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DEPARTMENT OF AGRICULTURE

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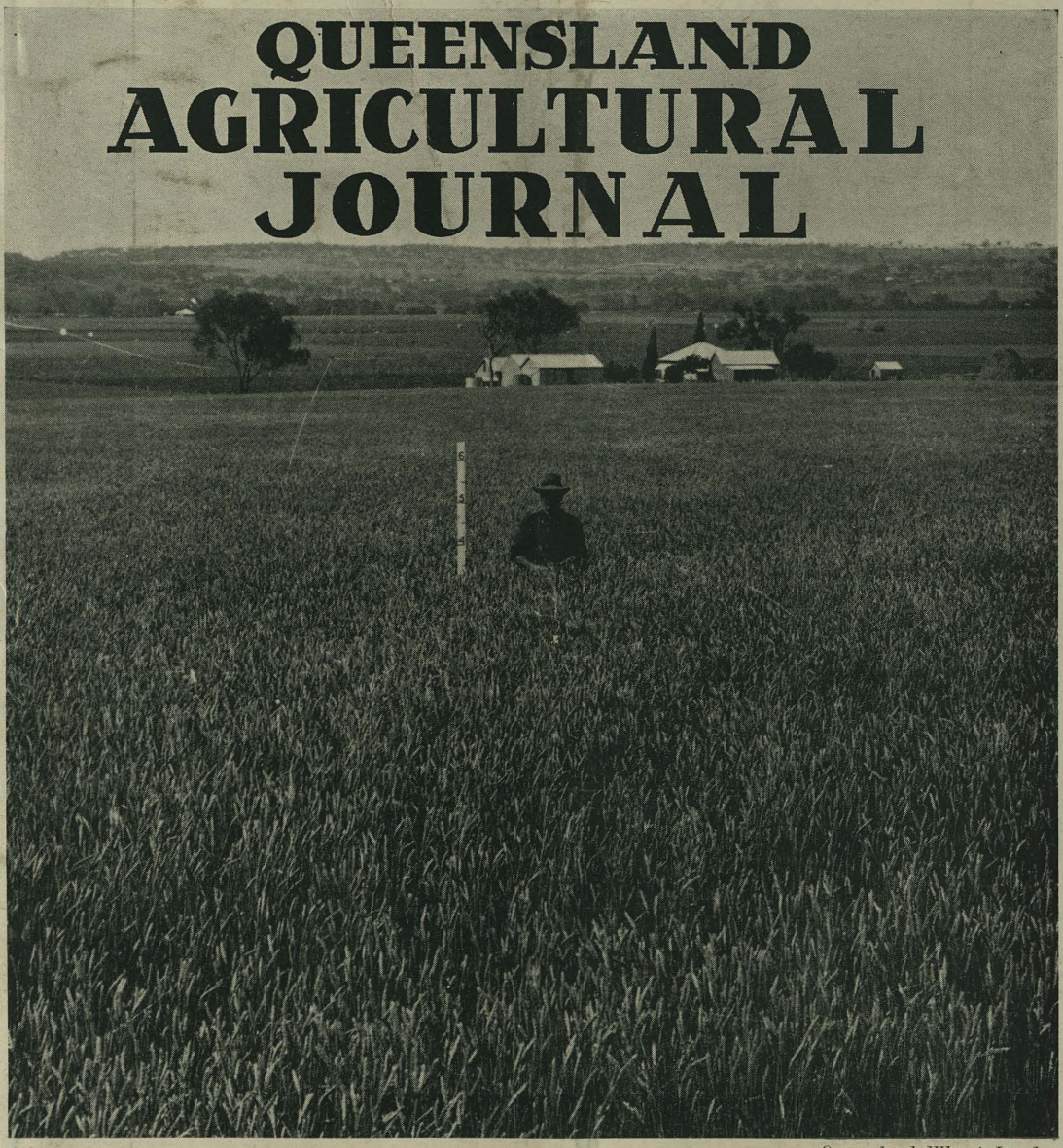

*Queensland Wheat Land, Allora, Darling Downs.*

LEADING FEATURES



Edited by J. F. F. REID

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# Contents

**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. LIV. 1 SEPTEMBER, 1940. Part 3.

# *Event and Comment*

**New Uses for Farm Products.**

THE development of a new branch of agricultural science in America during the past few years was mentioned by the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, in the Queensland Parliament recently. This new branch of science is called "chemurgy," and is expected to be of great value to Australia while the war is on. Actually, this new development is well known to Australian science workers, and they have been busy on it for some time.

In the United States a national farm chemurgic council has been constituted, which deals chiefly with the finding of new uses for farm products, apart from their use as food, and preventing the waste of unmarketable crops. The use of excess sugar cane for the making of power alcohol is a case in point.

The advantage of chemurgy is that it is based on farm crops, and it seeks the solution of marketing difficulties, rather than finding substitutes which might displace farm produce. Thus it brings both primary and secondary industry into closer relationship to the advantage of all concerned.

With their usual facility in adding new words to the English language, the Americans have found this new name, chemurgy, for the old process of converting a crop surplus, or crop residues, from waste into profit. The actual definition given to it is the winning of raw materials of industry from the soil, the air, and the sunlight by means of plant life.

**Objects of the Chemurgic Movement.**

THE specific objects of this chemurgic movement are stated in these words: "To find new non-food uses for farm produce and agricultural by-products, to prevent some of the economic loss which results from the tremendous volume of agricultural wastes which find only inferior markets or no market at all, and to enlarge the opportunities of farmers through the development of new crops which may be added to the agricultural economy."

In the United States, official recognition has been given to the soundness of these aims. Already over there 250 research workers are busy on a programme covering a wide range of products including maize, wheat, cotton, apples, peanuts, potatoes, sweet potatoes, tobacco, milk products, fruits, vegetables, and lucerne.

There is plenty of room for a chemurgic movement in Australia, Queensland particularly. The Old Country has contracted to buy our wool and our butter, but while the war lasts our prospects of increasing our exports of wheats, fresh fruits, and, in fact, all products except the concentrated foodstuffs will probably become much less bright than they are.

In the light of present experience, there will be many new problems for our primary industries to tackle when the war is over. Wool substitutes, butter substitutes, over-production of wheat and fresh fruits may be among those new problems; so it is plain that we shall have to do all we can to find new industrial uses for our farm products.

Many things can be made from crop surpluses and wastes. For instance, power alcohol can be made from corn, potatoes, and molasses; plastic materials from cereals and skim milk, and so on. Incidentally, we are told that Argentine farmers are now selling their maize for furnace fuel as a substitute for imported coal.

An examination of present needs and opportunities will show that, so far, the surface of the chemurgic field has barely been scratched. Take fruit juices, for example. Much of our fruit gathered in the course of a season is unacceptable on the market because of undersize or other defects or deficiencies. There should be nothing to prevent undersized fruit from being pulped for its juice. Once the public becomes appreciative of the value and acquires a taste for pure fruit and vegetable juices, properly processed and subject to rigid quality control, the fruit juice industry would no doubt repeat, relatively, the spectacular results of American fruit processors. The consumption of fruit juices has increased astonishingly in the United States in recent years, to the advantage of the fruitgrowers generally.

From apple wastes come apple pectin, a jellying agent for jams and confectionery; while citrus wastes may be converted into stock feed and fertilisers. In America the use of agrol—a power alcohol produced from surplus grain crops—is expanding rapidly.

So, in this new scientific field many practical benefits bearing on or contributing to our war effort—and, later on, no doubt to our peace effort—are promised, or are, at least, in prospect. Its development must increase the activity, the profitable activity of our primary industries.

**Soil Conservation.**

ANOTHER very important matter discussed during the Assembly debate on the Burdekin River Trust Bill, introduced by Hon. Frank W. Bulcock, and which is of interest to every man on the land in every part of the State, was soil erosion or, to use a better term, soil conservation.

All over the world some of the best brains are working on the problem of preserving that top layer of soil without which we could not exist. The classic example of what soil erosion means is what is called the Dust Bowl in the United States where the surface soil in intensely tilled areas has literally gone with the wind. In fact every country, and especially the comparatively newly-settled lands, provides impressive examples of the penalties man has to pay for despising nature's law relating to the fitting use and conservation of fertile soil.

While the United States provides some appalling evidence of man's folly in mishandling the gifts of Providence, that country also provides glowing examples of new and strikingly successful methods of soil erosion control. Not only has erosion been checked in many areas, but eroded land has been reclaimed and, in many cases, made richer than ever it was before.

"Not only does the American soil conservationist set to work to save the soil in a physical sense; he sets out to save it in a chemical, agricultural, and moisture sense," said Mr. Bulcock, in the course of his second reading speech. By terracing, contour-ploughing, and other methods, he has increased the moisture-holding capacity of lands which previously had been subject to serious erosion. That is one of the outstanding achievements of reclamation work in the Dust-bowl country where rainfall is usually very light. The conclusion of the modern agricultural engineering school is that soil conservation pays.

Our obvious job, then, is to be guided by the experience of other countries, particularly the United States, as to what to avoid and what to do in saving that spade's depth of soil from which we get our living.

Soil erosion is an insidious thing. Perhaps no single generation sees much of the consequences of wrong use of land. In South Africa, it probably took a couple of hundred of years for the erosion problem to emerge. The same thing may be said, perhaps, of the Argentine where sheet erosion became so serious as to impel the Government of that country to prohibit cultivation altogether in some districts and let the land go back to grass.

There are many causes of river, gully, and sheet erosion which are familiar to every farmer. One generation, after all, is only a trustee for the generation which is to come after. It is our duty, then, to protect our soil in every practicable way—by judicious clearing of timber, by tree reservations on hilltops and steep slopes and river banks, by contour cultivation and contour furrowing, and by all the other means prescribed on the basis of modern knowledge. If we do that, we shall have discharged a definite obligation to posterity.

# The Pineapple Soils of the Nambour, Woombye, and Palmwoods Districts.

L. G. VALLANCE, M.Sc., Assistant Research Officer and H. L. WOOD, B.Sc., Assistant to Research Officer.

*Continued from p. 101, August, 1940.*—*This article completes the second of a series of soil surveys covering the major pineapple-producing areas in southern Queensland. As the embodied data is necessarily of a technical nature, a short, non-technical discussion, with particular reference to the practical aspect of pineapple production in the Nambour-Woombye-Palmwoods area, will be presented shortly in this journal.*

## III. PHYSICAL ANALYSES AND MOISTURE RELATIONSHIPS.

### Mechanical Analyses.

A REPRESENTATIVE sample of each horizon within the type profiles was submitted to mechanical analysis. The figures obtained (Appendix) agree very closely with the field texture classifications. Consequently, a field texture classification may be regarded as being sufficiently accurate for use in extension and advisory work. In many cases, in fact, it is to be preferred to the much more elaborate laboratory estimation since the field estimation can be done rapidly and repeated several times in any small area. Moreover, the very act of "kneading"

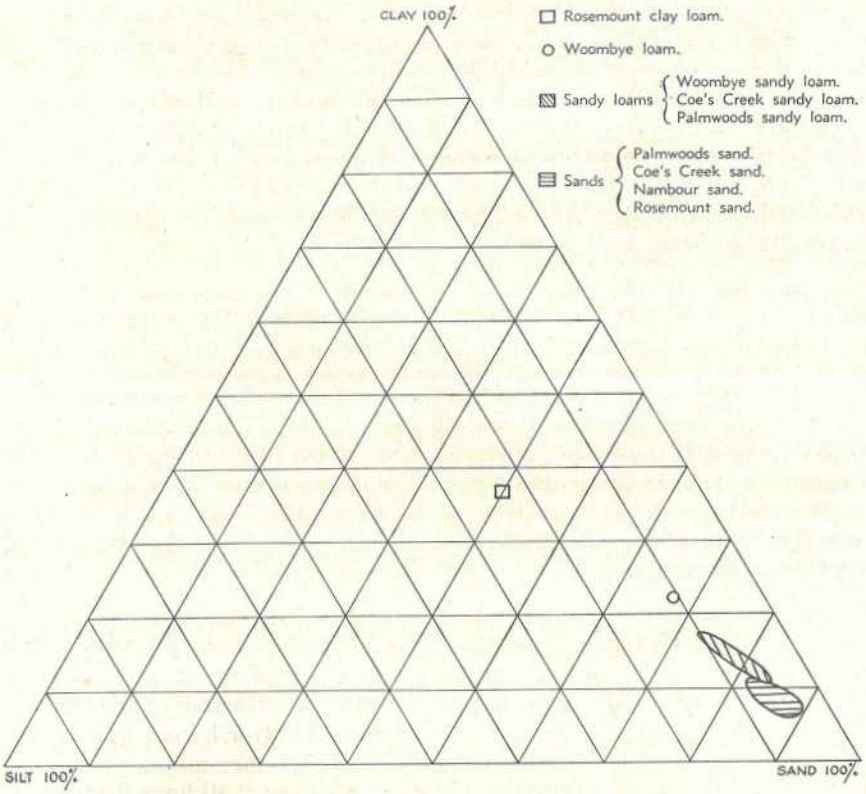



Plate 40.

MECHANICAL ANALYSIS DISTRIBUTION TRIANGLE OF SURFACE SOILS.

the soil in the hand at the requisite water content will give indications as to its permeability and consistence which is not necessarily revealed by a mechanical analysis. In the course of this survey, during which many hundreds of these field classifications were made, a striking agreement was observed to exist between the "feel" of moistened soil and its suitability for pineapple culture.

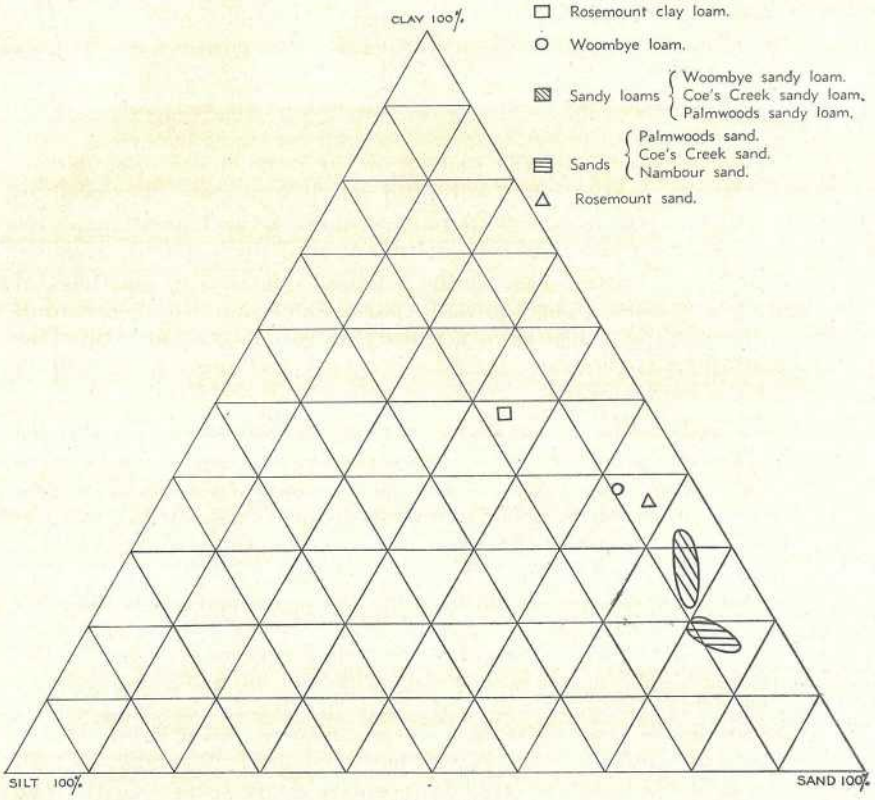



Plate 41.
Mechanical Analysis Distribution Triangle of Subsoils.

The mechanical analyses were carried out according to the method adopted by the International Society of Soil Science. In order to compare the textures of the surface horizons of the various soil types the mechanical analyses figures have been calculated as summation percentages of the sand, silt, and clay fractions. These have been plotted in Plate 40. For the sake of clarity the ranges covered by the sands and the sandy loams are shown as enclosed areas. As these fall close to that corner of the diagram which represents 100 per cent. sand, the general sandy nature of these surface soils is indicated. The samples refer to the $A_1$ horizons, the depth of which varies from 3 to 8 inches. These are typical of the majority of soils which are used for pineapple culture in the Nambour-Woombye-Palmwoods area. It is apparent that the sands and sandy loams are closely related texturally, and that there is a gradual transition from one class to the other. The position of the surface soil of the Rosemount clay loam illustrates the fundamental difference of this soil type.

The subsoils are similarly shown in Plate 41. The samples referred to are from the deeper portions of the B horizon proper, and may be regarded as the $B_2$. In some cases, e.g., the Nambour sand, this horizon is replaced by a BC. All of the subsoils show an appreciable increase in clay content. The greatest increase occurs in the Rosemount sand, in which there is slightly more than 35 per cent. clay. In the case of this soil type the sticky, highly impervious nature of the subsoil layer has a marked influence on the moisture relationships of the sandy A horizon, and its suitability for pineapple culture is determined very largely by the depth at which the B horizon occurs. These considerations apply not only to the Rosemount sand, however, but to all soil types within the district.

In order to present a clear picture of the particle size distribution of the surface soils the clay, silt, and sand fractions, expressed as summation percentages, have been plotted against the logarithm of the settling velocities. In Plate 42, the distribution of the particles is shown as a continuous function between the settling velocities of particles of size approaching the upper limit of coarse sand and the lower limit of silt. The settling velocities are spaced at equal intervals; thus the predominating particle sizes are those which lie along the steepest portion of the curve.

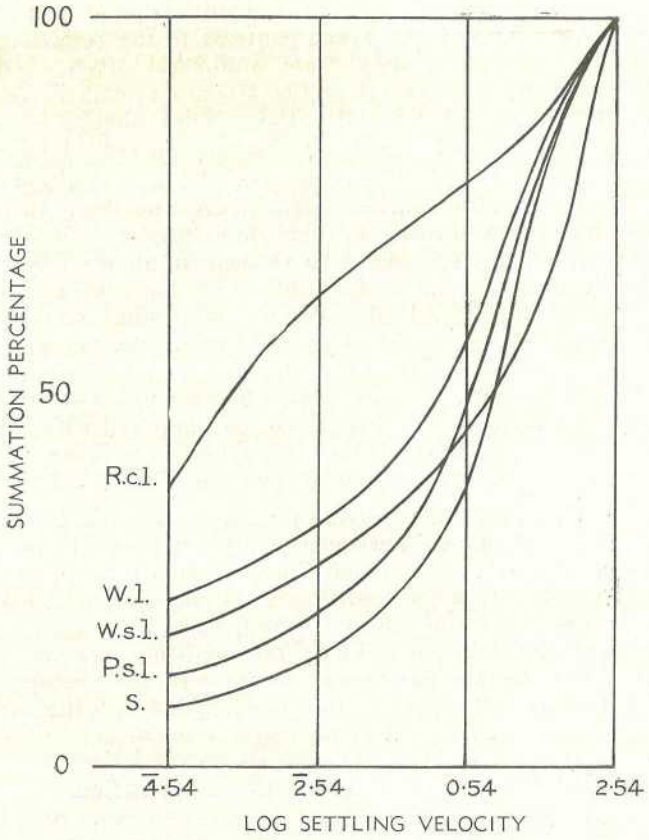
For all soils with the exception of the Rosemount clay loam, the dominant fraction is the coarse sand, that is, the fraction lying between the settling velocities 2·54 and 0·54, since the curve is always steepest over this part of its range. The similarity which exists in this respect between the loam, sandy loam, and sand soil types is carried, in a general way, into the 0·54 to 2·54 settling velocity range, i.e., the fine sand. The slope of the Rosemount clay loam is again markedly different.

There are, however, important differences between the loam, sandy loams and sands. Although all the curves flatten out as they approach the velocity whose logarithm is $_2$·54, they are by no means parallel. The slope indicates that there is a more uniform distribution of the particle size throughout the Woombye loam and Woombye sandy loam range, than in the sands and Palmwoods sandy loam. In the two latter groups, the maximum distribution of the particles is undoubtedly closer to the coarser end of the range of the fine sand fraction. This is also true of the Coe's Creek sandy loam, the curve for which is not shown, since it is typified by that of the Palmwoods soil. From these curves it will be observed that the soils of the grey-brown group—as represented by the Coe's Creek sandy loam, the Palmwoods sandy loam, and the several sand types—are notably coarser in texture than the Woombye series. This is in complete accord with the many field observations which were made during the course of the survey.

Throughout the range of the silt fraction—i.e., the interval 4·54 to 2·54—the curves for the Woombye soils are slightly steeper than those of the grey-brown soils, indicating a somewhat higher silt content. Generally, however, there is a very pronounced flattening of the curves in this region. The low silt contents are typical of the soils planted to pineapples, not only in the area under review, but also in the Beerburrum-Glasshouse Mountains-Beerwah districts (6). The higher silt content of the Rosemount clay loam again differentiates this soil.

### Structural Characteristics and Consistence.

The texture of the surface soils has a marked influence upon their structural characteristics. With the exception of the Woombye sandy loam, the sandy loams and sands are structureless. This is implied by the nature of the curves as shown in Plate 42. In these latter types, the predominance of the sand fraction and its high degree of coarseness is indicated by the steepness of the curve at the higher settling velocities. The single-grain nature of these surface soils is a reflection of the low content of clay, silt, and organic matter.




R.c.l. = Rosemount clay loam
W.l. = Woombye loam
W.s.l. = Woombye sandy loam
P.s.l. = Palmwoods sandy loam
S. = Sand types

Plate 42.

Summation Curves Illustrating Typical Mechanical Analyses of Surface Samples of the Various Soil Types.

Throughout the $A_1$ horizon of the Woombye loam, the particle size of the sand fraction is spread uniformly over the coarse sand–fine sand range, the fine sand grading into silt. The Woombye loam contains a greater percentage of both this latter constituent and of clay, than

the sands and sandy loams. These features, together with the increased organic content (Appendix) give rise to a definite structure development. Under virgin conditions, a marked crumb formation is apparent in the top two inches. The aggregates are firm, but may be crushed by the fingers. They are discrete particles, approximately 5 m.m. in diameter. Underlying this zone, the remainder of the $A_1$ horizon is characterised by the presence of soft, irregular aggregates. The porosity afforded by this structural development allows efficient water movement, and root penetration is quite good. If it is puddled at its sticky point, however, this soil will lose its normal state of aggregation very rapidly, its consistence will change, and it will become moderately plastic. This is in marked contrast to the behaviour of the single-grained soils of the sandy loam and sand types. Obviously therefore, the correct management of the Woombye loam is important: excessive cultivation at or near its sticky point should be avoided, particularly with heavy implements.

The surface soil of the Woombye sandy loam does not show a well-defined structure, although incoherent aggregates occur through the topmost portion of the A horizon. A crumb structure is rarely developed. The surface soils of this type may be worked at almost any moisture content without fear of compaction. This does not apply to its sub-surface horizon, however. Under virgin conditions the sub-surface horizon is porous and loose, but it compacts with cultivation, particularly if tilled with heavy implements when the soil is at or near the sticky point. During the survey, this was frequently demonstrated by the ease with which a 4-inch auger penetrated virgin, as compared with cultivated, soil. Movement of water through the compacted zones is impeded, with a consequent effect on the moisture relationships of the surface horizon.

However, the unfavourable effect of faulty soil management on the consistence of the sub-surface horizon is more noticeable in the heavier textured Woombye loam than in the Woombye sandy loam. When the impedance of water movement resulting from compaction is considered in relation to the prevailing rainfall conditions, it is apparent that periods must occur in which the soil moisture conditions are unfavourable to crop plants with rooting habits such as those of the pineapple. For these reasons, the Woombye loam cannot be regarded as being as suitable for pineapple culture as the Woombye sandy loam.

### Profile Development in Relation to Aeration.

Under conditions of heavy, though intermittent rainfall, a shallow sandy A horizon overlying an impermeable subsoil is not a suitable medium for the growth of pineapples. During rainy periods there is a rapid infiltration of water into the surface soil, and if this cannot readily escape through the heavy B horizon, temporary waterlogging of the root zone may ensue. Because of the extreme sensitivity of pineapple roots to deficient soil aeration, the inter-relation of soil type and prevailing climatic conditions is a consideration of the utmost importance.

In order to show the significance of the variation of texture with depth, diagrams have been prepared for the various soil types, in which the clay content at different levels has been plotted against the depth at which it occurs. These are shown in Plate 43. In the Rosemount sand and Palmwoods sandy loam it is quite clear that there is a large increase in the clay content at a depth of approximately 18 inches.

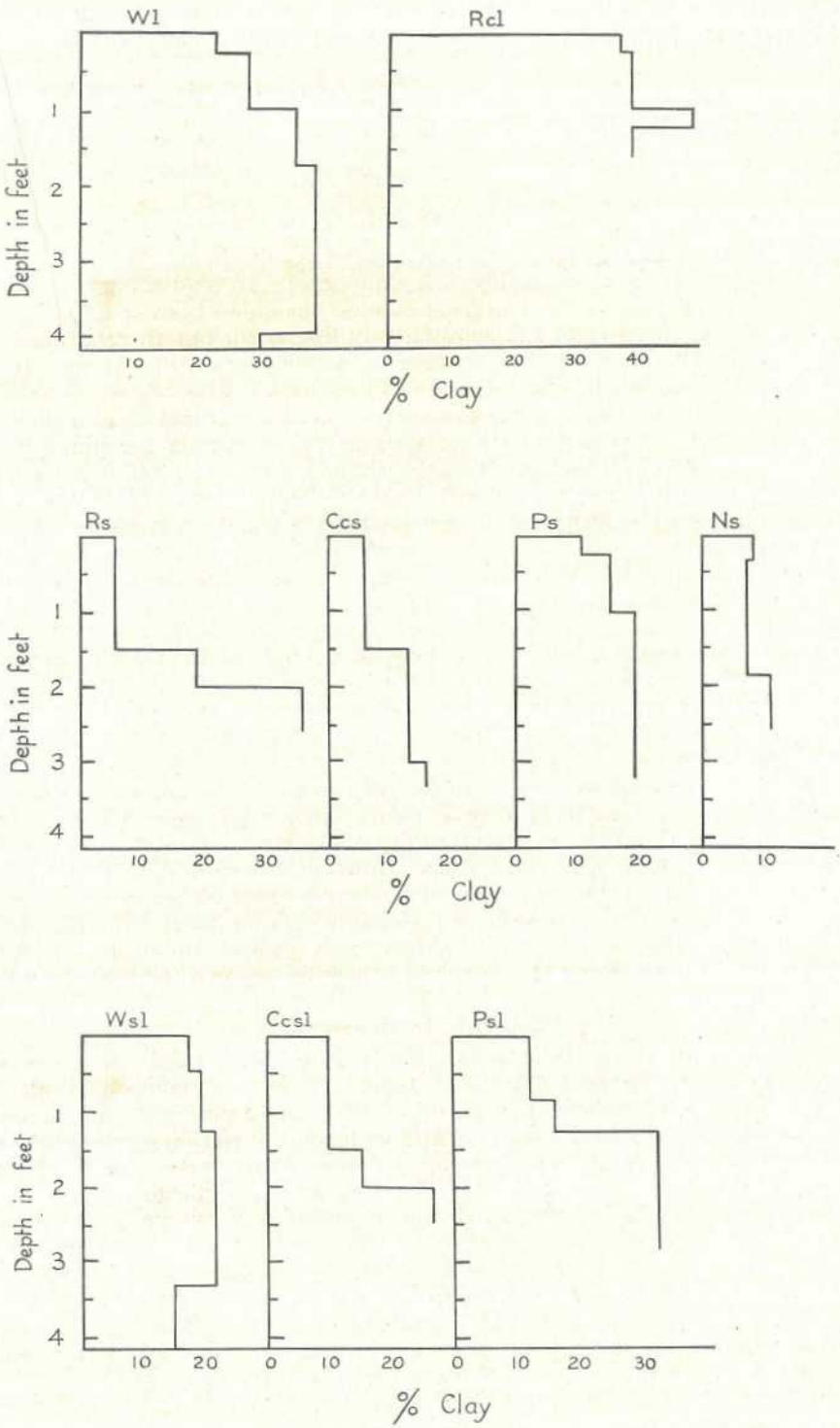



Plate 43.

Profile Development of Soil Types, Showing the Increase in Clay Content with Depth.

The sands and sandy loams of the Coe's Creek series show similar profile developments, although in the normal profile the A horizon is slightly deeper.

The nature of the slope is a major factor governing the extent to which the shallower phases of these types may be cultivated. When such areas lie at the foot of a slope they should be avoided, though areas of similar nature occurring on ridge slopes may be utilised if adequate attention is given to drainage.

There is a much greater uniformity in the texture of the various horizons within the profile of the Woombye sandy loam (Plate 43). In this soil, there is considerably less danger of "overwatering" of the surface horizon during wet periods because the subsoil is not only more permeable than those of the soils already discussed, but there is also a much smaller difference in the rate of water movement through the surface and subsoil layers.

With the exception of the Rosemount clay loam, Plate 43 also shows that the Woombye loam is the heaviest of the soils used for pineapple culture within the Nambour-Woombye-Palmwoods area. Its behaviour, under cultivation, points to the fact that a degree of waterlogging may sometimes occur, which is serious enough to affect the pineapple plant. This is particularly the case in those areas which receive run-off water from higher levels. Rain falling directly on this relatively heavy soil is rarely the cause of waterlogging, since the penetration is low once the moisture equivalent is reached. If surface water is allowed to accumulate, however, it will penetrate until impeded by the B horizon, which has a slower rate of percolation. When planting this soil to pineapples, therefore, it is important to avoid not only depressions, but also locations in which the gradient does not permit free run-off of surface water.

