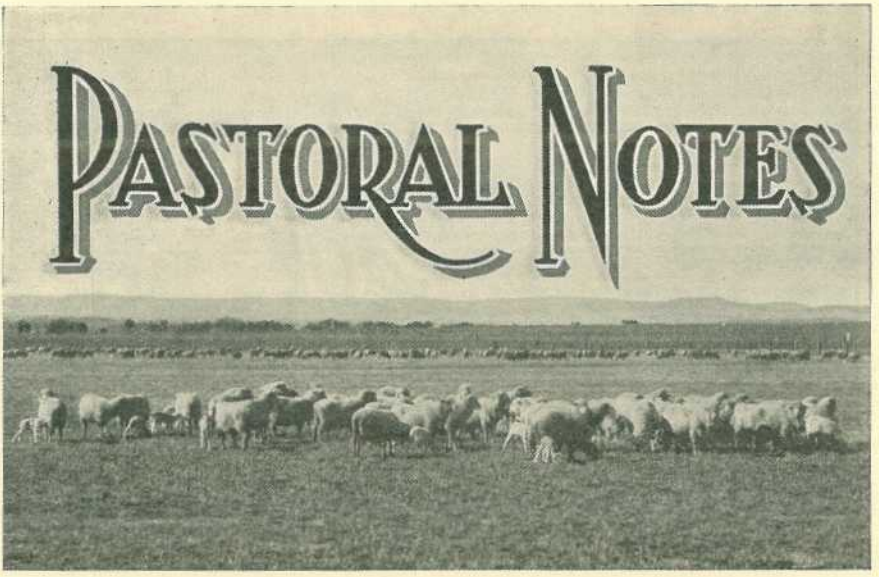
If fowls are deprived of green feed the most serious deficiency which is likely to occur is that of vitamin A. This vitamin is one of the "fat soluble" group; that is, it is present in high concentration in animal fats. But it may be, and customarily is, supplied by the feeding of green-stuff in which is a substance named carotine. This substance is transformed into the true vitamin A by the liver of the animal body and is stored there in relatively large quantities.

The absence of vitamin A is liable to produce very serious effects on poultry, because when supplies of this substance are inadequate the birds are more liable to bacterial infection. Consequently, a conjunctivitis—that is, an inflammatory condition of the eye—first appears and progresses until the eye has the appearance of an abscess. Further, there is usually a moderate mortality, and on post-mortem examination characteristic abnormalities are seen. Most marked is the presence in the mouth and throat of pustules and ulcers, which can be seen when these parts are opened up carefully. Another characteristic alteration, which is more difficult to detect, occurs in the kidney. Fine white lines may be noticed running through the tissue of that organ. This change is brought about by the deposition of substances called urates, which are excreted from the body by the kidneys.

The occurrence of this disease may be prevented by the feeding of adequate green-stuff, but it is realised that this may be difficult and expensive at the present time.

Additional foods rich in vitamin A are milk and milk by-products, yellow maize, and cod liver oil.

A cheap and convenient method of supplying vitamin A is to feed a goodly proportion of maize or maize meal to poultry.




# "Rattle-Pod"*—A Plant Suspected as Poisonous to Stock.

Dr. J. LEGG, D.V.Sc., Senior Veterinary Officer.

THIS plant is a native of tropical Africa, and has been introduced into many tropical and sub-tropical countries as a green manure. It is a bush 4 to 6 feet high, or even more, with a rather woody stem. The stem, leaf-stalks, and under-surface of the leaves are covered with short, rather scattered hairs. The leaves consist of three leaflets, borne at the end of a common slender leaf-stalk. The middle leaflet is somewhat larger than the side ones. All the leaflets are elliptical in shape and measure 1½ to 2 inches long and ½ to ¾ inch broad. The flowers are yellow, pea-shaped, and are borne in a raceme at the end of the branches. The pods are inflated, clothed with short hairs, and are about ¾ inch long. Numerous seeds, which are hard, shining, and reddish brown, are present in each pod.

It belongs to a group known as the "rattle-pods," several of which are known to be poisonous to stock, and as it was felt that this particular species, which has been introduced into Queensland for use as a green manure crop, might also be poisonous, the Poison Plants Committee of the Department of Agriculture and Stock arranged for it to be tested on sheep, with the results shown below.

### Feeding Test.

A sample of the mature plant carrying flowers and half-ripe pods was received in April of this year from one of the North Coast districts, and was placed before sheep which had been starved. They nibbled a little at the plant, but although hungry, they evidently preferred to starve rather than consume it.

* *Crotalaria goreensis.*

### Drenching Tests.

Since the animals would not eat the plant in the natural manner, it was decided to make water extracts by cutting up into small pieces weighed portions of the plant and soaking them overnight in water. By this means it was hoped that any poisonous principles of the plant could be extracted and then administered to the animals by means of the stomach tube.

A sheep was first starved for twenty-four hours and then given the watery extract obtained by pressing out the juice from 1 lb. of plant in 1 litre of water after soaking for twenty-four hours. This was repeated on each of four consecutive days, the sheep being allowed a small feed of bran and chaff each evening. The experimental animal was in no way inconvenienced.

### Conclusions:

(1) Sheep will not eat the plant, which appears to be obnoxious to the animal.

(2) Drenching of sheep with watery extracts failed to produce any symptoms of poisoning.

(3) Although the plant is grown in areas where sheep are less likely to have access to it than cattle, it is considered that the results obtained with experimental sheep would not have been different had cattle been used.

## BONE CHEWING.

No animal can thrive unless its food contains an adequate supply of certain elements, including the minerals phosphorus and calcium. The requirements of the different farm animals are, however, not the same. Normally, sufficient phosphorus to maintain the health of cattle is contained in the pasturage, but for various reasons—e.g., phosphorus deficient soils, and a succession of years in which the rainfall is scanty—a deficiency in this element arises in the natural feed.

An early symptom of phosphorus deficiency is a marked desire shown by affected animals to eat bones and offal. This condition is fairly common in parts of Queensland. Animals develop dropsical swellings, stiffness in gait, and symptoms similar to those of rickets in children. Young cows about the time of first and second calf, milking cows, and cows heavy in calf make heavy demands on the available phosphorus and are therefore very susceptible. Dry cows and older stock are less liable to suffer. Stock suffering from a shortage of phosphorus will chew bones, pieces of wood, bark, earth, &c.

Treatment, except in extreme cases, is followed by good results. On the smaller holdings where animals are watered at troughs, the addition of 6 drams of phosphoric acid to each 10 gallons water, supplemented by a ration of bran and chaff, gives very satisfactory results. Under station conditions, a lick containing sterilized bone meal two parts, and coarse salt one part—a proportion of 2 to 1—with the addition of molasses to increase palatability, should be made available to the animals.

# CASTRATION OF COLTS.

W. DIXON, Inspector of Stock.

SPRING is the best time of the year to castrate colts, especially when, as at present, green feed is available.

The colts to be gelded having been yarded over night, it is desirable, before proceeding with the operation, to take precautions against losses through infection of wounds. Crude carbolic acid or phenol in a solution of 7 oz. to 1 gallon is a suitable disinfectant, and should be sprayed over the ground and rails of the yard.

All instruments used should be sterilized by boiling for at least ten minutes, and should be wrapped in a sterile towel and kept in a box at the yard until required.

After each colt is done the instruments and hands of the operator should be washed in a weak solution of carbolic acid, this solution being kept in a separate vessel, and only sufficient for each disinfection being poured into a dish for the purpose, and then thrown away. The practice of using a petrol or kerosene tin filled with disinfectant to wash instruments and hands time after time is risky.

For unbroken colts, the rough and ready methods of roping, choking, and throwing as practised on many stations may cause the loss of valuable animals. These losses may be minimised if a crush with side gates is available, so that the colt can be haltered and side lines used on him before the gate is opened to cast him.

The colt having been cast on his left side, the hind legs drawn up to the shoulders and made fast with half hitches, the fore legs can now be secured with the knees bent to the hind feet.

The scrotum, sheath, and penis should be washed with warm water and soap, care being taken to remove any suety deposit from the penis and the cavity at the end of the penis. The left or lower testicle (the colt being on his left side) is seized in the left hand, and pressed until the skin is tight over it; a bold incision from front to back, parallel with the median line, is now made, penetrating the outer skin and the tunica, laying the testicle bare. As the incision is made, the cord should be grasped firmly in the left hand to prevent the retraction of the testicle upwards through the canal. When this happens it is sometimes difficult to recover, and the subsequent manipulation in an attempt to bring it down delays the operation, and causes unnecessary shock to the patient. The knife is now slipped between the anterior and posterior portions of the cord, and the latter (posterior), which the muscle retracts, is cut completely through.

The testicle now lies inert, connected by the anterior portion of the cord, which is composed of blood vessels, and should be drawn out until it is taut, without using force, when the emasculator (if that method is being used) should be used close to the belly, with a slow squeezing movement, taking care that the crushing part is nearest to the belly, and the cutting part to the testicle. The cord should be severed as short as possible, so that it may not hang below the wound, and so cause complications.

The other testicle may now be removed in a similar way.

It is advisable to swab the wound with a solution—1 to 2,000—of chloride of mercury. The ropes may now be removed, and the colt allowed to rise and walk out of the yard, so as to be away from dust.

If the operation has been performed carefully, and all antiseptic precautions taken, recovery should be rapid and no further treatment is necessary, but if undue swelling is noted, the wound should be opened with the fingers, after washing the hands with carbolic solution, so that there may be free drainage, and the wound swabbed with disinfectant.

Some bleeding always occurs, but rarely lasts for more than half an hour, but if copious bleeding persists after that time—as is the case when emasculators have been used carelessly—the cord must be found, and the artery tied with silk thread. If the stump of the cord cannot be found, the canal should be plugged with pledgets of tow or wool soaked in muriate of iron of the same strength as obtained from the chemist, which helps to form clots, and so closes the artery.

## A CAUSE OF SHIVERS OR STAGGERS IN STOCK.

About this time of the year, specimens of henbit or dead nettle are received by the Department of Agriculture and Stock, mostly from the Darling Downs. It is a native of Europe, but is now naturalised in most temperate countries. It is very closely allied to stagger or mint weed, and, like it, causes staggers or shivers in working or travelling stock.

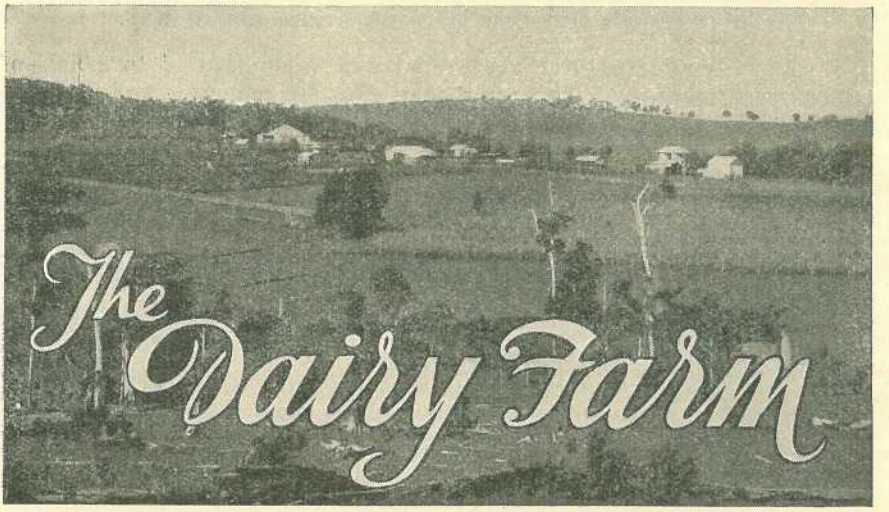
From feeding tests conducted in New South Wales, it would appear that the main symptoms result from the intoxication of the central nervous system. Post-mortem examination showed organs, muscles, &c., to be normal.

No poisonous principle has been extracted from the plant, and it is rather remarkable that although both it and the common stagger weed are abundant in parts of Europe and North America, they have never in those countries been accused of causing staggers or shivers in working animals, as they do in Australia.

No great alarm need be felt, as animals recover when taken away from affected areas or put on to ordinary feed. The symptoms, however, may continue in a modified form from a few days up to three weeks, according to the severity of the attack.

*Description*:—The plant is a rather weak, fleshy herb, about a foot high, the leaves opposite, mostly of a rather pale green, and rounded with blunt teeth on the edges. The flowers are like a garden salvia in miniature, and are purplish in colour. The seeds are small and usually occur in groups of four at the base of the calyx.

—*C. T. White.*




## HERD TESTING AND PROFITS.

The problem facing all dairymen is how to produce the maximum amount of butterfat at the lowest possible cost, while at the same time maintaining, or improving, the fertility and carrying capacity of the pasture and the health of the stock. On the farmer rests the responsibility for efficient pasture management; and on the stock that of producing the maximum amount of fat from the food consumed.

Some farmers may claim that they have good cows, and base their claim on factory returns. This, however, is only evidence that the herd as a whole is good, and not that each individual member of it is producing enough fat to pay its way. A drop in factory returns is unexplainable to such farmers, and when it happens they are in a quandary as to where the remedy lies.

The farmer who submits his herd regularly to testing can see—by comparing the production records of mothers and daughters—whether production is being maintained, whether the right cows are being used for breeding, and whether the herd sire is producing profitable or unprofitable heifers. By this means, he is able to remedy any possible fault before it affects his factory returns to any noticeable extent.

The productive ability of a cow can be ascertained only by testing. The figures obtained indicate her ability as a producer, under the existing feeding and management conditions, which are controlled by the weather and the farmer. There is ample evidence available to show that the average herd contains animals which do not produce sufficient fat to pay for the food which they consume.

Herd testing is essentially educational. The figures merely disclose the facts, and the responsibility is upon the farmer to act accordingly. A farmer who neglects to cull unprofitable animals has only himself to blame if production is stationary or shows a decrease. Failure to act on the part of the farmer cannot be construed, by any means, as a failure of the system of herd-testing.

—*L. A. Burgess.*

## ANIMAL MANURE ON DAIRY FARMS.

On the dairy farm, cow dung accumulates both in the holding yards and in the grazing paddocks. Periodically, the manure about the yards is collected and usually distributed on cultivation areas as a fertilizer. Cow manure contains a moderate amount of fertilizing materials which come originally from the pasture area, and to use the manure on crops to be sent away from the farm is virtually "robbing the pastures to keep up the fertility of the ploughed fields."

Far more serious, however, is the neglect of many dairy farmers to make good use of the manure left in the grazing paddocks by the stock. A dropping allowed to lie undisturbed, in addition to losing much of its fertilizing value to the air, promotes in that particular spot a rank growth of grass, which stock find distasteful. If full advantage is to be taken of the fertilizing value of the manure, the droppings should be spread uniformly over the paddocks before they become caked. The dung may be distributed with a special pasture harrow, or by running an ordinary peg harrow over the area, and about which several lengths of barbed wire are loosely coiled. A weatherboard or similar type of timber drag is quite satisfactory, but its use on wet dung in dry weather should be avoided in order to prevent the fouling of the pasture by extensive smearing.