The foregoing remarks apply equally to the Rosemount clay loam. In this soil, the profile is very shallow. Due to its relatively higher organic matter content, and the stability of the structural aggregates, the surface soil is quite open and porous. However, the subsoil, which occurs at a depth of 12 inches, is sticky, and percolation of water is very slow. Nevertheless, if there is sufficient slope to ensure quick run-off, and careful attention is paid to drainage, it is possible to overcome the temporary waterlogging which would otherwise occur during prolonged rainy periods.

### Moisture Equivalents.

Moisture equivalent determinations were carried out on a large number of surface soils from each type. These were made by centrifuging 30 gm. of moist soil in a field of 1,000 times gravity. The values obtained are given in Table III. Although some variation occurs within each type, there is a broad agreement between the moisture equivalent values and texture classification. The figures also indicate the heavier nature of the dark brown–red-brown group (Woombye series) as compared with the grey-brown soils of the area. In this latter group, the values for the Nambour and Rosemount soils are very low, which is to be expected from their general sandy nature. There is very little difference in the figures of the Woombye, Palmwoods, and Coe's Creek sandy loam. The highest moisture equivalents recorded in the district are those of the Rosemount clay loam, the figures for which are not given in Table III. Three samples of this type, however, gave values ranging from 26 per cent. to 33 per cent.

TABLE III.

DISTRIBUTION TABLE OF MOISTURE EQUIVALENT VALUES (PER CENT.) OF SURFACE SOILS.

| Moisture Equivalent Per Cent. | <4. | 4–6. | 6–8. | 8–10. | 10–12. | 12–14. | 14–16. |
|---|---|---|---|---|---|---|---|
| Woombye loam .. .. .. | .. | .. | .. | .. | 6 | 10 | 4 |
| Woombye sandy loam .. .. | .. | .. | .. | 13 | 5 | 1 | .. |
| Palmwoods sandy loam .. .. | .. | .. | 1 | 8 | 3 | 1 | 1 |
| Coe's Creek sandy loam .. .. | .. | .. | 1 | 4 | 3 | 4 | .. |
| Palmwoods sand .. .. .. | .. | .. | 6 | 2 | .. | .. | .. |
| Coe's Creek sand .. .. .. | .. | 2 | 7 | 3 | 1 | .. | .. |
| Nambour sand .. .. .. | 2 | 4 | 4 | 3 | .. | .. | .. |
| Rosemount sand .. .. .. | 1 | 5 | 4 | .. | .. | .. | .. |
| No. of samples .. .. | 3 | 11 | 23 | 33 | 18 | 16 | 5 |

## Wilting Coefficient.

B. daCosta (1) has adduced evidence showing that the soil moisture content at which permanent wilting occurs coincides very closely with a pF value of 4·2. Using the freezing point method, a series of pF determinations were made on a selected number of typical samples of the various soil types under discussion. From the data obtained, the wilting coefficients were calculated as percentages of the oven dry weight, and these are set out in Table IV.

TABLE IV.

WILTING COEFFICIENTS DETERMINED FROM THE DEPRESSION OF FREEZING POINT OF SOME TYPICAL SURFACE SOILS.

| Soil Type. | Wilting Coefficient (Per Cent. Dry Weight). |
|---|---|
| Woombye loam .. .. .. .. .. .. | 9·9 |
| | 8·9 |
| | 8·9 |
| Woombye sandy loam .. .. .. .. .. | 6·8 |
| | 7·2 |
| | 6·8 |
| Palmwoods sand .. .. .. .. .. .. | 5·4 |
| | 5·8 |
| Palmwoods sandy loam .. .. .. .. .. | 7·8 |
| | 6·0 |
| Nambour sand .. .. .. .. .. .. | 5·4 |
| | 5·4 |
| Coe's Creek sandy loam .. .. .. .. .. | 5·9 |
| | 7·0 |
| Coe's Creek sand .. .. .. .. .. .. | 3·8 |
| | 3·9 |
| Rosemount sand .. .. .. .. .. .. | 3·7 |
| | 3·4 |
| Rosemount clay loam .. .. .. .. .. | 17·0 |
| | 24·0 |

The figures indicate a general grouping according to texture classes. This is not unexpected, since the soils are of similar origin, and the samples are from corresponding horizons. The highest wilting co-efficient is that of the Rosemount clay loam. The sandy loams have values intermediate between the Woombye loam and the several sand types. In this respect there is a marked similarity to the distribution of the moisture equivalent values.

## Soil Moisture.

Since the uneven distribution of the rainfall throughout the year is a major climatic feature of the Nambour-Woombye-Palmwoods area, the moisture relationships of the various soil types assume considerable importance in determining their value for agricultural purposes. Reference to Plate 6 shows that, during the spring period, the monthly precipitation is less than the evaporation as calculated from the monthly saturation deficit. At the end of this period bush fires are prevalent, and the resultant loss of organic material from the surface cover is very great. Under such conditions, the suitability of each soil type for pineapple culture depends chiefly upon its capacity to supply water to the roots which, in this crop, are mainly restricted to the surface horizons.

Tables III. and IV. show that as the moisture equivalent values increase from the light sandy soils to the heavier types, there is also an increase in the wilting coefficients. The relationship which exists between these two single-value factors is shown in Plate 44 in which the moisture equivalents of a number of surface soils of all types are plotted against their wilting coefficients. However, the scatter of the points suggests that it would be unwise to regard the wilting coefficient as a constant function of the more easily determined moisture equivalent.

The moisture equivalent is not necessarily an absolute index of field capacity. This latter term is defined as that percentage of moisture which a soil will hold after all free water has drained away. Generally, such a condition occurs within one to three days after soaking rain. The agreement which has been found to exist between the moisture equivalent and the field capacity in the surface horizons of a number of soils from the Nambour-Woombye-Palmwoods area is shown in Table V.

TABLE V.

SHOWING RELATION BETWEEN MOISTURE EQUIVALENT AND FIELD CAPACITY OF CERTAIN SURFACE HORIZONS.*

| Type. | Field Capacity / Moisture Equivalent. |
|---|---|
| Woombye loam | 0·91 |
| Woombye sandy loam | 0·99 |
| Rosemount sand | 1·50 |
| Coe's Creek sand | 1·50 |

* These figures are taken from a series of field moisture investigations at present in progress on southern Queensland soils. They represent the means of many soil moisture and moisture equivalent determinations.

The field capacity of the Woombye loam is slightly less than its moisture equivalent. In the Woombye sandy loam the two values are practically identical, while in the sands the field capacity is considerably greater than the moisture equivalent.

The "available" moisture at field capacity is regarded as the total moisture at field capacity minus the moisture percentage at the wilting coefficient. Some typical figures for available moisture of surface soils obtained in this way are as follows:—Woombye sandy loam 4·0 per cent., Woombye loam 2·0 per cent. Coe's Creek sand and Rosemount sand 2·0-2·5 per cent. The figures for field capacity were determined by

actual field measurement, but it would have been equally valid to have obtained them by applying the requisite factor (Table V.) to the moisture equivalent.

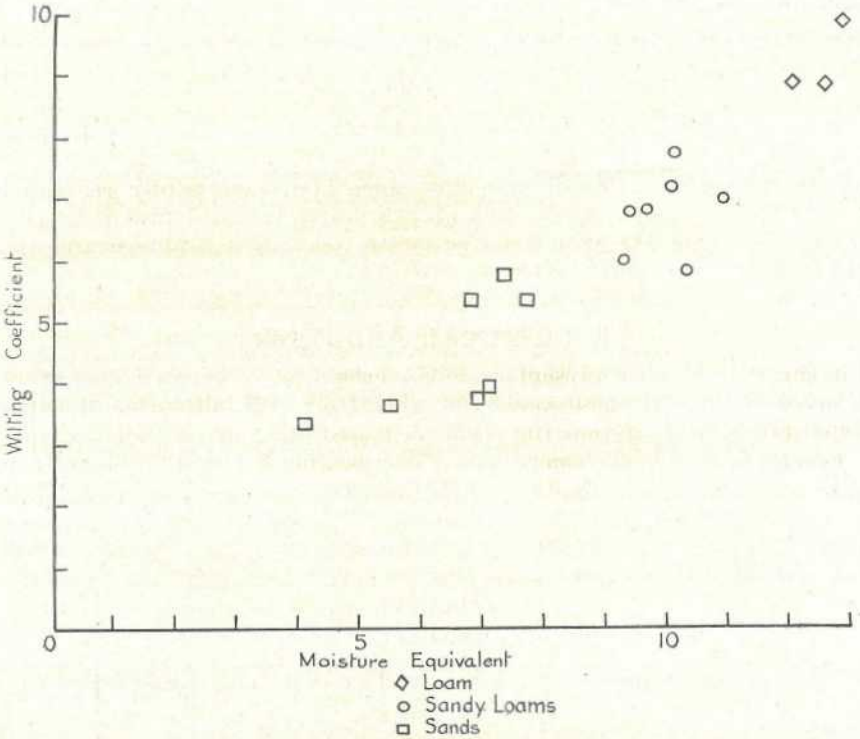



Plate 44.

Having due regard to the climatic conditions prevailing in the Nambour-Woombye-Palmwoods area the most favourable moisture relationships for pineapple growth occur in the sandy loams. This is reflected in the better growth which pineapples make during extended dry periods on soils of this type—and, to a lesser extent, on the sands—as compared with those of the Woombye loam type, especially where deterioration in the physical condition of the latter type has occurred as a result of faulty cultural practices. Although the drying out of the surface is greatest in the sand types, there is an appreciable diurnal addition of moisture from dew which condenses in the trough-shaped pineapple leaves (4). These small but regular increments are much more effective on sandy soils with their low wilting points, than they are on heavier types, such as the Woombye loam.

In the Nambour-Woombye-Palmwoods area, it has been found that the occurrence of the disease known as "top rot" or "wet rot" in young pineapple plants (3) is closely correlated with soil moisture relationships. Although the disease occurs on all soil types in this area, its incidence is most severe under conditions of poor drainage. Top rot is particularly associated with very shallow surface soils of a sandy nature which overlie heavy subsoils. It is also prevalent on depressed

areas in the Woombye loam, and on those where run-off is restricted. It is least likely to occur on the Woombye sandy loam and Coe's Creek sandy loam. In order to reduce the incidence of top rot, the following factors must be given careful attention when selecting land for pineapple culture:—

(1) Permeability of the surface horizon.

(2) Depth of the zone of impedance.

The effect of the microtopography of the plantation site upon these two factors is important. Many areas which once were susceptible to severe outbreak of this disease have since been successfully replanted to pineapples by the application of preventive cultural practices, viz., re-orientation of the crop rows to ensure maximum drainage and the rapid removal of surplus water.

## IV. CHEMICAL ANALYSES.

A large number of surface soils representative of each type were selected for laboratory investigation. These were all taken from uncultivated areas in order that the chemical constitution of the soils in their virgin state could be determined. Each sample represents an average of three samples to a depth of 9 inches. In most cases, samples taken to this depth comprise the whole of the $A_1$ horizon and the topmost portion of the $A_2$ horizon. All percentages refer to the air dried soil passing a 2 m.m. sieve.

TABLE VI.

DISTRIBUTION OF ORGANIC CARBON (PER CENT.) OF SURFACE SOILS.

| Per Cent. Organic C. | ·5–1·0. | 1·0–1·5. | 1·5–2·0. | 2·0–2·5. | 2·5–3·0. |
|---|---|---|---|---|---|
| Woombye loam | .. | .. | 1 | 13 | 6 |
| Woombye sandy loam | .. | 3 | 5 | 9 | 2 |
| Palmwoods sandy loam | .. | .. | 8 | 5 | .. |
| Coe's Creek sandy loam | .. | 1 | 3 | 2 | 4 |
| Palmwoods sand | .. | 2 | 5 | .. | 1 |
| Coe's Creek sand | .. | 3 | 4 | 4 | 2 |
| Nambour sand | 2 | 4 | 5 | 1 | .. |
| Rosemount sand | 2 | 5 | 4 | .. | .. |
| Rosemount clay loam | .. | .. | .. | .. | .. |
| All types | 3 | 18 | 35 | 34 | 15 |

| Per Cent. Organic C. | 3·0–3·5. | 3·5–4·0. | 4·0–5·0. | 5·0–6·0. | 6·0–7·0. |
|---|---|---|---|---|---|
| Woombye loam | 1 | .. | .. | .. | .. |
| Woombye sandy loam | .. | .. | .. | .. | .. |
| Palmwoods sandy loam | .. | 1 | .. | .. | .. |
| Coe's Creek sandy loam | 2 | .. | .. | .. | .. |
| Palmwoods sand | .. | .. | .. | .. | .. |
| Coe's Creek sand | .. | .. | .. | .. | .. |
| Nambour sand | .. | .. | .. | .. | .. |
| Rosemount sand | .. | .. | .. | .. | .. |
| Rosemount clay loam | .. | .. | 1 | 1 | 1 |
| All types | 3 | 1 | 1 | 1 | 1 |

### Organic Carbon, Nitrogen, and C : N Ratio.

The figures for the organic carbon content of the surface soils are given in Table VI. No carbonates are present under virgin conditions. The organic carbon content of the Rosemount clay loam, in its virgin state, is regarded as being very fair to good, and, as previously mentioned, the structure and general physical condition of this soil is satisfactory. As the texture of these surface soils becomes more sandy, however, their carbon content decreases, that of both the Nambour and Rosemount sands being extremely low.

As in the case of organic carbon there is a marked correlation between textural characteristics and total nitrogen content (Table VII.). With the exception of the Rosemount clay loam the nitrogen content of these soils cannot be regarded as good. Of the two major soil groups, the Woombye loam contains the greatest amount, but even in this soil there is a considerable variation between samples and few have been found to contain more than 0·15 per cent.

TABLE VII.

DISTRIBUTION OF NITROGEN (PER CENT.) OF SURFACE SOILS.

| Per Cent. N. | ·025–·05. | ·05–·075. | ·075–·10. | ·10–·125. | ·125.–·15 |
|---|---|---|---|---|---|
| Woombye loam | .. | .. | 7 | 3 | 5 |
| Woombye sandy loam | .. | .. | 10 | 3 | 5 |
| Palmwoods sandy loam | .. | 1 | 10 | 2 | .. |
| Coe's Creek sandy loam | .. | 1 | 5 | 2 | 4 |
| Palmwoods sand | .. | 4 | 4 | .. | .. |
| Coe's Creek sand | 2 | 3 | 6 | 2 | .. |
| Nambour sand | 3 | 5 | 4 | .. | .. |
| Rosemount sand | 2 | 5 | 3 | .. | .. |
| Rosemount clay loam | .. | .. | .. | .. | .. |
| All types | 7 | 19 | 49 | 12 | 14 |

| Per Cent. N. | ·15–·20. | ·20–·25. | ·25–·30. | ·30–·35. | — |
|---|---|---|---|---|---|
| Woombye loam | 4 | 2 | .. | .. | .. |
| Woombye sandy loam | 1 | .. | .. | .. | .. |
| Palmwoods sandy loam | 1 | .. | .. | .. | .. |
| Coe's Creek sandy loam | .. | .. | .. | .. | .. |
| Palmwoods sand | .. | .. | .. | .. | .. |
| Coe's Creek sand | .. | .. | .. | .. | .. |
| Nambour sand | .. | .. | .. | .. | .. |
| Rosemount sand | .. | .. | .. | .. | .. |
| Rosemount clay loam | 1 | .. | 1 | 1 | .. |
| All types | 7 | 2 | 1 | 1 | .. |

The carbon : nitrogen rations are given in Table VIII. For the majority of the surface soils this ratio is a wide one, implying that the greater part of the organic matter present is of a woody nature. Such conditions are in keeping with the vegetation associations of the area, as these give rise to a surface litter unfavourable to the production of humified material. Table VI. shows that the organic carbon content of all soils is distributed around a mean of 2 per cent. In general, the dark brown–red-brown group as exemplified by the Woombye series have narrower C : N ratios than the grey-brown soils.

TABLE VIII.

DISTRIBUTION OF C : N RATIOS OF SURFACE SOILS.

| C : N Ratios. | 10–15. | 15–20. | 20–25. | 25–30. | 30–40. |
|---|---|---|---|---|---|
| Woombye loam | 2 | 10 | 7 | 2 | .. |
| Woombye sandy loam | 2 | 10 | 6 | 1 | .. |
| Palmwoods sandy loam | .. | 5 | 7 | 2 | .. |
| Coe's Creek sandy loam | .. | 2 | 8 | 2 | .. |
| Palmwoods sand | .. | 1 | 5 | 1 | 1 |
| Coe's Creek sand | .. | .. | 6 | 7 | .. |
| Nambour sand | .. | 3 | 9 | .. | .. |
| Rosemount sand | .. | 3 | 7 | .. | .. |
| Rosemount clay loam | .. | 1 | 2 | .. | .. |
| All types | 4 | 35 | 57 | 15 | 1 |

## Replaceable Bases.

Estimations of replaceable bases have been made on surface soils from all types. The figures for replaceable K, which are used as an index of potassium availability, are given in Table IX.

TABLE IX.

DISTRIBUTION OF REPLACEABLE K (M.E. PER CENT.) OF SURFACE SOILS.

| Replaceable K. m.e. per Cent. | ·<·10. | ·10–·20. | ·20–·30. | ·30–·40. | ·40–·50. | ·50–·60. | ·60–·70. | ·70–·80. |
|---|---|---|---|---|---|---|---|---|
| Woombye loam | .. | .. | 1 | 1 | 3 | 2 | .. | 2 |
| Woombye sandy loam | 3 | .. | 1 | .. | 2 | .. | 1 | .. |
| Palmwoods sandy loam | 5 | 1 | .. | .. | .. | .. | .. | .. |
| Coe's Creek sandy loam | 2 | 1 | 3 | 3 | .. | 1 | .. | .. |
| Palmwoods sand | 2 | 2 | 4 | .. | .. | .. | .. | .. |
| Coe's Creek sand | .. | 1 | 5 | 3 | .. | .. | .. | .. |
| Nambour sand | 1 | .. | 5 | 2 | 1 | .. | 1 | 1 |
| Rosemount sand | 1 | 1 | 3 | 1 | .. | .. | .. | 1 |
| Rosemount clay loam | 2 | 1 | .. | .. | .. | .. | .. | .. |
| All types | 16 | 7 | 22 | 10 | 6 | 3 | 2 | 4 |

Although there is considerable variation in each soil type, the figure obtained from the majority of the estimations on all soil types is less than 0·31 m.e. of replaceable K per 100 grams of air dry soil. In the Woombye loam the mean level of replaceable K was higher than in any other of the soils examined. A majority of the samples of this soil were found to contain between 0·4 and 0·6 m.e., while two contained in excess of 0·7 m.e. The widest range occurs within the Nambour sand where some unexpectedly high values of between 0·6 and 0·8 m.e. were obtained, although the majority of the samples contained less than 0·3 m.e.

Tables X. and XI. show the replaceable calcium and magnesium content of surface soils. The former element is the major exchangeable constituent. In general, the figures are not high, and they are in keeping with the slightly acid nature of the soils. While none of the analyses suggest the presence of an absolute deficiency of lime or magnesia, the low base status of these soils is evident.

TABLE X.

DISTRIBUTION OF REPLACEABLE Ca (M.E. PER CENT.) OF SURFACE SOILS.

| Replaceable Ca. m.e. per Cent. | 1·0–2·0. | 2·0–3·0. | 3·0–4·0. | 4·0–5·0. | 5·0–6·0. | 6·0–7·0. | 7·0–8·0. |
|---|---|---|---|---|---|---|---|
| Woombye loam | 1 | 1 | 4 | 2 | 1 | .. | .. |
| Woombye sandy loam | 2 | 4 | 2 | .. | 1 | 1 | .. |
| Palmwoods sandy loam | .. | 4 | 2 | .. | .. | .. | .. |
| Coe's Creek sandy loam | .. | 1 | 1 | 1 | 2 | .. | .. |
| Palmwoods sand | 1 | 1 | 1 | .. | .. | .. | .. |
| Coe's Creek sand | 1 | .. | 2 | .. | 1 | .. | .. |
| Nambour sand | .. | .. | 4 | 1 | 1 | 2 | 1 |
| Rosemount sand | .. | 1 | 2 | .. | 1 | .. | .. |
| Rosemount clay loam | 2 | .. | .. | .. | .. | 1 | .. |
| All types | 7 | 12 | 18 | 4 | 7 | 4 | 1 |

TABLE XI.

DISTRIBUTION OF REPLACEABLE Mg (M.E. PER CENT.) OF SURFACE SOILS.

| Replaceable Mg. m.e. Per Cent. | <·5. | ·5–1·0. | 1·0–1·5. | 1·5–2·0. | 2·0–2·5. | 2·5–3·0. | 3·0–3·5. |
|---|---|---|---|---|---|---|---|
| Woombye loam | 2 | 3 | 3 | 1 | .. | .. | 1 |
| Woombye sandy loam | .. | 1 | .. | 4 | 1 | 1 | 2 |
| Palmwoods sandy loam | 3 | .. | 1 | 2 | .. | .. | .. |
| Coe's Creek sandy loam | .. | .. | 1 | 3 | .. | 1 | .. |
| Palmwoods sand | 1 | 2 | .. | .. | .. | .. | .. |
| Coe's Creek sand | .. | 1 | .. | 1 | 2 | .. | .. |
| Nambour sand | 4 | 2 | 1 | 1 | .. | .. | 1 |
| Rosemount sand | .. | 1 | .. | 3 | .. | .. | .. |
| Rosemount clay loam | .. | 1 | .. | 2 | .. | .. | .. |
| All types | 10 | 11 | 6 | 17 | 3 | 2 | 4 |

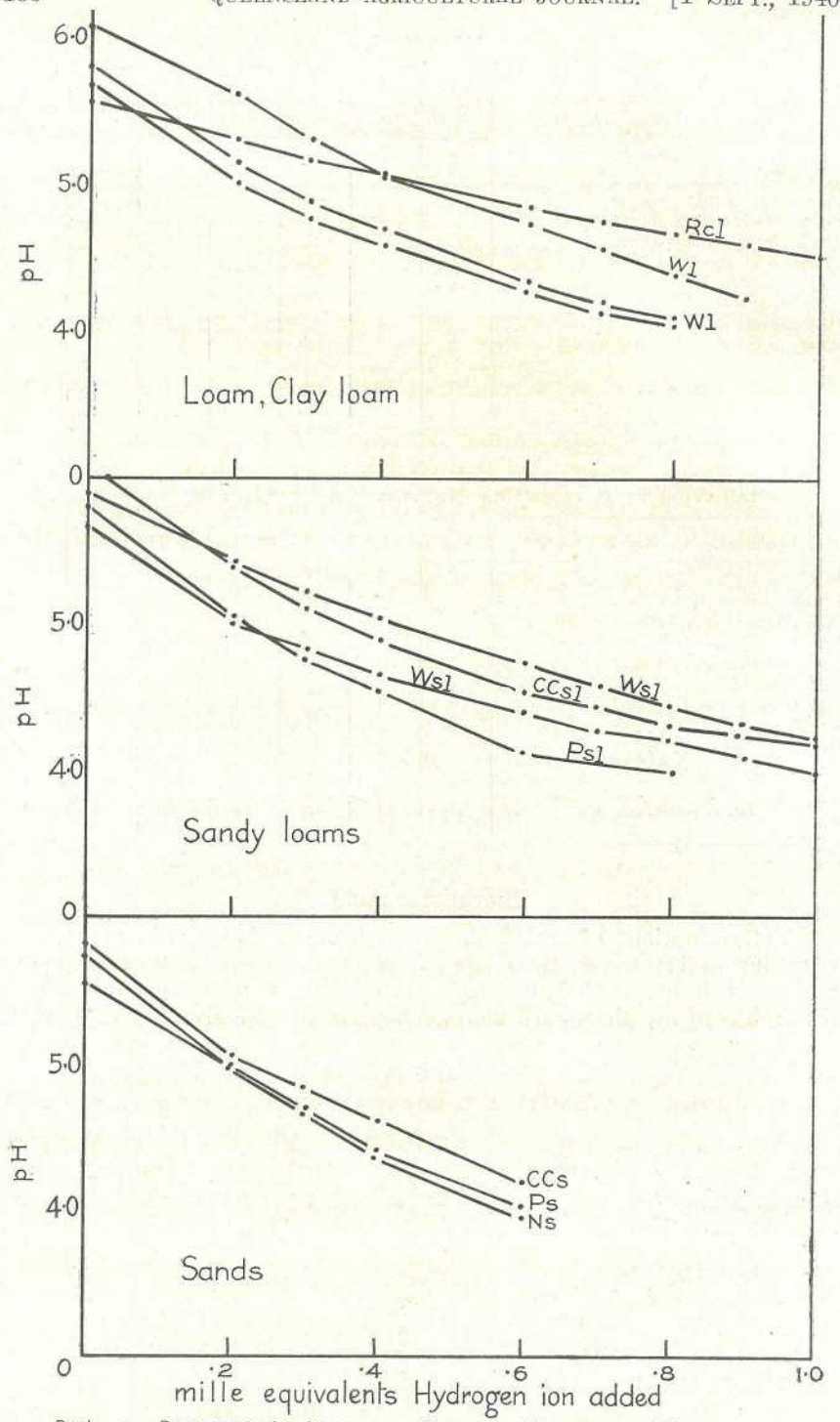
## Phosphoric Acid.

Determination of available phosphoric acid was carried out according to Truog's method, since data obtained in this way are being used as an index of the phosphate requirement of the pineapple plant. The results of the phosphoric acid determinations are given in Table XII.

TABLE XII.

DISTRIBUTION OF AVAILABLE P (PARTS PER MILLION) OF SURFACE SOILS.

| Available P ; Parts per Million. | 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|---|
| Woombye loam | 10 | 6 | 3 | 1 | .. |
| Woombye sandy loam | .. | .. | 14 | .. | .. |
| Palmwoods sandy loam | 13 | 1 | .. | .. | .. |
| Coe's Creek sandy loam | 4 | 1 | 7 | .. | .. |
| Palmwoods sand | .. | 6 | 1 | .. | .. |
| Coe's Creek sand | 5 | 1 | 4 | 1 | 2 |
| Nambour sand | 1 | 7 | 3 | 1 | .. |
| Rosemount sand | 2 | 7 | .. | 1 | .. |
| Rosemount clay loam | 3 | .. | .. | .. | .. |
| All types | 38 | 29 | 32 | 4 | 2 |




R.c.l. = Rosemount clay loam.
CCsl. = Coe's Creek sandy loam.
CCs. = Coe's Creek sand.
Wl. = Woombye loam.
Wsl. = Woombye sandy loam.
Psl. = Palmwoods sandy loam.
Ps. = Palmwoods sand.
Ns. = Nambour sand.

Plate 45.
BUFFERING CURVES OF SURFACE SOILS.

The available phosphoric acid content is extremely low in all soil types; none were found to contain more than five parts per million. For the successful production of pineapples in these soils, therefore, adequate phosphatic fertilisation is necessary.

The phosphate which is soluble in constant boiling point hydrochloric acid is also low. This will be seen by reference to data tabulated in the Appendix. Out of ten estimations, seven samples contained less than 0·05 per cent. $P_2O_5$. The highest content occurs in the Rosemount clay loam, viz., 0·077 per cent. $P_2O_5$. These low values are characteristic of the weakly podsolised coastal soils of southern Queensland.

### Hydrochloric Acid Analyses.

Samples from the various horizons of the type profiles were digested with constant boiling point hydrochloric acid. The analyses of the acid extracts are given in the Appendix. In general, the values for lime, magnesia, potash, and phosphate are low, and they are in accord with the slightly acid reactions of these soils. The C horizons, which are decomposition layers overlying the parent rock, are also poorly supplied with these constituents. However, there is, in general, an increased concentration of Ca, Mg, and P in the surface horizons resulting from the decomposition of plant residues. In all profiles, the greatest percentage of calcium occurs within the $A_1$ horizon while a similar—though less marked—distribution was found in the case of magnesium. The figures for $P_2O_5$ also indicate a tendency for the $A_1$ horizon to be richer in this constituent than the illuvial portion of the solum. Potash is distributed throughout the profile, there being no tendency for it to accumulate in any one horizon.

A noticeable feature of these soils is the enrichment of the illuvial zone by sequioxide material.

### Reaction, Buffer Capacity and Sulphur Requirement.

*Reaction.*—All pH determinations were carried out by means of the glass electrode. From Table XIII. it will be seen that the reaction of the majority of the surface soils lies within the range pH 5·4 to 6·2. Within each soil type the range is limited. Moreover, with the exception of the Rosemount clay loam, there is no great variation from type to type. The Rosemount soil, which contains the highest percentage of organic matter of any soil of the area, is also the most acid. The least acid soils are those which comprise the dark-brown–red-brown Woombye series, but the differences between the pH values of this series and those of the grey-brown group are slight.

*Buffer Capacity.*—During the past few years, field experience has demonstrated that the optimum soil reaction value for the growth of pineapples in southern Queensland soils lies within the range 5·0 $\pm$ 0·4. The application of sulphur to obtain the desired degree of acidity is now a general practice in the Nambour-Woombye-Palmwoods area. It is specially of value in the control of pineapple wilt (2), and the beneficial effects are particularly marked in those soils which have been planted to pineapples for a number of years.