## MILK FROM NEWLY-CALVED COWS.

With the approach of spring, dairy farmers should be careful about their increased milk supplies, especially colostrum milk. The milk of the newly-calved cow is abnormal, and is called colostrum or beastings. It is yellow in colour, has a rather strong pungent taste, an unpleasant odour, a sickly albuminous flavour, a high specific gravity, a high total of solids, high albumen, and low figures for fat and sugar. The fat of colostrum has different properties from that of normal milk, and the sugar is largely glucose and not lactose—it also shows a larger proportion of phosphate.

Colostrum milk serves only as food for the new-born calf, and not as a means of increasing the supply to the factory. Besides serving as food for the calf, it also increases the resistance of the calf to disease during the first few days of its existence. The milk approaches normal day by day until, in seven days after calving, it is practically normal, although it may take up to a fortnight to attain perfect normal composition.

It is advisable to isolate the newly-calved cows, and for the first seven days at least this colostrum milk should not be mixed with normal milk, either for butter or cheese making. Cream from such milk blended with good cream results either in the whole delivery being graded down to second grade, or in its being completely rejected. For that reason, this milk should not be separated at all. Colostrum milk is quite unfit for cheese-making, since it is easily coagulated by heat, curdles very slowly with acids and rennet, and results in very poor quality cheese.

It should be remembered, therefore, that:—(1) Colostrum milk is food for young calves only; (2) it should on no account be sent to cheese factories or, as cream, to butter factories.

*—O. St. J. Kent.*

# MILK PRODUCTION IN SUMMER.

With the approach of warmer weather, it will be necessary for dairy farmers to take greater care in milk and cream production, if defects in milk or cream are to be avoided.

Milk is an ideal food for bacteria—microbes or germs as they are popularly called—which thrive on milk and soon spoil it, with the result that not only the milk, but its derivatives are degraded in quality. Spring and summer temperatures in Queensland are conducive to the rapid multiplication of most bacteria, and the summer heat especially favours organisms which impart objectionable taints to milk and cream.

The prevention of faults in milk and cream is almost entirely dependent on the methods of production. It may be claimed that clean milk production calls for much greater effort and correspondingly increased costs, for which there are no compensating returns. This is not so. Milk of a very low bacteria count may be produced with little, if any, additional work or time in ordinary hygienic surroundings and with inexpeneive equipment. On the other hand—although not usually—dirty milk may be produced in elaborate buildings and with faultless equipment. Success in clean milk production, like most other activities, depends largely on the will of the persons engaged in it. If those responsible exercise cleanliness and care in every operation from the moment the milk leaves the udder until the delivery of cream at the factory, undesirable fermentation caused by the entry and multiplication of harmful bacteria will be largely prevented, because the normal lactic acid-producing bacteria are more likely to gain control and suppress the growth of the objectionable types. With milk for cheese making an attempt should be made to check the development of too much acid by keeping the evening's milk as cool as possible while it is being held overnight on the farm. Passing the milk over a tubular metal cooler through which water is circulating is the method for rapidly cooling milk most easily adapted to ordinary farm conditions.

The chief factors governing the production of choice quality milk and cream are set out briefly below:—

1. Clean flanks and udders with a cloth moistened in water in which there is a weak solution of Condy's fluid.
2. Wash the hands before, and as often as necessary during milking.
3. Thoroughly clean and sterilise utensils after use in the following manner:—
   - (*a*) Rinse with cold or lukewarm water.
   - (*b*) Wash in hot water in which washing soda is dissolved using a scrubbing brush for the purpose.
   - (*c*) Immerse in, or scald with, boiling water.
4. Allow utensils to drain and dry in an inverted position on a dust-free rack. Do not use a cloth to dry them.
5. Cool milk and cream immediately after milking and maintain as cool as possible until delivery.
6. Exercise care in sterilizing utensils at all times, and more than usual care in summer when temperatures are more favourable for bacterial multiplication.

—*E. B. Rice.*

## SOME CAUSES OF STERILITY.

In each year, with careful management, the proportion of calves dropped should approach 100 per cent.; but on many dairy farms, perhaps, the number of calves dropped ordinarily would not approximate 80 per cent. Hence, about one-fifth of the progeny is lost.

Apart from disease, the most common causes of sterility are protracted periods of semi-starvation, and the other extreme of overfeeding. The latter cause usually occurs among cattle prepared for the show ring. But with show cattle the trouble may be overcome by making the animals work hard for their living, by turning them into a paddock where feed is short, and where they have to walk long distances to grass and water.

When starvation is the cause, the remedy is obvious. Failure to make provision for the hard times, which always come along, leads to loss through cows not breeding regularly, involving the loss of the calf, the production of the cow, and often the cow herself.

The provision of stacks of hay or silage in favourable seasons, and keeping them in reserve until required, may make all the difference between profit and loss.

The breeding animal should be of adult age, neither under- nor over-fed, and should have moderate exercise.

The common practice of allowing the bull to run with the cows is not commendable. With the bull under control, he is able to serve many more cows, and the time of cows coming in may be so arranged that they will calve when feed should be available in normal seasons, and when butter fat is not usually at its lowest price.

*—W. Dixon.*

## WHAT IS PROFITABLE DAIRYING?

Some farmers consider that the more cows they milk, the more efficient and profitable their dairying practice becomes. But when success in dairying is mentioned, many other factors must come into reckoning.

Pasture management, milk and cream quality, and stock diseases can all be controlled by the farmer. Good pasture management requires the introduction of the best grasses, rotational grazing, the conservation of fodder, pasture renovation, and the use of any necessary fertilizers.

The quality of milk and cream is controlled largely by the attention given to milking, separating, storage on the farm, freedom of the pastures from milk-tainting weeds, and the health of the herd. The incidence of disease in the dairy herd, of course, depends largely on the care and attention given to the animals.

The milking capacity of the herd depends obviously on the milking capacity of the individual cows. The question as to which are the best producers can be determined by systematic herd testing. Unprofitable cows should be culled as soon as practicable. Only the best cows should be kept as breeders. Boiled down, the yield of butter-fat to the acre determines the soundness of dairy farm management.

Good farm management and a poor herd are just as bad as a good herd and poor management. Good management and a good herd together must result in a high yield per acre.

*—L. A. Burgess.*


# Dwarf Grain Sorghums.

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

DURING the past two seasons on the Darling Downs trials of several dwarf types of grain sorghums, introduced by the Department of Agriculture, have demonstrated their superiority to maize in yield of grain as well as fodder. Maize, as is well known, is injured by a check in growth through insufficient soil moisture, while the yield is further depleted if dry weather is experienced at the tasselling stage. Sorghums, on the other hand, will withstand much dry weather and yield a crop under conditions that would cause maize to fail. Their culture on the Darling Downs and other districts where the average annual rainfall does not exceed 30 inches is commended.

Analyses made by the Agricultural Chemist of the growths at the flowering stage and when the seed had matured and been harvested, as well as the grain, show the following digestible nutrients. Those of maize and wheat are given for comparison. All are calculated as moisture-free, so it will be necessary to take one-fifth to allow for 80 per cent. of moisture at the flowering stage, one-fourth to allow for 75 per cent. of moisture when the grain was removed, and nine-tenths to allow for 10 per cent. of moisture in the grain.

| At Flowering Stage. | Digestible Nutrients per 100 lb. | | | |
|---|---|---|---|---|
| | Crude Protein. | Other Nutrients. | Total. | N. Ratio. |
| Dwarf Pink | 6·53 | 57·95 | 64·48 | 1 : 8·8 |
| Kalo | 7·09 | 55·67 | 62·76 | 1 : 7·85 |
| Brown Yolo | 7·23 | 56·41 | 63·64 | 1 : 7·8 |
| Wheatland Milo | 7·52 | 54·71 | 62·23 | 1 : 7·27 |
| Mature, less seed head— | | | | |
| Dwarf Pink | 5·33 | 51·08 | 56·41 | 1 : 9·58 |
| Kalo | 6·16 | 46·93 | 53·09 | 1 : 7·61 |
| Brown Yolo | 6·62 | 47·51 | 54·13 | 1 : 7·1 |
| Wheatland Milo | 8·14 | 44·51 | 52·65 | 1 : 5·46 |

| Grain. | Digestible Nutrients per 100 lb. | | | |
|---|---|---|---|---|
| | Crude Protein. | Other Nutrients. | Total. | N. Ratio. |
| Dwarf Pink .. .. .. .. | 12·96 | 76·23 | 89·19 | 1 : 5·9 |
| Kalo .. .. .. .. .. | 11·25 | 78·91 | 90·16 | 1 : 7·0 |
| Brown Yolo .. .. .. .. | 9·96 | 80·39 | 90·35 | 1 : 8·0 |
| Wheatland Milo .. .. .. | 11·34 | 80·18 | 91·52 | 1 : 7·0 |
| Maize .. .. .. .. .. | 8·38 | 87·42 | 95·8 | 1 : 10·4 |
| Wheat .. .. .. .. | 10·24 | 78·92 | 89·16 | 1 : 7·7 |

The digestibility of a foodstuff is a measure of its value when fed alone. Better results may be expected when it is fed as part of a balanced ration.

The fodder analyses are illuminating, especially of the plants after the seed head had been removed. At the latter stage the stems were still succulent and making a regrowth noted by shoots from the stems. This regrowth accounts for the satisfactory protein content and allows the nutritive value to be only approximately 10 per cent. less than at the flowering stage. After maize is harvested the value of the stalks is negligible for fodder purposes. Though maize grain shows higher in total nutrients owing to a greater fat or oil content, the nutritive ratio of the sorghums is much more satisfactory and about on a par with wheat. For all classes of stock sorghum grain appears to be suitable, but crushing or grinding may be advisable in the case of very hard grain for cattle, horses, and pigs, as much of it would otherwise pass whole through the digestive system. For sheep, which masticate more thoroughly, and poultry, crushing does not appear imperative.

Yields of grain from the dwarf varieties under good seasonal conditions can be expected up to 40 or, possibly, 50 bushels per acre.

Three to four pounds of seed are required to sow an acre in drills around 30 inches apart. As the plants stool fairly freely, the dropping of single seeds 4 or 5 inches apart in the rows is indicated. Satisfactory sowing can be effected with the combine by blocking the runs between the first, fifth, ninth, and so on to space the rows 28 inches, or the first, sixth, eleventh, and so on to space the rows 35 inches apart.

The time to sow will be dictated by seasonal conditions, late November or December being suggested for the Darling Downs and Maranoa. This should allow of flowering after the heat wave has passed and of maturity being reached before frost occurs.

Inter-row cultivation should be practised or the crop harrowed after the plants have become established. Harvesting is effected by the header in a similar manner to wheat. Slight adjustments, however, in the machine are desirable to prevent undue cracking of grain. The speed of the cylinder may be reduced to two-thirds or a half of that used for wheat, though that of other parts need not be altered. One or two rows of concave teeth might be removed and the remainder lowered if much grain is being cracked, but the clearance between cylinder and concave teeth should be uniform. Adjustments of the sieves will also probably be suggested during use.

It cannot be said that a market exists for any large quantity of sorghum grain, but its value on the farm in the drier districts warrants its production owing to a higher grain yield with a better nutritive ratio than maize and for the value of the fodder remaining when the grain has been removed. The dwarf varieties can be expected to carry less caney matter or hard fibre than taller-growing kinds, and to be thus more suitable for sheep. As the crop would be harvested when wheat, oats, &c., are being grazed in early growth, access thereto would allow the animals to secure a better balance in the food daily consumed. For topping up sheep or lambs the feeding of lucerne hay with the grain in a self-feeder for ten days or so should obviate wastage in transit to market and provide a bloom on the dressed carcase that would add to its value.

## LUCERNE AS A GRAZING CROP.

The success of lucerne as a grazing crop depends so much on the way in which it is treated during growth that every consideration should be given to methods which will prolong the life of the stand and ensure maximum production from it.

If possible, grazing by heavy stock should be avoided for the first twelve months, the best method being to run sheep on the new stand of lucerne and feed only half the growth. This promotes maximum root development at an early period, and establishes greater resistance against summer heat and dry weather.

A common cause of failure with lucerne is overstocking. In a dry spell, when native grasses are going off, there is every temptation to crowd stock on to lucerne paddocks, and the crop is thus over-grazed. Even if plantings have to be made progressively year by year, every effort should be made to bring the area of lucerne up to a level consistent with the maximum number of stock it will be expected to carry. After some experience this can be done without much difficulty, taking into consideration such factors as soil type, carrying capacity of the property, other crops grown, and the conserved fodder available.

Rotational grazing is very desirable with lucerne. Feeding off has to be controlled in order to prevent grazing too close to the ground, which injures the crown of the plant and may thin the stand out considerably. Grazing in one large paddock is very wasteful.

One of the most important factors in lucerne management is renovation. The beneficial results following this practice have been amply demonstrated on the Western Downs, and it can be stated quite definitely that renovation at least once or twice a year is essential. Tynes are preferable to discs for this work because of the danger of cutting the crowns with disc implements. The stirring of the soil around plants helps in the distribution of manure over the paddock, aerates the soil, allows rain quicker access and easier penetration to roots, and forms a soil mulch which decreases the evaporation of moisture. Renovated paddocks, therefore, retain vitality for a longer period, recover more rapidly after grazing and after rain, and are less likely to thin out during droughts.

*—C. F. Defries.*

## PREPARATION OF SEED-BED FOR PASTURE.

Various types of seed-bed, ranging from uncultivated forest land to the onion-bed type, are employed for sown pastures. The seed-bed provided by partly cleared forest land, even though some form of harrowing has been done, is very unsuitable for pasture establishment, the competition of native grasses and undergrowth usually proving too severe for the seedlings of sown pastures. Likewise, established pastures of native or other grasses are not receptive of additional pasture plants unless a disturbed seed-bed is provided, and a temporary check given to the growth of the established plants, by drastic harrowing. The ashes resulting from scrub burns provide quite a good seed-bed for pasture plants.

By far the best seed-bed is that resulting from the thorough tillage of fertile soil. Most of the common pasture plants have small seeds and require a seed-bed of fine tilth, and by compacting the soil close to the surface a seed-bed is provided which is favourable to the fine, early root systems of the pasture plants. The seed-bed should contain ample moisture, and in dry districts, particularly, cultural operations throughout the seed-bed preparation period should be done with due regard to the conservation of moisture. Ploughing well in advance of sowing is desirable, and the land should be allowed to lie in the rough state for a few weeks before further cultivation is undertaken. Heavy tine harrows, or a spring-tooth cultivator, will be required to break down the clods. Subsequent working should be designed for the destruction of weeds and the compaction of the sub-surface soil, and shallow harrowings will help. If the land becomes weedy and the surface sets hard, a disc harrow may have to be used to destroy the weeds. Rolling before sowing may be desirable in cases where the ordinary cultivation has not sufficed to form a fine seed-bed.

*—C. W. Winders.*

## GRADING OF ONIONS.

Onion harvesting generally will commence in October. Flavour, size, firmness of texture, and capacity to carry well without serious bruising or other damage all influence their market value.

Buyers, however, sometimes complain of onions being marketed without due regard to their classification in accordance with the size of the bulbs. It is the custom of some growers to include large and small sized onions in the same bag. This practice is against the interests of the farmer, contrary to the wishes of the selling agents, and results in comparatively lower market values.

Onions should be classified according to size. The small sized onions —say, below 2 inches in diameter—should represent one "size" grade. Onions ranging from 2 inches to less than 3 inches in diameter should comprise another grade, and onions from 3 inches to 4 inches in diameter should form still another grade.

Some growers prefer to classify the onions in grades in accordance with each ½-inch increase in diameter. This practice ensures evenness and uniformity in appearance in each grade.

The number of grade classifications should be determined by the variation in the size of the individual bulbs comprising the crop. In ordinary circumstances, the classification of the bulbs into three or four grades will suffice. It is important, however, that the onions should be graded as evenly as practicable. All "outsized" bulbs, especially the onions which are coarse, and are customarily referred to as "bull-necks," should be rejected.


## Queensland Pigs in London.

QUEENSLAND'S pig industry was well represented in the All-Australian Export Pig Competition conducted by the Australian Meat Board and judged in London last June. Of the twenty-one exhibits of porkers Queensland provided eleven entries, and the same number of entries in the total of seventeen baconer exhibits. The pigs came from Central and Southern Queensland.

The Queensland exhibits were as follows:—

BACONER CARCASES.

| Name. | Breeding of Pigs. | Percentage of Marks Gained. |
|---|---|---|
| A. J. Cliffe, Mundubbera .. .. | Tamworth x Berkshire .. .. | 78·8 |
| Port Curtis Co-operative Dairy Association, Biloela | Large White .. .. .. | 68·0 |
| W. A. Collard, Maleny .. .. | Large White x Berkshire-Tamworth | 73·06 |
| J. Alcorn, Maleny .. .. .. | Large White .. .. .. | 74·93 |
| A. Herron, Conondale .. .. | Berkshire x Large White .. .. | 63·2 |
| A. Ley, Kinleymore .. .. .. | Large White x Gloucester Old Spots | 56·0 |
| Kingston Pig Farm Co., Kingston .. | Large White x Large White x Large White-Poland China | 77·33 |
| Kingston Pig Farm Co., Kingston .. | Large White .. .. .. | 75·2 |
| A. Hemes, Salisbury .. .. .. | Large White .. .. .. | 77·6 |
| O. F. Haack, Beenleigh .. .. | Tamworth x Middle White .. | 79·2 |
| H. B. Kerner, Ipswich .. .. | Middle White .. .. .. | 64·55 |

The winning entry of baconer carcases was a pen of Large Whites exhibited by Mr. A. Virgano, South Morang, Victoria; these carcases scored 81·33 per cent.

Porker Carcases.

| Name. | Breeding of Pigs. | Percentage of Marks Gained. |
|---|---|---|
| Port Curtis Co-operative Dairy Association, Biloela .. .. | Large White x British Black .. | 67·53 |
| Salvation Army Farm, Riverview .. | Tamworth x Middle White .. | 63·77 |
| M. G. Bayliss, Maleny .. .. | Large White .. .. .. | 77·39 |
| Kingston Pig Farm Co., Kingston .. | Large White .. .. .. | 74·49 |
| O. F. Haack, Beenleigh .. .. | Berkshire x Tamworth .. .. | 71·59 |
| A. F. H. Johnston, Chermside .. | Middle White x Berkshire–British Black | 53·63 |
| G. W. Winch, Zillmere .. .. | Middle White x Tamworth .. | 58·26 |
| G. W. Winch, Zillmere .. .. | Middle White x Berkshire.. .. | 62·90 |
| H. B. Kerner, Ipswich .. .. | Middle White .. .. .. | 65·22 |
| T. Bradshaw, Chermside .. .. | Middle White x British Black .. | 60·58 |
| A. F. H. Johnston, Chermside .. | Tamworth x Berkshire–British Black | 53·04 |

The winning exhibit in the porker carcase class also was an entry of Berkshires from Messrs. Wickham and Candy, O'Halloren Hill, South Australia; these pigs gained 79·12 per cent.

Commenting on this competition Mr. L. A. Downey, Instructor in Pig Raising, says:—

The outstanding observations from the results of carcase appraisal so far are the amount of overfatness and deficiency in body length of the majority of the Australian pigs. Of the 114 pigs appraised in this All-Australian export competition 80 per cent. were overfat and only two pigs reached the required standard of body length. Whilst excessive fatness aggravates the relative body shortness, it is found that of the 20 per cent. of the pigs in this competition which were not overfat, all except one were still below the standard for body length. The average total marks gained by all pigs in the competition were 67·83 per cent., but the average marks gained by all pigs for body length were only 55.31 per cent.

Body length is one feature which is just as important to breeders as to the pork and bacon trade, for it is an indication of capacity to produce and rear large and good litters, and extra body length means increased weight in pigs.

Every breeder strives to produce long-bodied pigs, and most breeders think they have done so, but carcase appraisal has shown how far astray some breeders are in their visual judgment of body length. It is not until the tape is placed on two fixed points on the carcase and that measurement valued according to the weight of the pig that one can say with any degree of certainty whether a pig is long or short in proportion to its weight.

## WHAT CANADA IS DOING.

The Canadian Chamber of Agriculture has undertaken the task of fully informing the farmers of Canada of the decisions of the Sydney Conference and of observing their reactions to the conference proposals. Like Australia, Canada is a land of immense distances and varied agricultural interests, so the job will take some time. The Sydney decisions have been circulated far and wide. The interest shown in the reports so far is remarkable, and it is believed that when definite decisions are made they will be in favour of organised and orderly marketing within the Empire on the lines laid down.

## WHEN BUYING A PIG.

It is not every day that we buy a pig, so it is worth while remembering a few points when considering the purchase of stores. Having decided the class and type of animals required, the next thing to do is to inspect the pigs on offer. Move them around and inspect each one individually, observing defects like rupture, rough, coarse skin and hair, and estimating what is the real and not the apparent average weight.

A point that cannot be overstressed is that if a pig sale is attended for the purpose of purchasing stores and there is nothing really suitable on offer, or the prices are too high, it would be wise from a financial point of view to forget all about them.

Far too many people just buy because that was their original intention, forgetting the point as to whether the pigs put up for auction are worth a higher bid.

It is important to know the highest figure that should be bid, and the one which will turn out to be economically sound when the pigs are fattened up to pork or bacon weights. The class and age of the animals, of course, must be considered, but it is just as well to make sure that there is a reasonable margin of profit in prospect when the pigs go eventually to the butcher or the bacon curer. Only a simple calculation is needed, and the error, if any, should be on the low side, for optimism may turn out to be monetarily disastrous.

It is impossible to get away from the fact that some people are born salesmen or born buyers, but the qualities of both can be cultivated. It is a good thing to know just when to "get in" or "get out," but that knowledge must go hand in hand with sound practical farm management. A note of warning: Cheap pigs in low condition are no good to any man, and must eventually cause a heavy instead of a light expenditure.

## YIELD OF CARCASE IN PORK AND BACON PIGS.

The loss of weight in transit of a pig from farm to factory, and then during dressing, varies very much, and it is not possible to say exactly what weight a pig will lose.

Factors which affect the amount of loss are:—The size of the pig—the larger pig will lose a lower percentage; how the pig has been fed; the length of the journey from farm to factory; the conformation and condition of the pig and the amount of food contained in its alimentary tract when it is weighed alive.

In tests it has been shown that under conditions similar to those ordinarily ruling in Queensland, pigs weighing 150 lb. to 200 lb. alive on the farm lose about 10 per cent. of this weight in transit to the factory, and then another 20 per cent in dressing. Lighter pigs, weighing 100 lb. to 140 lb. alive, usually lose approximately 33 per cent. by the time they are dressed. Whilst these figures possibly are a fair average, individual pigs vary considerably according to the factors already mentioned.

As a rough guide in estimating dressed weight from live weight, farmers usually take seven-tenths of the live weight for baconers and two-thirds of the live weight for porkers.

*—L. A. Downey.*


## GARDEN SEED SELECTION.

In selecting and saving seed for future plantings, the most vigorous, healthiest, and heaviest-bearing plants should always be reserved for the purpose. Type and production are essentials that should always be observed.

Various methods are used in the harvesting and cleaning of garden seeds, but the actual principles remain more or less steadfast. Seeds should not be harvested until fully ripe or mature. It is equally important that the crop should be promptly gathered when the proper time has arrived. If seed be left too long on the plant, sprouting or moulding may occur, and the seed, at least, will discolour. Seeds are generally ripe when the pods or seed capsules turn yellow, or the fruits —such as tomatoes and melons—lose their firmness.

Bright sunny weather should be selected, if possible, for the harvesting of crops which require threshing—such as beans and peas. The plants should be dried thoroughly before threshing, and it is always better to select days of low humidity for this operation. No matter how the seed is threshed, the greatest care should be taken to prevent breaking the seeds. Winnowing is often necessary for the final cleaning of the seed.

In obtaining clean seed of such fruits as tomatoes and melons, the ripe fruits must stand for some time in their juices to remove the mucilaginous covering. A common method is to throw the cut specimens or the scooped-out pulp into any convenient vessel—such as a bucket, tin, or small barrel—and stir daily until fermentation has loosened the covering about each seed. This requires from three to six days. To prevent the discolouring of seeds, the fermentative process should not be continued longer than necessary.

After fermentation, the seeds are separated from the pulp and the skin by washing as often as may be required to obtain clean seeds. The good seeds settle to the bottom of the vessel, while the pulp, skin, and light seeds rise to the top and may be poured off. Three or four washings are usually sufficient, and the use of sieves in this process of separation is recommended.

After winnowing or washing, as the case may be, all seeds must be cured thoroughly before storing. They should be spread in layers on trays in well-ventilated places until completely cured. It is an advantage to wash early in the mornings of bright days to facilitate drying, which should always be done under shade. Seeds may be stored in either cloth or paper bags. The greatest enemy to the preservation of seeds is moisture, but usually the conditions in an ordinary living-room are satisfactory. Provided the seeds are well cured and the humidity remains low, ordinary fluctuations in temperature do not affect the vitality of the seed. It is a well-known fact that seeds do not keep well in North Queensland, because of the great amount of moisture in the atmosphere. Some seeds—such as cabbage, turnip, and radish—stand a very great chance of becoming mouldy unless kept in well-ventilated containers.

## THE CHOKO.

The choko is a popular vegetable, grown largely in Queensland for both market and home use. It has the advantage that, once planted, it comes into bearing each year from the original root. The plant will die down only during the coldest months, and in the spring will shoot again from the tuber which is formed under the ground.

The choko requires a rich loamy soil to which has been added a heavy dressing of well-rotted stable manure. Additions of dried blood and bone dust, or of manure during growth, are of great benefit, as being a perennial and a heavy feeder, the choko's food requirements are considerable.

The method of planting the choko differs greatly from that used for other varieties of the same family. Whole choko fruits are used as planting material, the growth coming from the shoot from the kernel in the fruit. The fruit should be planted on the side with the broad end sloping downwards and the stem end slightly exposed.

A trellis is essential to satisfactory growth, although, if planted near a fence or old stump, the plants will spread over it very quickly. When chokos are grown commercially, it pays to erect a suitable trellis. This may be done with logs or rough timber. Sometimes an ordinary "T" trellis is used, over which strong fencing wire is stretched.

A good permanent trellis may be constructed as follows:—Two rows of strong posts are set firmly in the ground with a height of about 6 feet 6 inches above the surface, the rows being about 9 feet apart and the posts about 8 feet apart in the rows. The tops of the posts support cross timbers on which strong fencing wire is stretched with about 18 inches between the wires to carry the vines. Stays support the outside posts, and wires for trellising also should be stretched on these.

The choko takes some months to come into full bearing, but will commence to bear fruit generally about four to five months after planting. The plants seem to improve with age when properly cultivated and manured.

There are two varieties, the green and the cream. The cream-coloured variety is the more popular.

Chokos should be picked fresh and, after having been peeled, should be cut into suitable portions and boiled or baked.

*—C. N. Morgan.*

## THE EGG PLANT.

The egg plant is easily grown and produces an excellent culinary vegetable. It is grown similarly to the tomato, and like that plant, is very sensitive to cold. It requires a light, rich, loamy, well-drained soil, and poorer ground may be improved by the addition of a 1-4-1 mixture of sulphate of ammonia, superphosphate, and sulphate of potash at the rate of about 5 cwt. to the acre, or by heavy dressings of well-rotted stable manure to which a small quantity of superphosphate has been added.

For an early crop the seed may be sown under cover during July and August; and, when all danger of frost is over, the plants should be set out about 2 feet apart in rows 3 feet apart. Difficulty may be experienced with transplanting, and, it is sometimes desirable to sow the seed in the permanent positions for the plants after all danger of cold weather has passed.

Cultivation and plenty of water are necessary for the plants, as they do not recover readily after a check in growth. The plants may be staked like tomatoes. As soo as the fruits are formed, they should be thinned out to leave only eight or ten to each plant. The fruits are picked when from 4 to 6 inches in diameter. The time from seed planting to transplanting is approximately two months, and from seed planting to mature fruit five months. The best variety is the New York Purple Spineless.

For cooking, the fruit should be cut into slices, salted, and fried in batter. In boiling or baking, the fruit should be seasoned with butter, pepper, and salt.

—*C. N. Morgan.*

## TOMATOES IN THE CENTRAL DISTRICT.

With the higher level of prices which usually operates from September to December, the tomato crop assumes greater importance to the farmers in the tomato-growing areas of the Central district. This period coincides with an increased incidence of pest and disease troubles. Particular attention, therefore, should be paid to the cultural requirements of the plants and to pest and disease control in order to prolong the bearing period.

Normally with tomato patches on scrub burns, weeds do not trouble the young crop unduly; but it is advisable to check the weed growth which sometimes becomes serious at picking time. The soil around the base of the plants should be kept loose, at the same time, with the hoe. In cultivated areas, the land should be kept well stirred and free of weeds, which both rob the soil of valuable moisture and encourage the breeding of pests such as the corn-ear worm and the tomato mite.

Old plants may be cut back profitably if the root systems are reasonably sound and a bunch of fresh growth is shooting from the main stem. If excessive, this flush of new shoots may be thinned lightly. Severe thinning is undesirable, as it is necessary to retain sufficient foliage to keep a reasonable balance between the root system and the parts of the plant above the surface.

A handful of a 4-11-10 chemical fertilizer, containing sulphate of ammonia, superphosphate, and sulphate of potash, should be applied to old plants and backward young plants, in order to stimulate new growth and blossoming. When the first fruit has set, a dressing of 50-60 lb. of sulphate of ammonia per acre will help to keep the plants moving.