TABLE XIII.

DISTRIBUTION OF pH VALUES OF SURFACE SOILS.

| pH. | 4·8–5·0. | 5·0–5·2. | 5·2–5·4. | 5·4–5·6. | 5·6–5·8. |
|---|---|---|---|---|---|
| Woombye loam | .. | .. | .. | .. | 6 |
| Woombye sandy loam | .. | .. | .. | .. | 2 |
| Palmwoods sandy loam | .. | .. | 2 | 1 | 9 |
| Coe's Creek sandy loam | .. | .. | .. | 1 | 6 |
| Palmwoods sand | .. | .. | .. | .. | 2 |
| Coe's Creek sand | .. | .. | 7 | 2 | 3 |
| Nambour sand | .. | .. | 2 | 2 | 4 |
| Rosemount sand | .. | .. | .. | .. | 5 |
| Rosemount clay loam | 1 | .. | .. | 2 | .. |
| All types | 1 | .. | 11 | 8 | 37 |

| pH. | 5·8–6·0. | 6·0–6·2. | 6·2–6·4. | 6·4–6·6. | Arith. Mean. |
|---|---|---|---|---|---|
| Woombye loam | 5 | 6 | 2 | 2 | 5·99 |
| Woombye sandy loam | 4 | 11 | 2 | .. | 6·03 |
| Palmwoods sandy loam | 2 | .. | .. | .. | 5·64 |
| Coe's Creek sandy loam | 3 | 2 | .. | .. | 5·81 |
| Palmwoods sand | 4 | 2 | .. | .. | 5·87 |
| Coe's Creek sand | 1 | .. | .. | .. | 5·47 |
| Nambour sand | 5 | .. | .. | .. | 5·68 |
| Rosemount sand | 5 | .. | .. | .. | 5·82 |
| Rosemount clay loam | .. | .. | .. | .. | 5·29 |
| All types | 29 | 21 | 4 | 2 | 5·73 |

The amount of sulphur required varies with the initial pH and the buffering capacity of the soil. The method which has been adopted for determining the buffering capacity is as follows:—Sulphuric acid (0·05 normal) is added to 20 gm. samples of air-dried surface soil (passing 2 m.m. sieve) in increments corresponding to 0·1 mille equivalents of hydrogen ion. The mixtures in duplicate are stoppered and shaken overnight, when apparent equilibrium is obtained. The pH is then determined, using a saturated calomel-glass electrode system in conjunction with a Cambridge electrometer valve pH meter. The duplicates show good agreement and are always reproducible.

The buffering curves of a large number of surface soils of all types were determined in this way. Some typical examples of these curves are given in Plate 45. It is evident that the heavier textured soils oppose any change in reaction more strongly than do the sandier types. The greatest inactivation of added hydrogen ion occurs in the Rosemount clay loam. This soil has a high organic matter content, and its base exchange capacity is known to be the highest of all soils examined in the area. The curves are similar in nature, in that there is a general tendency to flatten out as the pH decreases.

*Sulphur requirement.*—Field experience has shown that the calculated equivalent of sulphur, as indicated by the laboratory determination of buffer capacity, agrees remarkably well with the amount of powdered sulphur which it is necessary to apply to the soil before planting. It may be assumed, without serious error, that the depth

to which sulphur affects the soil reaction is about 6 inches. The soil weight at this depth is, approximately, as follows:—Rosemount clay loam—1,400,000 lb., Woombye loam—1,700,000 lb., sandy loams—1,800,000 lb., sand types—2,000,000 lb. Using this data, the amount of sulphur required to bring the field reaction within the required region has been calculated from the buffering curves. From field determinations of pH and texture, the required amounts of sulphur may be estimated from Table XIV.

TABLE XIV.

SULPHUR REQUIREMENT (POUNDS PER ACRE) OF SOIL TYPES.

| Initial pH. | 6·5–6·0. | 5·9–5·8. | 5·7–5·6. | 5·5–5·4. |
|---|---|---|---|---|
| Rosemount clay loam .. .. .. | .. | .. | 500 | 300 |
| Woombye loam .. .. .. | 600 | 500 | 400 | 300 |
| Woombye sandy loam .. .. .. | 500 | 400 | 300 | 200 |
| Palmwoods sandy loam .. .. | | | | |
| Coe's Creek sandy loam .. .. | | | | |
| Palmwoods sand .. .. .. | 400 | 300 | 200 | 200 |
| Nambour sand .. .. .. .. | | | | |
| Coe's Creek sand .. .. .. | | | | |
| Rosemount sand .. .. .. | | | | |

## V. PEDOGENESIS.

The pedogenesis of the soils of the Nambour-Woombye-Palmwoods area has been discussed by Vallance in a detailed investigation of the nature and significance of the silica-sesquioxide ratios and exchange capacities.* In general, there is a well marked degree of uniformity in the silica-alumina ratios of their A and B horizons. The probable molecular compositions of the soil colloids from the A, B, and C horizons of the various types are given below. These figures represent the means of a large number of analyses.

A horizon. $2{\cdot}13\ SiO_2\ Al_2O_3\ 2{\cdot}83\ H_2O$ B horizon. $1{\cdot}75\ SiO_2\ Al_2O_3\ 2{\cdot}2\ H_2O$

C horizon. $2{\cdot}37\ SiO_2\ Al_2O_3\ 2{\cdot}39\ H_2O$

When the solum proper is compared with the parent material of the C horizon, it will be seen that silica has been lost at a greater rate than alumina. This implies laterisation. However, the differences are small, and, the lateritic trend is not very definite. In some cases the converse is true, i.e., there are indications of slight podsolisation in which there is a relatively greater loss of sesquioxide than silica. Thus, the pedogenic processes within the area preserve a balance between laterisation and podsolisation; both of these reactions have affected the soils, but neither has gone to completion. The podsolised appearance is due to the down washing of the highly coloured colloid in an essentially unaltered state rather than to differential movement in favour of sesquioxide material.

The accumulation of bases in the illuvial horizon, which is a marked attribute of a true podsol, does not occur in these soils. Hydrogen is the major cation of the exchange complex in all horizons, and the

* Thesis, University of Queensland (1938).

degree of unsaturation is usually high. However, the illuvial horizons are more highly unsaturated than the eluvial zones and this is reflected in the decrease of pH with depth.

In view of the evidence of both the silica sesquioxide ratios and of the exchange capacities, it is suggested that the term "pseudo-podsol" is a better designation for these soils than that which is usually implied by the term podsol itself.

The clays are of the kaolinite-halloysite type, and it may be assumed that such clays are in complete agreement with the control, which the prevailing climatic conditions impose on pedogenesis in this area, viz., effective leaching throughout the year, rapid deterioration of plant residues, and slightly acid reaction of surface soils together with a minimum formation of acid humus.

The soils should be classed as Pedalfers, and of the major soil groups of the world the closest affinity is with the Red and Yellow soils of the Eastern United States. In fact, the Nambour-Woombye-Palmwoods soils have many features in common with this group, which has been described by many workers as having both lateritic and podsolic attributes.

## VI. SUMMARY.

The soils described occur in the pineapple producing districts of Nambour, Woombye and Palmwoods. The chief topographical features of this area are the numerous ridges which rise some 200 to 300 feet above sea level; they are somewhat abrupt in the northern portion, but south of Woombye, more gentle slopes are encountered.

The country rock of the area is a Mesozoic sedimentary series, consisting of sandstones and interbedded shales. Igneous rocks are not of material importance. The soil formations are mainly secondary in relation to the geological features. The parent material is a red-yellow-white decomposition zone.

Eucalypt forest forms the main vegetation association of the area, but there is a occasional development of tropical rain forest.

The mean annual rainfall is 64 inches at Nambour and 65 inches at Palmwoods. A marked feature of the climate is the intense though intermittent character of the summer rainfall. In the spring, the mean monthly rainfall is less than the mean monthly evaporation, so that the agricultural value of the various soil types is determined by their moisture relationships.

The soils fall naturally into two main groups, viz.—

(1) The dark brown–red-brown soils with reddish subsoils.

(2) The shallower grey-brown soils characteristically leached in appearance, which overlie yellow-brown subsoils.

The first group has been classified as the Woombye series and comprises two soil types:—the Woombye loam and Woombye sandy loam. The soils of the grey-brown group are represented by the Palmwoods Series, Coe's Creek Series, Nambour sand and Rosemount sand. The Palmwoods Series consists of two soil types:—the Palmwoods sand and Palmwoods sandy loam, while the Coe's Creek sand and Coe's Creek sandy loam form the Coe's Creek Series. Because of its endodynamomorphic differences, the Rosemount clay loam is not included in the two major soil groups.

There is considerable variation in the textures of the surface horizons as is implied by the names given to the soil types. In general, the A horizons of the grey-brown group of soils are coarser in texture than those of the Woombye Series. The textures of the surface soils have a marked influence upon the structural characteristics. A well-defined structure is present in the Woombye loam and Rosemount clay loam, but the sandy loams and sands are structureless with the exception of the Woombye sandy loam, in which a system of incoherent aggregates occurs. Since the efficiency of water movement in the Woombye loam and Rosemount clay loam is dependent on the porosity afforded by their structural development, correct management of these soils is important.

The percentage of water retained at the moisture equivalent varies with the texture, being greatest in the heavier soils. A similar agreement exists between wilting coefficient and texture. The field capacities of the soils may be calculated from the moisture equivalent values by the application of a suitable factor. This factor has been determined for several of the soil types, and from it the "available" moisture has also been determined. Since the rainfall of the area is intermittent, the aim of cultural practices on these soils should be the maintenance of soil moisture at field capacity.

While the organic matter content of the surface horizons of both the major soil groups is generally low, the red-brown soils are usually richer in carbon and nitrogen than the grey-brown group. The carbon: nitrogen ratios of the former are also narrower than those of the latter. The greatest accumulation of organic matter occurs in the Rosemount clay loam.

The replaceable base content is not high. The average replaceable potash content is less than 0·31 m.e. per cent.: in all but two of the soil types one or more samples were found to contain less than 0·1 m.e. replaceable K. The Woombye loam contains the highest mean level of this constituent. Calcium is the major exchangeable base.

In all of the soil types the available phosphoric acid content is extremely low, all estimations being less than five parts per million.

The reaction of the majority of the surface soils lies within the range pH 5·4 to 6·2. Since this is somewhat greater than the optimum soil reaction for pineapple growth, the buffering capacities of a number of typical samples were determined. From the data obtained, the sulphur requirement of the various soil types has been tabulated.

The soils of the Nambour-Woombye-Palmwoods area are Pedalfers. Of the major soil groups of the world their closest affinity is with the Red and Yellow soils of the Eastern United States. The movement of silica and sesquioxide within the profiles indicates that pedogenesis has preserved a balance between laterisation and podsolisation; both of these processes have affected the soils, but neither has gone to completion.

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## APPENDIX.

### Mechanical and Chemical Analyses of Profiles.

WOOMBYE LOAM.

| Lab. No. | 4041 | 4042 | 4043 | 4044 | 4045 |
|---|---|---|---|---|---|
| Horizon | $A_1$ | $A_2$ | $B_1$ | $B_2$ | C |
| Depth in inches | 0–3 | 3–12 | 12–21 | 21–48 | 60–66 |
| | Per cent. | Per cent. | Per cent. | Per cent. | Per cent. |
| Coarse sand | 42·7 | 38·8 | 35·3 | 31·6 | 39·3 |
| Fine sand | 21·8 | 21·9 | 20·9 | 21·1 | 23·2 |
| Silt | 9·8 | 9·8 | 7·2 | 8·9 | 12·7 |
| Clay | 21·2 | 26·4 | 34·2 | 37·6 | 22·9 |
| Loss acid treatment | 1·0 | 1·3 | 0·9 | n.d. | n.d. |
| Moisture | 1·9 | 1·5 | 1·3 | n.d. | n.d. |
| Soluble in HCl $R_2O_3$ | 13·64 | 17·05 | 21·60 | 24·38 | 31·27 |
| Soluble in HCl $Fe_2O_3$ | 5·48 | 7·04 | 8·56 | 10·40 | 16·96 |
| Soluble in HCl $P_2O_5$ | 0·044 | 0·040 | 0·037 | 0·044 | 0·081 |
| Soluble in HCl CaO | 0·21 | 0·133 | 0·091 | 0·056 | 0·140 |
| Soluble in HCl MgO | 0·158 | 0·199 | 0·165 | 0·056 | 0·141 |
| Soluble in HCl $K_2O$ | 0·094 | 0·094 | 0·120 | 0·129 | trace |
| Organic C | 2·60 | 1·23 | 0·61 | 0·20 | 0·11 |
| pH | 5·8 | 5·9 | 5·7 | 5·3 | 5·6 |

WOOMBYE SANDY LOAM.

| Lab. No. | 4046 | 4047 | 4048 | 4049 |
|---|---|---|---|---|
| Horizon | $A_1$ | $A_2$ | B | C |
| Depth in inches | 0–6 | 6–15 | 15–42 | 54–57 |
| | Per cent. | Per cent. | Per cent. | Per cent. |
| Coarse sand | 52·9 | 48·0 | 47·7 | 49·6 |
| Fine sand | 14·8 | 20·3 | 20·8 | 24·0 |
| Silt | 9·6 | 9·9 | 8·4 | 11·2 |
| Clay | 16·4 | 18·2 | 21·3 | 15.2 |
| Loss acid treatment | 1·3 | 1·2 | 0·7 | n.d. |
| Moisture | 2·2 | 1·3 | 1·1 | n.d. |
| Soluble in HCl $R_2O_3$ | 10·17 | 11·97 | 13·17 | 16·35 |
| Soluble in HCl $Fe_2O_3$ | 4·38 | 4·88 | 6·24 | 9·60 |
| Soluble in HCl $P_2O_5$ | 0·064 | 0·047 | 0·046 | 0·076 |
| Soluble in HCl CaO | 0·266 | 0·175 | 0·133 | 0·119 |
| Soluble in HCl MgO | 0·291 | 0·266 | 0·150 | 0·393 |
| Soluble in HCl $K_2O$ | 0·018 | 0·022 | 0·030 | 0·085 |
| Organic C | 2·89 | 1·29 | 0·43 | 0·06 |
| pH | 6·2 | 6·2 | 6·0 | 6·1 |

PALMWOODS SANDY LOAM.

| | | | | |
|---|---|---|---|---|
| Lab. No. | 4050 | 4051 | 4052 | 4053 |
| Horizon | $A_1$ | $A_2$ | $B_1$ | $B_2$ |
| Depth in inches | 0–5 | 5–12 | 12–15 | 15–30 |
| | Per cent. | Per cent. | Per cent. | Per cent. |
| Coarse sand | 50·0 | 49·0 | 46·8 | n.d. |
| Fine sand | 28·3 | 30·0 | 28·3 | n.d. |
| Silt | 6·7 | 6·1 | 6·5 | 4·6 |
| Clay | 11·6 | 11·7 | 15·7 | 30·20 |
| Loss acid treatment | n.d. | n.d. | n.d. | n.d. |
| Moisture | n.d. | n.d. | n.d. | n.d. |
| Soluble in HCl: $R_2O_3$ | 5·84 | 6·95 | 8·60 | 16·96 |
| $Fe_2O_3$ | 1·76 | 1·76 | 2·20 | 5·16 |
| $P_2O_5$ | 0·025 | 0·020 | 0·011 | 0·019 |
| CaO | 0·126 | 0·105 | 0·084 | 0·084 |
| MgO | 0·058 | 0·038 | 0·048 | 0·093 |
| $K_2O$ | 0·069 | 0·106 | 0·069 | 0·301 |
| Organic C | 2·41 | 1·06 | 0·67 | 0·43 |
| pH | 5·7 | 5·8 | 5·5 | 5·0 |

PALMWOODS SAND.

| | | | | |
|---|---|---|---|---|
| Lab. No. | 4058 | 4059 | 4060 | 4061 |
| Horizon | $A_1$ | $A_3$ | B | C |
| Depth in inches | 0–3 | 3–12 | 15–36 | 42–48 |
| | Per cent. | Per cent. | Per cent. | Per cent. |
| Coarse sand | 53·3 | 51·2 | 51·4 | 72·6 |
| Fine sand | 23·9 | 24·7 | 18·4 | 8·7 |
| Silt | 7·9 | 4·9 | 10·6 | 9·3 |
| Clay | 10·5 | 16·0 | 18·9 | 10·0 |
| Loss acid treatment | n.d. | n.d. | n.d. | n.d. |
| Moisture | n.d. | n.d. | n.d. | n.d. |
| Soluble in HCl: $R_2O_3$ | 7·91 | 9·41 | 12·54 | 6·99 |
| $Fe_2O_3$ | 2·68 | 3·24 | 4·60 | 2·16 |
| $P_2O_5$ | 0·031 | 0·022 | 0·026 | 0·023 |
| CaO | 0·161 | 0·112 | 0·084 | 0·084 |
| MgO | 0·048 | 0·074 | 0·086 | 0·054 |
| $K_2O$ | 0·058 | 0·123 | 0·092 | 0·039 |
| Organic C | 1·94 | 1·03 | 0·53 | 0·17 |
| pH | 6·6 | 5·9 | 5·5 | 5·6 |

COE'S CREEK SANDY LOAM.

| | | | | |
|---|---|---|---|---|
| Lab. No. | 4054 | 4055 | 4056 | 4057 |
| Horizon | $A_1$ | $A_2$ | $B_1$ | $B_2$ |
| Depth in inches | 0–6 | 6–18 | 18–24 | 24–27 |
| | Per cent. | Per cent. | Per cent. | Per cent. |
| Coarse sand | 62·3 | 63·6 | 59·1 | 50·5 |
| Fine sand | 17 8 | 17·2 | 18·0 | 15·3 |
| Silt | 4·7 | 5·7 | 6·3 | 4·8 |
| Clay | 9·8 | 10·2 | 14·2 | 25·8 |
| Loss acid treatment | 0·9 | 0·8 | 0·9 | 1·8 |
| Moisture | 1·3 | 1·1 | 0·9 | 0·4 |
| Soluble in HCl: $R_2O_3$ | 6·32 | 7·41 | 9·06 | 14·25 |
| $Fe_2O_3$ | 3·04 | 3·24 | 3·84 | 5·28 |
| $P_2O_5$ | 0·036 | 0·042 | 0·038 | 0·044 |
| CaO | 0·189 | 0·108 | 0·080 | 0·056 |
| MgO | 0·029 | 0·056 | 0·036 | 0·069 |
| $K_2O$ | 0·053 | 0·110 | 0·169 | 0·237 |
| Organic C | 2·21 | 1·21 | 0·65 | 0·58 |
| pH | 6·2 | 6·0 | 5·3 | 4·5 |

COE'S CREEK SAND.

| | | | | |
|---|---|---|---|---|
| Lab. No. | 4062 | 4063 | 4064 | 4065 |
| Horizon | $A_1$ | $A_2$ | $B_1$ | $B_2$ |
| Depth in inches | 0–8 | 8–18 | 18–36 | 36–39 |
| | Per cent. | Per cent. | Per cent. | Per cent. |
| Coarse sand | 68·8 | 67·5 | 61·6 | 57·9 |
| Fine sand | 15·8 | 20·9 | 19·1 | 19·3 |
| Silt | 2·9 | 6·0 | 5·3 | 5·6 |
| Clay | 6·2 | 5·3 | 13·1 | 16·4 |
| Loss acid treatment | 1·1 | 0·7 | 0·6 | 0·8 |
| Moisture | n.d. | 0·3 | 0·6 | 0·6 |
| Soluble in HCl: $R_2O_3$ | 2·40 | 1·87 | 5·18 | 7·60 |
| $Fe_2O_3$ | 0·92 | 0·68 | 1·24 | 2·40 |
| $P_2O_5$ | 0·021 | 0·006 | 0·009 | 0·009 |
| CaO | 0·112 | 0·045 | 0·035 | 0·042 |
| MgO | 0·117 | 0·036 | 0·063 | 0·028 |
| $K_2O$ | 0·031 | 0·020 | 0·024 | 0·024 |
| Organic C | 1·95 | 1·12 | 0·89 | 0·42 |
| pH | 6·1 | 6·3 | 5·2 | 4·8 |

NAMBOUR SAND.

| | | | | |
|---|---|---|---|---|
| Lab. No. | 4066 | 4067 | 4068 | 4069 |
| Horizon | $A_1$ | $A_2$ | $A_3$ | BC |
| Depth in inches | 0–4 | 4–15 | 15–30 | 30–33 |
| | Per cent. | Per cent. | Per cent. | Per cent. |
| Coarse sand | 59·5 | 63·2 | 63·9 | 49·7 |
| Fine sand | 20·2 | 18·5 | 18·4 | 19·0 |
| Silt | 8·1 | 8·8 | 9·2 | 9·5 |
| Clay | 8·0 | 7·1 | 6·9 | 19·9 |
| Loss acid treatment | 0·6 | 0·7 | 0·9 | n.d. |
| Moisture | 1·1 | 0·8 | 0·6 | n.d. |
| Soluble in HCl: $R_2O_3$ | 5·41 | 5·44 | 8·22 | 10·96 |
| $Fe_2O_3$ | 3·20 | 2·44 | 2·16 | 4·80 |
| $P_2O_5$ | 0·026 | 0·024 | 0·021 | 0·021 |
| CaO | 0·133 | 0·084 | 0·084 | 0·077 |
| MgO | 0·086 | 0·056 | 0·055 | 0·146 |
| $K_2O$ | 0·153 | 0·180 | 0·202 | 0·248 |
| Organic C | 2·21 | 1·02 | 0·53 | 0·16 |
| pH | 5·7 | 5·7 | 5·7 | 5·3 |

ROSEMOUNT SAND.

| | | | | |
|---|---|---|---|---|
| Lab. No. | 4074 | 4075 | 4076 | 4077 |
| Horizon | $A_1$ | $A_2$ | B | C |
| Depth in inches | 0–3 | 3–18 | 24–30 | 36–42 |
| | Per cent. | Per cent. | Per cent. | Per cent. |
| Coarse sand | 61·9 | 61·0 | 38·3 | 63·0 |
| Fine sand | 23·8 | 24·6 | 16·8 | 11·6 |
| Silt | 5·7 | 8·7 | 6·1 | 7·4 |
| Clay | 5·8 | 5·7 | 35·2 | 14·8 |
| Loss acid treatment | 0·8 | 0·6 | 1·0 | n.d. |
| Moisture | 0·6 | 0·4 | 2·4 | n.d. |
| Soluble in HCl: $R_2O_3$ | 3·31 | 4·53 | 21·47 | 8·90 |
| $Fe_2O_3$ | 2·12 | 2·84 | 10·64 | 4·00 |
| $P_2O_5$ | 0·037 | 0·032 | 0·051 | 0·081 |
| CaO | 0·112 | 0·070 | 0·091 | 0·119 |
| MgO | 0·098 | 0·086 | 0·231 | 0·130 |
| $K_2O$ | 0·082 | 0·086 | 0·219 | 0·258 |
| Organic C | 1·55 | 0·46 | 0·29 | 0·29 |
| pH | 6·1 | 6·3 | 5·6 | 5·1 |

ROSEMOUNT CLAY LOAM.

| Lab. No. | 4078 | 4079 | 4080 | 4081 |
|---|---|---|---|---|
| Horizon | A | $A_2$ | B | BC |
| Depth in inches | 0–3 | 3–12 | 12–15 | 15–18 |
| | Per cent. | Per cent. | Per cent. | Per cent. |
| Coarse sand | 20·3 | 20·0 | 18·4 | 22·7 |
| Fine sand | 14·4 | 15·7 | 15·6 | 17·0 |
| Silt | 20·3 | 21·4 | 16·7 | 18·2 |
| Clay | 32·2 | 33·3 | 47·8 | 37·5 |
| Loss acid treatment | n.d. | n.d. | n.d. | n.d. |
| Moisture | n.d. | n.d. | n.d. | n.d. |
| Soluble in HCl — $R_2O_3$ | 19·96 | 21·70 | 25·68 | 25·28 |
| Soluble in HCl — $Fe_2O_3$ | 4·28 | 4·32 | 4·58 | 4·86 |
| Soluble in HCl — $P_2O_5$ | 0·077 | 0·048 | 0·050 | 0·020 |
| Soluble in HCl — CaO | 0·294 | 0·161 | 0·091 | 0·133 |
| Soluble in HCl — MgO | 0·313 | 0·221 | 0·144 | 0·193 |
| Soluble in HCl — $K_2O$ | 0·091 | 0·039 | 0·089 | 0·039 |
| Organic C | 5·98 | 3·15 | 3·66 | n.d. |
| pH | 5·6 | 5·4 | 5·40 | n.d. |

## SCIENCE AND THE SOIL.

Nowhere is the association of science and the land more clearly shown than in the work of the agricultural chemist. Every branch of agriculture owes a lot to his patient investigations.

New avenues of investigation are constantly opening. For instance, one of the recent problems was to discover or produce a variety of the lupin plant bearing seed free from poisonous alkaloid, so that it might be fed safely to stock.

The age-old problem of the cause of so-called "alkali disease" in stock was solved only in 1934, when American workers showed that this disease was caused by harmful amounts of an element—selenium—being absorbed from certain soils by plants and thus being eaten by stock. Naturally, such an important discovery could not fail to interest Australian stockowners, and investigations into the possible occurrence of this element in our native pastures were begun with, so far, reassuring results.

Mineral deficiency in pastures is under continuous investigation to the advantage of stockowners who are guided by results.

The formation of poisonous prussic acid in Sudan grass, and the conditions under which it is formed, is another of the numerous subjects of investigation by our agricultural chemists.

### NOTICE TO READERS.

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# The Phosphorus Problem in Western Queensland.

DR. E. HIRSCHFELD.

*The publication of this paper has been authorised as a contribution to a discussion on a subject of considerable importance to Queensland stockowners.—Editor.*

**Summary.**

1. Mineral plant foods on Bybera and further west:
   - (*a*) Rich in lime ;
   - (*b*) Ample in potash;
   - (*c*) Deficient in phosphorus;

   Their effects on the stock.
2. Making good the deficiency of phosphorus.
3. Main economic remedy for graziers is a lick of sterilised bonemeal.
4. Experience with licks on Bybera; pitfalls in using them.
5. Additional rations of phosphorus in the form of bonemeal licks brought about the following changes in our cattle:—
   - (*a*) They increased in fertility;
   - (*b*) They secured earlier maturity;
   - (*c*) They prolonged the life of the older cows;
   - (*d*) They tided the stock over the winter months and dry spells by enabling them to make better use of the dried and savourless grasses.
6. A theory is propounded from our experience on Bybera and from other data, *that an ample supply of phosphorus to the stock acts as the activating agent (Katalysator) of reproduction, probably in conjunction with Vitamin E; thereby increasing the calving and lambing, bringing about earlier maturity and increasing their resistance to disease.*

## Mineral Plant Foods in the Soil of Bybera.

Bybera is a selection in the Goondiwindi district. It consists mostly of brigalow and belah country with numerous melon-holes. At the time of our taking it over, it was practically in its virgin state, covered with thick scrub, between 800 and 1,000 trees to the acre. We ring-barked the place, and stocked it with Aberdeen-Angus cattle till the place would be ready for sheep.

It is known that the soil of Queensland, taking it as a whole, is deficient in phosphorus. This deficiency Australia shares with the rest of the world. The lack of phosphorus is said to get worse the further west we go. Knowing how indispensable phosphates are for human beings and that cattle would obey similar laws, I desired to obtain definite information as to how we stood on Bybera, not only regarding phosphates, but also other important mineral salts like lime, potash, magnesia, and iron. Confining ourselves to the brigalow and belah country, a series of samples were taken of the soil and submitted to the Agricultural

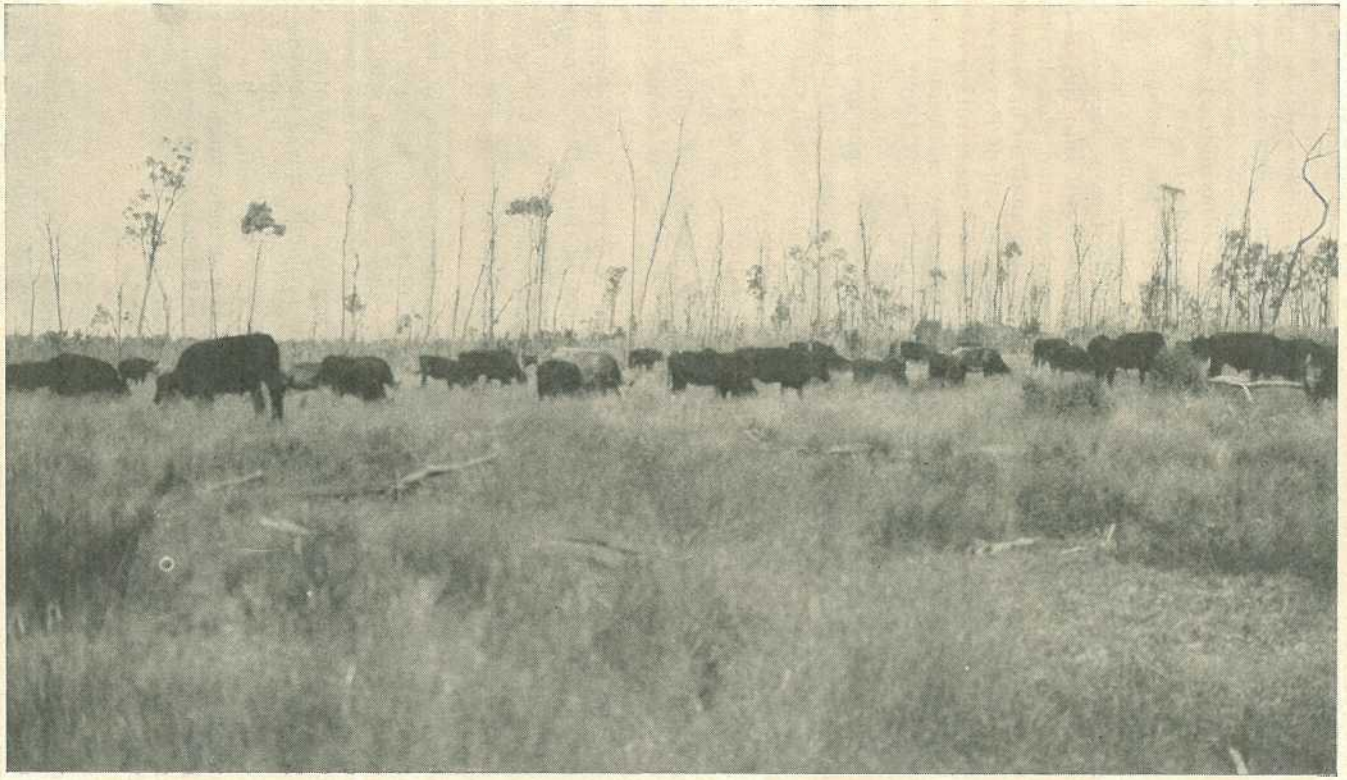


Plate 46.