Tomato mites spread rapidly as the warm weather approaches, and quickly cause a dying back of the foliage from the centre of the plant. Loss of foliage exposes the stems and the fruit to the hot sun with harmful results. For the control of the mite the plants may be sprayed with lime sulphur at a strength of one in eighty. Alternatively, a dust composed of flowers of sulphur and a good quality hydrated lime in the proportion of 1-1 can be used. If mites already are numerous on the plants, spraying is preferable to the dusting. However, if the plants are treated with a sulphur—lime dust from the seed-bed onwards, a satisfactory control of the mites will be obtained.

Damage by the corn ear worm also increases rapidly in the spring, and may be the cause of heavy losses of fruit if not checked at an early stage. Lead arsenate is the most reliable insecticide for this pest, and may be used as a spray or dust. A suitable spray can be prepared by adding 3 lb. of lead arsenate to 100 gallons of water and including a spreading agent. If mites are troublesome at the same time, colloidal sulphur may be included with the lead arsenate. As a dust, the lead arsenate is used diluted 1-1 with either a good quality hydrated lime or sulphur, the latter diluent having the additional advantage of controlling the mite.

Lead arsenate leaves an objectionable spray residue, and should not be used after the plants have commenced to fruit. Constant attention to the control of the corn ear worm up to this stage, however, gives an excellent chance of a reasonable crop.

Leaf diseases and black spot on the fruit frequently appear as the plants age and lose their vitality. Correct manuring, cultivation and pest control all help considerably to prolong the life of the plant.

When a fungicide is necessary, either a Bordeaux spray or a copper dust may be used to hold the diseases in check. To control pests and diseases with a combination spray, lead arsenate and a colloidal sulphur preparation may be added to the Bordeaux. Lime sulphur cannot be included in a Bordeaux spray, as such a mixture is liable to injure the plants.

Various proprietary dust mixtures containing lead arsenate, sulphur and a copper compound are marketed for the purpose of controlling pests and diseases in one operation.

*—W. J. S. Sloan and W. J. Ross.*

## PASSION FRUIT.

Passion fruit vines are prone to several diseases which, with proper attention, can be controlled, but which, when the vines are allowed to grow uncared for, quickly destroy them. Because of these diseases and the old haphazard method of cultivation, the idea has become current among orchardists that vines can be grown only for about two, or, at most, three years. That this is erroneous has been demonstrated by growers who have made passion fruit culture their main occupation, and who have vines bearing well at seven years of age. These growers,

however, prune correctly and spray at the right times, as advised by officers of the Department of Agriculture and Stock. They also grade and pack their product carefully for market.

It is stated by some that passion fruit growing entails too much work pruning and spraying, and that the results are not worth it. That is not necessarily so. Pruning the vine certainly is a tedious and lengthy operation. Spraying also is objectionable, but it should be remembered that citrus growers, grape growers, and practically all other fruit growers must also prune and spray.

Good passion vines produce up to half a bushel of fruit a year. They are usually planted 15 feet by 8 feet apart, or 363 vines to the acre. On a conservative average of 3s. 6d. per half-bushel clear of marketing expenses, the return would be £63 per acre per annum. Are there many other fruit crops netting orchardists this sum an acre?

The passion vine thrives in warm, moist situations, preferably in the coastal districts. It grows well on the coastal highlands, like the Blackall Range and Tamborine Mountain, and also on the lowlands between these and the sea. The vine will resist light frosts, but heavy frosts will cause damage.

Reasonably fertile scrub and forest loams, provided they are well drained, are suitable soils, and if a hillside site is chosen it should be well sheltered from heavy winds and, preferably, have an easterly or north-easterly aspect. It is important that the trellises be strongly made, and that they be at least 6 feet in height.

Two crops are borne each year, a summer and a winter crop, while occasionally intermediate crops are borne.

Spring is the best time to plant, although autumn planting is sometimes practised. Spring-planted vines sometimes return a small crop the following winter, but the first main crop can be looked for twelve to fifteen months after planting. With autumn-planted vines the first main crop often is not obtained until eighteen to twenty-one months after planting.

A pamphlet giving full cultural details is available free on application to the Department of Agriculture and Stock.

# The Fruit Market.

JAS. H. GREGORY, Instructor in Fruit Packing.

EARLY in September cool conditions prevailed, causing, to some extent, a decrease in the demand for citrus fruits and pineapples. The warmer conditions later in the month improved the market for citrus fruits, apples, and pears. Pineapples, unfortunately, did not share in this benefit because of supplies exceeding requirements. Northern mango-growers are advised not to send fruit until it has fully matured. Well-packed lines of mangoes arriving in good condition are always assured of a satisfactory price. Badly packed fruit spoils the market for future consignments. For Sydney or Melbourne only high-class fibreless types should be despatched, as the common mango is not popular with consumers. Through the repletion of factory supplies, towards the end of the month an oversupply of strawberries developed on the market. The prompt initiation of a scheme for supplying 4-lb. boxes direct to the public proved an unqualified success. The winter crop of bananas is not realising high prices on the interstate markets. The following were the ruling prices for the last week of September:—

## TROPICAL FRUITS.

### Bananas.

*Brisbane.*—Cavendish: Smalls, 5s. to 6s. 9d.; sixes, 5s. to 9s.; sevens, 6s. to 12s. 6d.; eights and nines, 10s. to 15s.

*Sydney* (practically unsaleable).—Sixes, 5s. 6d. to 9s.; sevens, 9s. to 13s.; eights and nines, 14s. to 16s.

*Melbourne.*—Sixes, 8s. to 10s.; sevens, 10s. to 12s.; eights and nines, 12s. to 14s.

*Adelaide.*—Good-quality fruit, 16s. to 20s. per case.

Growers are advised to watch for the date for the prohibition of the "small" grade on the Brisbane market.

*Brisbane.*—Lady's Finger, 2d. to 7½d. per dozen; few special bunches higher.

### Pineapples.

*Brisbane.*—Smoothleaf, 2s. 6d. to 5s. per case, 1s. to 3s. 6d. per dozen (market well supplied); Ripley, 4s. to 6s. per case, 6d. to 4s. per dozen.

*Sydney.*—Smoothleaf, 5s. to 8s. per case.

*Melbourne.*—Smoothleaf, 6s. to 8s. per case.

*Adelaide.*—Smoothleaf, 12s. to 13s. per case.

### Papaws.

*Brisbane.*—Yarwun, 3s. to 6s. tropical case; Gunalda, 2s. to 4s. bushel; Locals, 1s. 6d. to 2s. 6d. bushel case.

*Sydney.*—3s. to 10s. per tropical case. Too many green lines are being marketed.

*Melbourne.*—6s. to 10s. tropical case. Green lines unsaleable.

## CITRUS FRUITS.

### (Brisbane Market only.)

**Oranges.**—Tamborine Navels, 7s. to 9s.; common, 5s. to 7s.; small sizes, 3s. to 4s. and hard of sale.

**Mandarins.**—5s. to 11s. per bushel.

**Grapefruit.**—Gayndah, 8s. to 12s.; Locals, 6s. to 8s.

**Lemons.**—Gayndah, 6s. to 10s.; Locals, 3s. to 6s.

## DECIDUOUS FRUITS.

### (Southern Fruit only.)

#### Apples.

Jonathan, 7s. to 12s.; Granny Smith, 8s. to 15s.; Delicious, 9s. to 12s.; Cleopatra, 7s. to 10s.; Sturmer, 6s. to 10s.; Rome Beauty, 7s. to 10s.; Crofton, 11s. to 12s.; Tasma, 10s. to 12s.

With the advent of warm weather conditions, Southern shippers are advised not to send any of the softer varieties of apples, such as Rome Beauty, Statesman, Delicious, &c., to Queensland, as deterioration is rapid under the warm humid conditions which are likely to prevail in the future.

#### Pears.

Winter Cole, 10s. to 15s.; Josephine, 8s. to 14s.; Winter Nelis, 6s. to 12s.; Broom Park, 7s. to 10s.

All pears should be wrapped, as unwrapped lines show bad skin-marking.

## OTHER FRUITS.

#### Strawberries.

*Brisbane.*—4s. to 5s. per dozen boxes; choice, 6s. to 7s. per dozen boxes.

*Sydney.*—Trays, 1s. to 4s.; boxes, 4s. to 8s. per dozen.

#### Passion Fruit.

*Brisbane.*—Choice, 10s. to 12s.; second grade, 8s. to 9s.

*Sydney.*—6s. to 14s. per half-bushel.

*Melbourne.*—6s. to 11s. per half-bushel.

#### Tomatoes.

*Brisbane.*—Coloured, 5s. to 9s.; green, 5s. to 8s.; ripe, 3s. to 5s.; Bowen, 4s. to 9s.; Yarwun and Ambrose, 6s. to 9s.

*Sydney.*—Cleveland, 7s. 6d. to 10s. per half-bushel.

*Melbourne.*—Adelaide Hothouse, 22s. to 23s.; Western Australian, 6s. to 13s.

#### Cape Gooseberries.

5d. to 6d. per lb.

## MISCELLANEOUS, VEGETABLES, &c.

#### Marrows.

*Brisbane.*—1s. to 3s. per dozen.

*Sydney.*—6s. to 8s.

*Melbourne.*—8s. to 10s.

#### Cauliflowers.

Small, to 3s. per dozen; choice, 5s. to 7s. per dozen.

**Cabbages.**

Small, 6d. to 3s. per dozen; large, to 5s. per dozen.

**Beans.**

*Brisbane.*—4s. to 7s. per sugar bag.
*Sydney.*—1s. 6d. to 5s. per bushel case; demand slow.
*Melbourne.*—3d. to 6d. per lb.

**Peas.**

2s. to 5s. per sugar bag.

**Carrots.**

3d. to 6d. per bundle.

**Lettuce.**

6d. to 1s. per dozen.

**Pumpkins.**

5s. to 8s. per bag. *Melbourne.*—£10 to £12 per ton.

**Beetroot.**

3d. to 6d. per bundle.

**Cucumbers.**

*Brisbane.*—9s. to 11s. per bushel case.
*Sydney.*—10s. to 14s. per case.
*Melbourne.*—14s. to 18s. per case.

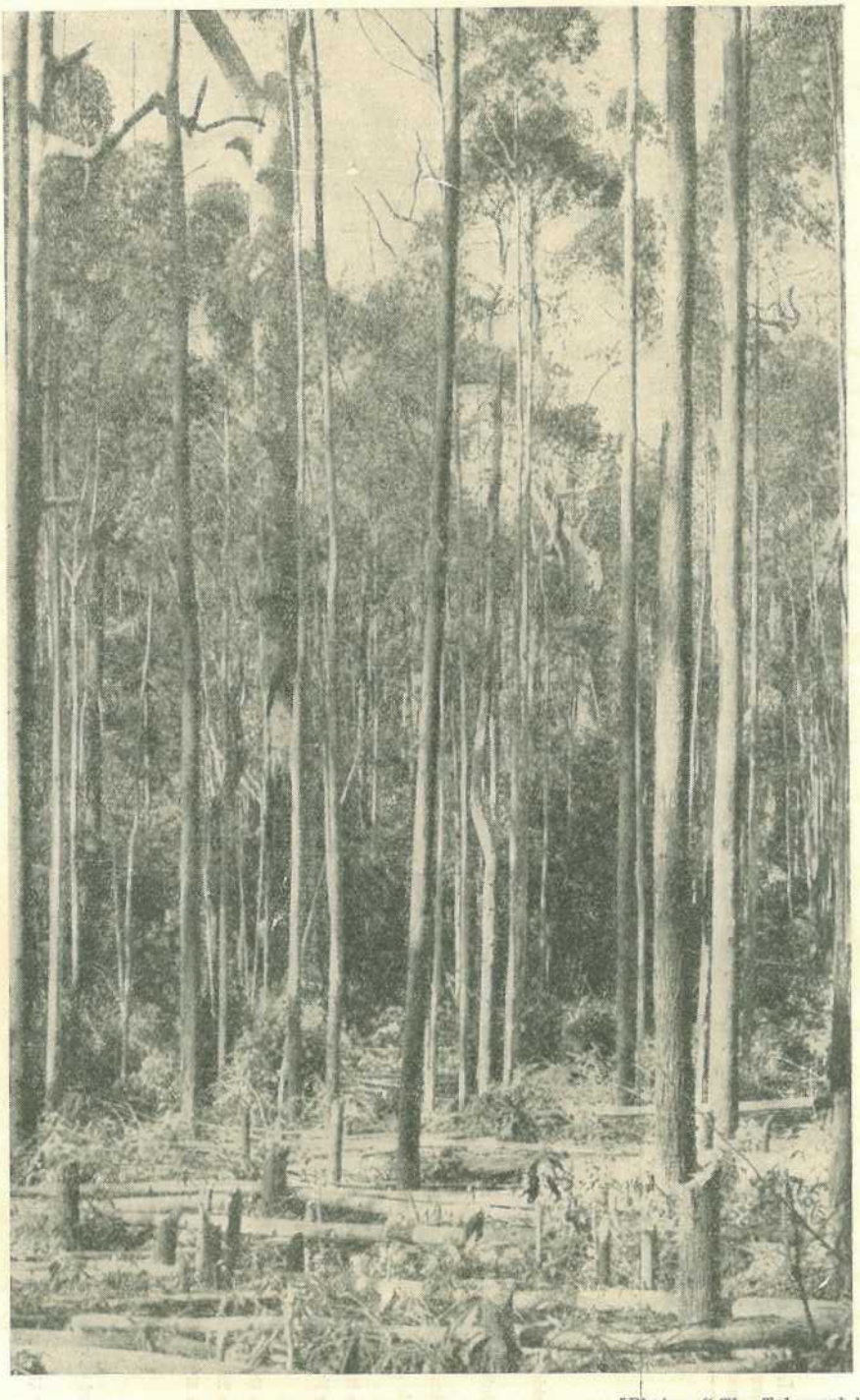
## CONTROL OF THE RED-SHOULDERED LEAF BEETLE.

In spring, the red-shouldered leaf beetle periodically makes its appearance in the coastal regions of south-eastern Queensland and causes a considerable amount of damage to a number of cultivated fruit trees and ornamental plants. Growers of susceptible crops should, therefore, become acquainted with the method of combating this pest as an invasion of the actively-flying adult beetles takes place without any warning and a delay of only a few days in applying control measures may involve much unnecessary loss.

Excellent control can be achieved by the use of either pyrethrum or pyrethrum and derris dusts. The pyrethrum can be mixed with an equal part by weight of kaolin, a cheap filler, to reduce the cost of the treatment. Dusts containing pyrethrum and derris are available in several proprietary lines.

The dusts are applied by means of a hand blower, preferably in the early morning when the beetles are relatively sluggish and less apt to fly when disturbed. The application should be thorough as the kill depends on each insect actually coming in contact with the dust. In large trees, for instance, dusting should be done both inside and outside the tree. Some beetles will usually be found resting on weeds, &c., in orchards, especially in the early mornings and these should also be treated. Most of the beetles will fall from the tree within a few minutes of dusting and a further light dusting when they are on the ground will increase the mortality rate.

On account of its effectiveness, ease of application, cheapness, and the surprisingly small quantities of dust required, growers can quickly apply this method of control whenever an infestation of red-shouldered leaf beetles occurs.



[*Photo.: "The Telegraph."*

Plate 182.
A young hardwood forest after thinning.

# 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, the Friesian Cattle Society, and the Guernsey Cattle Society, production charts for which were compiled during the month of August, 1938 (273 days unless otherwise stated).

| Name of Cow. | Owner. | Milk Production. | Butter Fat. | Sire. |
|---|---|---|---|---|
| | | Lb. | Lb. | |
| **AUSTRALIAN ILLAWARRA SHORTHORNS.** | | | | |
| MATURE COW (STANDARD 350 LB.). | | | | |
| Sunnyside Honey 8th (356 days) .. .. .. | P. Moore, Wooroolin .. .. .. .. | 16,630·5 | 685·619 | Bruce of Avonel |
| SENIOR, 3 YEARS (STANDARD 290 LB.) | | | | |
| Chasmin's Daisy .. .. .. .. .. | N. L. Siemon, Beaudesert .. .. .. | 9,945·15 | 398·574 | Thurles Cavalier |
| JUNIOR, 3 YEARS (STANDARD 270 LB.) | | | | |
| Folkestone Crystal (256 days) .. .. .. | Mr. N. Bidstrup, Ehlma Park, Warra .. .. | 9,373 | 386·235 | Dinkum of Thorndale |
| Fairvale Olive .. .. .. .. .. | J. H. Anderson, Southbrook .. .. .. | 7,024·05 | 285·596 | Blacklands Stately Major |
| SENIOR, 2 YEARS (STANDARD 250 LB.) | | | | |
| College Mayflower 2nd .. .. .. .. | Queensland Agricultural High School and College, Lawes | 7,122·15 | 253·675 | Trevlac General |
| College Fussy 2nd .. .. .. .. .. | Queensland Agricultural High School and College, Lawes | 6,370·78 | 252·224 | Duplex of Greyleigh |
| JUNIOR, 2 YEARS (STANDARD 230 LB.) | | | | |
| College Gold 3rd .. .. .. .. .. | Queensland Agricultural High School and College, Lawes | 8,394·08 | 326·006 | Trevlac General |
| College Thorn 2nd .. .. .. .. .. | Queensland Agricultural High School and College, Lawes | 6,978·19 | 250·505 | Trevlac General |
| College Kitty 3rd .. .. .. .. .. | Queensland Agricultural High School and College, Lawes | 5,643·95 | 233·914 | Trevlac General |
| **JERSEY.** | | | | |
| MATURE COW (STANDARD 350 LB.) | | | | |
| Eadie of Glenmoore .. .. .. .. | L. J. Comiskey, Warra .. .. .. .. | 7,405·2 | 395·818 | Beauty's Viscount of Woodbine |
| SENIOR, 3 YEARS (STANDARD 290 LB.) | | | | |
| Trinity Marshall's Coronada (365 days) .. .. | C. W. Barlow, Euston Road, Spring Creek, *via* Toowoomba | 8,666 | 496·946 | Trinity Field Marshall |

| | | | | |
|---|---|---|---|---|
| **SENIOR 2 YEARS (STANDARD 250 LB.)** | | | | |
| College Floss 2nd | Queensland Agricultural High School and College, Lawes | 6,024·65 | 310·476 | Belgonia Peggy 9th Duke |
| Bride of Glenmoore | L. J. Comiskey, Warra | 5,253·69 | 292·566 | Kelvinside Noble Golden Prince |
| **JUNIOR 2 YEARS (STANDARD 230 LB.)** | | | | |
| Glenview Flower | F. P. Fowler, Coulstoun Lakes | 6,024·15 | 324·69 | Trinity Governor's Hope |
| Oxford Rivoli Ballerina | E. Burton, and Sons, Wanora | 5,956·29 | 313·831 | Oxford Rivoli |
| Golden Fern of Chelsford | E. J. and H. G. Johnson, Gleneagle | 5,356·37 | 281·318 | Gunawah, Benedict |
| Glenmoore Lila (257 days) | L. J. Comiskey, Warra | 4,439·14 | 243·788 | Kelvinside Noble Golden Prince |
| **FRIESIAN.** | | | | |
| **SENIOR, 3 YEARS (STANDARD 290 LB.)** | | | | |
| Ryfield Ivy Dekol | P. P. Falt, Wondai | 8,722·75 | 352·933 | Ryfield Argus II. |
| **JUNIOR, 3 YEARS (STANDARD 270 LB.)** | | | | |
| Ryfield Dahlia IV. | P. P. Falt, Wondai | 7,785·45 | 310·989 | Ryfield Argus II. |
| **SENIOR, 2 YEARS (STANDARD 250 LB.)** | | | | |
| Ryfield Lady 3rd | P. P. Falt, Wondai | 7,705·4 | 306·412 | Ryfield Argus II. |
| **JUNIOR, 2 YEARS (STANDARD 230 LB.)** | | | | |
| Ryfield Ida 7th | P. P. Falt, Wondai | 8,374·85 | 311·076 | Dairymaid's Argus |
| **GUERNSEY.** | | | | |
| **SENIOR, 2 YEARS (STANDARD 250 LB.)** | | | | |
| Lilac Pretty Poppy | W. R. Smee, Peeramon | 6,236·35 | 272·779 | Mayfield Supreme |

# The Tropics and Man

## Keeping Cool.

DOUGLAS H. K. LEE, Professor of Physiology, University of Queensland.

KEEPING cool! How delightful that sounded; what pictures it conjured up of tinkling ice, chilly breezes and cool waters! With the sun daily mounting higher in the heavens and sun-baked walls nightly reradiating more absorbed heat, the memories of biting winds and frosty skies were becoming even more remote and taking on the quality of those fairy tales which captured our childhood imaginations.

### 1. The Body as Heat Producer.

To be sensitive to temperature changes is a handicap imposed upon all living matter, but, in the case of animals leading an active physical life, this becomes a veritable old man of the sea to those who live in hot climates. This old man's name is Heat Production. Every single process that goes on in the body from the passage of a nerve impulse to the muscular activity of hard work liberates its quota of heat. Physicists would quote you long and abstruse formulæ about the laws of thermodynamics. Chemists would dwell in loving detail on the miraculously intricate relationship of molecules, their private lives, and their thermal accompaniments. Physiologists like myself would steal boldly from both, but all this would, unless translated into concrete advice or definite action, render the unfortunate tropical dweller not one whit the cooler.

To forestall criticism, and convince you that there is sound reason behind the practical advice which comes later, I must deal a little with the more theoretical aspects of my subject. I have said that every process going on inside the body—and you would be astounded at their infinite number and complexity—liberates some amount of heat, large or small. Even at complete bodily rest considerable activity is going on in most of the tissues. Engines are kept warmed up, supplies of fuel are being transported to convenient sites, repairs are going on, renewals are being effected, a watch is being maintained against emergencies, chemical messengers are still running about their duties, and the nerve telephones of what we call the autonomic system are constantly in use. Even at complete rest, therefore, the body is by no means idle, and a considerable amount of heat is produced. In twenty-four hours the heat produced by an average resting man would suffice to raise nearly four gallons of ice-cold water to boiling-point. That sounds like a tale from Ripley, but it is true.

It will be obvious to you, of course, that a body not at rest, but doing work, must produce a great deal more heat than this. Under the very best conditions a muscle wastes three times as much heat as the energy it puts into the work it does; and muscles very seldom work under anything approaching the best conditions. A navvy produces about two and a-half times the amount of heat in twenty-four hours that the resting man produces. During the actual working period, of course, the ratio is very much greater. Not only does deliberate work speed up heat production, but other acts assist the process. The act of eating and the activities set in train thereby must increase heat production. This is particularly the case when a great deal of protein foods (meats and some cereals) are taken. Stimulating substances such as alcohol must, of course, entail increased heat production.

The whole of life, therefore, is inescapably bound up with the production of heat, which varies from a moderate level to fierce peaks of intensive activity.

### 2. How the Body Loses Heat.

Fortunately for us, and for life in general, the living body not only produces heat but it loses heat from itself to other objects. It can readily do this, of course, if its surroundings are cooler than itself, and the more readily the greater the difference. If the climate is a very cold one, the body loses heat so rapidly that it would rapidly die if measures were not taken to hinder the loss by warm clothing, fires, &c. With moderate differences, the body feels comfortable, i.e., with moderate clothing it is losing heat just about as rapidly as it is producing it without worry or strain to its myriads of contained activities. When the differences in temperature are small, however, then it is difficult for the body to lose heat as rapidly as it produces heat, and the body temperature is in danger of rising. Man, fortunately, is in a much better position than inanimate objects and in a much better position even than lower animals such as the frogs. Man can adjust the rate at which he loses heat to suit his surroundings. By throwing more blood into his skin blood-vessels he makes the skin warmer and thus able to get rid of heat more quickly. But his most valuable possessions in this respect are his sweat glands. No other animal, with the possible exception of the horse, has such well-developed and active sweat glands as has man. When loss of heat by ordinary physical channels is denied to him, man can still lose a considerable amount by producing sweat and allowing it to evaporate from his skin surface. This evaporation requires two things for its success—a reasonable dryness in the air and free circulation of air. The more humid the air the greater the need for free air movement; the drier the air the less movement required. Anything which interferes with the process of evaporation in hot climates—humidity, heavy and tight clothing, air stagnation—increases the difficulties experienced by the body in losing heat, and calls for appropriate remedy.

In illustration of the very important part played by the sweat glands, the experiences of certain unfortunate people who, by some freak of development, did not have any sweat glands are important. These people, if called upon to work in the fields, had to take with them buckets of water with which they damped their clothing every so often. If they failed to take this precaution they quickly suffered all the effects which we associate with an undue rise of body temperature. The horse sweats profusely when exercised on a hot day. Sometimes, particularly in India and Malaya, horses fail to sweat, and if played in a polo game die from heat stroke. Similarly, men working in hot desert country depend for their very existence upon the power of sweating, and if sweating is stopped by certain diseases or other causes heat stroke is almost inevitable.

Some heat, it is true, is lost by evaporation of water from the lungs into the inspired air. In the dog this may be of tremendous importance, since that animal, unfortunate in not being able to sweat, is fortunate in having a large, moist tongue over which he can move by rapid but shallow panting large amounts of air and secure rapid evaporation. In man, however, any advantage to be gained by more rapid breathing is of theoretical value only, and can make little difference to his heat loss.

### 3. The Importance of Body Temperature.

If the temperature of any living tissue is lowered the active processes we call life are slowed; if the temperature is raised they are hastened, but, most unfortunately, not only are the life processes hastened but the

destructive are hastened also, and, indeed, if the temperature rises much above 104 deg. F. the destructive processes start to take charge, while at 108 to 109 they are in complete control and the tissue dies. Man is equipped with the most complex and most sensitive systems in the animal series for keeping his body temperature steady under the widest variety of circumstances. This is another instance for Mr. Ripley—a man can stay in a perfectly dry atmosphere at 250 deg. F. (38 deg. above boiling point) for fifteen minutes without harm, while a beef-steak is partially cooked under the same circumstances in thirteen minutes. Undoubtedly such an exposure could not be maintained much longer than fifteen minutes, but it illustrates the enormous powers man possesses for combating the effects of temperature in his surroundings.

Only those who boldly pry into nature's secrets can appreciate the complexity and nicety of the shifts employed by the human body to keep its temperature constant. Heat production on the one hand has to be balanced against heat loss on the other, so that the balance in hand is always reasonably constant. The plan of action adopted by the body might not meet with the unanimous approval of economists, in that it attempts to exercise but little control over production—and that little is often flouted. To a certain extent the lassitude and reduction of appetite which accompany hot weather, particularly at its onset, are protective by diminishing heat production, but they are, I fear, largely accidental, and any good result achieved is easily wiped out by a small rise in body temperature. The body seeks rather to control heat loss, speeding this up by various means until the loss is restored to its normal level. It is easy, of course, to conceive surroundings in which adequate heat loss could not possibly be kept up (e.g., a still, saturated atmosphere of 97 deg. F.), but, very fortunately for man, such climates are practically non-existent under natural conditions.

This marvellous regulation of body temperature is not conducted, however, without expense to the body or its efficiency. Long before the critical level is reached, the adjustments the body is called upon to make, such as throwing more blood into the skin areas at the expense of the nervous system and internal organs, have their effect upon various bodily functions. It is wise, therefore, to reduce the strain thrown upon the heat-regulating mechanism to reasonable proportions. No careful car-owner throws the maximum burden on to its mechanism except in emergency, nor does he continuously impose a heavy strain upon it.

### 4. Helping the Body to Keep Cool.

Once we understand the general methods adopted by the body for keeping its temperature constant in hot weather, and the necessity for its continued success in this work, the rules for behaviour in hot weather are largely common-sense applications.

The first and most obvious course to adopt is to avoid the heat as much as possible by keeping in the shade and avoiding artificial sources of heat. It seems ridiculous to mention this, but the obvious is not always completely met. A good deal more could be done to shade the footpaths in our tropical streets, while anyone who knows the average conditions in the tropical kitchen will allow that there is vast room for improvement. A tiny kitchen with low, unceiled roof and unlined walls, often built on the sunny side of the house, containing a large, naked, iron stove with a flaring wood fire, and grossly ill-ventilated, is surely a manifold flouting of the obvious.

One often hears a controversy as to the relative merits of free ventilation on the one hand and insulation on the other in reducing the effects of hot climates. Like so many perpetual controversies, it has no real point, since the conditions calling for the one or the other are quite different. In this respect it is amusing to find our highly developed scientific intelligence coming to conclusions which have been put into empirical practice for thousands of years. From the dawn of history, almost, the inhabitants of the hot, arid regions have relied upon insulation, both in personal clothing which consists of voluminous loose robes, and in architecture, which utilises massive walls and narrow apertures closed against the heat of the day. The dry air permits of evaporation at a rapid rate with a minimum of air movement, and, indeed, the increased incidence of hot air from without only serves to render the body's difficulties in getting rid of heat more acute. On the other hand, the native dwellers of tropical coasts and humid forests reduce their clothing to a minimum and erect dwellings which are the acme of airiness. The air is relatively so full of moisture in these regions that it rapidly becomes saturated, and if evaporation is to continue new air must be constantly supplied. Empirical practice is well confirmed by scientific treatment; insulation is the key principle in hot, dry climates, ventilation and air movement in hot, wet climates—and yet we treat tropical Australia as though one rule will serve equally well in all parts.

Physical activity in hot weather is a matter of careful adjustment to each person's circumstances. Excessive activity must, of course, be avoided, but some people can stand up to a great deal more than others. Avoidable activity is best restricted to the cooler portions of the day. On the other hand, the habit of laziness is fatally easy of acquirement, and is as detrimental to physical health as it is to spiritual value. A deliberate devotion to moderate exercise is an essential part of the daily routine for a sedentary worker. Deliberate combating of lassitude is a great aid to maintaining efficiency, and to keep going is often to improve one's feelings of fitness. There are, of course, limits to this procedure, to overstep which would be foolish.