HOCK-DEEP IN RICH PASTURES.—This dense sward of nutritious grasses has replaced brigalow and belah scrub on Bybera.

Chemist for analysis. I am greatly indebted to the Department for the assistance received. It was painstaking work and entailed considerable labour. I summarise the findings.

The country is very rich in lime, not only in the surface layer, but actually increases in this mineral with depth. This fact became apparent as we were taking the samples, many of the clods in the depth of the hole being covered with white films of carbonate of lime. In sinking holes and taking samples at various depths, we found that at 6 inches from the surface the amount of lime had doubled, while at 12 inches it had increased to two and a-half times the surface percentage. The explanation is probably this: Heavy falls of rain leach out the lime from the surface and wash it down into the deeper layers, where they are caught by the clayey subsoil and stored. Fortunately, most of our soils further west, as repeated analyses have shown, also carry fair to good quantities of lime, just as the soil of Bybera does. This goes a long way to build up the framework and constitution of the stock grazing upon these pastures, and explains why cattle and sheep coming from the West enjoy such a high reputation for being big in frame and sound in constitution. Pastures rich in calcium, moreover, are likely to breed stock free from tuberculosis. We ought not to hide our light underneath a bushel, and should make it known to the world that, both on account of the open-air grazing and the wealth of lime in our soil, our cattle are less subject to tuberculosis.

Lime plays an important part in the production of milk. As the skeleton of a calf is built up in the short space of the first nine to twelve months, cow's milk carries a high percentage of calcium and phosphates—much higher than human milk. Hence this factor is also in our favour.

Regarding potash, the analyses returned a very fair and even amount throughout the first 12 inches of soil—enough for all our requirements for many years to come. The returns from further west, as far as analyses have been made, are also most satisfactory. In the Mitchell district the potash content of the soil runs up to twice the amount found on Bybera.

Potash is an important mineral food—more particularly for the sheepman. A full-grown wether with 10 lb. of wool on its back has in the neighbourhood of ¾ lb. of potash in his wool. When we send these millions of pounds of wool abroad, we send at the same time between one-tenth and one-fifteenth its weight of potash out of the country. The high potash content of the western downs is probably one of the reasons why the wool grown there is of such excellent quality. Fruit is rich in potash, and therefore requires plenty of it in the soil. All animals feeding on grasses consume much potash—at any rate, more than their constitution stands in need of; hence they are all ravenous for salt. The sodium in the salt pushes the excess of potash out of the body fluids and restores the balance.

### The Phosphorus in the Soil.

The report of the Chemist was not equally heartening concerning the phosphorus content of the soil on Bybera. There is a distinct deficiency of phosphorus. One remarkable fact stood out: While most of the lime was found in the deeper layers of the soil, most of the phosphorus was in the top layer—the first 3 or 5 inches. This is rather a serious matter. The surface, of course, is that part most liable to

erosion. As Bybera is fairly level country, erosion by running water is not to be feared; but erosion by wind during a prolonged dry spell is a factor to be reckoned with. When the surface becomes bare, as the grasses die off in a drought, some of the scanty stock of phosphorus is liable to go with the wind; the same applies even more so to the western plains. In Mitchell grass country the clumps of Mitchell grass grow widely apart, leaving fair-sized patches between them, where, even in a good season, let alone in a drought, the wind plays havoc with the surface. Most of the phosphorus of the green plant is gathered in the seed; the seed falls to the ground; hence the enrichment in phosphorus of the surface layer. Dr. M. White, with whom I discussed this matter, suggested this explanation, with which I agree.

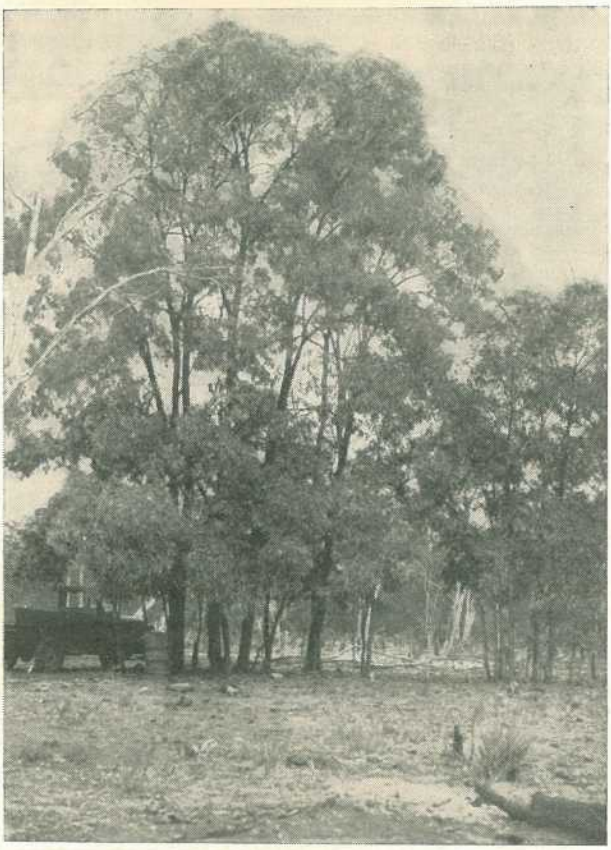


Plate 47.
A BRIGALOW GROVE RESERVED AS SHADE FOR STOCK ON BYBERA.

One of the best returns was from a sample taken at the bottom of a melon-hole. Evidently dead leaves and eroded particles of soil had settled there and enriched it. The opinion of the Chemist was endorsed by the cattle—they preferred to drink the stagnating water of the melon-holes rather than the pure water of the running stream. Their instinct sought out the place rich in mineral plant foods. Unfortunately, the lower half of the melon-holes is bare of grasses, only reeds growing

there; so the stock left those places alone during dry weather. We rather prided ourselves in outwitting nature; by systematically planting water-couch in the muddy soil just as the water dried off, we have managed to get a stand with the grass which thrives there.

Plate 48.
BRIGALOW COUNTRY IN ITS NATURAL STATE.

The deficiency of phosphorus is found not only all over Australia, but throughout the rest of the world. Wherever crops are grown the deficiency has to be made good by adding superphosphates. A grain crop takes heavy toll of the phosphorus in the soil, as grains are particularly rich in it. It has been computed that one crop of maize takes ninety times as much of phosphorus out of the soil as a year's grazing does. Maize is, of course, taken off the property, while about three-quarters of the grass eaten by stock is returned to the land in the form of manure. Nevertheless, we have to reckon with the fact that a marked deficiency has already made itself felt.

### Making Good the Deficiency of Phosphorus.

The obvious remedy for a deficiency of phosphorus in the soil is to add superphosphates. The farmer with a small acreage would be

immediately rewarded by an increased yield. But it is not feasible for the grazier. A ton of superphosphates costs at present £6 16s.; landed on Bybera, the cost would exceed £8; spreading it at the rate of 1 cwt. per acre means spending 8s. on each acre. Where the land is held on lease, no allowance for the expenditure would be made to the outgoing tenant. It is out of question, except for special purposes.

When the soil does not supply sufficient phosphorus, we have to give it to the grazing beast in the form of licks. That does not benefit the soil directly, but it does the beast. Whatever passes through the animal without being absorbed is dropped on to the soil; so the latter gets a small share of the benefit. It might be objected: Why not wait till the cattle show distinct signs of the deficiency? Long before a symptom stands out obvious to everybody, the beast may be suffering in health without any other sign except that it does not look so well, fails to put on enough flesh, that its coat is not so glossy, and becomes affected with worms. A disease is like the root of a grass—it is not noticed till it comes above the surface. *When the conditions for disease exist, it is good sense to act before you are forced to, and anticipate the disease.*

Plate 49.

FROM DENSE SCRUB TO SWEET PASTURE.—A well-grassed paddock on Bybera.

## On Licks.

All advertisements are loud on what they want you to buy and silent on what you really ought to buy. The whole truth is not always found in advertisements. Whatever portion of truth they contain is often made use of to season the claims which are not justified. The Department of Agriculture has issued a most valuable report on seeds, stock foods, fertilizers, &c., which ought to be in the hands of all men on the land. It sets forth the composition as declared by the seller, and gives side by side the figures as guaranteed by the seller. In this way the honest merchant is protected and the buyer enlightened as to what he pays his money for.

In choosing a lick for our requirements, it was obvious that one richest in phosphates would suit us best. From my experience as a

physican, however, I knew that what mattered was not what I prescribed, but what is absorbed by the patient. Many inorganic lime and phosphate salts, when taken, pass almost wholly through stomach and bowels without benefiting the patient; the system was not able to extract the phosphorus, given with the best intentions. I thought I'd follow the lead given to us by the cattle themselves. When bullocks are on pastures poor in phosphorus and lime, they start to chew bones. Fortunately, our pastures in Queensland have not yet come to the pass that has made bone-chewing a widespread disease in South Africa, although in the North-West—in the Cloncurry district—it has made its appearance during the drought. Bones are rich in mineral salts—more than four-fifths of the whole of the ash of a body is found in the bones—and they contain phosphate and lime salts in a combination which obviously must suit their constitution. For this reason, I chose *ground bone meal.* Dr. Montgomery White, an adviser of the Department of Agriculture, placed a small quantity of "Calphos" at my disposal. This "Calphos" was manufactured under his supervision at the abattoir. Dr. White was good enough to supply me with the following analysis:—

| | Per cent. | | Per cent. |
|---|---|---|---|
| Water at 105 .. .. .. | 6·2 | Phosphoric acid .. .. | 25·24 |
| Organic material .. .. | 28·98 | Chlorine .. .. .. | 0·21 |
| Nitrogen .. .. .. | 3·94 | Sulphur .. .. .. | 0·05 |
| Fat .. .. .. .. | 2·98 | Iron and aluminium .. .. | 1·14 |
| Inorganic material .. .. | 64·82 | Magnesium .. .. .. | 1·05 |
| Calcium oxide .. .. .. | 32·48 | Potash .. .. .. .. | 1·65 |

Readers will wonder why I selected a preparation which contained so much calcium although our soil is so rich in lime; surely that seemed spending money on something that was unnecessary! The answer is: The bulk of the phosphorus in the body is found in the form of salts in the combination, mainly with lime and a little with magnesia and other elements. As my object was to offer the phosphorus in such a combination as occurs in the body and therefore would be acceptable to the body, I had to take the lime into the bargain.

The high amount of organic material—29 per cent.—is useful to the stock, inasmuch as it supplies flesh-forming substance. It had not been artificially added to the "Calphos," but resulted from the treatment of the bones. The disadvantage of the admixture of the organic matter is that it makes it liable to decomposition and decay, if wet. The low content of water—6 per cent.—makes it safe while being kept; but when being exposed to the weather in open troughs, that is a different matter. In order to guard against this risk, my son (R. S. Hirschfeld) constructed the troughs in such a way as to be fairly sheltered against the weather. Nevertheless, the moisture which comes from the saliva of the bullock as he licks the "Calphos" seemed to me to be a risk; but it did not prove so in reality. No decay was found in any of the material. The mixing of the "Calphos" with salt evidently acted as a preservative. I dwelt on this point perhaps too strongly, but, being used in my profession to aseptic and antiseptic precautions, it seemed to me to be more important than it proved in practice.

Well, we exposed the lick in its troughs; we had made our preparations, but the cattle thought otherwise—they looked at it, but would not take to it, although it was close to the water-troughs where they were watering. It seemed to be one of our mistakes. I consulted the

authorities in Brisbane. They advised me to make the lick more palatable by adding molasses. I did not like the idea; if they stood in need of it, they would take to it as they take to chewing bones, even with adhering decayed flesh. Bribing their palate seemed to me spoiling the experiment. Cattle are curious by nature; they try everything once. Moreover, my son strongly objected to molasses—"We shall have all the flies in the Goondiwindi district around our waterholes." So we left the calphos-troughs and the cattle alone. Several months elapsed and the winter came on. With the colder weather a change came over the stock; they started to pay visits to the licks, and after a while the troughs were actually licked clean, and their contents had to be renewed. How strong the need of the stock was during the winter months for the phosphate lick was proved by the following incident:—We had run out of the lick for a couple of weeks, when a new supply arrived on the selection. I was present on the place as the troughs were being filled with the new material. The cattle were watering at the nearby bore. They watched us filling the troughs, and a cloud of dust arose as we were mixing the salt with the bonemeal; they sniffed the dust, but did not come near while we were there. As we rode away, there was a scramble for the troughs; it reminded one of the rush for a bargain sale in a drapery store.

What was the reason for the cattle keeping away from the licks during the summer months? An analysis of the young brigalow grass which I took to Mr. Gurney supplied the answer. The green shoots showed a high content of phosphorus. With the early spring rains much of the available phosphorus in the soil goes into solution and feeds the roots of the grasses; the roots convey it to the plants, and the cattle obtain a liberal supply of phosphorus in a natural and palatable form. This continues right through the summer while the soil is moist. The brigalow grass particularly is a bounteous and frequent seeder all through the summer months, and so are other grasses to a smaller extent. Consequently, there is no lack of phosphates during that time. But the pastures lose their phosphates as soon as the seeds are shed, for between half and three-quarters of the plant phosphorus collects in the seeds. With the coming of autumn the grasses begin to dry off. As a rule, we are not favoured with winter rains in Queensland; the grasses lose most of their nourishment and only supply bulk, with the exception of the brigalow grass, which always carries some green shoots amongst the dried-up stalks. Unless there have been good rains late in the summer, there will be but a scanty growth of herbage, and green feed is scarce in the winter. That's the time when the cattle turn to the troughs with the licks. All dry spells that use up the moisture in the soil lead to a lack of phosphorus in the natural fodder. Often even in a severe drought some dry feed can still be picked up in the paddock. That is the time when the phosphate lick will supply the seasoning that enables the stock to make use of whatever dried feed remains. From our own experience, I feel convinced that the phosphate lick will lessen losses of stock during droughts and keep the surviving stock in somewhat better condition.

All stock in Queensland need an additional supply of phosphorus during the winter and dry spells.

Now to the economic side. One ton of "Calphos" costs £9 10s.; one ton of coarse salt is £5 4s. The railage to Inglewood (252 miles) on both is in the neighbourhood of £5. That quantity will last a long

time. As the frame of sheep is more slender than that of cattle, they need less of the lick in proportion. It is not wise to mix too much salt into the lick for sheep, especially young sheep.

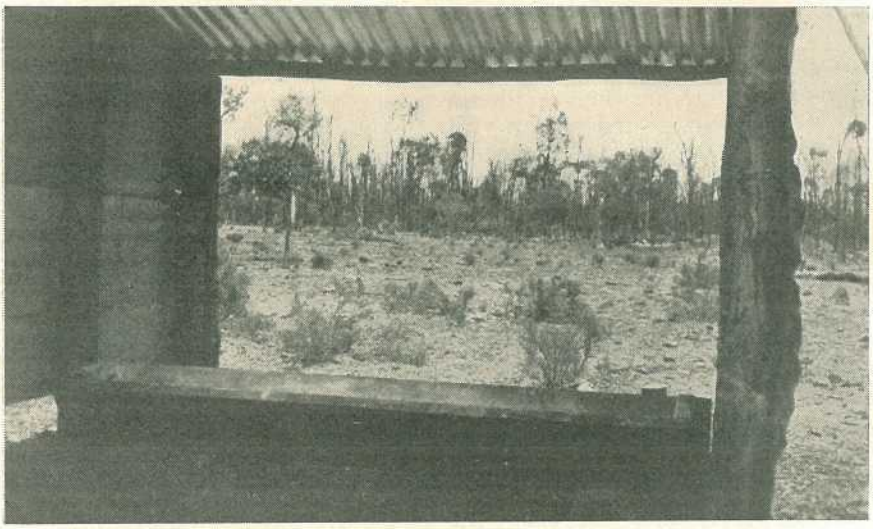


Plate 50.
SHELTERED LICK TROUGH IN A BYBERA PADDOCK.

### Effect of the Lick on Our Herd.

When we started to give the lick to our stock, we had no intention of conducting the experiment on strictly scientific lines, as it would have been on an animal health station, where rations are weighed out, the animals themselves being weighed at regular intervals and control animals watched. We have to rely on the judgment of the man who is in daily contact with his pastures and cattle.

The following facts stand out:—

1. The fertility of the cows has been increasing since we have been using the licks. At the muster this year we had a percentage of between 80 and 90 weaners. We do not ascribe the whole of this high percentage to the licks. The continued improvement of the pastures, the quality and number of the bulls employed, and a fair season—though not unusually so—have been important factors. But the greed with which the cattle consumed the lick in winter time has been impressive, and the percentage of calves unusually high. When taken in combination with other observations, the share of licks in bringing about such a high fertility becomes more conspicuous.

2. Improved condition of the stock during the winter. A dry winter is a severe testing time for pastures and management; our winters are very cold—15 to 17 degrees of frost are not unusual—and the rainfall scanty. There could be no doubt about the increased zest with which the stock tackled the dry feed in the paddocks since we introduced the lick. The house cows in the horse paddock, without additional feeding, continue to give milk.

3. Increased longevity of the old cows. Wo do not spey and fatten our old cows, but allow them to go on breeding, as one or two additional calves repays us. The lick gives them increased resistance against cold and dry spells, and enables them to survive on the savourless grass till the spring puts new life into them.

Plate 51.
A FAVOURITE RENDEZVOUS FOR CATTLE.—One of the cheaply-built shelters for stock licks on Bybera.

4. Earlier maturity of the stock has been an outstanding effect of the licks. This is reflected in the high prices we obtain for our weaners. In March last we sent a consignment of thirty-eight steers, mostly two years old, to the Cannon Hill saleyards and realised an average of £11 2s. 4d. This earlier maturity of the steers is on all-fours with the effect of phosphorus on plant-growth. "An adequate supply of phosphorus promotes rapid plant-growth, early maturing, hastens fruiting, and improves quality. Low supply of phosphorus leads to poor plant-growth and delayed maturity."

## Phosphorus and Fertility.

Of outstanding importance to all breeders of cattle and sheep is the role which phosphorus plays in promoting fertility. It may mean a huge increase in our national wealth. Anyone can understand why

phosphates build up a sound constitution and mature the beast earlier, for phosphate of lime is the main substance of which bone consists; a good framework is as necessary to the bullock and sheep as strong joists and uprights are in a house. But the influence on fertility is not so easy to understand.

A grown man has a little more than 3 lb. of phosphates in his body. Nearly nine-tenths of that amount is found in the bones; but there is phosphorus in every cell of every organ. The nucleus of the cell is the vital part of the cell, which is concerned with reproduction. Phosphoric acid and protein substances build up the nucleus. The bones, however, are the main storehouse of the phosphates. These phosphates are not immobilised in the bone, but merely stored; from the bones phosphorus is sent to any part of the body that needs it. As soon as the cow is in calf, she begins to need phosphorus for the building-up of her calf, but the demand becomes greatest in the latter months of the pregnancy. The increased demand is met by increased feeding. A time comes, however, when the pasture grasses are not able to supply the whole of the demand. Now the bones start to send out supplies of phosphorus; the skeleton of the calf is built up, if there is need for it, from the bones of the mother. The less phosphorus there is in the grasses the earlier and the greater the drain upon the bones; this drain continues after the calf is born, as the milk is rich in phosphates. This drain may become ultimately so great that the bones part with most of their mineral salts, till softening of the bones takes place. Some time before they lose the last ounce of their phosphates, nature steps in—their milk dries up, and the drain stops. But while the phosphates are needed for the calf all other organs supplied by the bones must go short and all the cells of the body function as poorly as a badly greased motor-car. The nuclei of the cells suffer most; the short supply of phosphorus, needed elsewhere, interferes with the chief function of the nuclei of all organs—reproduction. Hence the infertility.

That fertility suffers when there is not sufficient phosphorus at hand has been mentioned by Dr. A. W. Turner, of the Council for Scientific and Industrial Research. He was investigating the peg-leg disease in cattle in the Cloncurry and Charters Towers districts, and his investigation into and description of this disease is classical. He summarises his findings thus:—

> "Peg-leg is a disease of cattle in North Queensland, characterised by under-development, *relative infertility*, lameness, and various skeletal deformities. *It is most common in pregnant and lactating females.* It is due to a deficiency of phosphorus in the soil and herbage."

Compare with that the 85 per cent. fertility of the Bybera cows, where the lack of phosphorus had been anticipated! The post-mortem examinations made by Dr. Turner give conclusive proof of how the infertility arose: *"The ovaries were small and generally contain many small follicles, but there was a very low degree of ovulation." This bears out the contention that the organs of reproduction cannot function satisfactorily when there is an insufficient supply of phosphorus, without which ovulation does not take place normally.*

There are, however, many positive proofs of how intimately fertility is associated with phosphorus.

The grain of wheat represents the future plant. It is the main source of Vitamin E, which is the vitamin responsible for reproduction.

Is it a pure coincidence that a vast amount of phosphorus is massed in the grain? As a matter of fact, there is more phosphorus in the seed than there is embryonic tissue.

Let me give you another instance. The yolk of the egg is the embryonic fowl. The ash of the yolk consists two-thirds of phosphorus, while the white of the egg has only one-twenty-fifth of phosphorus in its ash.

The ash of the semen of man is three-quarters phosphate of lime; similarly, the roe of the sturgeon and of other fish, as far as they have been examined, abound in phosphorus.

There is no need to multiply instances. *Everywhere, in the animal and plant world, phosphorus is intimately associated with reproduction. Without phosphorus or with a deficient supply of phosphorus, reproduction is interfered with,* as Dr. Turner's researches and the above explanations have shown. With an ample supply of phosphorus, as proved by our experience on Bybera, there is a marked increase in reproduction.

We are driven to the conclusion that phosphorus is the katalysator—i.e., the activating agent of reproduction—in the grain of wheat as well as in the bullock. It probably acts in combination with Vitamin E. Other points remain yet to be settled. The phosphorus always occurs mainly in combination with calcium, and in a lesser degree with magnesia and potash and some other elements; but as they are amply supplied by our soil, they cannot play the decisive role. *Phosphorus is the indispensable element in reproduction.*

More phosphorus, where the soil does not supply enough of it, means more lambing and calving. It may add hundreds of thousand of pounds to our national wealth.

## CATTLE FATTENING.

There are large tracts of well-grassed land in South-eastern Queensland on which fattening of bought store cattle is practised. These cattle are usually animals which fatten into "heavies." Older stock can "handle" roughage much better than yearlings, and it takes less time and trouble to get them ready for market; but, in general, they do not give as good a net return as "baby beef."

The reasons are:—

(1) Buying of stores is a more speculative business and the outlay greater.
(2) Disease, drought, and other retarding influences make the money loss, if any, greater.
(3) The trade does not favour "heavies."
(4) Although the relative cost per 100 lb. is higher with the "young stuff," more can be bought for the same money.
(5) The young animal lays on both flesh and fat—i.e., it fattens while it grows.
(6) The trade pays more for the finished carcass.
(7) There is *always* a market for well-finished lightweights.

There are certain requisites for turning off baby beeves the year round:—

(1) On the part of the buyer, a sound knowledge of what "good doers" look like.
(2) On the property—well-planned subdivision, improved pastures, cultivation, and fodder conservation.

Improvements require a considerable outlay of capital, but in all cases where management has been sound the returns have made it well worth while.

It should always be remembered that the improvements are permanent, and that they enhance the value of the property.

# The Brisbane Exhibition.

THIS year's Royal Show was a great display of Queensland's industrial virility and progress, and a grand array of the State's resources and the result of their development.

Many problems of production and marketing have been caused by the war, and many more problems are likely to arise from it. The restriction of our sea-borne trade is one factor which will bring home to us all the economic aspects of the struggle; and, although some inconvenience and hardship may have to be endured, it will be recognised that this is only part of the price of ultimate victory. Yet, the war has presented both a challenge and an opportunity. Our capacity to take up the challenge and make most of the opportunity could not have been demonstrated more impressively than it was last month on the Brisbane Showground.

The Brisbane Show is a fountain of constructive ideas. It is, too, an educational influence, or, rather, institution, and there is no doubt of its value as a factor in the progress of the State.

The Show this year was proof of the attainment of high standards in every branch of husbandry, a demonstration of the importance of sound principles in alliance with applied science in farming practice, and an example of the linking of town and country in interest and in industry. Moreover, it was striking evidence of the energy, skill, ability, and organising powers of the people who are doing the real work of the nation.

The Court of the Department of Agriculture and Stock was among the big pavilion displays. The Department, after all, is really the farmers' own department, so producers generally are invited to take full advantage of every service it has to offer. In these days it is more necessary than ever to apply technical knowledge to farm practice in every possible way. In the interests of Australian trade it is most important that we should attain and maintain the highest possible standard of quality in all our products, especially those which we have to export. The trained officers of the Department are out to give assistance to rural industry whenever and wherever they can. Quality in every farm activity, quality in every product, raw or manufactured, is what is going to strenghen our hold on the world's markets—especially in the post-war period of economic readjustment. That, in the main, was the lesson conveyed by the Agricultural Court.

The Meat Industry Hall, the Hall of Dairying, and the Hall of Sugar provided concrete evidence of what can be done in the way of quality production through applied technical efficiency. In recent years our interests have widened vastly, and as an educative force the Royal National Association has spread its own interests accordingly. Agricultural advancement is, naturally, its first and most important consideration. This is as it should be, but in its annual pageant of Queensland manufactures and the skill of Queensland workers, the Association gives fitting recognition of the wisdom of bringing town and country together, and so demonstrating the interdependence and the interrelationship of urban and rural enterprise.

The daily stock parade at the Exhibition was one of the most obvious examples of its educational value. In the ring, the breeder's skill in combining high production with constitutional vigour was made manifest in every entry.

Generally, the Exhibition confirmed the fact convincingly that better farming and better ways of feeding stock bring greater satisfaction personally and higher returns materially. Every section provided examples of the common sense of intelligent co-operation which, applied completely, lightens the common task, ensures the common good, and adds immeasurably to the common wealth.

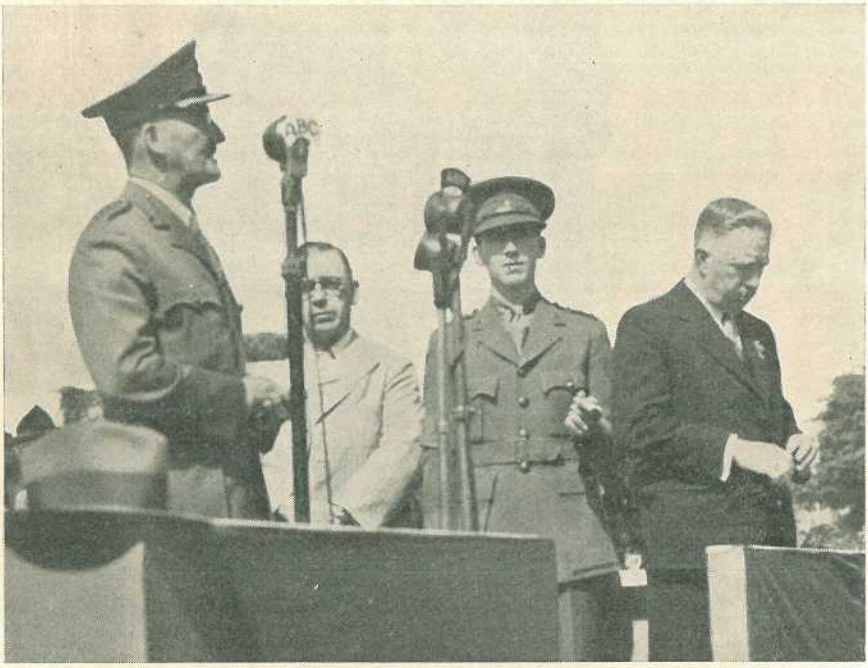


Plate 52.