Mental activity requires as much drill as the physical. The attempts to maintain body temperature probably detract from the normal blood supply of the nervous system and produce the mental sluggishness characteristic of hot weather. This is remedied by acclimatisation, and the remedy is aided by physical fitness. The lapse into mental sloth is insidious but real, unless active steps are taken to forestall it. If efficiency is to be maintained, this must be done. Mental inactivity as much as over-worry is a precursor of "tropical" neurasthenia.

Dietary regulations can play a useful part. A certain reduction in protein foods and their replacement by fresh fruits and green vegetables is a good rule. It is very doubtful if vigorous stimulation of appetite by spices and sauces is justifiable. Salt is a very necessary condiment, particularly in hot, dry regions, to replace that lost in the sweat. Stimulating drugs such as alcohol should be reduced to a minimum and confined to the cooler times of the day. Copious supplies of water are essential to replace sweat-loss. The Coolgardie cooler, or, better, the ice-chest, or, better still, the refrigerator is probably the most important fitting in the kitchen in providing cool, appetising food, and in keeping it without the destructive processes of preserving.

The application of common-sense principles in such a way as to maintain a reasonable balance amongst the different bodily requirements, yielding place to no particular fad, will do much to relieve the strain imposed by hot weather.

# Answers to Correspondents

## BOTANY.

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

### Prickly Poppy.

A.J.C. (Yeppoon)—

The specimen is the prickly poppy, *Argemone mexicana*, a native of Mexico and tropical America, now spread very widely as a weed over many warm countries. It is common in Queensland, and local names given to it include Californian thistle and silver thistle. It is not a real thistle, but a member of the poppy family. It is reputed to be poisonous to stock, but in addition to its prickly nature, it has an intensely bitter sap which makes it unpalatable and it is very rarely eaten. The only cases of reputed poisoning which have come under our notice have occurred when it has been cut and left to dry, and the subsequently softened plant eaten by calves.

### Net Fungus.

V. J. W. (Pittsworth)—

The specimen represents a species of *Clathrus* or net fungus. The offensive smell of this fungus is caused by slimy matter on the inner face of the net. Carrion-feeding insects, such as flies, are attracted to this. It contains the spores, and they are carried away on the feet of the insects. The plants are not very common, and are very short-lived.

### Paterson's Curse.

G.R.S. (Biggenden)—

The specimen has no flowers or fruit, but it is evidently the glue weed or Paterson's curse, *Echium plantagineum*. This is a native of the Mediterranean region of Europe. In New South Wales, it is a fairly serious pest in cultivation areas. It may be as well to get rid of it where it appears in cultivation here, as it is a very strongly-growing plant. At the same time, it does not appear likely to become such a pest on our coastal country, as it is further south. It is not harmful to stock; as a matter of fact, in its young stage it is reputed to be good fodder.

### Whitewood.

H.F.R. (Longreach)—

The specimens have been identified as the whitewood, *Atalaya hemiglauca*. The foliage of this tree has been fed to stock for quite a long time. Some years ago it was accused of being the cause of "walkabout" disease in North Australia, and it was claimed that feeding experiments had produced the symptoms. Some analyses made at that time showed that the young shoots and younger parts contain saponin. This saponin content may possibly be the attractive agent in the palatability of the leaves of this tree.

### Scarlet Pimpernel.

E.D.W. (Cooroy)—

The specimen is the pimpernel or scarlet pimpernel, *Anagallis arvensis*, a native of Europe and now a naturalised weed in most temperate countries. It is a very common weed in parts of Queensland during the winter and early spring months, but usually dies off on the approach of the hot weather. The present time should be a good one to chip out or eradicate the plant, as probably it has not yet started seeding. Later on, it will be a mass of seed. If the area is too large for chipping out, there is no known method of eradicating it other than by chipping, hand-picking, and poisoning, and we think the thing is to get the weed at the right stage, and the present time should be a favourable one, particularly for poisoning.

# General Notes

**This Month's Cover.**

This month's cover block is from a photograph by Mr. A. Groom, Binna Burra.

**Staff Changes and Appointments.**

Mr. T. G. Mann (Proserpine) has been appointed millowners' representative on the Proserpine Local Sugar Cane Prices Board, *vice* Mr. R. Shepherd, deceased.

Mr. R. W. Peters, Experimentalist, Cotton Section, has been appointed Research Officer, Agricultural Section, Division of Plant Industry (Research), Department of Agriculture and Stock, and Mr. S. Marriott, B.Sc.Agr. (Queensland), Assistant Plant Breeder, Queensland Agricultural High School and College, has been appointed Assistant Research Officer, Agricultural Section, Division of Plant Industry (Research), Department of Agriculture and Stock.

The following Border gatekeepers for the New South Wales Department of Agriculture have been appointed also inspectors under the Queensland Diseases in Plants Acts for the purpose of inspecting consignments of potatoes entering Queensland from New South Wales *via* the Border crossings:—

Messrs. F. W. Avery (Killarney), E. C. Onions (Sugarloaf), J. C. Sabine and G. Allen (Stanthorpe), (Mrs.) F. E. Heydon, E. L. Carpenter, and J. V. Boxwell (Wallangarra), H. Blake (Mount Lindesay), S. J. Graves and L. E. C. Scott (Texas), and V. I. Spalding (Goondiwindi).

Messrs. R. H. MacKay and R. F. Young, of "Stuartdale," Ripley, Ipswich, have been appointed honorary protectors under the Fauna Protection Act.

Mr. F. H. Stevens, Homebush road, Mackay, has been appointed canegrowers' representative on the Racecourse Local Sugar Cane Prices Board for the remainder of the present sugar season, *vice* Mr. A. Turner, resigned.

**Council of Agriculture.**

A Regulation has been issued under the Primary Producers' Organisation and Marketing Acts prescribing the members who shall represent commodity boards on the Council of Agriculture. These are:—Messrs. J. McRobert (Maryborough) and W. J. Sloan (Malanda) (Butter Board); D. G. O'Shea (Southbrook) (Cheese Board); H. F. Lindenmayer (Mundubbera) (Cotton Board); L. R. Crouch (Atherton) (Atherton Maize Board); C. Brumm (Woongoolba) (Arrowroot Board); R. V. Woodrow (Woodford) (Honey Board); E. Fitzgerald (Felton) (Barley Board); O. A. W. Evans (Warwick) (Egg Board); H. Zischke (Hatton Vale) (Broom Millet Board); W. A. Ross (Macalister) (Canary Seed Board); C. W. Roseblade (Yungaburra) (Northern Pig Board); P. J. Savage (Brookfield) (Committee of Direction of Fruit Marketing); G. Johnson (Mirani) (Queensland Cane Growers' Council); W. J. Brimblecombe (Pirrinuan) (Wheat Board); G. A. Duffy (Chairman, Timber Advisory Board) (Plywood and Northern Plywood Boards).

The Regulations under the abovementioned Acts have also been amended to provide that the annual conference of the Council of Agriculture shall be held on such date after the close of the financial year as shall be fixed by the Executive Committee of the Council with the approval of the Minister.

**Banana Industry Protection Board.**

A Regulation has been issued under the Banana Industry Protection Acts providing that, in lieu of election, the growers' representatives on the Banana Industry Protection Board shall be nominated by the Committee of Direction of Fruit Marketing from the Banana Sectional Group Committee. This action has been taken in recent years, the nominees holding office for a period of one year. Messrs. M. Buchanan (Gympie) and W. J. Branch (Russell Island) have accordingly been nominated by the C.O.D. from the Banana Sectional Group Committee and have been appointed growers' representatives on the Board until the 30th September, 1939. The Government representatives on the Board are Messrs. R. Veitch (Director, Division of Plant Industry (Research)) and H. Barnes (Director of Fruit Culture).

**Tableland Maize Board.**

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts amending the constitution of the Atherton Tableland Maize Board in relation to the delivery of maize to such board. At present it is prescribed that the conditions of delivery of maize shall be fixed by a notice approved by the Minister published in any newspaper or newspapers circulating in the district. This provision has been deleted.

# Rural Topics

### Feeding of Concentrates.

Farmers are often averse from feeding concentrates, which impart a flavour or "taint" to the butterfat. Peanut products are a typical example. In many cases the difficulty may be overcome by feeding the material immediately after milking. The animal then is assured of sufficient time, before the next milking, in which it can utilise the constituents which give the off flavour.

### Tar Branding of Sheep.

Some stockowners still persist in using a tar brand on sheep, apparently without realising the loss which this practice entails. Wool from tar-branded sheep is often sold at a lower price than wool marked with one or other of the several recognised branding fluids, which are harmless and easily emulsifiable. Tar spoils the wool, from which it is very difficult to remove during the process of manufacture.

The grazier, who uses tar for branding should, obviously in his own interest, discontinue the harmful and costly practice. Furthermore, the practice is illegal.

### Feeding Farm Horses.

It is not unusual to see a farm hand pitchfork hay into a yard over which manure is thickly scattered. This is a source of loss and risk. Much of the hay is trampled into the dust or mud and rendered unusable. Even ensilage may be wasted in this way. A far greater, although more indirect, loss to the stockowner is caused by the contaminated feed. Many farm horses are infested with worms of various kinds, and dirty yards may teem with the parasites in their initial stages. These get into hay, or other feed tossed on to the ground, and are swallowed by stock, often with disastrous results. Deaths among farm horses have been traced to worm infestation, and owners will find it worth while to take great care in feeding their working animals. A rack or a trough ensures greater cleanliness and saves waste of good feed.

### Dairying and Lamb-raising in New Zealand.

In New Zealand in recent years shortage of farm labour has caused, either wholly or in part, certain variations from routine practice on what were formerly entirely dairying areas. One of these changes has been the introduction of breeding ewes and the practice of fattening store lambs in partial substitution of some of the dairy stock.

### Pasture Improvement.

Down in Victoria, experimental work is being done to ascertain how far New Zealand methods and practices in pasture management would be beneficial under the conditions in that State.

New Zealand farmers increase the stock-carrying capacity of their pastures by means of increased fertilizer treatment, intensive rotational grazing methods, the sowing of leafier and more prolific pasture grasses and clovers, grass topping, frequent harrowing to promote soil aeration, the spreading of animal droppings, and the use of nitrogenous fertilizer to stimulate out-of-season growth. From the results recorded, however, it is apparent that the building up of soil fertility by the use of superphosphate must be the basis of all pasture improvement in southern Victoria.

### The Pig Parade at the Show.

For those who could not watch the judging, the pig parade at the Brisbane show provided the only opportunity of seeing the prize-winners in such a way that they could be satisfactorily compared. It would be a good thing, however, if the breeds were paraded separately in groups. There are plenty of people who are interested in more than one breed, and if the parades were at intervals of, say, ten minutes or a quarter of an hour, it would be better for the spectators from every point of view.

### Roots Low in Vitamins.

Root crops, with the exception of carrots, are very low in vitamins A, B, and D, so that when they form a large part of the pigs' diet, care should be taken to have good pasture available, or to feed an allowance of yellow maize.

# Orchard Notes

## NOVEMBER.

## THE COASTAL DISTRICTS.

**Citrus Fruits.**

In the citrus orchard the increase in temperature and the possibility of a dry period call for the utmost attention to soil conditions, particularly aeration and moisture conservation. At the slightest sign of distress, owing to lack of moisture, trees should be irrigated thoroughly whenever water is available for this purpose.

At the same time care and attention should be given to cultivation, particularly on hillside orchards, and in the coastal districts the possibility of the approach of storms will prompt growers to consider the completing of each cultivation by forming shallow drains to care for excess water and prevent soil losses.

Attention must be given to the incidence of mites, which are the direct cause of the darkening of the skin of the fruit known as "Maori." Usually the first indication of the trouble is when, with the sun shining on it, the fruit has the appearance of being covered with a grey dust. If examined with a good lens, the skin will be seen to be covered with numerous yellow slug-like insects which are living on the skin.

Under certain weather conditions scale movement may be expected.

Detailed information regarding insect control may be obtained from the Department publications on the subject.

**Pineapples.**

Continue planting pineapples as discussed in these notes last month, always remembering that the modern practice is smaller areas, close planting with more pineapples per acre, quicker, better and more healthy growth, and finally better fruit by liberal fertilising through the leaf bases with 10-6-10. Taken all together, these recommendations tend towards the elimination of wilt.

**Bananas.**

*New Plantings.*—November and December are very suitable planting months in most districts. Just as modern methods have effected great improvements in pineapple culture, so they might be applied in principle to banana growing. Smaller areas and large production per acre should cut overhead costs and lighten labour, lengthen the profitable life of the plantation, and reduce the time of waiting for the crop. To this end select planting material with care, plant in large holes, and break up the ground as soon as possible after planting. To prevent the loss of top soil by erosion and to provide the bananas with a cooler and moister environment, plant a cover crop as soon as weather permits, and initial weed growth has been suppressed. This will hold the loose surface soil during the summer rains.

*Young Plantations.*—The correct follower or followers for each plant should be selected, if not already done, and all additional suckers suppressed. Cultivate to conserve moisture and mulch with a cover crop. A complete fertilizer will improve the coming crop.

*Old Plantations.*—De-sucker to one follower to each plant. Apply a complete fertilizer, if not already done, and cultivate to conserve moisture.

*General.*—Bait for borers; be prepared for caterpillar plagues; watch for bunchy top.

## THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

KEEP the orchards and vineyards in a thorough state of cultivation, so as to keep down all weed growth and conserve moisture in the soil. This is important, as if a long spell of dry weather sets in, the crop of summer fruit will suffer severely from the lack of moisture. Citrus trees should be irrigated where necessary, and the land kept in a state of perfect tilth. Spraying for codling moth should be continued, and all pip fruit trees must be bandaged by the beginning of the month; further, the bandages must be examined at frequent intervals and all larvæ contained in them destroyed. The neglect to spray thoroughly and to attend to the bandages

properly is responsible for the increase in this serious pest in the Granite Belt, and growers are warned that they must pay more attention to the destruction of this pest if they wish to grow pip fruit profitably. Fruit fly may make its appearance in the cherry crop; if so, every effort should be made to stamp out the infestation at once, as, unless this is done, and if the fly is allowed to breed unchecked, the later ripening crops of plums, peaches, apples, pears, apricots, and Japanese plums are bound to become more or less badly infested. Combined action must be taken to combat this the most serious pest of the Granite Belt, and growers must realise that, unless they take this action and see that careless growers do not breed the fly wholesale, they will never keep it in check, and it will always be a very heavy tax on their industry. A sharp lookout must be kept for brown rot in fruit, and, on its first appearance in a district, all ripening fruit should be sprayed with lime sulphur 1 in 120.

All grape vines, potatoes, and tomatoes should be sprayed with Bordeaux or Burgundy mixture as required for the control of downy mildew and anthracnose of the grapes, and Irish blight and target spot of the potato and tomato.

## ANGLO-AUSTRALIAN TRADE TALKS.

There may have been some disappointment at the outcome of the talks with Australia, but the months spent in the discussions cannot be considered wasted when a document of such wide scope and significance as the resulting Government White Paper is the outcome. The "Memorandum of Conclusions" constitutes a valuable compromise. It is recognised that Australia has a vital interest in the United Kingdom as the greatest market for her exports of primary products. The United Kingdom, similarly, has a vital interest in Australia as one of the greatest customers for British goods and as the domicile of the largest amount of British capital invested in any single overseas country, and as a field for future investment. It would seem that for the first time the two Governments have got down to bedrock and have succeeded in drawing up a statement of general principles, which should do much to facilitate future negotiations. Therefore, although no new trade agreement has been made, there has been a definite clearing of the air in the realms of defence, foreign policy, and the general principles of economic relationship. Pending further inquiry and a probable return of the Australian delegates, the existing agreement will remain in force.—*The British Trade Journal and Export World.*

# Farm Notes

## NOVEMBER.

WHEAT harvesting will become general during November, so that header-harvesters, tractors, and other equipment utilised, should be placed in thorough working order.

Modern machinery is efficient, but should receive adequate lubrication and periodic adjustment in order to avoid stoppages at a critical stage.

The menace of rust does not assume serious proportions now that the bulk of the crop is derived from the moderately rust-resistant "Three Seas" and "Seafoam," together with varieties such as "Flora" and "Florence," which usually mature sufficiently early to escape rust.

November is regarded generally as the best period for the establishment of the main maize crop, because the tasselling period coincides usually with normal summer rains. Too much attention cannot be given to the preparation of land intended for maize, preparation which should now be in an advanced stage, as no amount of into-row cultivation will overcome the retarding influence of faulty initial preparation.

Inter-row cultivation should become progressively shallower as growth proceeds, and may be discontinued at the cobbing stage. Increased attention is being given to the growing of grain sorghums, chiefly in districts where the rainfall is insufficient to assure profitable yields from maize. Instances are on record of yields up to 12 bags per acre being obtained under conditions which were fatal to maize, while the ability of header-harvesters to successfully harvest the new dwarf-growing varieties is a big factor in economical production. Seed supplies of suitable varieties are apparently difficult to secure at present, but should become adequate in the near future.

For intermediate or catch crops, the rapidly maturing millets, Japanese millet and white panicum, can be recommended for present sowing, being suitable for grazing, silage, or hay. If seed production is desired, preference should be given to the variety known as "Giant Panicum" or "Giant Setaria," and to the French millet.

Local potatoes and onions will now be reaching the market, and in order to obtain the best possible returns, attention should be given to grading, and to marketing in sound, clean, or preferably new bags.

To retard infestation by the potato tuber moth, the potatoes should be bagged, sewn, and removed from the field with a minimum of delay, as if exposed overnight, some infestation may result during storage. Do not cover with potato tops.

The planting of peanuts will be continued in the main South Burnett districts, where Virginia Bunch and Red Spanish are the principal varieties.

Growers are reminded of the better germination obtained where seed is treated with the fungicide "Ceresan" before sowing.

In addition to the crops mentioned above, seasonal sowings of Sudan grass, broom millet, buckwheat, pumpkins, melons, &c., can be made, and cow cane and sweet potatoes planted out.

Where broom millet is grown as a sideline, it is sometimes preferable to make small succession sowings in order to spread the harvesting over a longer period.

## THE BOY ON THE FARM.

At an agricultural conference in South Australia recently a farmer who introduced the subject thought that farmers' sons were not given sufficient responsibility, and he suggested that they should be given a definite share in the work of the farm and be expected to undertake it on their own initiative. This might give the necessary stimulus and help to keep boys on the farm. "If the Australian farmer's son is encouraged a little," he said, "there will not be the cry of 'Back to the Land!' "


# 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.*

## THREADWORMS.

BABY clinic nurses receive many inquiries regarding the treatment of threadworms. Recently a mother called at the clinic to secure advice about her child aged twelve months who was passing these worms. She said that she had an older child aged four years who had been suffering from worms for years. She had taken him to several doctors and although she had carried out various forms of treatment she had not succeeded in curing him; in fact, she had given up trying to get rid of them. Another wrote stating that she had two small children who were causing her a good deal of worry on account of worms. The older boy, aged three years, had been troubled for some months and she had been unable to secure satisfactory advice. Acting upon her doctor's instructions she had given him salt injections and some powders. This treatment had brought away large numbers of worms, but after two courses spread over a period of two months, he was still passing large numbers. The mother stated that she felt very discouraged and wanted to know what else she could do. She was feeling anxious about the younger child who was a year old, and wanted to prevent the trouble arising in his case, if possible. She added that she looked after the children herself and had been particular in giving them the diet advised by the doctor and had been very careful to withhold sweets of all kinds.

We sympathise with mothers such as these who are taking great trouble to manage their children to the best of their ability and knowledge.

Threadworms occur quite commonly in children and in many cases are associated with an unhealthy state of the bowel. They produce itching and irritation and are often associated with a poor or a capricious appetite, restlessness, irritability, and sleeplessness.

### Predisposing Cause.

It has been said by a world-renowned specialist in children's diseases that worms are a symptom of disease and not a disease in themselves. They are a symptom of a form of indigestion or disorder of the bowel known as mucous disease in which there occurs in the bowel an excessive secretion of mucus which forms a good medium in which the worms can live and feed and lay their eggs. This condition is often associated with malnutrition and the child appears pale and wasted. While in some cases the appetite is poor, in other cases the mother will tell you that although the child eats a great deal he does not seem to gain weight. In some cases the child has the desire to eat such things as dirt or cinders. Constipation is often present and the motions usually contain a clear Jelly-like substance as well as worms. Such a child may suffer from "wetting of the bed at night." Occasionally there is a history of the child turning suddenly pale at intervals. Frequently a short irritable cough occurs. One frequently exciting cause of mucous disease is the excessive consumption of sugar.

### General Treatment.

In the first place it is necessary to treat the unhealthy state of the bowel. This is done by paying attention to the child's food. Sweets, sugar, and cakes must be avoided and a restriction placed on starchy foods; otherwise the child is fed according to the diet recommended for his age. He is encouraged to live out of doors in order that he may get as much fresh air, sunlight, exercise, and sleep as he requires.

### Special Treatment.

As the child may become infected by swallowing earth or rubbish containing eggs of the worms or by contact with another infected child, care must be taken to protect him from these sources of infection. The worms reach the lower part of the bowel where the female deposits her eggs. The wriggling of the worms produces irritation and itching in the region of the anus or back passage. The child scratches himself particularly at night time and the eggs become transferred to his fingers and lodged under his nails and are carried to his mouth. It is necessary, therefore, to wash the child's hands and clean his finger-nails particularly before meals and before going to bed; otherwise the child will reinfect himself. Mere clearing out of the worms is of little use, unless this reinfection is prevented. The region round the anus must be well washed after each motion and smeared with an ointment. He should be clothed in a garment which will prevent his fingers from coming into direct contact with the anal region.

### Expulsion of the Worms.

On the first day the child should be given a simple light diet. This consists of bread baked in the oven, milk and water and fruit juice, avoiding porridge, biscuits, pastry, jam, and sweets of all kinds. In the afternoon the worms are driven down into the lower part of the bowel by giving a full dose of castor oil. When this has acted the bowel should be emptied by an injection of about 1 pint of warm water. This should be injected slowly and retained as long as possible.

On the second day no food should be allowed, but as much boiled water as possible given. Administer a powder prescribed by a doctor.

On the third, fourth, and fifth days give a daily warm bath and an enema of warm water followed after the bowels have acted by an injection of about one breakfast cupful of warm water and salt (one teaspoon to 1 pint).

The child may be given a simple light diet on the third day and a return made to a normal diet by the sixth day.

The chance of reinfection must be kept always in mind. Careful attention must be paid to the diet in order to avoid a recurrence of the unhealthy state of the bowel. Milk, meat, fish, eggs, butter, vegetables, and fruit may be given acording to age, and a minimum amount of sugar.

It may seem to some that the instructions given involve a great deal of time and trouble for the curing of such a trivial ailment, but the distress that threadworms and the conditions associated with them may cause the sufferers and the anxiety they may cause those are are in charge of the children affected, justify the time and trouble necessary.

It follows from what has been said that the infected child should not be allowed to play with other children or their toys until he is cured. Bed clothes, towels, &c., should be kept separate. Other members of the family should be examined and treated if necessary.

# IN THE FARM KITCHEN.

## FACTS ABOUT THE PAPAW.

The papaw tree takes a prominent place among the many tropical fruits that thrive in Queensland. The papaw originally came from Central America and is known there by the natives as the "papaya" or "mamai" (father and mother) tree, according to the sex of the plant. Introduced many years ago, the papaw gradually became acclimatised until it found conditions so congenial that it now thrives throughout the coastal areas of Queensland.

Papaw trees grow from seeds. The tree is a small one seldom exceeding 20 feet in height, is of spongy texture and is usually hollow in the middle. It is practically branchless, and is surmounted by a crown of large palmate leaves, at the base of which fruit is produced.

The male tree flowers profusely, bearing flowers at the end of long stems which hang down and suspend vertically any fruit if formed. As the fruit borne by male trees is small and of no commercial value, the trees are usually cut out as soon as the sex can be determined, a few only being left for purposes of fertilization of the seeds in the fruit of the female trees.

The female tree bears flowers at the base of the stem of each leaf and a profusion of fruit forms close to the stem. The fruit are often so thick on the stem of the tree that many of the papaws are crushed as they develop, and ripen in a mis-shapen condition.

The papaw tree, being of tropical origin, is particularly liable to damage from frost, and must be grown in positions sheltered from heavy winds and frost.

Seeds are planted in beds in the spring and early summer, and the small seedlings transplanted to the field when from 6 to 12 inches in height. In order to make full allowance for the cutting out of the male trees, two and at times even three seedlings are planted to each stool, but of these not more than one tree is allowed to bear fruit. Trees are spaced from 8 to 10 feet square. The young plant develops rapidly and, given suitable growing conditions, the female will at times commence to bear fruit within 2 feet of the ground. Particularly vigorous trees will at the one time have from 4 to 6 feet of the stem literally covered with fruit. Trees will bear in approximately twelve months, and although their commercial bearing life is short, seldom exceeding four years, the actual weight of fruit produced per tree is high. The fruit ripens from the base upwards, and no part of the stem ever bears more than one crop. As the tree ages the fruit is developed higher and higher from the ground, and it is a common sight to see branchless trees so high that ladders must be used for picking.

The skin of the papaw is very thin and particularly delicate when the fruit is fully ripe. The thinness of the skin makes it pecularly susceptible to outside influences, and accounts for so many of the ripe papaws showing blemishes. These, however, do not detract from the eating quality of the fruit.

**Production.**

Gradually the health-giving properties of the papaw are receiving wider recognition, and the acreage under papaws is increasing. The papaw is grown at Sunnybank, Manly, Aspley, and Brookfield (districts within easy reach of Brisbane), Woombye, Yarwun, and other North Coast centres, and in North Queensland. So popular is this fruit in Queensland that numerous householders grow a few trees to meet their own requirements.

As a table fruit the papaw is delicious and wholesome. Some palates may not appreciate the flavour at first, but the papaw habit is well worth acquiring in such cases. The addition of a little orange or lemon juice or passion fruit greatly improves the flavour. For salads, papaws are especially valuable. The size of fruit varies on each tree, but most fruit marketed will provide from 1 to 5 lb. of succulent flesh, which, by the addition of sliced oranges and pineapples, quickly makes a delightful salad, and one that will allow generous helpings. Papaws are in season from April to December.

**Papaw Uses.**

The papaw is used in various forms:

(*a*) In its ripe state as a breakfast fruit, for which purpose it is cut lengthwise into individual portions, and the seeds are removed. It is flavoured to suit the taste by the addition of lemon or orange juice and sugar—or with sugar only.

(*b*) As a dessert fruit when it is sliced and eaten with sugar and crushed ice, or diced and incorporated with other fruits as a fruit salad.

(*c*) As a salad combined with lettuce or in mayonnaise; or served with green celery and onions.

(*d*) The green fruit may be boiled or baked and served as a vegetable.

(*e*) As a crystallised fruit, and it is sometimes made into pickles, marmalade, jelly, pie, jam, ice-cream, and sherbet.

(*f*) As the main constituent of the following commercial lines; Tropical fruit salad and papaw chutney.

Nearly all parts of the papaw have some medicinal value. The most important medicinal properties are said to be found in the milky juice which occurs most aboundantly in the green fruit. These properties of the juice are due to the active principle called "Papain," which has been long recognised as of considerable value in dyspepsia and kindred ailments. Its digestive action is undoubted, and it is a not uncommon practice to rub a slice of green juicy papaw on tough meat to make it tender. Another practice is to wrap the meat in crushed papaw leaves over-night preparatory to cooking it.

The papaw is a valuable aid to digestion, and many sufferers from dyspepsia have obtained relief by eating this fruit. Papaw juice contains papain, a powerful digestive ferment, which is often used instead of pepsin. The seeds have the flavour of watercress and are an efficient vermifuge.

Papaws contain no sucrose, but contain laevulose, which is specially suitable for diabetics.

## PAPAW RECIPES.

**Papaw Preserve.**

Take 1 lb. of sugar, ½ pint of water, to make a syrup, 2 tablespoonfuls of lime, and a gallon of water. Put the lime into the water, and stir until dissolved; peel the fruit, and cut into slices about 2 inches thick and the length of the fruit. Put these pieces into the lime water and allow to remain for about 8 to 10 hours; then taken the fruit out, make the syrup, and when boiling put in the papaw; boil quickly for half an hour; take out the fruit and arrange lengthwise in a glass jar. When the syrup is cool, fill the jar and cork down tightly.

**Fruit Salad.**

Take as many different fruits as possible—oranges, papaws, pineapples, apples, bananas, passion fruit, and the juice of a lemon. Cut bananas into thin slices, and papaws and pineapples into cubes, peel the apples and slice them in. Remove pith from oranges and slice them in. Sprinkle each alternate layer with sugar, squeeze over the juice of the lemon and the passion fruit. Serve with whipped cream.

**Mixed Fruit Jelly.**

Take 2 large apples, 3 bananas, a nice piece of papaw, a small piece of pineapple, and any other fruit you like. Cut it all up in nice fine slices, squeeze passion fruit all over the top, sweeten a little, then make a pint of jelly, and when fairly cool, pour over the fruit. This can be eaten with whipped cream or custard or served plain.

**Papaw Dessert.**

Cut up in rather large pieces, put in enamelled stewpan with about a pint or so of water to 3 lb. of fruit, 1 small teacupful of sugar, the juice of 2 lemons, bring to the boil and simmer for 10 minutes, set aside to cool, and serve with a milk pudding, or it may be set in jelly.

**Papaw Salad.**

By adding a little orange or lemon juice to diced or mashed papaw you can produce a lovely salad in a few minutes. This is the most inexpensive fruit salad possible and is simply delicious.

**Tropical Fruit Salad.**

Papaws, bananas, and pineapple combine to make a delicious tropical fruit salad. Use in quantities to suit taste, dicing the papaw and pineapple and slicing the bananas. Crush a little of the pineapple to secure juice and sprinkle this over whole with a little sugar, and serve.

**Icy Fruit Slices.**

Cut a papaw into sections lengthwise, sprinkle with lemon and sugar, and place in ice chest until thoroughly cold. When serving sprinkle with crushed ice if desired.