His Excellency the Governor of Queensland, the Right Hon. Sir Leslie Orme Wilson Declaring the 1940 Show Open.

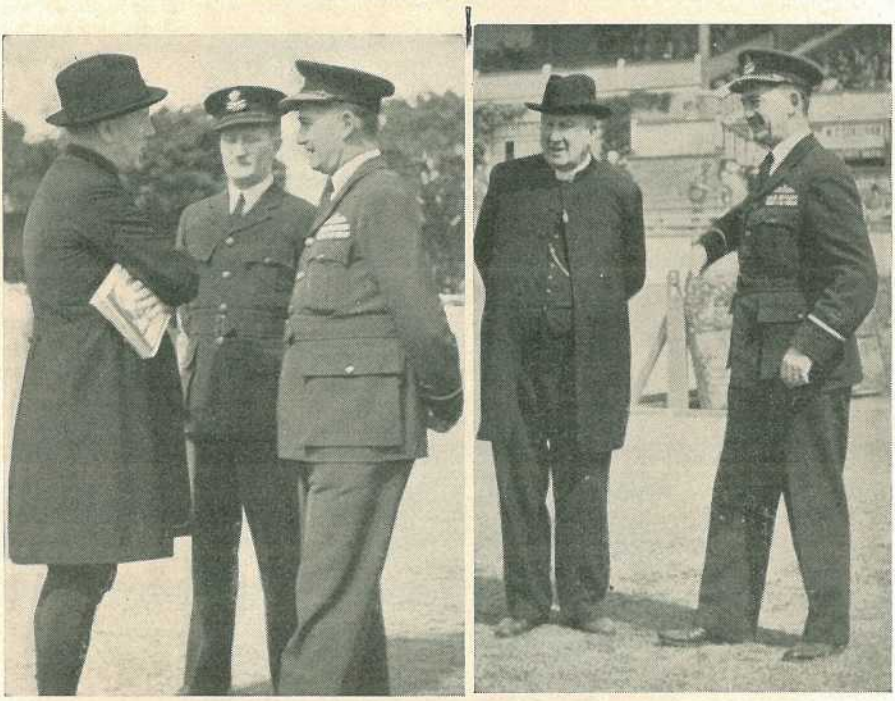


Plate 53.

The Church and the Air Force were Worthily Represented at the Show.

*Left.*—His Grace Archbishop Wand. *Right.*—His Grace Archbishop Duhig.

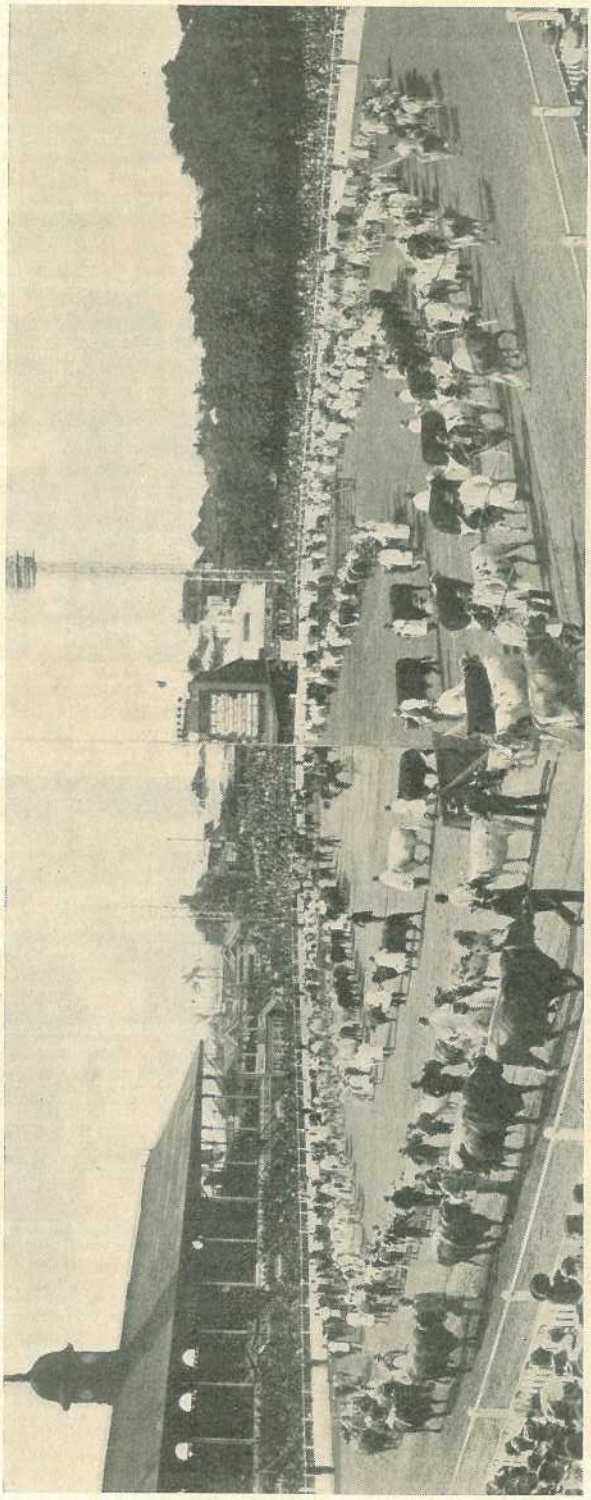


Plate 54.

THE GRAND PARADE, A POPULAR DAILY EVENT AT THE BRISBANE EXHIBITION.

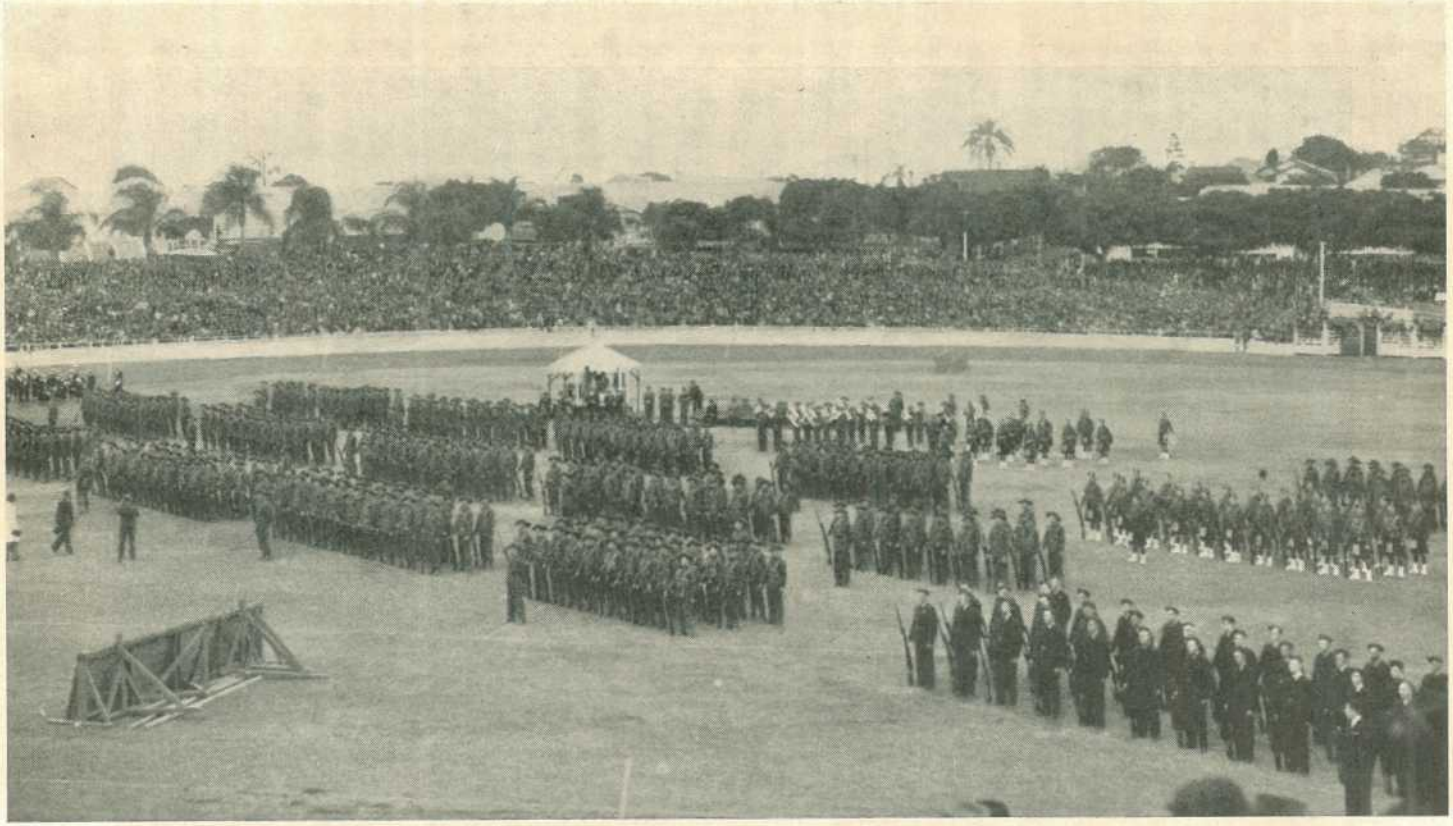


Plate 55.

THE NAVY, THE ARMY, AND THE AIR FORCE WERE FITLY REPRESENTED IN THE GUARD OF HONOUR.

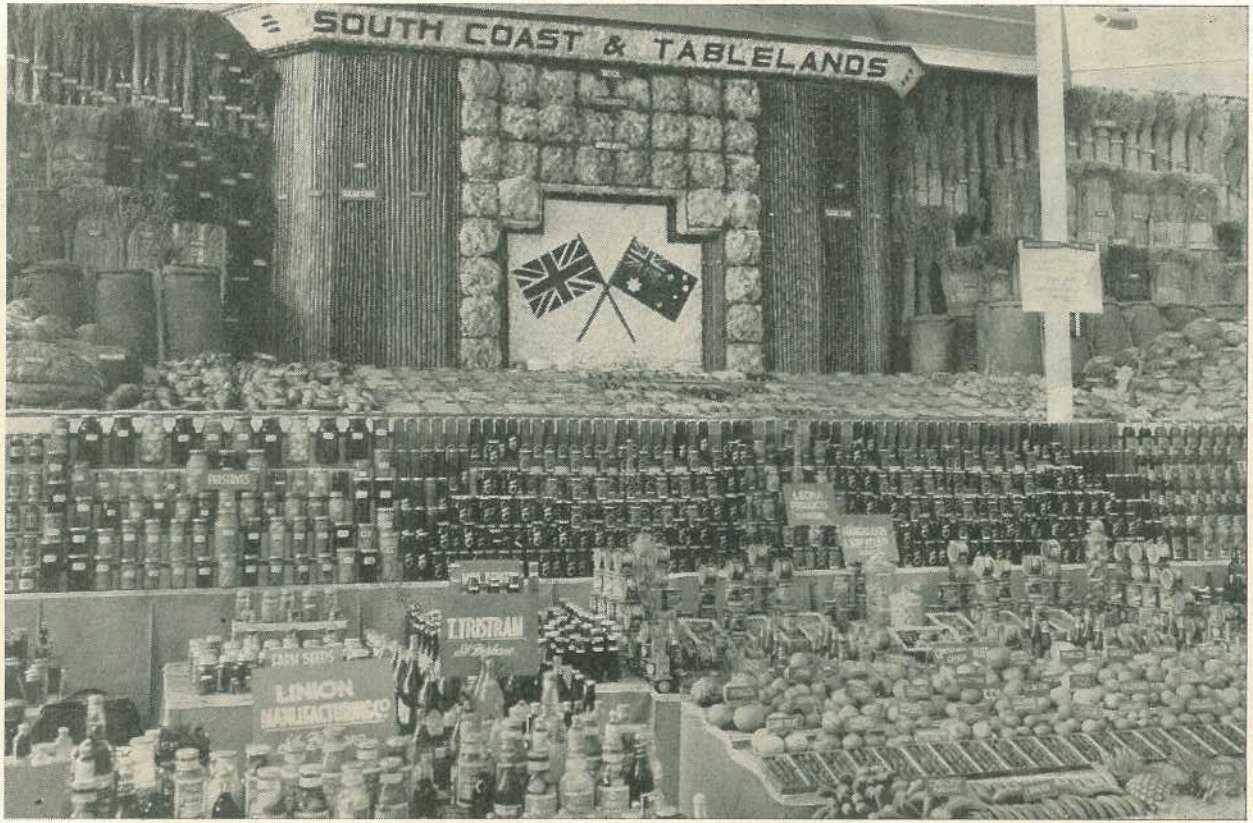



Plate 56.
THE WINNING "A" GRADE DISTRICT EXHIBIT.


Plate 57.
THE WINNING "B" GRADE DISTRICT EXHIBIT.

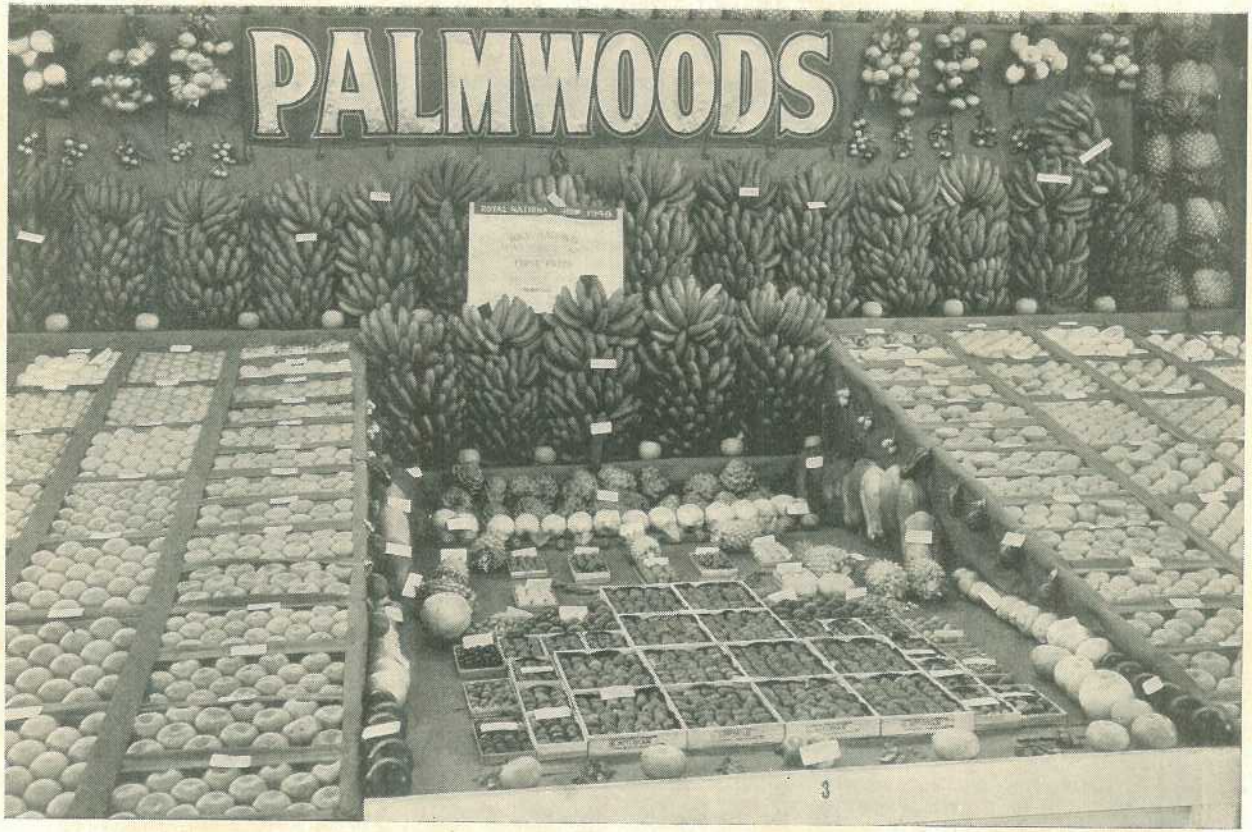



Plate 58.
THE WINNING DISTRICT FRUIT DISPLAY.

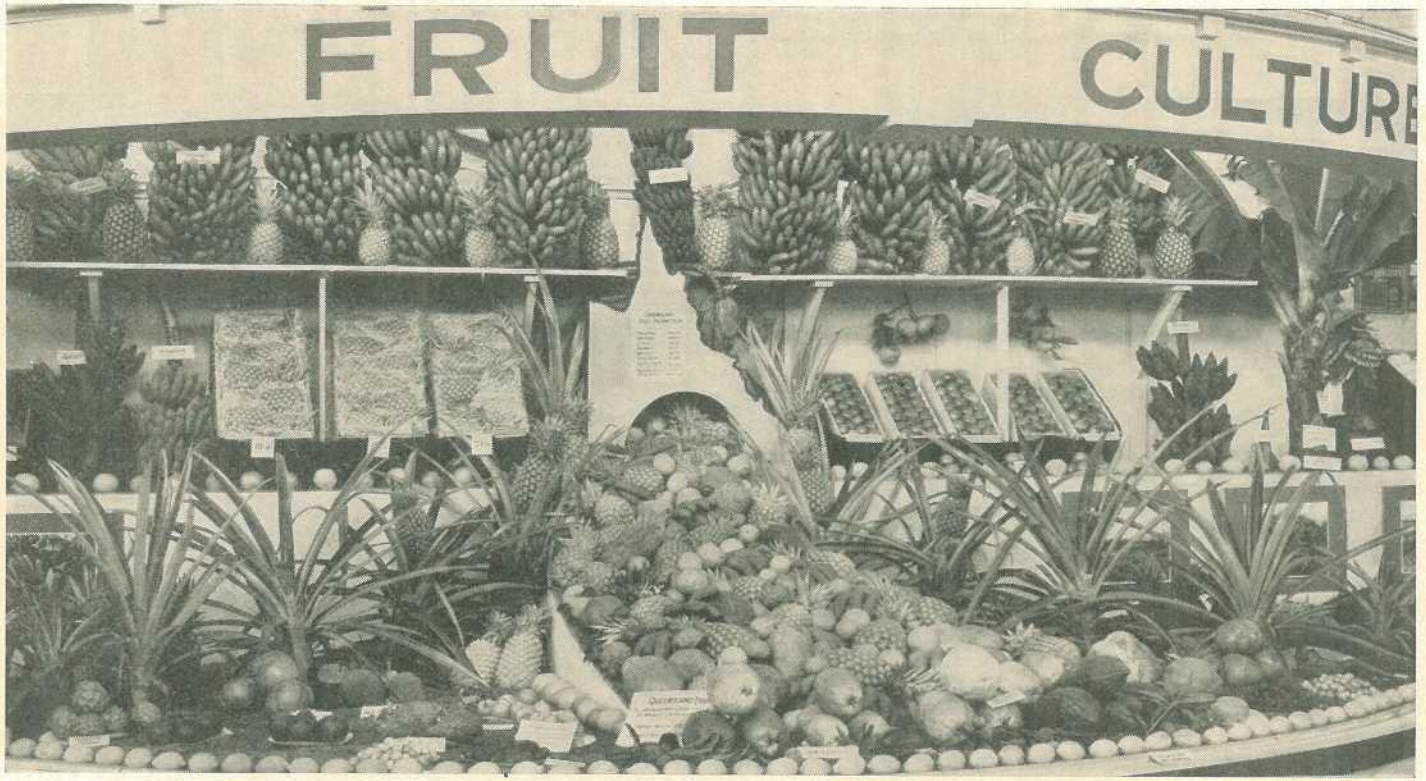



Plate 59.

Products of a Fruitful Land.—In this exhibit, officers of the Fruit Branch demonstrated the extraordinary range and richness of Queensland's orchard lands in both temperate and tropical regions.


Plate 60.

COTTON FOR THE COMMONWEALTH.—Officers of the Cotton Branch of the Department arranged this excellent exhibit of Queensland cotton and crop derivatives. The cotton-grower has an assured market and a guaranteed price. Farmers with suitable soils are urged to plant as big an acreage of cotton as they can properly cultivate.

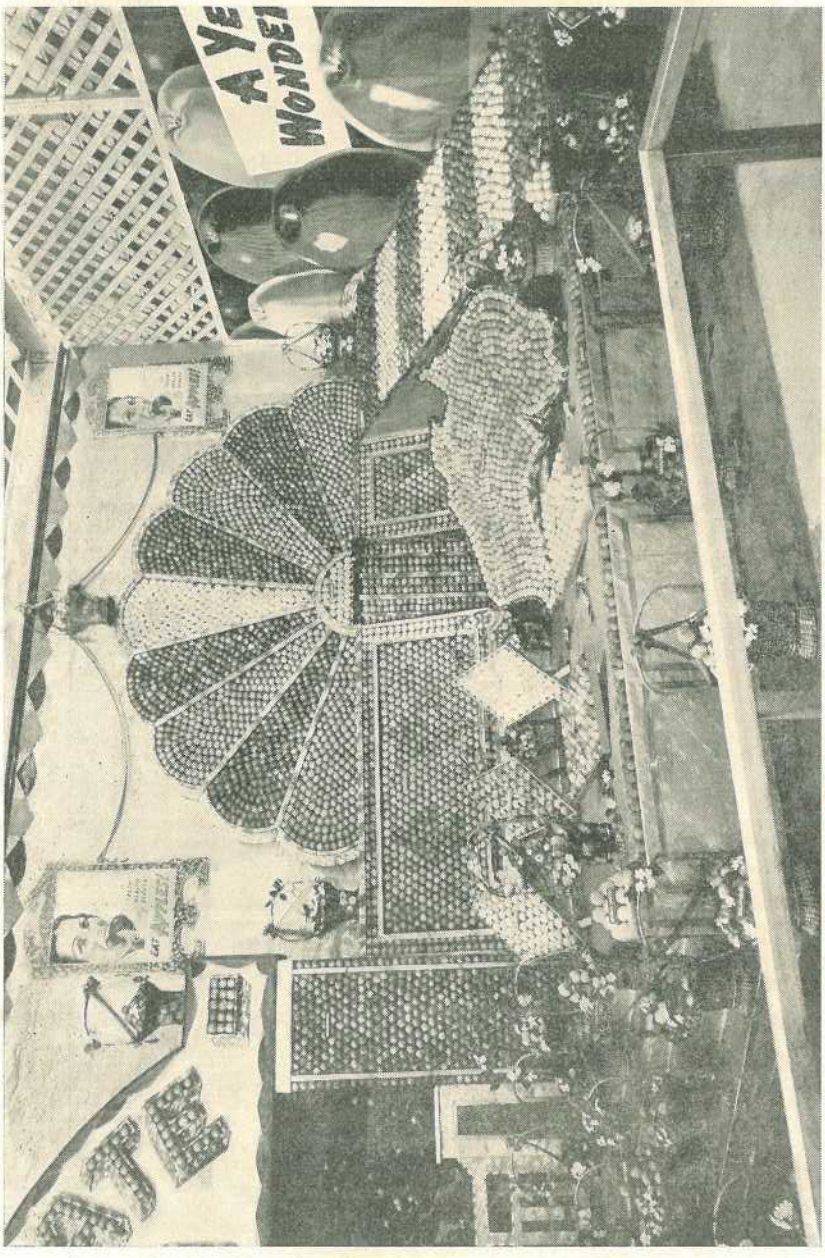



Plate 61.
Apple and Pear Varieties in Colourful Contrast.


Plate 62.
THE DISPLAY ARRANGED BY THE AUSTRALIAN APPLE AND PEAR BOARD.

Plate 63.
A Troop of Queensland Mounted Police—The Governor's Escort.

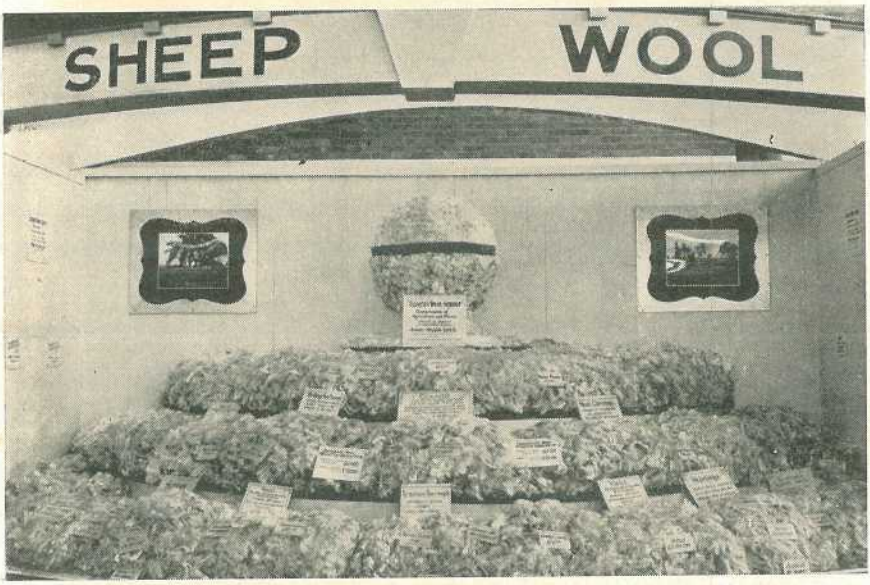



Plate 64.

The Wealth of Western Pastures.—Wool, greasy-grey from the shears and snow-white from the scour, piled high in fleecy billows in an alcove in the Court of Agriculture. The sheep-breeding industry supplies one-half of Australia's aggregate annual exports. One of the best ways of serving the nation is to wear more wool.


Plate 65.

HOW ANIMAL HEALTH IS PRESERVED.—Queensland is one of the healthiest of stock countries, and this exhibit by the veterinary staffs of the Animal Health Stations showed how the flocks and herds of the State are protected from disease and pests.


Plate 66.

HEALTH AND WEALTH IN THE DAIRY.—The central feature of this display by the officers of the Dairy Branch was a model of a Bundaberg Dairy—a material expression of Departmental maxims in dairy practice.

Last year Queensland's dairy production added £10,000,000 to the national income. Co-operation among farmers, factory staffs, and Departmental officers was the chief factor in this achievement.

Plate 67.

IRRIGATION IN THE ORCHARD.—This section of the Fruit Exhibit in the Departmental Court showed how the overhead sprinkler system of watering works effectively.

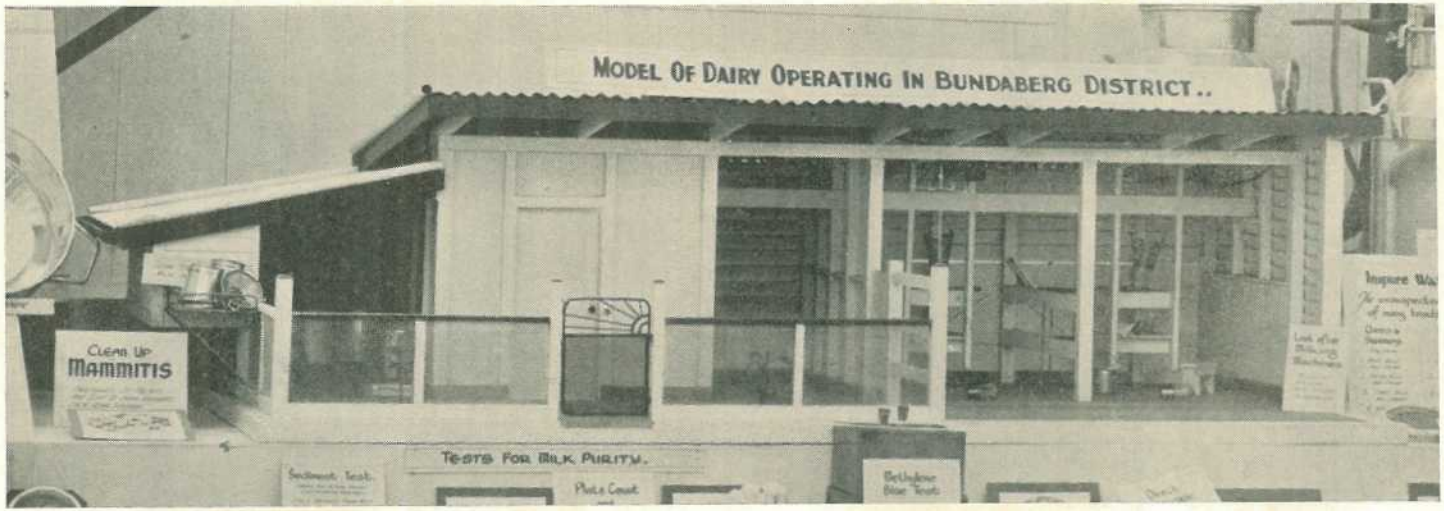



Plate 68.

A DAIRY "IDEAL."—This model attracted much attention and stimulated resolutions to "go even one better." Among the interesting gadgets is the draining rack on the left, with a woven-wire "platform" ensuring airing of the upturned utensils placed on it to dry.

Plate 69.

CEREALS IN SHEAF AND GRAIN.—This fine display was a demonstration of the skill of Departmental plant breeders and the productivity of Queensland's great grain lands. Last season's wheat harvest, aggregating nearly 7,000,000 bushels of good-quality grain, was the highest State yield yet recorded.