**Crystallising Fruits.**

Choose good sound fruit, not too ripe, and prick with a needle. Place in a pan of cold water and bring to the boil. The fruit will rise to the surface, and must be lifted out and placed carefully in cold water. Prepare a syrup by boiling 2 lb. of cane sugar in 1 pint of water till on dipping a skewer into the syrup and blowing through it bubbles will be formed on the other side of the skewer. Then put the fruit into the syrup and boil up. Remove the scum. Take the pan off the fire and pour contents into a basin. Leave till the next day, then pour off the syrup and boil till it threads. Pour over the fruit and allow to stand overnight. Repeat the process for four days and on the fifth day boil the syrup to the "crack," dip the fruit into it and drain on a sieve in a warm place. Sprinkle with fine sugar. Pack carefully and keep in a cool dry place.

**Papaw Tart.**

One and a-half cups of self-raising flour, rub in 1 tablespoon of butter, add 1 teaspoon of sugar and a little salt. Mix with milk or water to make a light dough. Roll out thin, spread on a plate, prick all over, and fill with thinly-sliced papaw sprinkled with sugar and lemon juice or passion fruit. Cover with pastry and bake in a moderate oven.

**Frozen Papaw Jelly.**

Peel a firm fully ripe papaw, cut the end sufficiently to allow the removal of seeds. Dissolve jelly crystals, when cool pour into papaw cavity; place on ice and allow to set. Cut into rings and serve with whipped cream.

## THE EMPIRE MARKET.

Some time must necessarily elapse before the full results of the Empire Producers' Conference in Sydney are felt. One important point is that both the British and Australian Governments have reached an agreement on the desirability of collective action by Empire producers' associations. One of the main objectives of the conference was to enable producers throughout the British Commonwealth to plan a long-range policy to ensure orderly marketing and stability of prices. It is believed that a sound foundation for future development has been laid, and, given the whole-hearted co-operation of producers throughout the Empire, a permanent and lasting policy is possible—a policy that will ensure to producers a price commensurate with costs of production and that will raise the standard of farming as a whole to a much higher level. In the Sydney resolutions there is the basis of a constructive policy which should be acceptable—at least, it is hoped so—to producers throughout the Empire; and, what is just as important, should gain for producers the sympathy and support of consumers.

# RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF AUGUST, IN THE AGRICULTURAL DISTRICTS TOGETHER WITH TOTAL RAINFALL DURING 1938 AND 1937, FOR COMPARISON.

| Divisions and Stations. | Average Rainfall. | | Total Rainfall. | | Divisions and Stations. | Average Rainfall. | | Total Rainfall. | |
|---|---|---|---|---|---|---|---|---|---|
| | Aug. | No. of years' records. | Aug., 1938. | Aug., 1937. | | Aug. | No. of years' records. | Aug., 1938. | Aug., 1937. |
| *North Coast.* | In. | | In. | In. | *South Coast—contd.* | In. | | In. | In. |
| Atherton .. .. | 0·89 | 37 | 0·98 | 1·31 | Gatton College .. | 1·09 | 39 | 1·25 | 1·54 |
| Cairns .. .. | 1·71 | 56 | 1·50 | 1·18 | Gayndah .. .. | 1·14 | 67 | 1·97 | 1·40 |
| Cardwell .. .. | 1·25 | 66 | 1·19 | 0·26 | Gympie .. .. | 1·70 | 68 | 1·55 | 2·26 |
| Cooktown .. | 1·19 | 62 | 0·53 | 0·52 | Kilkivan .. .. | 1·39 | 59 | 1·61 | 1·07 |
| Herberton .. | 0·63 | 52 | 0·63 | 0·42 | Maryborough .. | 1·65 | 67 | 1·82 | 0·89 |
| Ingham .. .. | 1·44 | 46 | 1·59 | 0·21 | Nambour .. .. | 1·88 | 42 | 0·74 | 3·20 |
| Innisfail .. .. | 4·91 | 57 | 9·64 | 5·26 | Nanango .. .. | 1·31 | 56 | 0·99 | 1·41 |
| Mosman Mill .. | 1·29 | 25 | 1·09 | 0·81 | Rockhampton .. | 0·81 | 67 | 1·41 | 0·29 |
| Townsville .. | 0·49 | 67 | .. | 0·01 | Woodford .. | 1·65 | 51 | 0·63 | 1·42 |
| *Central Coast.* | | | | | *Central Highlands.* | | | | |
| | | | | | Clermont .. | 0·67 | 67 | 1·41 | 0·05 |
| Ayr .. .. | 0·54 | 51 | .. | .. | Gindie .. .. | 0·62 | 39 | .. | 0·22 |
| Bowen .. .. | 0·63 | 67 | .. | 0·05 | Springsure .. | 1·01 | 69 | 0·85 | 0·25 |
| Charters Towers .. | 0·51 | 56 | .. | 0·01 | | | | | |
| Mackay .. .. | 1·01 | 67 | 0·27 | 0·31 | *Darling Downs.* | | | | |
| Mackay Sugar Experiment Station | 0·85 | 41 | .. | 0·48 | Dalby .. .. | 1·19 | 68 | 1·20 | 1·51 |
| Proserpine .. | 1·36 | 35 | 1·88 | 2·68 | Emu Vale .. | 1·09 | 42 | 1·52 | 2·49 |
| St. Lawrence .. | 0·79 | 67 | 0·10 | 0·23 | Hermitage .. | 1·15 | 32 | .. | 1·89 |
| | | | | | Jimbour .. .. | 1·14 | 50 | 1·18 | 1·20 |
| *South Coast.* | | | | | Miles .. .. | 1·10 | 53 | 2·92 | 1·41 |
| | | | | | Stanthorpe .. | 1·77 | 65 | 2·27 | 3·43 |
| Biggenden .. | 1·07 | 39 | 1·89 | 1·11 | Toowoomba .. | 1·62 | 66 | 1·57 | 2·27 |
| Bundaberg .. | 1·27 | 55 | 1·33 | 1·45 | Warwick .. .. | 1·44 | 73 | 1·72 | 2·90 |
| Brisbane .. .. | 1·96 | 86 | 1·21 | 1·40 | | | | | |
| Caboolture .. | 1·51 | 51 | 0·83 | 1·61 | *Maranoa.* | | | | |
| Childers .. .. | 1·19 | 43 | 2·00 | 0·80 | | | | | |
| Crohamhurst .. | 2 19 | 45 | 0·92 | 2·94 | Bungeworgorai .. | 0·70 | 24 | 0·65 | 0·36 |
| Esk .. .. | 1·43 | 51 | 1·48 | 1·09 | Roma .. .. | 0·89 | 64 | 0·68 | 0·41 |

A. S. RICHARDS, Divisional Meteorologist.

# CLIMATOLOGICAL TABLE—AUGUST, 1938.

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 .. .. | 29·98 | 79 | 68 | 83 | 24, 25, 26 | 56 | 28 | 53 | 7 |
| Herberton .. .. | .. | 71 | 52 | 84 | 25 | 40 | 26 | 63 | 4 |
| Rockhampton .. .. | 30·14 | 74 | 53 | 84 | 27, 28 | 44 | 2, 3 | 142 | 5 |
| Brisbane .. .. | 30·19 | 69 | 50 | 80 | 27 | 41 | 3 | 121 | 6 |
| *Darling Downs.* | | | | | | | | | |
| Dalby .. .. .. | 30·20 | 66 | 41 | 77 | 27 | 26 | 3 | 120 | 5 |
| Stanthorpe .. .. | .. | 59 | 37 | 70 | 27 | 20 | 3 | 227 | 8 |
| Toowoomba .. .. | .. | 62 | 42 | 73 | 15, 27 | 24 | 4 | 157 | 4 |
| *Mid-Interior.* | | | | | | | | | |
| Georgetown .. .. | 30·01 | 86 | 57 | 93 | 26 | 42 | 26 | 0 | .. |
| Longreach .. .. | 30·12 | 77 | 49 | 93 | 27 | 36 | 9 | 51 | 1 |
| Mitchell .. .. | 30·18 | 68 | 38 | 86 | 27, 28 | 24 | 3, 4 | 66 | 3 |
| *Western.* | | | | | | | | | |
| Burketown .. .. | 30·01 | 84 | 60 | 95 | 26 | 54 | 10, 11 | 0 | .. |
| Boulia .. .. .. | 30·10 | 77 | 49 | 94 | 27 | 39 | 8 | 0 | .. |
| Thargomindah .. | 30·14 | 69 | 46 | 90 | 27 | 35 | 3 | 30 | 2 |

# ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY A. C. EGLINTON.

## TIMES OF SUNRISE, SUNSET, AND MOONRISE.

### AT WARWICK.

| | October. 1938. | | November. 1938. | | MOONRISE. Oct., 1938. | MOONRISE. Nov., 1938. |
|---|---|---|---|---|---|---|
| | Rises. | Sets. | Rises. | Sets. | Rises. | Rises. |
| 1 | 5·34 | 5·51 | 5·3 | 6·9 | a.m. 10·39 | a.m. 11·58 |
| 2 | 5·33 | 5·51 | 5·2 | 6·10 | p.m. 11·33 | p.m. 12·51 |
| 3 | 5·32 | 5·52 | 5·1 | 6·11 | 12·24 | 1·45 |
| 4 | 5·31 | 5·52 | 5·0 | 6·11 | 1·16 | 2·42 |
| 5 | 5·29 | 5·53 | 5·0 | 6·12 | 2·8 | 3·35 |
| 6 | 5·28 | 5·53 | 4·59 | 6·13 | 3·2 | 4·33 |
| 7 | 5·27 | 5·54 | 4·58 | 6·13 | 3·56 | 5·34 |
| 8 | 5·25 | 5·54 | 4·57 | 6·14 | 4·53 | 6·36 |
| 9 | 5·24 | 5·55 | 4·57 | 6·15 | 5·48 | 7·40 |
| 10 | 5·23 | 5·55 | 4·56 | 6·15 | 6·48 | 8·42 |
| 11 | 5·22 | 5·55 | 4·56 | 6·16 | 7·49 | 9·40 |
| 12 | 5·22 | 5·56 | 4.55 | 6·17 | 8·50 | 10·31 |
| 13 | 5·21 | 5·56 | 4·55 | 6·18 | 9·52 | 11·21 |
| 14 | 5·20 | 5·57 | 4·54 | 6·18 | 10·52 | .. a.m. |
| 15 | 5·19 | 5·57 | 4·54 | 6·19 | 11·46 | 12·5 |
| 16 | 5·18 | 5·58 | 4·53 | 6·20 | .. a.m. | 12·45 |
| 17 | 5·17 | 5·59 | 4·53 | 6·21 | 12·35 | 1·30 |
| 18 | 5·16 | 5·59 | 4·53 | 6·21 | 1·21 | 2·2 |
| 19 | 5·14 | 6·0 | 4·52 | 6·22 | 2·4 | 2·43 |
| 20 | 5·13 | 6·1 | 4·52 | 6·23 | 2·45 | 3·20 |
| 21 | 5·12 | 6·1 | 4·52 | 6·24 | 3·25 | 4·3 |
| 22 | 5·11 | 6 2 | 4·51 | 6·25 | 4·3 | 4·47 |
| 23 | 5·10 | 6·2 | 4·51 | 6·26 | 4·43 | 5·32 |
| 24 | 5·9 | 6·3 | 4·51 | 6·27 | 5·25 | 6·30 |
| 25 | 5·8 | 6·4 | 4·51 | 6·28 | 6·10 | 7·12 |
| 26 | 5·7 | 6·4 | 4·50 | 6·29 | 6·56 | 8·6 |
| 27 | 5·7 | 6·5 | 4·50 | 6·29 | 7·42 | 8·59 |
| 28 | 5·6 | 6·5 | 4·50 | 6·30 | 8·31 | 9·49 |
| 29 | 5·5 | 6·6 | 4·50 | 6·31 | 9·22 | 10·39 |
| 30 | 5·4 | 6·6 | 4·50 | 6·31 | 10·11 | 11·32 |
| 31 | 5·4 | 6·7 | | | 11·7 | |

### Phases of the Moon, Occultations, &c.

| | | | |
|---|---|---|---|
| 1st Oct. | ☽ First Quarter | 3 6 | p.m. |
| 9th ,, | ○ Full Moon | 7 37 | p.m. |
| 16th ,, | ☾ Last Quarter | 7 24 | a.m. |
| 23rd ,, | ● New Moon | 6 42 | p.m. |

Apogee, 2nd October, at 9.0 p.m.
Perigee, 16th October, at 6.0 p.m.
Apogee, 30th October, at 5.0 p.m.

Jupiter will apparently come to a standstill on the 19th, though, in reality, moving for a short period by fractions of a second. Travelling on its direct course, it will cross from the constellation Capricornus into Aquarius at the end of the month.

At 10 a.m. on the 26th, Venus will be 8 degrees south of the crescent Moon. Good eyes may then find a faint image of the bright planet about halfway from the eastern horizon to the zenith. On the 30th it will reach its stationary point, after which it will rapidly decline in altitude, and in less than a month leave our evening sky.

Mercury rises at 5.20 a.m., 14 min. after the Sun, and sets at 5.17 p.m., 34 min. before the Sun, on the 1st; on the 15th it rises at 5.5 a.m., 14 min. before the Sun, and sets at 6.11 p.m., 14 min. after the Sun.

Venus rises at 7.36 a.m., 2 hr. 2 min. after the Sun, and sets at 9.19 p.m., 3 hr. 28 min. after it; on the 15th it rises at 7.13 a.m., 1 hr. 54 min. after the Sun, and sets at 9.7 p.m., 3 hr. 20 min. after it.

Mars rises at 4.35 a.m. and sets at 4.8 p.m. on the 1st; on the 15th it rises at 4.5 a.m. and sets at 3.53 p.m.

Jupiter rises at 2.25 p.m. on the 1st and sets at 3.34 a.m. on the 2nd; on the 15th it rises at 5.22 p.m. and sets at 5.12 a.m. on the 16th.

Saturn rises at 6.21 p.m. on the 1st and sets at 6.11 a.m. on the 2nd; on the 15th it rises at 5.22 p.m. and sets at 5.12 a.m. on the 16th.

Of a total eclipse of the Moon, nothing will be visible in Queensland; and in Western Australia, only the beginning on the 8th of next month. On the same date there will be a conjunction of Mercury and Venus nearly an hour before they rise, but they will not be far apart near the western horizon, Venus setting at 7.6 p.m. and Mercury about half an hour later.

The Southern Cross will become invisible at the end of October, but the brilliant stars of Orion will rise in the east while Scorpio is setting in the south-west.

| | | | |
|---|---|---|---|
| 6th Nov. | ○ Full Moon | 8 23 | a.m. |
| 15th ,, | ☾ Last Quarter | 2 20 | a.m. |
| 23rd ,, | ● New Moon | 10 5 | a.m. |
| 30th ,, | ☽ First Quarter | 1 59 | p.m. |

Perigee, 11th November, at 2.0 p.m.
Apogee, 27th November, at 1.0 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.