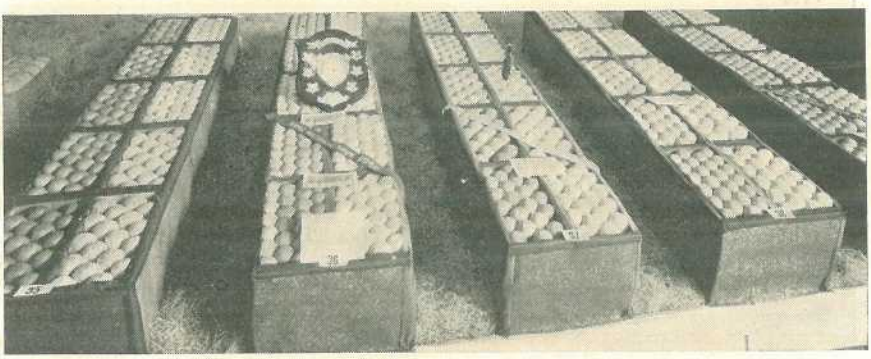


Plate 70.

A SECTION OF THE SCHOOL PROJECT CLUB FRUIT-PACKING DISPLAY.

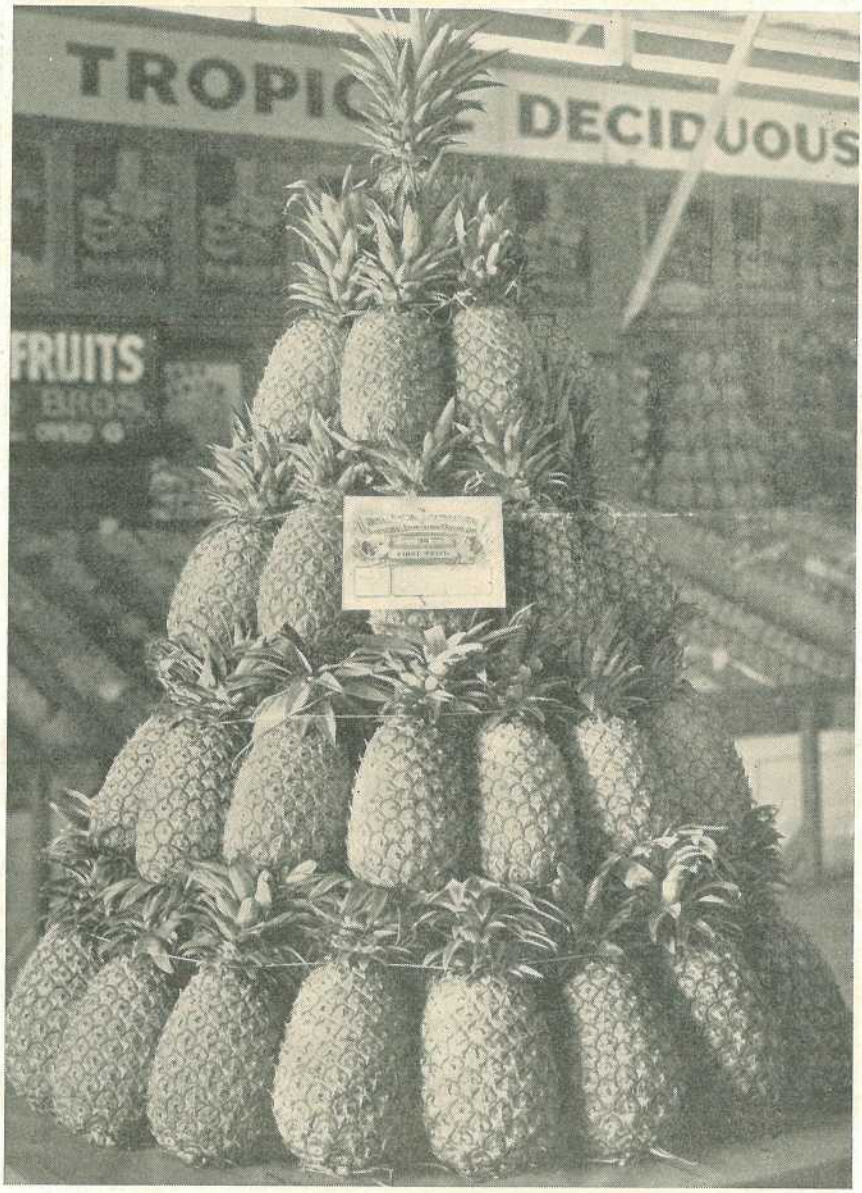



Plate 71.
THIS PYRAMID OF PINEAPPLES WAS A WINNING EXHIBIT.


Plate 72.

AGRICULTURE'S S.O.S.—"Save our Soil" methods were strikingly demonstrated in this exhibit by the field officers of the Agricultural Branch.

Soil conservation by correct cultivation and prevention of wind and water erosion is one of the major interests of the Department of Agriculture and Stock.


Plate 73.

FODDER CONSERVATION.—Modern practice in stock food storage was impressively demonstrated by this display in the Court of Agriculture arranged by field officers of the Agricultural Branch. Model silos—stack, pit, and overhead—built to scale, and a variety of stock foods illustrated means, methods, and the finished products.


Plate 74.

GRAIN SORGHUMS.—This exhibit illustrated the work of the Department of Agriculture and Stock in the development of suitable types for Queensland conditions. Good-quality grain sorghums compare, pound for pound, with maize or wheat in poultry-feeding.


Plate 75.

PASTURE GRASSES AND POISONOUS PLANTS IN EDUCATIONAL CONTRAST.

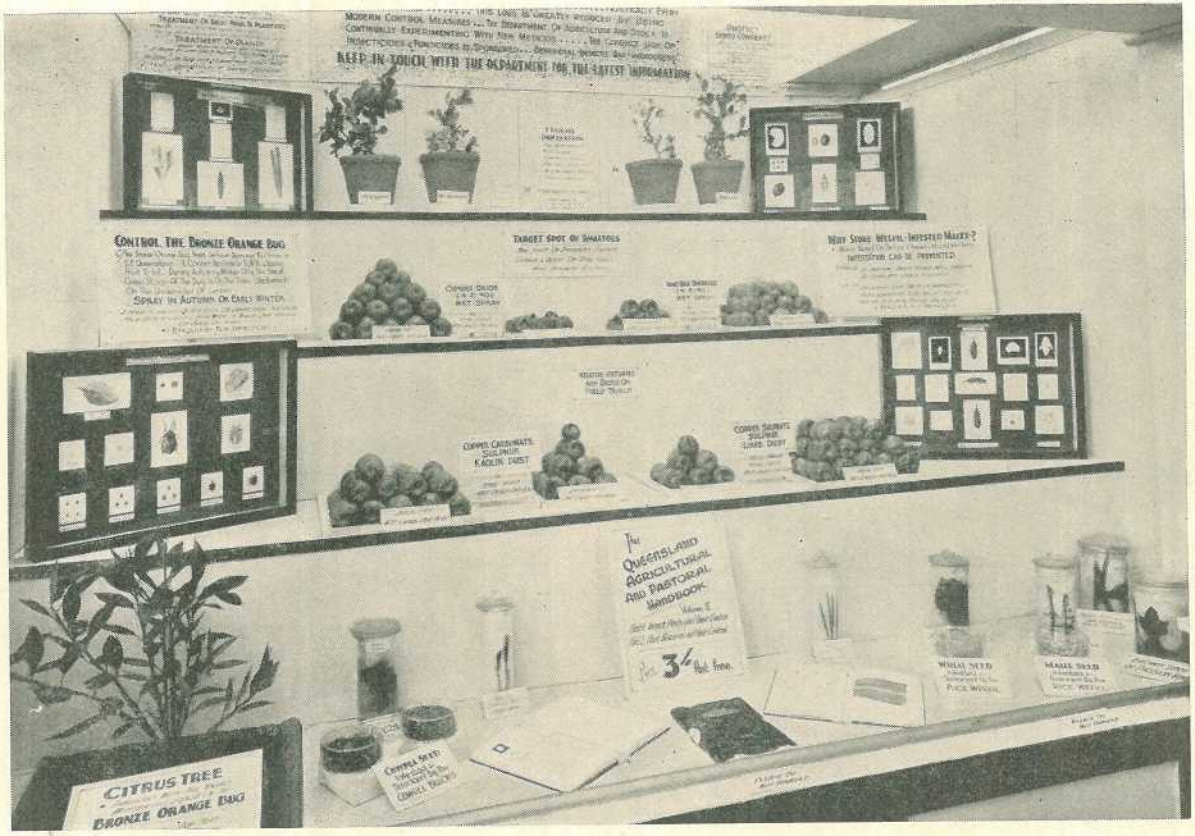



Plate 76.

THE ETERNAL WAR AGAINST VEGETABLE PESTS AND DISEASES.—In this alcove in the Agricultural Court the work of the Research Division was impressively illustrated.

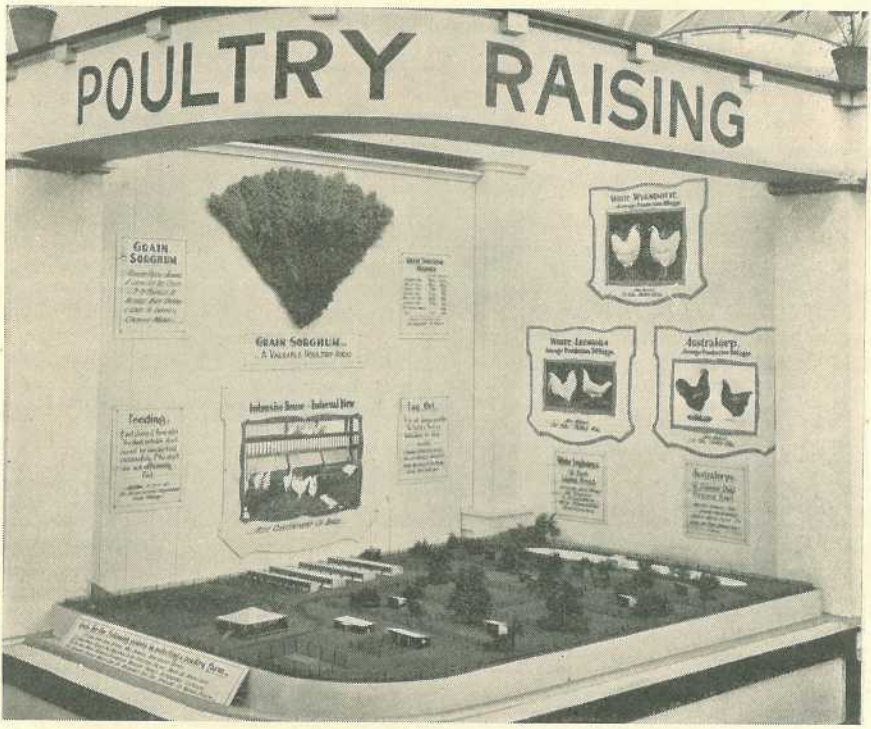



Plate 77.

THE POULTRY ALCOVE IN THE AGRICULTURAL COURT.—Production in the Queensland poultry industry continues to expand at a remarkable rate. Nearly 30 per cent. of the Queensland Egg Board receivals are exported to Britain, where the quality of the shipments has stimulated an increasing demand.


Plate 78.

THE JOURNAL CORNER.—A well-organised and efficient information service for farmers at the Show was provided by the Department of Agriculture and Stock. Messrs. Frank Richards and Stan. Ives were the young officers in charge.


Plate 79.
POINTS IN PIGGERY MANAGEMENT.

## SHADE FOR PIGS.

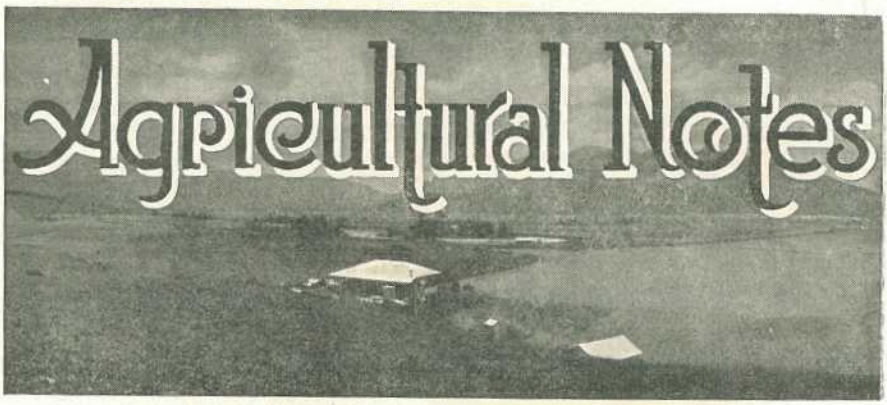
Adequate shade for pigs should be provided during summer. The ordinary sty, particularly if it has an iron roof, is very hot, and some other shade is necessary in the heat of the day. If there are no trees nearby, a wooden shed will do.

Another important aid to the health and comfort of pigs is a bath in which they can lie in hot weather. To wallow in the mud is the pig's natural method of cooling itself. Unfortunately, the wallow sometimes seen on the pig farm is a filthy puddle-hole. If there is infection of any kind in the yard, it is to be found in just such a place. Dirty wallows should be drained and filled in, and a concrete or similar bath provided. This can be kept clean, and the risk of infection diminished.

Comfortable and hygienic conditions are most important in maintaining the health and well-being of pigs.

## SKIM MILK FOR PIGS.

Skim milk and butter milk—they should not be mixed with wash water—are of equal feeding value. These dairy products supply all the proteins necessary to balance the carbohydrate content of the grain portion of the pig's ration. Together with lucerne, rape, barley, or other green feed—which may be either grazed or fed in the pig pen—they form an excellent ration.




# Paris Green Bait Substitutes.

PARIS green is almost unprocurable at present and the place of this insecticide in pest control practice must therefore be filled by other arsenicals which can be obtained without difficulty. Paris green has been very generally used as the toxic ingredient in poisoned bran baits for the control of cutworms, armyworms and false wireworms. It was preferred in those baits because of its intense green colour; the small amounts used imparted to the bait a faint green tint which served as an indicator of thorough mixing. Now that this material is not available, other arsenicals must be used, and some modifications in the formula of the bait and in the method of mixing it will be necessary.

Two suitable substitutes for Paris green are arsenic pentoxide and arsenate of lead. When using the alternative arsenicals, some consideration must be given to their relative toxicities and it is adequate to consider toxicity in terms of arsenical content. The following table indicates the arsenical content of the three compounds under discussion:—

| Type of Arsenical Compound. | Arsenical Content Expressed as Arsenic Trioxide ($As_2O_3$). |
|---|---|
| Arsenate of lead .. .. .. .. .. .. .. | 25·8% |
| Paris green .. .. .. .. .. .. .. | 55 % |
| Arsenic pentoxide .. .. .. .. .. .. | 71·4% |

It will be noted that the arsenical contents of arsenate of lead, Paris green, and arsenic pentoxide, respectively, are approximately in the ratio of 1 : 2 : 3. Cutworm bran bait formulæ have in the past been most conveniently expressed in quantities involving the use of 1 lb. Paris green, which is roughly equivalent to either ¾ lb. arsenic pentoxide or 2 lb. arsenate of lead. The calculated arsenic trioxide content of these quantities of the arsenicals are as follows:—

| Arsenical Compound. | Arsenic Trioxide Content. |
|---|---|
| 1 lb. Paris green .. .. .. .. .. .. .. | 0·55 lb. |
| ¾ lb. Arsenic pentoxide .. .. .. .. .. .. | 0·54 lb. |
| 2 lb. Arsenate of lead .. .. .. .. .. .. | 0·52 lb. |

A bait with arsenate of lead as the toxic ingredient may thus be made up as follows:—Thoroughly mix together 2 lb. arsenate of lead and 25 lb. dry bran. The mixing must be thorough, and, to aid this, the bran should be spread out on the mixing board and the arsenate of lead powder sprinkled over it. These materials should then be turned and mixed several times to ensure that the poison is uniformly

distributed through the bran, remembering that as arsenate of lead is a white powder, visual proof of thorough mixing will be lacking. Dissolve 4 lb. molasses in 1 pint boiling water and make the solution up to 2 gallon. Pour the solution on to the poisoned bran and mix the ingredients to the consistency of a uniformly moist but loose mash.

Alternatively, arsenic pentoxide may be used as follows:—Dissolve ¾ lb. arsenic pentoxide in 1 pint of boiling water and similarly mix 4 lb molasses in 1 pint of boiling water in another container. Mix the two solutions and add cold water to make the whole up to 2 gallons. Place 25 lb. dry bran on a suitable mixing board or in a large tub and pour the poisoned solution on to it. Mix all of the ingredients thoroughly to the consistency of a uniformly moist loose mash.

The quantities of poison used in each of these formulæ should not be exceeded, for there is evidence to show that for some pest smaller amounts may be effective. Thus in the control of plague locusts a bait containing ½ lb. arsenic pentoxide in each 25 lb. bran is known to be effective.

The bait containing arsenic pentoxide will burn tender foliage, owing to its high soluble arsenic content. It should therefore be used chiefly for eradicating cutworms or false wireworms in the field before a crop is planted. The bait may also be used on grassland for the control of insects such as armyworms, provided the mash is broadcast evenly and thinly over the pasture. In preparing and distributing this bait it is advisable first to smear the hands with petroleum jelly or axle grease.

The bait containing arsenate of lead, has a very low soluble arsenic content and may be safely used for the control of cutworms or false wireworms attacking seedbeds or for protecting seedlings recently planted out in the field.

The above formulæ will usually give sufficient bait for the treatment of about ½ to ¾ acre of ground. Where seedlings are already established, the bait should be scattered thinly between the rows; otherwise it should be broadcast thinly. Distribution should occur in the late afternoon so that the bait will be moist and attractive for the night feeding insects. All mixing implements and vessels should be thoroughly cleaned and the hands scrubbed after preparing and distributing any bait.

## SEEDS OF NATIVE GRASSES.

Within recent years intenser interest has been shown, both by pastoralists and by dairymen, in the sowing-down of pastures of drought-resistant native grasses. Many graziers who have sought information about the availability of native grass seeds desire seed for the artificial reseeding of natural pastures which have been thinned out by drought. Numerous other sheep and cattle raisers are eager to sow-down, on their own properties, drought-resistant native grasses from other parts of the State. Many dairy farmers also desire to test out the best of the native pasture grasses under local conditions.

Grasses most in demand by pastoralists are the Mitchell grasses. There are four distinct types of Mitchell grasses—Curly Mitchell, Hoop Mitchell, Barley Mitchell, and Blue Mitchell—and of these, perhaps, the best one for general purposes is the Curly Mitchell.

Seed of Curly Mitchell is now being collected in large quantities for commercial purposes. If sown broadcast about 4 lb. an acre should suffice to give a good stand; and this quantity may be reduced by half if the seed is sown in drills with a combine.

In some circumstances, one or more of the other three types of Mitchell grasses are to be preferred to the Curly Mitchell, but, so far as can be ascertained, no seeds of these types are yet available.

While the purchaser of Mitchell grass seed has at present little choice in the matter of the origin of the seed (practically all of the seed being harvested in northern New South Wales), he should bear in mind that seed collected in his own district or in a district with similar climatic conditions is likely to be better for local sowing than seed from other sources.

Seed of Australian blue grass has been on the market for many years. This, also, is harvested in New South Wales, and, consequently, may not be as valuable as locally collected seed for sowing in Queensland.

## KIKUYU GRASS—A GOOD PASTURE BUT A BAD WEED.

Introduced from East Africa some years ago, Kikuyu grass has gained favour with dairy farmers, although many old-established stands now seem to be declining in productivity.

Kikuyu grass is a perennial which spreads rapidly over and through the ground by means of running stems. Both the surface and underground runners root freely at the nodes, anchoring the plant firmly in the ground and forming a dense turf which stands heavy trampling by stock. The stems carry a large quantity of leaf, and the stems also are very succulent. Under good conditions, Kikuyu grass makes a very dense growth, often 2 feet or more in height.

In Queensland the grass has adapted itself fairly well to different districts. It does best under warm, moist conditions, but will withstand a considerable degree of cold and keep green in spite of fairly severe frosts. For this reason it is very valuable for late autumn and early winter feed. Its drought resistance is fairly good, and some success with the grass is reported from the Burnett and Darling Downs.

Kikuyu grass spreads most quickly and yields most heavily on loose, rich soils; and while it may provide fair grazing on some less fertile soils of a sandy or clayey nature, it is advisable to restrict plantings to rather productive soils, unless in special circumstances—such as when a grass is required for rough places or as a soil binder to prevent erosion. Kikuyu grass makes a heavy drain on the soil, and periodical ploughing or severe cultivation is necessary to improve the soil conditions.

In Australia, Kikuyu grass sets seed very rarely, and commercial supplies are not available. It is necessary to establish the grass by planting pieces of the runners.

In addition to its value as a pasture grass, Kikuyu grass has some value for bracken control. If planted out in bracken Kikuyu attracts stock, which trample down the fern while feeding on the grass.

Although a very valuable grass in its place, Kikuyu grass may become a troublesome weed if it is permitted to encroach on ploughed land. For this reason it should not be planted near areas likely to be required for cultivation. In wet weather portions of the grass are often broken off by grazing animals, and these pieces may be carried on the hooves to other portions of the farm and become established after tramping in. Patches started in this way on land required for cultivation should be dug out immediately.

## WHY BIRDS SHOULD BE PROTECTED.

At this time of the year, when birds are nesting, an earnest appeal is made to all to become interesed actively in the preservation of wild bird life. The value of birds in our rural economy is incalculable. It has been well said that the service that birds render in protecting forest trees is more nearly indispensable to man than any other benefit they confer on him. Were the natural enemies of forest insects annihilated, every tree would be threatened with destruction, and man would be powerless to prevent the calamity. He might make shift to save some orchard or shade trees; he might find means to raise some garden crops; but the protection of all the trees would be beyond his powers. Yet this herculean task ordinarily is accomplished as a matter of course by birds and other insectivorous creatures without trouble or expense to man.

During recent grasshopper visitations, many thousands of starlings were to be seen feeding on the insects, but starlings were not alone in their assault on the common enemy. Every insectivorous bird fed to fullness on the hoppers. The indiscriminate shooting of bush birds has, therefore, nothing to commend it from any point of view.

Fortunately, very few native birds are not protected legally, but even the despised crow is a friendly ally in the continuous war against insect pests. Crows eat grasshoppers, and it takes a lot of hoppers to fill the craw of a crow. The crow also is an energetic scavenger. It eats carrion and maggots. From maggots come blowflies, and the loss to Australian woolgrowers caused by blowfly infestation runs into millions of pounds annually.

## LUCERNE HAY.

Baled lucerne hay, or lucerne chaff, and maize grain are now recognised as the basis of all supplementary or drought feeding, if the fodder has to be transported over long distances. Increased attention is, therefore, being given to the production of good-quality lucerne hay. Good hay containing 45 per cent. to 50 per cent. of leaf will always command a good price, while a weathered or sweated consignment will be hard to sell.

Very careful handling is required from the time lucerne is cut until it is stacked or baled for market. Prime lucerne hay should be green in colour, dry, free from weeds or rubbish, and should contain a high proportion of leaf. Prevailing climatic conditions are naturally an important factor, and, whenever possible, cutting should commence in bright, fine weather. Lucerne should be cut shortly after the first flowers have appeared, when numerous young shoots will usually be observed at the base of the crowns. When the plants are allowed to become over mature, actual loss of weight and feeding value occur, as leaf will be lost, and the stems will harden, thereby becoming largely indigestible. It is customary to commence mowing in the morning as early as possible, after any heavy dew has evaporated. During fine, hot weather, raking may commence about midday. Raking into windrows should, if practicable, be completed by nightfall, as much leaf may be lost if the lucerne is left too long in the swath. After wilting for a few hours in the windrows, fork into high narrow cocks which encourage the natural transpiration of moisture better than if broad flat cocks are made. If rain occurs the lucerne will require turning to prevent the formation of mould, but during fine, hot weather it is possible to stack within two days of cutting. Excess moisture will induce mould, and possibly combustion in the stack, while if the lucerne is allowed to become too dry, it will lose appreciably in palatability, weight, and appearance. Before carting, the stems should be tested by twisting them between the hands, when any excess moisture will become evident.

Wherever possible, lucerne hay should be stored in sheds, but if it becomes necessary to stack it in the field, a framework of logs should be laid down, care being taken to keep the centre of the stack high during building. Large stacks which are likely to be held for some years may be protected by thatching or by a temporary galvanised iron roof.

Proximity and accessibility to the chief markets is obviously an important factor in the profitable production of lucerne hay for direct sale.

## GOOD SEEDS.

Although nearly everyone will agree that better seeds mean better crops, it must not be overlooked that better cultivation means better seeds.

Seeds to be good must have a high germinating capacity, be true to variety name, and free from weed seeds, inert matter, and disease or insect infestation. No matter how careful the grower may be, all crops will contain some plants other than those which it is intended to produce. A cleaning machine should, therefore, be used before the seed is offered for sale. In Queensland, as in every other part of the world, the most critical buyers will be found among the merchants with efficient cleaning machinery.

A modern seed-cleaning plant can make good samples of uncleaned seeds better, but it cannot make bad samples good. With a full knowledge of their machinery possibilities, most merchants are willing to buy on a clean seed basis. They are not, however, inclined to purchase poor samples, and the usual market for seeds of indifferent quality is with dealers who have little appreciation of impurities. The actual seed user who insists on buying his supply on a price rather than on a quality basis encourages the vendors of goods of inferior quality. Unfortunately, seeds of indifferent quality usually carry a large profit to the seller.

Good seeds cost money to produce and money to clean, and the general improvement of farm seeds rests largely with the farmers themselves. When practically every farmer insists on a high-grade product the demand for poor-quality seeds will cease. Only the best-quality seeds are worth buying.


# Mite Injury of Tomatoes.

WITH the approach of the warmer spring months, tomato growers in central Queensland will need to take precautions against injury caused by the tomato mite.

The mite is minute, creamy-white to greyish in colour, and invisible to the naked eye. Its presence, therefore, is not detected until the first symptoms of injury appear. Normally the field crop does not show obvious symptoms until in bearing, but seedbeds and newly planted-out seedlings may carry heavy populations of the pest. The mites breed rapidly, particularly if a wet period is followed by warm weather.

Mite injury to tomato plants is frequently wrongly attributed to unfavourable soil or climatic conditions. The injury, however, is quite characteristic and is first seen at the base of the plant. The lower leaves curl slightly, acquire a bronze colour, wither, and die. The stem loses the surface hairs, becomes smooth and smoky in appearance, and may show superficial cracks. Because of the stem discolouration, mite injury is often known as "smoky stem." The mites gradually spread along the vines towards fresh growth, discolouring the stem and destroying the foliage until, ultimately, only small bunches of new growth remain at the tips. Heavy blossom loss is common, and the setting of the fruit is seriously curtailed. In Central Queensland, stem and foliage injuries are most important, but occasionally, in very heavy infestations, fruit may be damaged. Attacked fruit loses its lustre and then develops a pronounced darkening and cracking of the skin, which produce an unsightly though usually edible fruit.

Smaller fruits, a shortened picking period, and greater susceptibility of the fruit and stem to sunburning are some of the obvious results of mite attacks.

The wild gooseberry, the cape gooseberry, and other allied plants commonly found in the tomato areas of Central Queensland carry a mite similar in habits and appearance to that on the tomato plant. Mites on these weeds very probably spread to the tomato plant, and clean cultivation throughout the season on the headlands and within the field is therefore desirable.

Sulphur dusts and sulphur compounds are very satisfactory for the control of the tomato mite.

Proprietary dusting sulphurs, flowers of sulphur, or ground sulphur can be used at the rate of 4 lb. to 14 lb. per acre, depending on the age and size of the treated plants. The addition of an equal quantity of fine hydrated lime or kaolin to the flowers of sulphur or ground sulphur gives a free running dust which is more easily applied than sulphur alone.

Lime sulphur, one in 80 to 120, gives excellent control, the weaker dilution being used in warm weather. Several proprietary brands of wettable sulphur are also satisfactory.

A thorough spraying with lime sulphur checks mite infestation more quickly than the sulphur dusting, but the effect of the latter treatment persists for a longer period.

Tomatoes should be treated from the seedling stage onwards, the interval between applications depending on the weather. In the warmer months treatments may be necessary every fortnight, but in the winter once in six months may be sufficient.

In the warm coastal areas, the successful culture of tomatoes without the use of mite control measures is frequently impossible. The loss of foliage cover is such that plants wilted by the tomato mite seldom regain their normal vigour. Consistent attention to the control of the tomato mite will result in better yields, larger and more attractive fruit, and a marked extension in the bearing period of the crop.

## THE VALUE OF HUMUS IN THE CITRUS ORCHARD.

Humus is an organic compound formed by the decay of vegetable matter in the soil, and is of great value in the citrus orchard.

Comparatively small amounts of humus are present in hot, dry localities on account of the higher temperatures. In such areas the humus is burnt out of the soil rapidly and does not accumulate to the same extent as it does in a moist or cool climate. Humus possesses the power of retaining moisture in the soil, whilst other advantages are that it makes heavy soils more porous, and sandy soils more cohesive.

It is possible to maintain a high humus content in the soil by annually working in vegetable matter—such as stable manure, green cover crops, leaves, and weeds—for these, if used, supply decaying vegetable matter to the soil.

When the humus content is low, sandy soils lose water quickly, and heavy soils become hard and baked after heavy rains. Under such conditions, trees make poor growth, and the tops of the trees become thin. Small fruit may be formed, and it is subject to sunburn and splitting.

It is, unfortunately, difficult to obtain anything like adequate supplies of stable manure or similar material of a humus-forming nature, and, in order to make up the deficiency, the growing of green manure crops between the trees at times to correspond with the rainy season is recommended. Growing cover crops during dry periods is not desirable, because trees must not be deprived of the available soil moisture at such times. Under average conditions, green crops should be planted in citrus orchards about February and may be turned under about June.

## MARKING TREES IN THE ORCHARD.

Because it is found impracticable to apply corrective methods immediately to drone fruit trees, or to trees known to require some specialised treatment for disease at some more opportune time, it is wise not to leave future identification of the tree to guess work. The simplest way of marking such trees is by tying a narrow strip of cloth—preferably white— to a conspicuous limb.

In the case of individual trees giving light annual crops, pruning may be at fault. It is possible, too, that an individual tree may be a host of some serious pest that has not yet established itself throughout the orchard. The white rag indicator will serve as a reminder at a time later on when the necessary control can be conveniently applied. By marking the tree, the observant orchardist also will be able to note from time to time the efficiency of the control applied.

Unsuitable varieties and poor fruit types observed during harvesting and marked are not likely to be overlooked when reworking is being done in the proper season if they can be easily identified.

# THE FRUIT MARKET.

JAS. H. GREGORY, Instructor in Fruit Packing.

AUGUST was a month of disappointments from the marketing standpoint. Prices which normally show at this time of the year a tendency to rise were on a downward curve.

Complaints about immature fruit have been received from all markets, in respect particularly of papaws, pineapples, and tomatoes. The remedy is obviously in the grower's own hands. Many lines have already been rejected because of non-conformity with accepted standards. New marketing regulations governing matured and size standards gazetted recently in Queensland and New South Wales should remove all causes of complaint in the future.

Prices during the last week of the month were:—

## TROPICAL FRUITS.

### Bananas.

*Sydney.*—Cavendish: Sixes, 14s. to 17s.; Sevens, 16s. to 19s.; Eights and Nines, 18s. to 23s.

*Melbourne.*—Cavendish: Sixes, 13s. to 17s.; Sevens, 14s. to 19s.; Eights and Nines, 18s. to 21s.

*Newcastle.*—Cavendish: Sixes, 16s. to 18s.; Sevens, 18s. to 19s.; Eights and Nines, 20s. to 21s.

### Pineapples.

*Brisbane.*—Smoothleaf, 4s. to 7s. case; 1s. 6d. to 5s. dozen. Roughleaf, 4s. to 6s. case; 1s. to 4s. dozen.

*Sydney.*—Smoothleaf, 6s. to 8s.

*Melbourne.*—8s. to 10s. case. Blackheart prevalent.

*Newcastle.*—6s. to 9s. case.

*Adelaide.*—11s. to 13s.

### Passion Fruit.

*Brisbane.*—Firsts, 7s. to 10s.; Seconds, 4s. to 6s.

*Melbourne.*—12s. to 15s. half-bushel.

### Papaws.

*Brisbane.*—Locals, 2s. to 3s.; Specials, 3s. 6d. to 4s. 6d. bushel; Gunalda, 3s. to 4s. bush; Yarwun, 5s. to 7s. tropical case. Green fruit hard to sell.

*Sydney.*—8s. to 11s. Green fruit hard to dispose of.

*Melbourne.*—8s. to 14s. Coloured lines wanted.

## CITRUS FRUIT.

### Oranges.

*Brisbane.*—5s. to 7s., inferior lower; Navels, 6s. to 8s.

### Mandarins.

*Brisbane.*—Emperors, 6s. to 10s.; Scarlets, 3s. to 8s.;Glens, 7s. to 11s.; Ellendales, 9s. to 13.

Poor grades of all varieties 2s. to 3s. lower.

### Lemons.

*Brisbane.*—7s. to 11s.; Inferior, 4s. to 6s.

### Grapefruit.

*Brisbane.*—5s. to 8s.

### Strawberries.

*Brisbane.*—6s. to 11s. dozen boxes; inferior lower.

*Newcastle.*—9s. to 12s. dozen boxes.

### DECIDUOUS FRUITS.

#### Apples.

*Brisbane.*—Tasma, 6s. 6d. to 8s. bushel; Granny Smith, 8s. to 11s.; Sturmer, 6s. 6d. to 8s.; Crabs, 6s. 6d. to 7s. 6d.

#### Tomatoes.

*Brisbane.*—Green, 2s. to 3s.; Coloured, 3s. to 4s.; Specials to 4s. 6d.

*Sydney.*—4s. to 6s.; Special and repacked lines higher.

*Melbourne.*—5s. to 7s. half-bushel; few higher.

### MISCELLANEOUS, VEGETABLES, ETC.

*Cabbages.*—9d. to 3s. dozen.

*Lettuce.*—1s. 6d. to 3s. dozen.

*Rhubarb.*—8d. to 1s. bundle.

*Cauliflowers.*—4s. to 10s. dozen.

*Beans.*—Brisbane, 8s. to 11s. bag; poor quality lower. Melbourne, 2d. to 4d. lb.

*Peas.*—Brisbane, 5s. to 8s. bag; Melbourne, 2d. to 3d. lb.

*Pumpkins.*—5s. to 6s. 6d. bag.

*Marrows.*—2s. 6d. to 5s. dozen.

*Parsnips.*—9d. to 1s. 6d. bundle.

*Carrots.*—3d. to 9d. bundle.

*Beetroot.*—3d. to 8d. bundle.

*Cucumbers.*—Brisbane, 10s. to 12s. bushel; Melbourne, 12s. to 16s. bushel.

## LADY FINGER BANANAS.

The fruit of the Lady Finger variety of banana has a very pleasant flavour, its keeping qualities are good, and it is always in demand.

Alluvial flats with a subsoil of free clay suit the variety best, but it can be grown successfully on hillsides of even contour where the rainfall is copious and regular, and where shelter is provided from heavy winds.

Thorough preparation of the soil is necessary, and, where possible, it should be worked to a depth of at least 12 inches. Healthy butts, at least nine months old, with a minimum diameter of 6 inches, are the best planting material. On the loamy flats the distance apart should be 18 feet by 16 feet, with three followers; on hillsides and other less favoured sites, 15 feet by 15 feet, with two followers.

To prepare for planting with two followers, the butt should have about 2 feet of the pseudo stem left and all visible eyes or buds gouged out with the exception of two, which should be on opposite sides. The same method is adopted for three followers, except that three buds are left spaced equally round the butt.

Two, or, as the case may be, three suckers will appear in a short time after planting and trees are allowed to grow, but all other growth must, for at least nine months, be removed as soon as convenient after it appears above the soil. After the selected suckers have made two-thirds of their growth towards maturity, giving them a height of approximately 8 feet, a follower can, under favourable conditions, be selected on each plant in a straight line away from the parent plant and left to form the fruiting material for the second crop. The growth habit by which successive suckers may be selected in a straight line away from the original plant will persist for the life of the plantation, and all other growths should be removed as soon as possible. By careful attention to this and other cultural methods, maximum returns can be expected and realised.

Periodical applications of fertilizer, when the soil is of average fertility, will have beneficial results.

Cultivation should be shallow to avoid destroying the root system.

The planting of Mauritius beans down the centre of each row at a distance of 30 inches between plants would ensure a good mulch during hot summer weather and considerably retard weed growth.

Covering of the fruit with a suitable material, as advocated for Cavendish and Mons Marie varieties, during their maturing periods amply repays the grower.

# General Notes

### Staff Changes and Appointments.

Mr. B. R. Martin, B.Sc., has been appointed Instructor in Pig Raising, Department of Agriculture and Stock.

A Regulation issued under *The Primary Producers' Organisation and Marketing Acts* provides that the canary seed hail insurance regulations shall not apply to and shall have no force or effect in respect of canary seed planted during the year 1940.

The officer in charge of Police at Dajarra has been appointed also an acting inspector of stock.

Mr. E. P. Flegler has been appointed millowners' representative on the Tully Local Sugar Cane Prices Board, *vice* Mr. S. Theodore, resigned; and Mr. J. W. Clayton has been appointed millowners' representative on the Isis Local Sugar Cane Prices Board to fill the vacancy caused by the death of Mr. A. Adie.

Messrs. F. H. Bishop, Chermside, and T. P. W. O'Keeffe, Hamilton, have been appointed honorary rangers under *The Native Plants Protection Act* and honorary protectors under *The Fauna Protection Act.*

Mr. J. V. Hayden, manager, Gin Gin Co-operative Sugar Milling Association, Ltd., has been appointed millowners' representative on the Gin Gin local sugar cane prices board in place of Mr. J. Cormack.

Mr. H. C. F. Mackie, Burra Burri, Proston, has been appointed an honorary inspector of stock.

Mr. J. H. Rayner, Scarness, has been appointed an honorary protector of fauna.

### Cane Committee Levies.

Regulations have been issued under *The Primary Producers' Organisation and Marketing Acts* empowering the Qunaba, Inkerman, and Fairymead mill suppliers' committees to make further general levies for administrative purposes at the rate of one penny per ton, in each case, on suppliers of sugar-cane to the Qunaba, Inkerman, and Fairymead mills, respectively.

Levies already in force for these mill suppliers' committees are:—Qunaba ¼d., Inkerman ¾d., and Fairymead ½d.

### Pineapple Levy.

A Regulation has been issued under *The Fruit Marketing Organisation Acts* empowering the Committee of Direction of Fruit Marketing to make a levy on all pineapples marketed during the ensuing twelve months.

The sums raised by the levy will be expended for administrative, advertising, and stabilisation purposes in the general interests of pineapple growers.

The pineapple levy has been in force for a number of years, but the present Regulation provides for an increase from ½d. to 2d. per case for Smoothleaf pineapples, while the levy for the Rough and Ripley varieties remains at ½d. per case.

### Peanut Board.

The election of growers' representatives on the Peanut Board resulted in the return of the present members, Messrs. Adermann and Young.

The voting was as follows—

DISTRICT NO 1 (WIENHOLT AND NANANGO).

| | Votes. |
|---|---|
| Charles Frederick Adermann (Kingaroy) .. .. | 223 |
| Leslie Vivian Young (Wooroolin) .. .. .. .. | 202 |
| Daniel Noel Carroll (Kingaroy) .. .. .. .. | 101 |
| Hans Larsen (Boonenne, Kingaroy) .. .. .. | 88 |

The successful members will be appointed for a term of three years. Messrs. Nothling and Quilter were returned unopposed for Districts 2 (Central Queensland) and 3 (Rest of Queensland), respectively.

**Pig Imports.**

An Order in Council has been issued under *The Diseases in Stock Acts* prohibiting the introduction into Queensland of swine infected with contagious porcine abortion, or suspected of being so infected, unless they have been submitted to the agglutination test for contagious porcine abortion, and found not to react by a Government veterinary surgeon, or an approved veterinary surgeon.

**Gifts for the Troops. Canteen Orders.**

Canteen orders on Australian Defence Canteens Service are available to relatives, friends, and the general public for the benefit of men of the Forces in Palestine and in Australia. They are issued by all Money Order Post Offices and are similar to postal notes, with all the protection of a crossed cheque. They will not be available for the troops in the United Kingdom until Australian canteens are established there.

Canteen orders are obtainable throughout Australia in denominations of 5s. (blue ground), 10s. (red ground), and 20s. (purple ground). They enable the recipient to choose his own gift—that is, he can select what he wants—therefore duplication is prevented, delay is avoided, and postage is saved.

A canteen order can be used for the payment of goods only, and it is necessary for the soldier, when presenting his canteen order for making his purchase, to produce his pay book for identification purposes, thus ensuring that the rightful owner receives the gift. The name and number of the soldier, together with the name and address of the donor, appear on the order.

Goods sold in overseas canteens by the Australian Defence Canteens Service are not subject to any duties, sales tax, excise, or other imposts; therefore, Diggers are able to obtain far better value than is possible when gifts are purchased in Australia and posted to members of the A.I.F., while all canteens are carrying a wide range of products suitable for members of the Forces.

All profits made from the sale of goods in canteens operated by Australian Defence Canteens Service are the property of and are returned to the troops in the form of contributions to regimental funds or by the provision of additional amenities.

This system is suitable also for members of group organisations to contribute to a common fund for the purchase of canteen orders. These orders can be forwarded to commanding officers of units for distribution of gifts among the soldiers or for the provision of additional amenities for general distribution and use.

**Farleigh Mill.**

Regulations have been issued under *The Primary Producers' Organisation and Marketing Acts* empowering the Farleigh mill suppliers' committee to make an additional levy for administrative purposes on suppliers of sugar-cane to the Farleigh mill at the rate of ¼d. a ton. A levy of ¼d. was imposed in June last.

The Minister for Agriculture and Stock (Mr. F. W. Bulcock) has announced the following adjustments and additions to the Cotton Staff of his Department in pursuance of Government policy for the expansion of the cotton industry, and to place that industry on a more efficient basis:—

Mr. W. G. Ferguson, who has hitherto been field assistant in the Department, has been appointed Cotton Pest Control Officer, and Mr. F. Chippendale, B.Sc.Agr., has been appointed Instructor in Cotton Irrigation. It is intended that the headquarters of these officers should be at Biloela.

The grading staff of the Cotton Section will be increased by the appointment of an additional grader, which position will be advertised. In addition, Mr. T. R. Wilbraham has been appointed an assistant cotton grader.

Mr. A. Hutchings, who has had experience in the Cotton Section at Biloela, has been appointed field assistant. Mr. R. W. George was recently appointed to a similar position.

The appointment has also been made as cadets in the Cotton Section of Messrs. N. H. Adams and H. M. Goulter, who have received the Diploma of Agriculture at the Queensland Agricultural High School and College.

The Minister also referred to the recent secondment of Mr. G. D. Hubbie from the Soils Division of the Council for Scientific and Industrial Research for at least two years for soils investigation work in the cotton areas.

In addition to these adjustments and appointments the full-time services of members of the extension staff of the Agricultural Branch of the Department are being utilised in the cotton stimulation programme.

# Answers to Correspondents

## BOTANY.

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

### O'Connell River Plants Poisonous to Stock. Results of Feeding Experiments.

S.C.S. (Mackay)—

Plant specimens collected in the O'Connell River district have been identified as under:—

1. *Passiflora foetida*, a wild passion vine, native of South America.
2. *Trema amboinensis*, Broad-leaved Peach.
3. *Commersonia echinata*, Brown Kurrajong.
4. *Paspalum paniculatum*, Russell River Grass.
5. *Polygonum convolvulus*, a Smart Weed.
6. *Solanum nigrum*, Black Nightshade.
7. *Hibiscus heterophyllus*, a native Hibiscus.
8. *Alphitonia moluccana*, White Leaf.
9. *Macaranga tanarius*, sometimes called Wild Castor Oil.
10. *Trema aspera* var. *viridis*, a variety of Peach-leaf Poison Bush.
11. *Asclepias curassavica*, Red Head or Red Cotton Bush.
12. *Mallotus ricinoides*.
13. *Trema aspera*, Peach-leaf Poison Bush.
14. *Pipturus argenteus*.
15. *Phyllanthus albiflorus*.
16. *Callicarpa pedunculata*.

Nos. 13, 11, 6, and probably 10 are poisonous to stock. No. 11 is not often eaten by stock. No. 6 contains a poisonous alkaloid, solanin, in the green fruit and leaves. The symptoms observed in animals affected by solanin poisoning are narcosis and paralysis, and sometimes salivation, vomiting, and diarrhœa.

Recent feeding experiments have shown No. 13, the Peach-leaf Poison Bush, to be poisonous. It is quite likely that the variety No. 10 also is poisonous, and, perhaps, also the closely allied No. 2. Feeding on these peach-leaf poison bushes may be the cause of the deaths of stock on the O'Connell River. The feeding experiments carried out by the Poison Plants Committee of the Department of Agriculture and Stock so far indicate that the Peach-leaf Poison Bush is much more poisonous in North Queensland than in South Queensland. This is shown by feeding experiments carried out at Oonoonbah and Yeerongpilly respectively. At Oonoonbah, one experiment showed that 5 lb. of the plant were sufficient to kill a steer. At Yeerongpilly, it took 18 lb. of the southern plant to cause the death of a steer.

The densest growth of Peach-leaf Poison Bush occurs mostly in regrowth in new clearings.

If any further investigations of the area are made, it would be as well to observe whether the peach-leaf poison bushes have been trimmed by stock.

### Dead Nettle or Henbit.

C.G. (Murgon)—

The specimen is the Dead Nettle or Henbit (*Lamium amplexicaule*), a native of Europe, now a naturalised weed in many parts of Australia. It is fairly common on the Darling Downs. It is closely allied to Stagger Weed, and, like that plant, is capable of causing staggers or shivers in working stock. Ordinary paddock resting stock, such as dairy cattle, are unaffected by the plant, and, as a matter of fact, for them it is regarded as quite a good fodder. It is only with animals that are driven or excited in some way that the symptoms are manifested.

# Rural Topics

### Value of the Light Horse.

It is the long-considered judgment of General Sir Harry Chauvel, the great Light Horse leader of the last war, that Light Horse is the most valuable arm of the land defences of Australia. He considers them the most mobile of the fighting forces, and that they must still be employed in the sort of country that would not be suitable for mechanised units.

"I cannot think it likely that any army invading Australia could bring sufficient tanks and armoured cars here to compete with the mobility of our mounted divisions," he said. "There is no comparison between the invasion of Poland by German tanks and armoured cars against Polish cavalry and the usefulness of our cavalry in the defences of an island continent such as Australia."

### The Export Markets—Post-War Planning.

At the recent Hobart conference of the Australian Council of Agriculture an outstanding matter of interest to the producers of the whole Commonwealth was a suggestion for post-war planning for the disposal of our exportable commodities. It was accepted that the minimum requirement for post-war planning is a guaranteed market for a volume of exports equal to that of Australia's exports during the war.

It is understood that consideration will be given to post-war planning in relation to the pastoral and agricultural industries by the Commonwealth Government. The belief is that guaranteed markets overshadow all other factors in the post-war plan, and if an amicable settlement can be reached, all other relevant matters will fall fittingly into gear.

### Frozen Bacon for Britain.

There is a growing feeling that of all the primary industries of Australia there does not appear to be, in any direction, so many opportunities for expansion as in the pig industry—more especially as, under existing conditions, bacon must be exported in a frozen state, leaving the curing to be done in England.

In view of the effect of the war on British trade with European countries, which are normally heavy suppliers of dairy produce, an unequalled opportunity is afforded Australian producers to supply the United Kingdom with bacon and pork. This opportunity for trade expansion should mean much more than the actual supplying of current requirements as far as possible, for by the supplying, in present circumstances, of excellent quality bacon to the British market, a demand may be set up which will enable the Australian producers to retain a much bigger proportion of that market after the war is over.

### Flashes from "The Lighter."

From Canada every quarter comes "The Lighter," published by the Tobacco Division, Experimental Farms Service, of the Dominion Department of Agriculture. Statistics and pithily written field data, salted with humour and sparkling epigram, are its contents, and the following paragraph expresses its philosophy:

"In the light, quick smoke of the cigarette, an acquaintance is made. In the seclusion of the den, before an open fire, friendships deepen in the hazy sweetness of a mellow pipe. Man's own true philosophy comes to light under this influence. And, when one has feasted to the capacity at one of those rare banquets when the roast has been turned just to a nicety, when the dessert has been served as only an artist can serve it, then one turns naturally to that masterpiece of the tobaccos—the cigar. For nothing can round out a perfect dinner like a good cigar. In its three most widely used forms, the cigarette, the pipe, and the cigar, tobacco has become a tradition in its promotion of friendship and good spirits."

With an apology to old Omar, let us versify that slab of honest philosophy and twang a lilting tune on the departmental harp—

Now when the golden glory fades to grey
On this the borderland of night and day
Sit down with us and light the evening weed
That puffs the world and all its cares away.

**Lacquering of Fruit Cans—An Interesting Experiment.**

An interesting experiment, which may have far-reaching effect on the citrus industry, was conducted at Gosford (New South Wales) recently when cans of orange and lemon juice were packed.

For some years those concerned have been collaborating with the Federal and State Governments, can makers, and lacquer makers in the development of a lacquer which will protect the metal of ordinary fruit tins from the corrosive effect of the juices. Very promising results have been obtained from a locally-made product, and the experiment was designed to test it on a commercial scale.

A large number of cans were packed with various juices and concentrates, which will be opened and examined some months hence.

**Blood Meal as Sheep Feed.**

It has long been established that blood meal, containing 80 per cent. protein of a high quality and digestibility, is the most concentrated source of protein available to stock.

If suitably sterilised and mixed with a substance to preserve it, blood meal can be fed to sheep to increase and maintain the lamb crop, to check mortality in times of drought, and to keep grown sheep in reasonable condition.

**The Plough as a Weapon of War.**

The plough has always been regarded as the traditional symbol of peace, but now, because of its vital importance as a factor in national defence, it has, in effect, changed from an instrument of peace into a weapon of war.

In any broad view of the Empire war effort, fortunately time appears to be on the side of the British farmer, especially in the Old Country, where an enormous acreage of grassland is now being converted to cultivation. In this great forward movement, the agricultural engineer is working in double harness, so to speak, with the farmer. The agricultural engineering effort is now in full swing, and it will be no fault of the implement maker should the farmer fail to "produce the goods" for want of adequate field equipment. However, there is no likelihood of failure on that score, but the farmer will have to thank the engineer for his ability to do the job which the nation has allotted to the primary producer.

It is acknowledged that without agricultural engineering the farmer would be, to a large degree, helpless in the present war-time pressure on the producing industries, for there is no generous supply or surplus of man-power to enable the farmer to get the work done in more leisurely ways with horses. Horses for cultivation work are, of course, being used to the fullest extent possible, but the bigger factor in the war-time ploughing-up scheme is tractor power, which, of necessity, will continue to be the basis of war-time agricultural progress in Great Britain.

The British farmer is tackling his task forthwith on the right lines and in the right proportions. He is not aiming immediately at the maximum—and thereby running the risk of strained and over-taxed effort—but is working up gradually to a climax in power farming that should be very gratifying in its results.

**The Pneumatic Tyre Increases Efficiency of Farm Machinery.**

In a series of tests at Leeton Research Station, in New South Wales, it was shown that many advantages are to be obtained from fitting pneumatic tyres to farm and orchard wagons, headers, and other cultivation implements. Reductions in draw-bar pull of something like 50 per cent. were recorded in these tests, in addition to increased speed of work, earlier working of wet land, less damage to soft land, and many other benefits of particular value to both farmer and orchardist.

These advantages, however, were limited to machines hauled by horses or tractors. While the pneumatic-tyred tractor proved efficient under good farming conditions, it was not as satisfactory as the steel-wheeled or the crawler tractor under wet, sticky-soil conditions.

The general results of the tests indicate that double the load could be hauled under all farm conditions—that is, hard, muddy, and boggy farm roads, soft and boggy ploughed land and soft grass land—by the farm horses when the lorry was fitted with pneumatic tyres.

It was particularly noticeable that the rubber tyres increased the efficiency of the farm horses, even more under hard road conditions than under boggy conditions.

The value of pneumatic tyres for farm machinery is certainly appreciated to a greater extent than formerly in Australia.

**Electric Fence for Fat Lamb Raising.**

Fat lamb raisers in New Zealand are finding the electric fence is especially suited for use in fencing off breaks and such crops as rape. If rape is to be fed economically, some method of holding lambs on to the feed until it is eaten out is necessary; and for this purpose the electric fence, which can be put up and removed so easily, is hard to beat.

Cheapness and saving of time are the big advantages of the electric fence, but it must be well built, for good results cannot be obtained from a makeshift job. From experience it has been found that, unlike pigs, more than a single wire is required to hold sheep. Where it is necessary to put in a gateway, the overhead method of taking the power over the opening is the best.

—*From "The New Zealand Farmer Weekly."*

**A New Hope for British Agriculture.**

The agricultural policy of the British Government, which has developed from war-time necessity, has created a new hope for agriculture.

The Government has declared that both farmers and workers are entitled to a reasonable measure of security—and against that, it is admitted by every section of the community, there is no argument.

The new policy suggests that the importance of agriculture in the conduct of the war is fully realised. After the outbreak of the war the policy developed by fits and starts, as some obstacle had to give way under pressure, and later by steady progress.

In general terms, it was laid down that the land must produce more and farmers were urged to get on with the job. They had the encouragement of a grant for ploughing up permanent pasture. Now the British Government has given an undertaking that it will see that conditions are established that will enable the farmers to deliver the goods. It is acknowledged that a higher level of prices will be necessary, but rightly this level will guard against extravagant or uncontrolled increases.

As the new agricultural policy is amplified, early notions about ploughing are expanding and general field practice is undergoing some form of improvement. A reasonable wage to workers is to be part of the scheme for fixing prices, and the policy is to be one the farmers can follow with confidence.

There is no case of the British farmers and their men holding the country to ransom; there is only recognition that farmers can't do the impossible.

As in Queensland, the British farmer needs no spur to his patriotism in time of national emergency, but he must be given a fair and square deal and the British Government is, in effect, guaranteeing that he will get it.

**Great Cattle Weights.**

Pasture improvement and quality stud stock are two vital necessities in successful cattle raising. That was evident in a yarding of cattle at Flemington, near Sydney, recently. One pen of nine station-bred de-horned Shorthorn steers topped the market. The oldest was no more than two years and nine months; they were estimated to weigh from 980 lb. to 1,000 lb. when dressed, and they sold to £17 3s.; the average was £16 3s. 9d.

The principal paddock on which they had been running had been continuously top-dressed with a hundredweight of superphosphate to the acre for the past fifteen years.

On this property, during the past five or six years all cattle have been de-horned before reaching the age of four months. Above that age, the local experience is that de-horning is too severe on the cattle.

As an insurance against drought, 4,000 tons of fodder is conserved on this property. Top-dressing the paddocks has greatly increased its carrying capacity, but care is taken that when a dry time comes there is enough fodder conserved to meet the emergency.

The area of the holding is 13,000 acres and it is carrying comfortably 650 head of cattle, 80 horses, and more than 20,000 merino sheep. Could there be a better argument for good pasture management and improvement?

# Farm Notes

## OCTOBER.

CULTIVATORS or scufflers should be kept moving through early-sown row crops to keep down weeds and maintain a surface mulch, for rain falling on a caked surface soil may not penetrate to any great depth. To check losses of soil during summer storms, all row crops should be sown at right angles to or athwart the prevailing slope.

Sowings of maize, sweet sorghums, grain sorghums, sudan grass, millet, cowpea, peanuts, pumpkins, melons, may be continued and sweet potatoes planted out.

More attention may be given to the sweet sorghums, both in the coastal areas and on the Darling Downs. On the Downs, the crop is profitably fed to cattle, horses, and sheep.

On the western Downs and Maranoa, farmers are advised to sow sudan grass, which has proved itself in recent years as a summer crop, whether for grazing, hay, or silage.

Growers should be in a position to provide State requirements of lucerne, wheaten and oaten chaff, sudan chaff, millet, and panicum chaff, stover, and other fodders.

As a summer-growing fodder plant rich in protein, which can be grazed, or converted into hay or silage (in combination with maize or sorghum) cowpea should be considered. Suitable varieties are groit, poona, brabham, and black. October is a good month for the establishment of summer grasses, chiefly paspalum and Rhodes. Paspalum may be broadcast on scrub burns, or ploughed land of reasonably high fertility, at the rate 8-12 lb. seed to the acre, adding white clover seed at the rate of 2 lb. to the acre. Rhodes grass, which is preferred in districts too dry to support paspalum, may be sown from October to January, the ashes left after the burning of timber on scrub land providing an excellent seedbed. No useful results are obtained by broadcasting Rhodes or other grasses on uncultivated land other than a scrub "burn." From 4 to 6 lb. of tested seed to the acre usually provides a good stand.

In the wheat areas, haymaking will be in progress where crops are not too far advanced for this purpose. Crops cut a few days after the flowering stage contain the maximum nutritive value, the nutriment being then spread evenly thoughout the plant. A greater tonnage can be obtained by cutting at a later stage, but only at the expense of feeding value and colour.

As harvesting becomes general during November, all necessary machinery should be given a complete overhaul, in order to avoid stoppages at a critical period.

## TICK TREFOIL—A VALUABLE FODDER PLANT.

Tests of the capacity for natural regeneration of tick trefoil, a valuable fodder plant, when protected from stock are now in progress near Blackall.

A specimen of one variety was received for identification from a station near Longreach by Mr. Cyril White, Government Botanist, recently. On the station it had been observed that the stock ate it greedily, and the owner thought that it might have possibilities as a fodder. This particular variety was first described from Sturt's Creek, in Central Australia. It is found in several districts in Queensland, but never in any great quantity, for the reason, probably, that stock soon eat it out.

The plant is abundant on one of the areas near Blackall now closed to stock for the purpose of studying the natural regeneration of grasses and fodder plants. The tick trefoil group is a large one and is well represented in Queensland. It has contributed greatly to the fodder value of wider areas of pastoral country, and most varieties are worth fostering. The plants take their name from the fact that the seed pod is divided into several one-seeded parts. Each of these parts breaks off and, clothed with tiny hooked prickles, it fastens on to clothing or the coats of animals and is thus carried from place to place.

# Orchard Notes

## THE COASTAL DISTRICTS.

## OCTOBER.

OCTOBER is usually a dry month over the greater part of Queensland, consequently the advice given in the notes for August and September on the necessity of thorough cultivation to retain moisture is again emphasised. Thorough cultivation of all orchards, vineyards, and plantations is imperative if the weather is dry, as the surface soil must be kept in a state of soil mulch.

All newly-planted trees should be watched carefully; if they show the slightest sign of scale or other pests they should receive attention at once.

**Bananas.**

In the warmer districts, banana planting may be continued. All winter trash should be removed and the stools cleaned up. If not already done before the winter, young plantations planted in the previous season should be desuckered without delay. Plants desuckered last autumn should be gone over again, and old plantations also should receive attention. Grow to each stool the number of stems which experience proves to be permissible, but only allow each stem to grow a single follower. Borers will be active again soon, and trapping should be intensified towards the end of the month and supplies of paris green and flour (one part to six by weight) made up in readiness. Caterpillar and grasshopper plagues often occur from the end of the month onwards, and it is wise to lay in a supply of arsenic pentoxide for use in the preparation of bran baits. Watch the plantation carefully for bunchy top, and kerosene and destroy any affected plants without delay. The season of vigorous growth is now commencing, and it will pay well in more and better fruit and in stronger suckers for the next crop to apply a dressing of a complete fertilizer to each stool. Cultivate well to retain moisture, aerate the soil, and kill weeds before they seed. This will also prepare the soil for the planting next month of a green cover crop such as *Crotalaria goreensis*, thus shading the soil, preventing erosion on slopes, and enriching the soil with nitrogen and humus.

Clean out all banana refuse from the packing shed, and resolve not to allow it to accumulate in future. This will reduce the risk of the development of many fungus rots in the packed fruit.

**Pineapples.**

From now onwards pineapples may be planted in most districts. Plough thoroughly, remembering always that in the life of a plantation there will be several seasons during which it will be neither possible nor desirable to do more than disturb the surface layer. Obtain advice from the Department of Agriculture and Stock as to whether the soil is sufficiently acid, and, if not, how much sulphur to apply. Care should be taken in the layout of the rows to save time and labour in cultivation and harvesting, and minimise erosion. Select planting material with discrimination from healthy and vigorous plants of a good bearing type. Beware of planting "collars of slips." Always strip off the base leaves and dry in the sun for a few days, and plant shallow. As soon as the roots form, apply 3 cwt. of 10-6-10 fertilizer to the acre. All established plantations are due for their spring fertilizer at the rate of not less than 5 cwt. to the acre. Keep down weeds with a dutch hoe, but do not disturb the soil deeply, always remembering that the pineapple is shallow-rooted and receives a sharp setback if the roots are cut or disturbed wtih horse-drawn implements. Clean out all pineapple refuse from the packing shed and surroundings, and thus prevent much fungus trouble in the summer pack.

## THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

MUCH of the matter contained under the heading of "The Coastal Districts" applies equally to the Granite Belt and the Southern and Central Tablelands, for on the spring treatment the orchard and vineyard get the succeeding crop of fruit very largely depends. The surface of all orchards and vineyards should be kept loose. In the western districts, irrigation should be applied whenever necessary, but growers should not rely on irrigation alone, and should combine it with the thorough cultivation of the land so as to form and keep a fine soil mulch to prevent surface evaporation.

All newly-planted trees should be looked after carefully and only permitted to grow the branches required. All others should be removed as soon as they appear. If there is any sign of woolly aphis, peach aphis, or scale insects, or of any fungus disease on the young trees, they should be dealt with at once by the use of such remedies as black leaf forty, bordeaux mixture, or a weak oil emulsion. In older trees, similar pests should be systematically fought, for if kept in check at the beginning of the season the crop of fruit will not suffer to any appreciable extent. Where brown rot has been present in previous years, the trees should be sprayed with bordeaux mixture and lime sulphur according to the schedule recommended by the Department. All pear, apple, and quince trees should be sprayed with arsenate of lead—first when the blossom is falling, and afterwards at intervals of about three weeks. Spraying for codling moth is compulsory in the fruit district of Stanthorpe, and wherever pomaceous fruit is grown it must be attended to if this insect is to be kept in check.

In the warmer localities, a careful check should be kept on any appearance of the fruit fly, and, if found, every effort should be made to trap the mature insect and to gather and destroy any affected fruit. If this is done, there is a good chance of saving much of the earlier-ripening summer fruit, if not the bulk of the crop. Tomato and potato crops will require spraying with bordeaux mixture, likewise grape vines. Keep a very strict watch on all grape vines, and, if they have not been treated already, do not delay a day in spraying if any sign of an oil spot—the first indication of downy mildew—appears on the top surface of the leaf. Spraying wtih bordeaux mixture at once, and following the first spraying up with subsequent sprayings, if necessary, will save the crop; but if this is not done and the season is favourable for the development of the particular fungus causing this disease, growers may be certain that their grape crop will not take long to harvest.

Where new vineyards have been planted, spraying also is necessary, for if this is not done the young leaves and growth are apt to be affected so badly that the plant will die.

## 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.


# Maternal and Child Welfare.

*Under this heading is issued each month an article, supplied by the Department of Health and Home Affairs Maternal and Child Welfare Service, dealing with the welfare and care of mother and child.*

## YOUR CHILD'S TEETH.

IS anything more pleasing than to see your child's happy smile enhanced by two rows of pearly white teeth? Are any gems more handsome or more precious to their owner? With what interest does each mother watch the cutting of her baby's first teeth, little realising the very important part she herself plays in the formation of those teeth? What a big responsibility it is for a mother to realise that it depends largely on herself whether her little boy or girl is to have beautiful teeth that will last a lifetime or ugly overcrowded teeth that will quickly decay! Let us see what we can do to help her carry this responsibility.

### How Teeth Develop.

Before baby is born the first teeth or "milk teeth" begin to form in the gums. As baby is entirely dependent on his mother for his nourishment it is important that she should eat the kind of food which goes to form sound teeth and that she should keep herself fit and strong by taking regular exercise and recreation in the fresh air and sunshine and by taking enough rest and sleep.

### Mother's Diet.

From the earliest stage of his development baby needs lime and phosphorus to form good teeth as well as to form good bones, and so it is important that the food the mother eats should contain plenty of lime and phosphorus. For this reason the following diet is recommended for her:—

Three meals a day are sufficient and should include—

Milk—1½ to 2 pints as a minimum. (If fresh milk cannot be obtained, full cream dried milk may be used.) It may be flavoured with cocoa or taken with wholemeal porridge or in the form of junket or in milk puddings.

One egg.

Cheese—1 oz.

Butter—1½ to 2 oz.

Meat, in moderation. This may include the ordinary cuts as well as liver, rabbit, tripe, poultry, or fish. Liver and fish are valuable.

Vegetables—A liberal allowance of uncooked and cooked vegetables. Salads can be made from lettuce, tomatoes, celery, grated carrot, finely shredded cabbage heart, and sweet peppers. Most of these can be grown in a small vegetable garden. Cooked vegetables should include peas, beans, cabbage, cauliflower, and potatoes (English or sweet). Potatoes should be cooked in their jackets and eaten every day.

Fruit—Oranges, papaws, and pineapples are valuable, but all fruit in season is good when eaten in moderation. Uncooked fruit is better than cooked.

Bread and scones should be made of wheatgerm or wholemeal flour. Avoid bread and scones made of white flour or flour artificially coloured.

## Cutting of Teeth.

About the seventh month—the exact age varies even in healthy babies—the first tooth appears, usually a lower middle or front tooth. Within the next two or three months all the front teeth may be cut. About the beginning of the second year the first back teeth usually appear, and at about eighteen months the eye teeth make their appearance between the front and back teeth.

Towards the end of the second year the last of the back teeth appear. This completes the first set of temporary or milk teeth, twenty in all.

## Teething is a Natural Process.

While teething is a natural process it may cause some fretfulness and sleeplessness, and the child may refuse his food. This is due to pain or discomfort caused by swelling of the gums. Sometimes a baby will develop a cough when teething, due to excess secretion trickling to the back of his throat. No severe illness should be attributed to teething.

## Preservation of Good Teeth.

Prevention is better than cure. In order to understand prevention, it is necessary to study nature's method of protection. Each healthy tooth has a white glistening protective covering called enamel, which is the hardest substance in the body. As long as the enamel is intact no harm can come to the tooth. Nature preserves the enamel by keeping it bathed in saliva. The quantity of saliva poured out in twenty-four hours may amount to several pints. Saliva does not flow continuously at the same rate. As soon as the sense of taste is stimulated, especially by weak acids such as are present in certain kinds of fruit, such as oranges, lemons, and apples, there occurs a flow of a thin watery saliva which persists for at least fifteen minutes. Nature's protective mechanism for the teeth is perfect for all animals who live in a natural state. Decayed teeth are rarely seen among them. Until about 100 years ago, when man began to eat refined cereal foods, his teeth also were well formed and well preserved. Sweet foods, especially when made from refined finely-ground flour, stimulate the secretion of a viscid sticky saliva, which with starchy material may form a paste which tends to become lodged in the crevices of the teeth, and in the spaces between them. Unless this is removed, fermentation may occur with the formation of acids which may attack any crack in the enamel. Once a break in the enamel occurs, the process of decay may continue until the vital part of the tooth is destroyed.

As it is important for the mother during pregnancy to take food of the right kind in order that sound teeth may be formed, so it is for the child after birth, if the teeth are to be preserved. The growth and development of the jaws, like that of other bones, depends chiefly on muscular action. In young children vigorous sucking is the best form of exercise, and every effort should be made to establish breast feeding. In older children the most important actions promoting the development of the jaws and of strong teeth are those connected with biting and chewing of raw food. Rusks, not tough crusts, should be given, and when he is old enough the child should be given a diet containing the foundation foods consisting of milk, eggs, cheese, butter, meat, green and root vegetables, wheatgerm bread, and uncooked fruit.

## Care of the Teeth.

The teeth should be brushed after each meal with a medium or soft, short toothbrush having bristles of unequal length to enable them to get between the teeth. They should be brushed both back and front in an up and down direction. Many think

This, in turn, will lead to overcrowding of the permanent teeth.
that the early decay of a temporary tooth is not important, but it may be a serious matter. Not only may it cause pain, but it may lead to loss of teeth, which will interfere not only with the child's nutrition, but with the development of his jaws.

The child's teeth should be examined by a dentist every three to six months from the time he is two years old. The dentist's first aim should be to secure the confidence and co-operation of the child, so that his visit becomes an interest, if not a pleasure.

### School Age is Too Late.

A large number of those children who attend school for the first time are found to have decayed teeth. This is the universal experience of every school dental officer. These children should have received dental care two or three years earlier. Probably in no form of disease is treatment in the early stages more necessary or attended with more satisfactory results than in the decay of teeth. It is the responsibility of every parent to see that his child receives the benefit of this treatment.

You may obtain information on all matters concerning infant and child welfare by visiting the nearest Maternal and Child Welfare Centre (Baby Clinic), or by writing to the Sister in Charge, or by communicating direct with the Maternal and Child Welfare Centre (Baby Clinic), Alfred street, Fortitude Valley, N.1, Brisbane.

## IN THE FARM KITCHEN.

### LUNCHEON AND DINNER DISHES.

#### Curried Lamb and Rice Mould.

Line a small basin with rashers of bacon, then line it with 2 cups rice, previously cooked till tender in stock or water. Melt 1 heaped dessertspoon of good dripping in a saucepan, and 1 tablespoon flour, cook until brown, then add 1 teaspoon curry-powder, stir well, add 1 cup stock, salt, pepper, and 1 lb. lean minced lamb, 2 minced onions, 1 teaspoon lemon juice. Stir until well mixed, then simmer for 1 hour. Drain some of the liquid off the mince and reserve it for the sauce. Fill prepared rice mould, cover with a thick layer of rice, place in a baking tin with a little water in the bottom, and bake for forty-five minutes. Turn out carefully and serve with the sauce served separately.

#### Sausage and Egg Pie.

Bring 1 lb. pork sausages to boil and simmer very gently until they feel quite firm. Allow to cool, then remove skin and cut into dice. In the meantime boil 4 or 5 eggs until hard and cut them into slices. Melt 1 tablespoon butter in a saucepan, add 1 tablespoon flour, cook a little, then add 2 cups milk or white stock. Stir over gas until thickens, then add 1 dessertspoon grated onion, 1 tablespoon each tomato sauce and shredded and fried bacon, 1 cup diced potatoes, sausages, eggs, 1 teaspoon chopped parsley, salt and pepper to taste. Place in a pie-dish and cover with puff pastry and bake in a hot oven for ten minutes, then lower heat and bake for half an hour.

#### Vienna Steaks.

Mix together 1 lb. lean minced steak, 2 cups soaked bread, 2 teaspoons chopped parsley, 2 tablespoons grated onion, 1 tablespoon tomato sauce, 1 teaspoon Worcester-shire sauce, a little ground mace, pepper and salt to taste, and, if liked, a little savoury herbs. Bind with one beaten egg and form mixture into round cakes, flatten out a little, sprinkle with flour, and fry in a little butter or good dripping. When they have all been fried, place in a baking dish or casserole dish, cover with a little sauce made by cooking 1 finely-chopped onion in the fat in which the steak was cooked; add 1 dessertspoon flour, cook a little, then add 2 cups stock or water and salt and pepper to taste. Cook for about twenty-five minutes in a moderate oven. A little scrambled egg placed on top of each steak is an improvement, as illustrated.

#### Baked Veal Rolls.

Cut 1½ lb. fillet veal in slices and flatten out a little. Sprinkle with pepper, salt, and a little finely-grated lemon-peel. Make a seasoning with a cup each of boiled rice and soft bread-crubs, 1 dessertspoon minced onion, 1 teaspoon parsley, pepper,

salt, and a little ground mace and grated lemon rind. Bind with 1 egg and 1 dessertspon melted butter. Spread mixture on veal and roll up; fix securely with a toothpick, put the prepared rolls in an ovenproof dish, cover with thinly-sliced onion, sprinkle with pepper and salt, and a little plain flour. Pour over 1 cup water, 2 tablespoons tomato sauce, 1 dessertspoon Worcestershire sauce, and 1 teaspoon made mustard. Cover with lid and bake in moderate oven for one and a-half hours. When ready to serve, sprinkle with finely-chopped parsley.

**Savoury Fritters and Bacon.**

Mix together 1 cup finely-diced cold meat, 1 teaspoon each grated onion and chopped parsley, pepper and salt to taste, 1 tablespoon each self-raising flour and tomato sauce, and 2 beaten eggs. Drop in dessertspoonfuls on a well-greased hot pan, press out a little, and fry until a golden brown; turn and brown on the other side and serve with crisp bacon.

**Noisettes of Lamb.**

Remove the bones from as many lamb cutlets as required; flatten them out and roll in seasoned flour. Melt a little butter in a pan, add meat, and fry quickly on each side until a nice brown. Take up and place them in the oven to keep hot. To the remaining fat in pan add a little flour, pepper and salt, cook a little, then add enough water to make rather a thin sauce. Place the prepared meat back in pan, cover with a lid, and barely simmer for forty-five minutes. Too much cooking and cooking too hard will dry and toughen the meat. Dish up in the centre of dish and surround with baked tomatoes filled with creamed spinach.

**Orange Tart.**

Prepare and bake a tart-shell, and when cold fill with the following:—Place in saucepan 1 cup each water and orange juice, juice of 1 lemon, ½ cup sugar. Dilute 1 tablespoon cornflour in a little of the water, bring liquid ingredients to boiling point, add cornflour, and cook over a low gas until mixture is quite clear, stirring all the time. Take off the gas and add 1 tablespoon butter, a little at a time, beating it well in.

**Fried Apples and Bacon.**

Wash apples and cut into thick slices without peeling and fry in hot butter until a golden brown. Dish up and garnish with rashers of crisp bacon and fried parsley.

**Creamed Salmon and Spaghetti.**

Boil 4 oz. spaghetti in plenty of boiling salted water until tender; drain well, then place back in saucepan with 1 cup white sauce, not too thin, 1 beaten egg, pepper and salt to taste, and if liked a little curry powder. Well grease a ring mould and fill with the prepared spaghetti, then place mould in a dish of water and place in oven for about ½ hour. In the meantime, melt 1 dessertspoon butter or margarine in a pan, add 1 dessertspoon flour, cook a little, then add 1 cup milk and stir over gas until thick and smooth. Cook for a few minutes, then add 1 medium-size tin salmon. Allow to become very hot, add the juice of ½ lemon, and 1 teaspoon finely-chopped parsley. Turn out spaghetti and fill centre with salmon.

**Baked Veal Cutlets with Peas.**

Prepare veal cutlets as follows:—Remove bone and twist flank round thick end, sprinkle with pepper and salt and a little lemon juice, allow to stand for half hour. Now dip in egg and breadcrumbs. Place in a well-greased baking dish, sprinkle over some very fat bacon, cut into dice. Bake in a hot oven for about twenty minutes or until nicely browned. Turn cutlets and brown the other side. A little more bacon may be needed to finish the cooking, but on no account add dripping, as this spoils the flavour. Dish cutlets in a border on a hot dish and fill the centre with peas. Serve with a well-flavoured tomato sauce.

**Fruit Dessert.**

Hull and wash 1 punnet strawberries, dry well, and cut into four if large, and in two if small. Mix them with 1 cup tinned pineapple cubes, 3 oranges, cut in segments. Place the fruit evenly into individual glasses. Soak 1 teaspoon gelatine in ¼ cup pineapple juice, then dissolve over a low gas. When cold, add another ¼ cup pineapple juice, ½ cup orange juice, 1 tablespoon lemon juice, and ½ cup sweetened condensed milk. Beat until well mixed and beginning to set. Then add 2 tablespoons whipped cream and pour over prepared fruit. Serve with sponge fingers.

# RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF JULY IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1940 AND 1939, FOR COMPARISON.

| Divisions and Stations. | Average Rainfall. | | Total Rainfall. | | Divisions and Stations. | Average Rainfall. | | Total Rainfall. | |
|---|---|---|---|---|---|---|---|---|---|
| | July. | No. of years' records. | July, 1940. | July, 1939. | | July. | No. of years' records. | July, 1940. | July, 1939. |
| *North Coast.* | In. | | In. | In. | *South Coast—contd.* | In. | | In. | In. |
| Atherton .. .. | 1·13 | 39 | 0·90 | 0·91 | Gatton College .. | 1·43 | 41 | 0·11 | 2·33 |
| Cairns .. .. | 1·56 | 58 | 0·94 | 0·53 | Gayndah .. .. | 1·50 | 69 | 0·81 | 2·75 |
| Cardwell .. .. | 1·37 | 68 | 0·96 | 0·48 | Gympie .. .. | 2·10 | 70 | 0·93 | 2·81 |
| Cooktown .. | 0·95 | 64 | 2·28 | 0·60 | Kilkivan .. .. | 1·61 | 61 | 1·21 | 2·00 |
| Herberton .. | 0·89 | 54 | 0·63 | 0·32 | Maryborough .. | 1·97 | 69 | 1·11 | 2·89 |
| Ingham .. .. | 1·69 | 48 | 0·63 | 1·33 | Nambour .. .. | 2·72 | 44 | 2·86 | 3·41 |
| Innisfail .. .. | 4·78 | 59 | 3·98 | 3·78 | Nanango .. .. | 1·68 | 58 | 1·15 | 1·81 |
| Mossman Mill .. | 1·30 | 27 | 0·27 | 0·36 | Rockhampton .. | 1·75 | 69 | 0·61 | 0·45 |
| Townsville .. | 0·78 | 23 | .. | 0·07 | Woodford .. | 2·35 | 53 | 0·86 | 2·37 |
| *Central Coast.* | | | | | *Central Highlands.* | | | | |
| Ayr .. .. | 0·71 | 53 | .. | .. | Clermont .. | 1·07 | 69 | .. | 1·42 |
| Bowen .. .. | 0·93 | 69 | .. | 0·10 | Gindie .. .. | 1·11 | 41 | .. | 1·33 |
| Charters Towers .. | 0·65 | 58 | .. | 0·27 | Springsure .. | 1·21 | 71 | .. | 1·20 |
| Mackay P.O. .. | 1·67 | 69 | 0·04 | 0·35 | *Darling Downs.* | | | | |
| Mackay Sugar Experiment Station | 1·47 | 43 | .. | 0·15 | Dalby .. .. | 1·74 | 70 | 0·43 | 2·17 |
| Proserpine .. | 1·58 | 37 | 0·03 | 1·85 | Emu Vale .. | 1·60 | 44 | .. | 1·94 |
| St. Lawrence .. | 1·36 | 69 | 1·45 | 0·20 | Hermitage .. | 1·69 | 33 | .. | .. |
| *South Coast.* | | | | | Jimbour .. .. | 1·54 | 52 | 0·55 | 1·58 |
| | | | | | Miles .. .. | 1·64 | 55 | 0·44 | 1·66 |
| | | | | | Stanthorpe .. | 2·02 | 67 | 0·13 | 1·50 |
| Biggenden .. | 1·44 | 41 | 0·35 | 2·64 | Toowoomba .. | 2·09 | 68 | 0·16 | 2·14 |
| Bundaberg .. | 1·88 | 57 | 0·67 | 1·47 | Warwick .. .. | 1·83 | 75 | .. | 1·50 |
| Brisbane .. .. | 2·21 | 88 | 0·32 | 2·00 | *Maranoa.* | | | | |
| Caboolture .. | 2·16 | 53 | 0·78 | 2·80 | | | | | |
| Childers .. .. | 1·74 | 45 | 1·08 | 2·18 | Bungeworgoral .. | 1·37 | 26 | .. | 1·57 |
| Crohamhurst .. | 2·97 | 47 | 2·18 | 3·80 | Roma .. .. | 1·45 | 66 | 0·15 | 1·64 |
| Esk .. .. | 1·98 | 53 | 0·27 | 2·37 | | | | | |

A. S. RICHARDS, Divisional Meteorologist.

# CLIMATOLOGICAL TABLE—JULY, 1940.

COMPILED FROM TELEGRAPHIC REPORTS.

| Divisions 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 .. .. | 30·04 | 77 | 64 | 80 | 30 | 55 | 22 | 228 | 9 |
| Herberton .. .. | .. | 68 | 48 | 73 | 4, 5 | 37 | 18, 21 | 63 | 6 |
| Rockhampton .. .. | 30·18 | 75 | 50 | 78 | 2, 3, 30 | 40 | 13, 16, 19 | 61 | 4 |
| Brisbane .. .. | 30·23 | 70 | 48 | 76 | 30 | 38 | 14 | 32 | 5 |
| *Darling Downs.* | | | | | | | | | |
| Dalby .. .. .. | 30·26 | 68 | 36 | 76 | 31 | 25 | 21 | 43 | 1 |
| Stanthorpe .. .. | .. | 61 | 28 | 72 | 30 | 16 | 20 | 13 | 2 |
| Toowoomba .. .. | .. | 62 | 43 | 70 | 30 | 34 | 13 | 16 | 2 |
| *Mid-Interior.* | | | | | | | | | |
| Georgetown .. .. | 30·09 | 82 | 52 | 87 | 4 | 38 | 20 | .. | .. |
| Longreach* .. .. | 30·19 | 75 | .. | 82 | 30, 31 | 32 | 19 | .. | .. |
| Mitchell .. .. | 30·25 | 68 | 31 | 80 | 31 | 22 | 16 | .. | .. |
| *Western.* | | | | | | | | | |
| Burketown .. .. | 30·10 | 82 | 54 | 87 | 4 5, | 45 | 18, 19 | .. | .. |
| Boulia .. .. .. | .. | 74 | 41 | 84 | 30, 31 | 33 | 18 | .. | .. |
| Thargomindah .. | 30·22 | 69 | 40 | 78 | 28 28 | 30 | 19 | .. | .. |

*Longreach minimum readings incomplete.

# ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY A. C. EGLINTON.

## TIMES OF SUNRISE, SUNSET, AND MOONRISE.

### AT WARWICK.

| | September, 1940. | | October, 1940. | | Sept., 1940. | Oct., 1940. |
|---|---|---|---|---|---|---|
| | Rises. | Sets. | Rises. | Sets. | Rises. | Rises. |
| | | | | | MOONRISE. | |
| | | | | | a.m. | a.m. |
| 1 | 6·6 | 5·38 | 5·32 | 5·52 | 4·58 | 5·2 |
| 2 | 6·5 | 5·39 | 5·31 | 5·52 | 5·45 | 5·48 |
| 3 | 6·4 | 5·39 | 5·30 | 5·53 | 6·29 | 6·35 |
| 4 | 6·3 | 5·39 | 5·29 | 5·53 | 7·14 | 7·24 |
| 5 | 6·2 | 5·40 | 5·28 | 5·54 | 8·0 | 8·15 |
| 6 | 6·0 | 5·40 | 5·27 | 5·55 | 8·46 | 9·8 |
| 7 | 5·59 | 5·41 | 5·25 | 5·56 | 9·34 | 10·3 |
| 8 | 5·58 | 5·41 | 5·24 | 5·56 | 10·24 | 10.58 |
| 9 | 5·57 | 5·42 | 5·24 | 5·57 | 11·16 | 11.53 |
| | | | | | p.m. | p.m. |
| 10 | 5.56 | 5·43 | 5·23 | 5·58 | 12·9 | 12·47 |
| 11 | 5·55 | 5·43 | 5·22 | 5·58 | 1·3 | 1·40 |
| 12 | 5·53 | 5·44 | 5·20 | 5·58 | 1·57 | 2·32 |
| 13 | 5·52 | 5·44 | 5·18 | 5·59 | 2·51 | 3·23 |
| 14 | 5·51 | 5·45 | 5·17 | 6·0 | 3·45 | 4·14 |
| 15 | 5·50 | 5·45 | 5·16 | 6·0 | 4·36 | 5·5 |
| 16 | 5·49 | 5·46 | 5·15 | 6·1 | 5·27 | 5·55 |
| 17 | 5·47 | 5·46 | 5·14 | 6·1 | 6·18 | 6·47 |
| 18 | 5·46 | 5·46 | 5·13 | 6·2 | 7·9 | 7·38 |
| 19 | 5·45 | 5·46 | 5·12 | 6·3 | 8·0 | 8·30 |
| 20 | 5·44 | 5·47 | 5·10 | 6·3 | 8·51 | 9·22 |
| 21 | 5·43 | 5·48 | 5·10 | 6·4 | 9·43 | 10·14 |
| 22 | 5·41 | 5·48 | 5·9 | 6·4 | 10·34 | 11·3 |
| 23 | 5·40 | 5·49 | 5·8 | 6·5 | 11·26 | 11·51 |
| 24 | 5·39 | 5·50 | 5·8 | 6·6 | .. | .. |
| | | | | | a.m. | a.m. |
| 25 | 5·38 | 5·50 | 5·7 | 6·6 | 12.18 | 12·38 |
| 26 | 5·37 | 5·51 | 5·6 | 6·7 | 1·8 | 1·23 |
| 27 | 5·36 | 5·51 | 5·5 | 6·8 | 1·57 | 2·7 |
| 28 | 5·35 | 5·51 | 5·4 | 6·8 | 2·45 | 2·52 |
| 29 | 5·34 | 5·52 | 5·3 | 6·9 | 3·31 | 3·36 |
| 30 | 5·33 | 5·22 | 5·2 | 6·9 | 4·17 | 4·20 |
| 31 | | | 5·1 | 6·10 | | 5·8 |

## Phases of the Moon, Occultations, &c.

| | | | |
|---|---|---|---|
| 2nd Sept. | ● | New Moon | 2 15 p.m. |
| 9th „ | ☽ | First Quarter | 5 32 a.m. |
| 17th „ | ○ | Full Moon | 12 41 a.m. |
| 25th „ | ☾ | Last Quarter | 3 47 a.m. |

Apogee, 3rd September, at 4.0 p.m.
Perigee, 18th September, at 6.0 p.m.

There is always a feeling of hope with September. Is it because most of the winter has passed and spring is at hand, or is it the primitive man within who, long ago, when he saw the little Pleiades, the Bull, and great Orion rising in the morning, knew that the time for sowing had come? In times past the starry heavens were the countryman's calendar, and agricultural operations were performed according to the rising or setting of certain stars. It may be, however, that the modern man knows that in September the southern Spring Equinox occurs, and the sun, which has sojourned in the northern hemisphere for the past six months, is returning to bring us the summer. On 23rd September Old Sol will have reached as far south as the equator, and as he continues his southward journey, the days will rapidly lengthen. Until now the day has been shorter than the night; on 23rd September the day and night will be of equal duration over the whole earth. After that the day will be longer than the night. Another useful and interesting observation is that only at the equinoxes the sun rises and sets due east and west respectively; it is easy then to mark the compass points on the horizon.

Everyone who was about before dawn last month must have been attracted by the brilliancy of Venus. Since then the Morning Star has climbed much higher in the sky with declining brightness. On 5th September the planet will have reached her greatest distance from the sun—46 degrees. After that, Venus will begin to sink back again toward the eastern horizon.

We have not seen Mars for a long time; a year ago he shone brighter than Jupiter now shines in the morning. On 7th June, when Venus was still the Evening Star and low in the west, she passed Mars, which appeared only as a tiny star. At the end of August Mars passed on the far side of the sun into the morning sky.

| | | | |
|---|---|---|---|
| 1st Oct. | ● | New Moon | 10 41 p.m. |
| 8th „ | ☽ | First Quarter | 4 18 p.m. |
| 16th „ | ○ | Full Moon | 6 15 a.m. |
| 24th „ | ☾ | Last Quarter | 4 4 p.m. |

Perigee, 2nd October, 2.0 a.m.
Apogee, 15th October, 8.0 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.